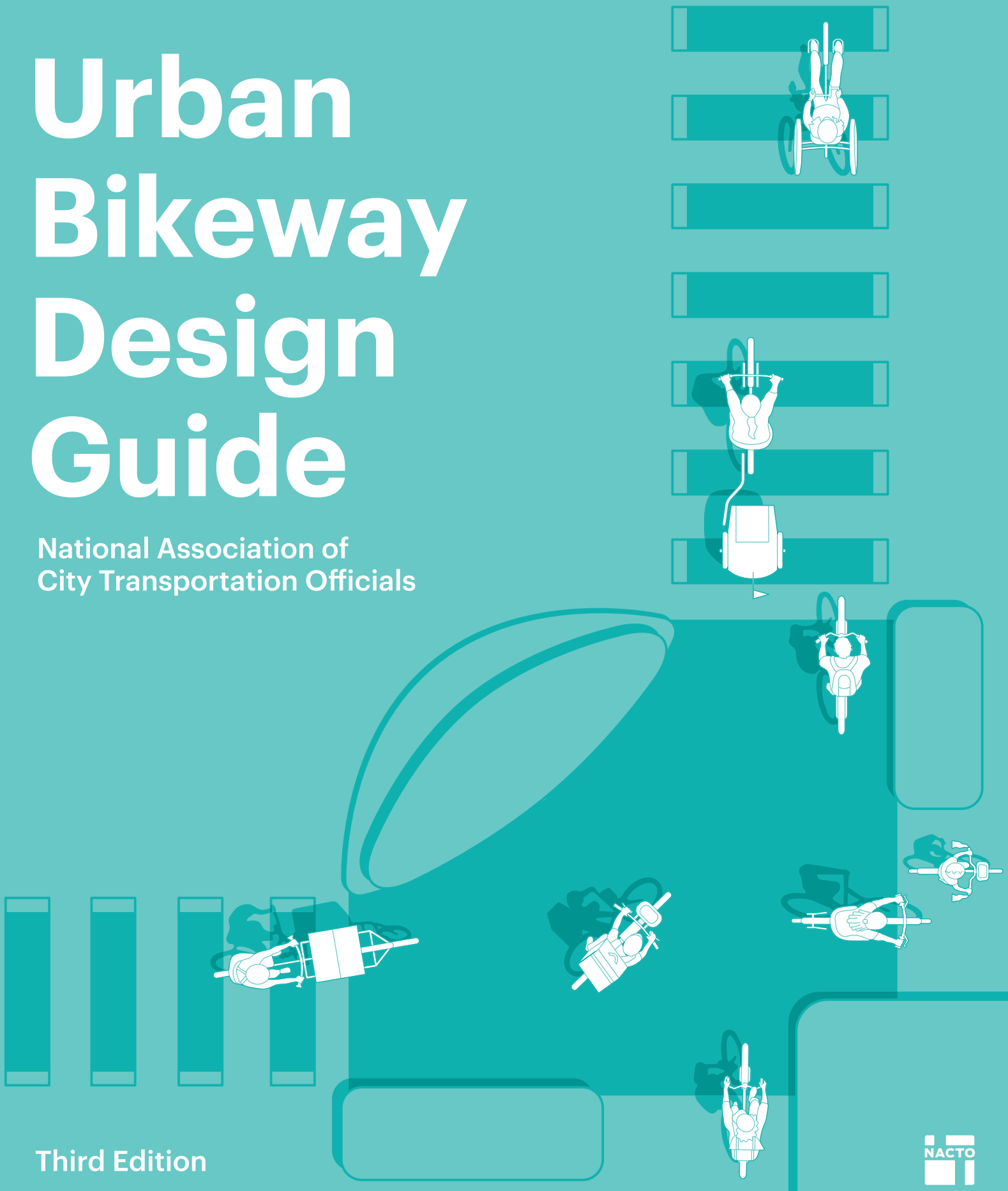
PREVIEW

Urban Bikeway Design Guide

National Association of City Transportation Officials



Third Edition

NACTO

NACTO
National Association of City Transportation Officials

ABOUT NACTO

The National Association of City Transportation Officials (NACTO) is an association of major North American cities and transit agencies formed to exchange transportation ideas, insights, and practices and cooperatively approach national transportation issues.

NACTO's mission is to build cities as places for people, with safe, sustainable, accessible, and equitable transportation choices that support a strong economy and vibrant quality of life. NACTO does this by:

- → **Building the Movement:** Connecting a national network of cities, empowering the individuals who comprise the progressive transportation movement, and cultivating strong leadership capacity among city transportation officials.
- → **Leading the Conversation:** Communicating a bold vision for 21st-century urban mobility and street design, and empowering a coalition of cities to advance people-focused transportation policy at the local, state, and federal levels.
- → **Accelerating Change:** Raising the state of the practice for local policies, programs, and street designs that prioritize people walking, biking, and taking transit.

NACTO is a 501(c)(3) non-profit association. Since its founding in 1996, NACTO has provided a forum for the exchange of ideas and best transportation practices among North American cities and helped ensure that cities are leading the way with forward-thinking transportation policy. NACTO is committed to empowering cities to realize their goals for stronger, safer, fairer transportation and communities, and looks forward to working with others who share this commitment.

National Association of City Transportation Officials

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NACTO EXECUTIVE BOARD

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- → Barr Foundation
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- → ClimateWorks Foundation
- → NUMO
- → Trek

PROJECT TEAMS

The third edition of the *Urban Bikeway Design Guide* is based on the real-world experience of planning, designing, implementing, and maintaining bike facilities across North America and abroad. NACTO staff worked closely with bikeway planning and design professionals from NACTO member agencies, as well as engineering and design consultants and researchers.

WORKING GROUP

A group of over 150 individuals employed at more than 60 municipalities and transit agencies in the United States and Canada participated in the development of this guide:

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San Diego, CA
San Francisco, CA
San Jose, CA
Santa Rosa, CA
Ventura, CA
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We're grateful for Jessie Singer's attention to detail as our fantastic copy editor. A talented team took our ideas and turned them into helpful illustrations: Anthea Fernades, Martha Hall, Riva Heinrich, Aditya Inamdar, Lyubava Kroll, Jade Ma, Alex Reasbeck, and Craig Toocheck. Julio Ibarra turned sketches into lovely three-dimensional renderings. Ana Bercovich was instrumental in developing and executing the guide's layout.

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A NEW ERA FOR SAFE, BIKEABLE CITIES

Biking is an increasingly integrated and integral part of city life across North America. Cities are building more places for people to bike, shared micromobility systems are registering record ridership, and people are riding down bike lanes on an increasingly wide variety of mobility devices, including electric bikes, cargo bikes, scooters, and adult tricycles. New, creative street designs are meeting this surge in demand, making biking even more popular and accessible.

We've come a long way since 2009 when cities banded together to develop NACTO's *Urban Bikeway Design Guide*. This first-of-its-kind document–bikeway design guidance developed by cities, for cities–sparked a design revolution nationwide, elevating city ingenuity and values in service of safe, vibrant streets and transportation networks.

The first and second editions of the *Urban Bikeway Design Guide* established a new vision for city streets: safe, accessible, and inviting for people on bikes. This groundbreaking resource documented how cities collaborated to exchange ideas, vet designs, codify best practices, and implement bike-forward street redesigns. It was endorsed by the U.S. Department of Transportation and dozens of local and state governments across North America. NACTO's new guidance gave transportation practitioners permission to experiment, confidence to demonstrate what was possible, and clarity about what to build to improve bikeability. As a result, in the years since the *Urban Bikeway Design Guide* was first published, cities have championed people-centered streets as a critical tool in stemming North America's traffic safety, equity, and climate crises.

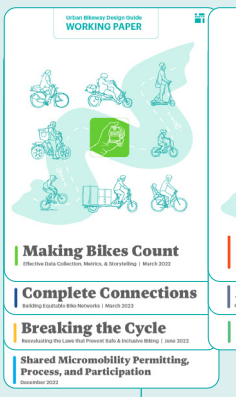
PROTECTED BIKE LANE MILEAGE IN THE US

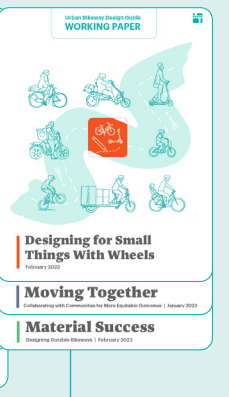
2008 2009 2010 2011 2012 2013 2014 2015 2016

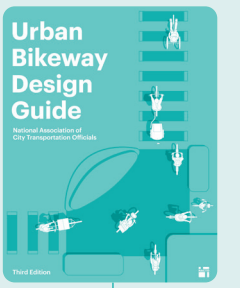
This third edition of the *Urban Bikeway Design Guide* moves beyond illustrating what we *can* do. Instead, it defines what we *must* do to make city streets safe, connected, accessible, and equitable.

It sets new standards for bike network planning, bikeway design, and program and project evaluation to create bikeable cities for people of all ages and abilities. It identifies new practices for integrating faster-moving vehicles, such as e-bikes and scooters, and wide vehicles, such as cargo bikes, into the design process. And it demonstrates how to center equity as the cornerstone of a safe and connected bike network.

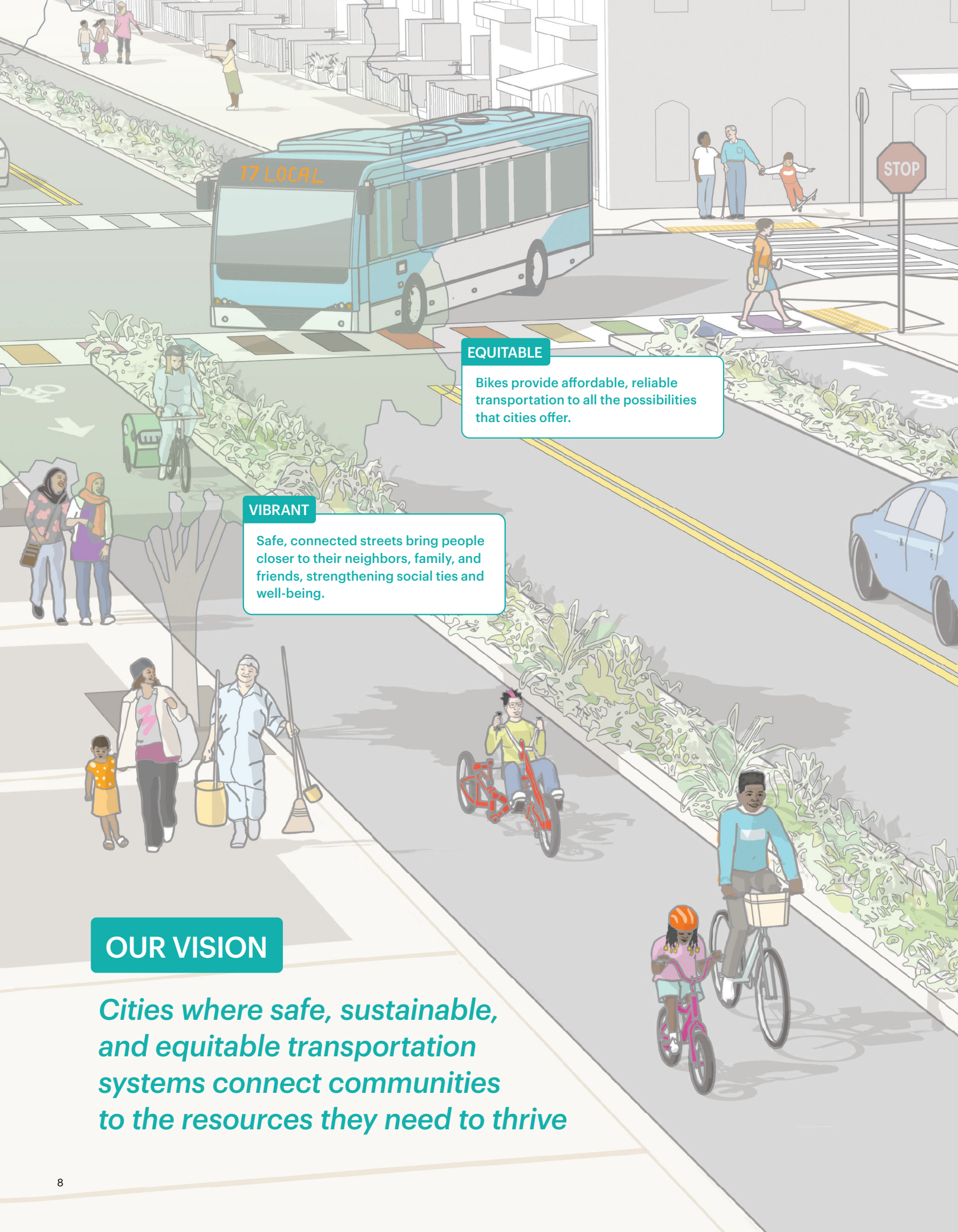
What was once groundbreaking is now routine, with millions of people riding bikes and scooters to commute to work and school, meet friends, pick up groceries, or access healthcare. However, there is much more to be done. NACTO and our members are proud of the *Urban Bikeway Design Guide*'s role in transforming streets. With this new edition of the guide, we commit to raising the state of the practice again– and call for policymakers, elected officials, engineers, planners, and community members to join us by committing to help usher in a new era of sustainable, accessible transportation for all– with biking at the fore.







2017 2018 2019 2020 2021 2022 2023 2024 2025



EQUITABLE

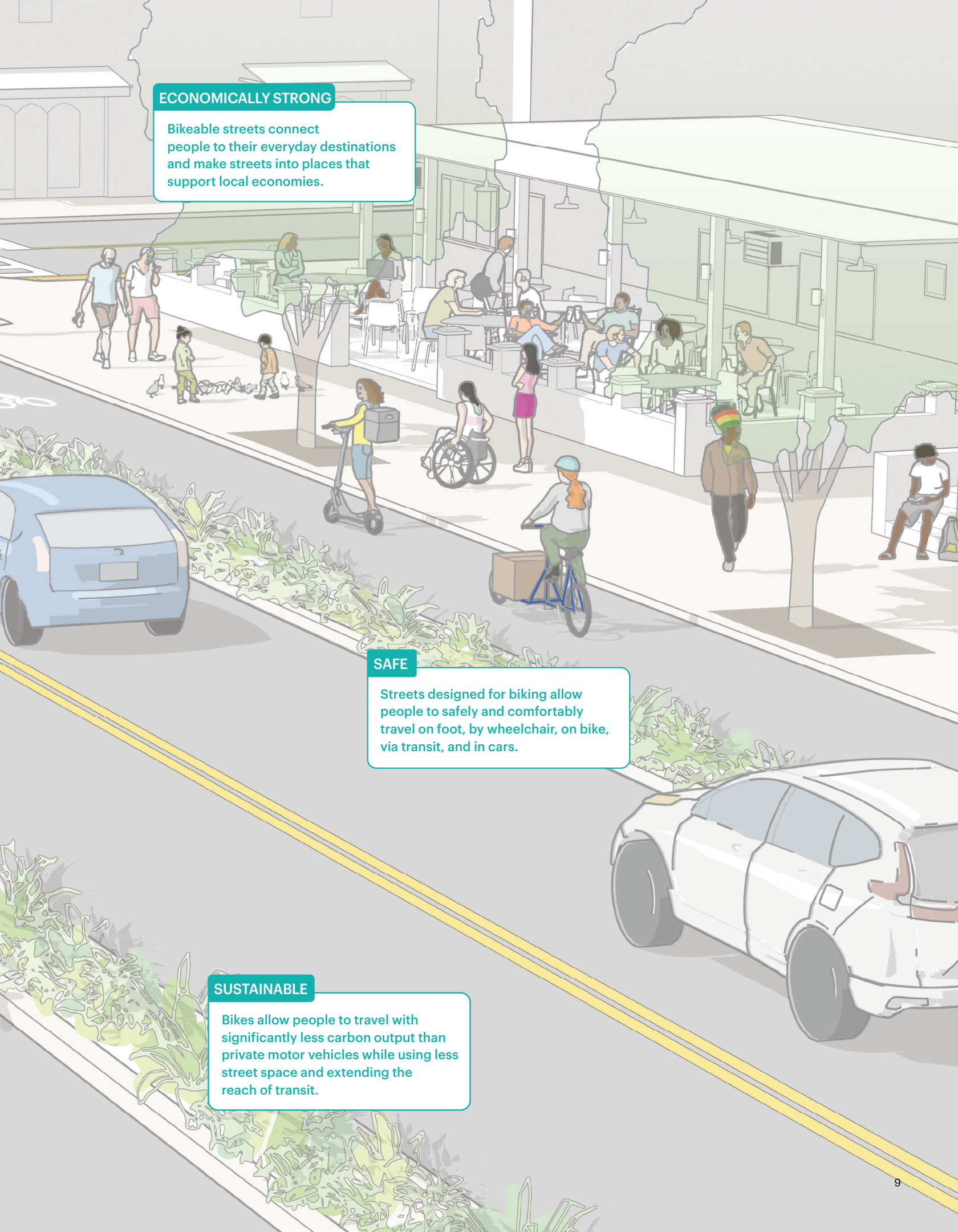
Bikes provide affordable, reliable transportation to all the possibilities that cities offer.

VIBRANT

Safe, connected streets bring people closer to their neighbors, family, and friends, strengthening social ties and well-being.

OUR VISION

Cities where safe, sustainable, and equitable transportation systems connect communities to the resources they need to thrive



ECONOMICALLY STRONG

Bikeable streets connect people to their everyday destinations and make streets into places that support local economies.

SAFE

Streets designed for biking allow people to safely and comfortably travel on foot, by wheelchair, on bike, via transit, and in cars.

SUSTAINABLE

Bikes allow people to travel with significantly less carbon output than private motor vehicles while using less street space and extending the reach of transit.

DESIGNING FOR ALL AGES & ABILITIES

Bikeway design must meet the needs of a diverse array of potential bike riders.[2] Across North America, however, many existing bike facility designs provide enough comfort for only the boldest people biking and exclude many who might otherwise ride.

An **All Ages & Abilities** (AA&A) bikeway is one that feels comfortable and provides safety for all current and potential users. AA&A is inclusive of age, ability, type of bike or mobility device, socioeconomic status, race, gender, or any other identity and experience a person may hold. For many people, feeling safe and comfortable goes beyond just physical protection from motor vehicles. High-quality AA&A bikeways can create a sense of safety by helping people feel as though they belong, are safe from potentially dangerous interactions with police officers, and are welcome to use a variety of adaptive bikes and mobility devices.

AA&A bikeways are safe and comfortable for people:

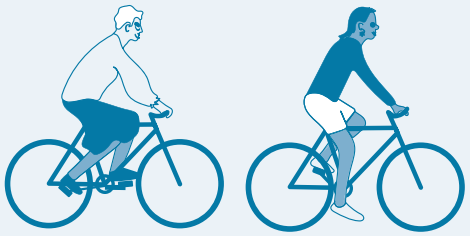
Of all ages, sizes, and physical abilities. On an AA&A bikeway, grandparents and grandkids can ride bikes together. These designs support children and older adults, who sometimes have lower visual acuity and slower riding speeds, and people with disabilities who might use lower-profile or wider three-wheel adaptive bikes. Those with disabilities who are not using bikes or micromobility devices but need to cross or navigate around bikeways are also taken into account.

Of all races and ethnicities. Black and Latine people on bikes are more than four times as likely to be killed in a traffic crash than white people on bikes. Additionally, law enforcement officers issue a disproportionate number of traffic tickets to Black and Latine people on bikes for actions such as biking on the sidewalk. High-quality bike infrastructure makes streets safer and reduces police interactions. Research from Chicago found that major streets with bike lanes had half the number of tickets compared to similar streets without bike lanes.

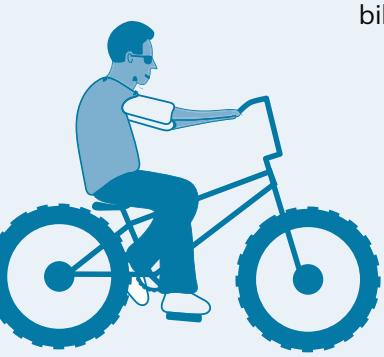
Of all incomes. Low-income bicyclists make up half of all Census-reported commuter bicyclists, relying extensively on bicycles for basic transportation needs such as getting to work. Research shows that unhoused people are given a disproportionate number of bike tickets in some jurisdictions, including for minor issues such as riding helmetless. Basic infrastructure is often deficient in low-income neighborhoods, creating real safety issues for those who bike there.

Of all experience levels and despite past experiences. Bikeways need to be welcoming to people who have little experience biking on urban streets and those who have had previous negative experiences while riding a bike or other micromobility device. AA&A bikeways enable people to feel confident biking–and learn to feel comfortable biking on a wider variety of urban streets.

Of all gender identities and sexual orientations. In most North American cities, people who bike are predominantly male. Surveys reveal that women in particular cite safety and lack of bike infrastructure as core reasons why they choose not to bike. Women and LBGTQ+ people also report regular harassment while biking. High-quality facilities on urban streets create a sense of safety by being well-lit and highly visible to passersby. AA&A bikeways feel safe and welcoming for people of a diversity of gender expressions and experiences.



Working in a variety of industries. Often paid per delivery, workers who deliver on bikes need bike lanes that accommodate faster speeds and a wider range of devices, including e-bikes and cargo bikes. AA&A bikeways are suitably wide and feature intersection designs that enable these workers to get around at pace. People who work using bikes also benefit from infrastructure that limits interactions with police, as every interaction risks time and money lost from a day's work.



Using all types of bikes and micromobility devices. AA&A bikeways are designed for people moving goods or cargo, whose bikes are often wider and longer; caregivers with children on their bikes, who are extra concerned with safety and may require frequent stops; people riding electric scooters or electric bikes, who move faster than many other people on bikes; and people riding adaptive bikes and adult tricycles, whose bikes are larger and slower than other bike facility users.

FROM PROJECTS TO NETWORKS: BUILDING A SUCCESSFUL BIKE PROGRAM

Cities need to have the internal infrastructure to deliver safe, sustainable, and equitable transportation systems. When city agencies align internal conditions and desired outcomes, they are more likely to deliver projects on time and on budget and more able to scale outputs to meet needs and solve issues early and quickly.

A Bike Network Plan is an opportunity to begin moving from a project-by-project workstream to a programmatic one. Transportation agencies need to establish streamlined and scalable approaches to political engagement, community collaboration, network and project planning, project delivery, and project and program evaluation. This process might be challenging at first, but over time the process will become smoother and less energy-intensive.

	People	Policy	Engagement
LEVEL 1	**STAFF UP** Hire staff with design, engagement, and program management skills	**SHARED UNDERSTANDING** Establish shared values and a vision for a bikeable city	**TRANSPARENCY** Share project information with the public early and often, translating into the languages preferred in your community
LEVEL 2	**INTERNAL SUPPORT** Align staff time and resources to deliver prioritized projects	**SUPPORTIVE POLICIES** Update or adopt new local policies to make bike facilities a default element of projects	**TRUSTED PARTNERS** Work with advocacy groups and other community organizations to amplify messages and build connections with residents
LEVEL 3	**POLITICAL LEADERSHIP** Demonstrate political support with reliable, multi-year funding commitments to implementation	**NEW PROTOCOLS** Create reliable strategies for implementing projects of all scales across agencies and partners	**EXPANDED CAPACITY** Hire community members and organizations to share knowledge and conduct outreach

Planning	Design and Delivery	Evaluation
PROJECT INVENTORY Find overlap between your bike network projects and other plans and programs, such as resurfacing	**CONTRACTS** Award on-call contracts for the design and implementation of your bike projects	**COLLECT DATA** Build a baseline dataset relevant to your shared values that can guide project decisions and intended outcomes, such as injury-causing crashes and multimodal counts
NETWORK ACTION Publish a program map and timeline to communicate project timelines with other agencies and the public	**STANDARDS AND SPECS** Update contract documents, technical specifications, and design details to simplify design and construction	**ANNUAL REPORTING** Form protocols for evaluating individual projects and for evaluating equitable progress on network goals
THINK BIGGER Use successful projects to harness political and financial opportunities for more complex and larger-scale projects that involve more stakeholders, resources, and time	**NETWORK DELIVERY** Institute a pipeline of projects in various stages of design, approval, delivery, and maintenance to build mini-networks of connected bikeways every year	**STORYTELLING** Demonstrate the impact of the bike network as it relates to political and community vision through data visualizations, photos, user feedback, writing, press outreach, and video

BIKEWAYS AT A GLANCE

BIKEWAYS FOR LOW-SPEED, LOW-VOLUME STREETS

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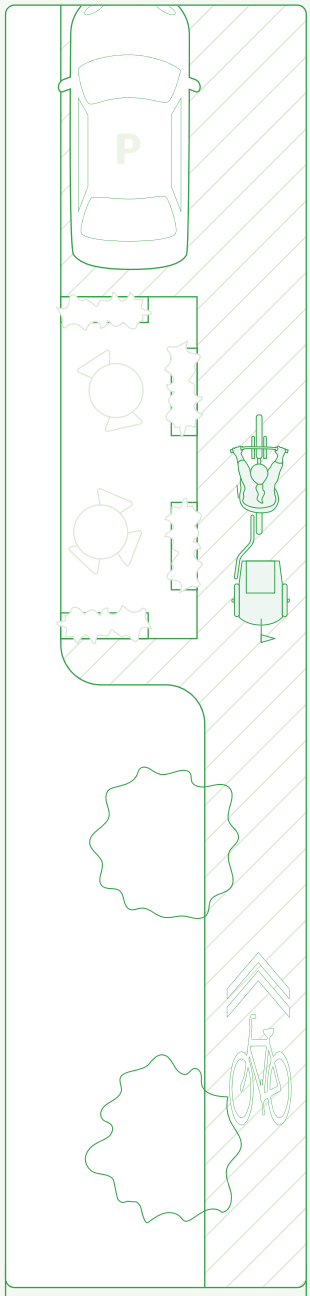

Shared Space
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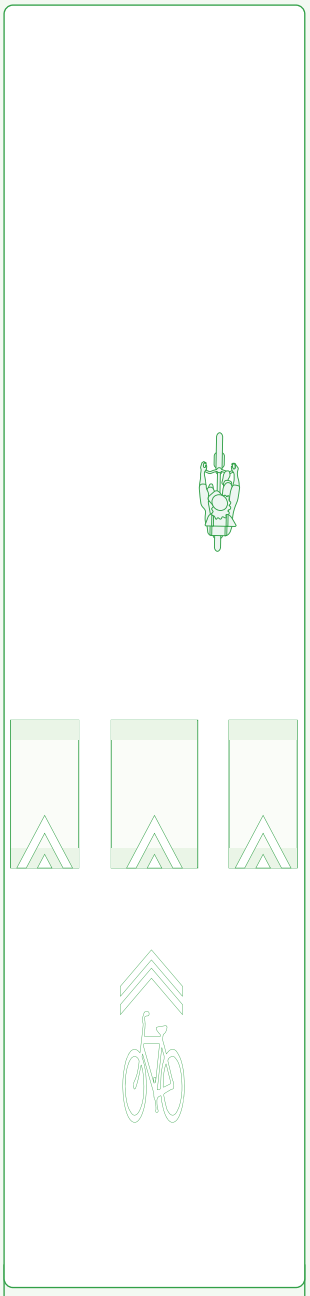

Bike Boulevard
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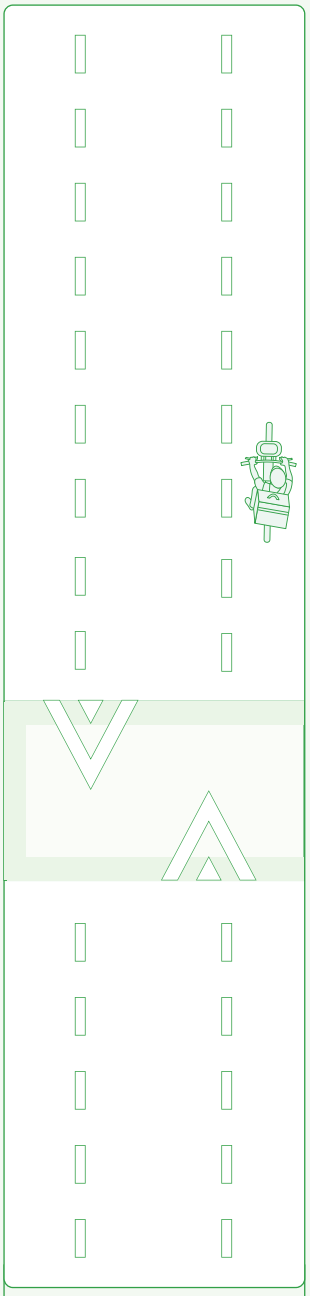

Advisory Bike Lane
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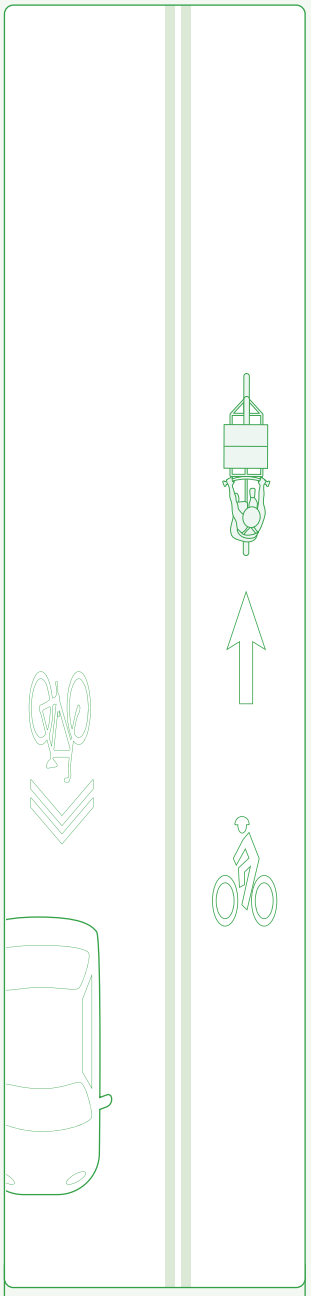

Constrained Bike Lane
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PROTECTED / SEPARATED BIKE LANES

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PATHS

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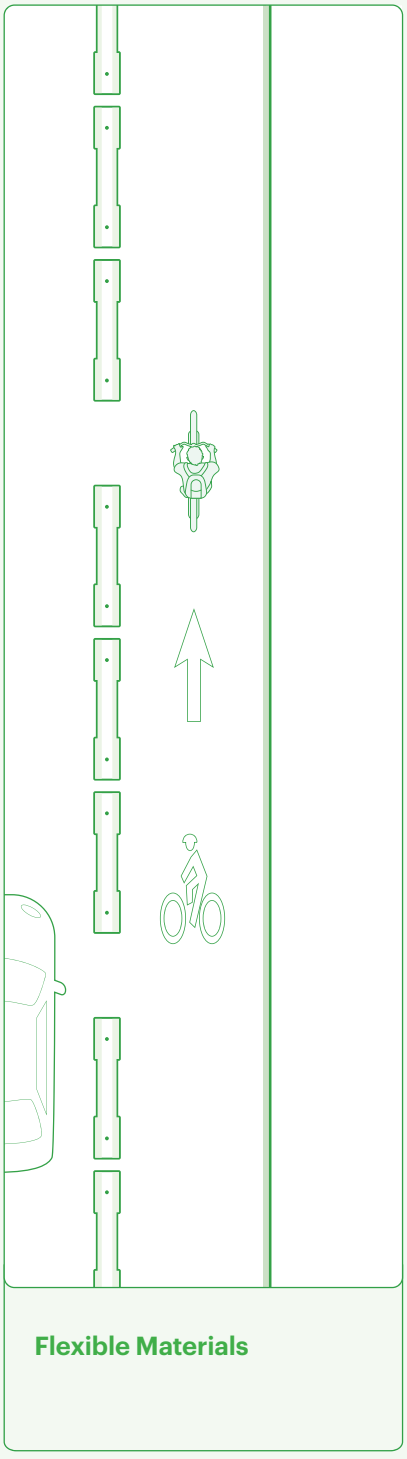
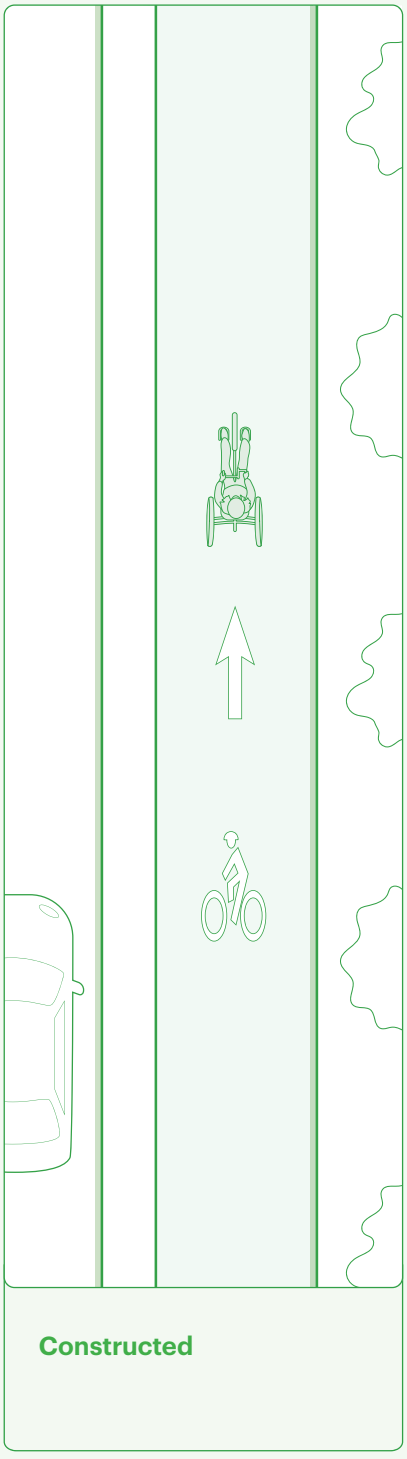
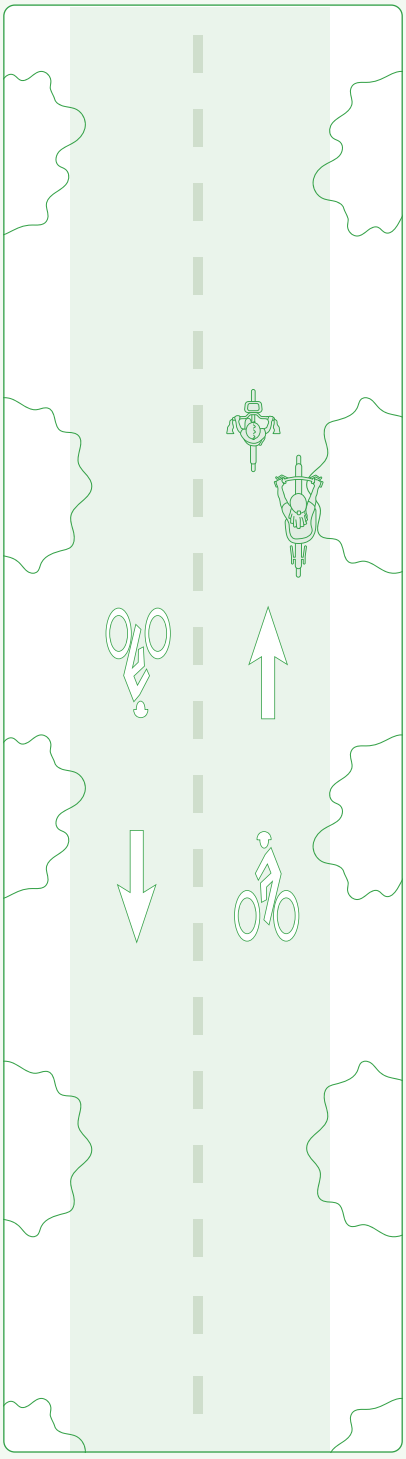


Flexible Materials



Constructed



GUIDANCE FOR SELECTING ALL AGES & ABILITIES BIKEWAYS

Bikeway	Target Motor Vehicle Speed	Motor Vehicle Volume per day	Motor Vehicle Volume Peak Hour in Peak Direction
Protected Bike Lane	Any	Any	Any
Shared Spaces	≤10 mph ≤15 km/h	≤ 1,000	≤60
Bicycle Boulevard	≤ 20 mph ≤ 30 km/h	≤ 500 - 2,000	<50-150
Advisory Bike Lane	≤ 20 mph ≤ 30 km/h	≤ 500-2,000	<50-150
Constrained Bike Lanes	≤ 20 mph ≤ 30 km/h	≤ 1,500-3,000	≤ 300
Constrained Bike Lane *with Buffer*	≤ 25 mph ≤ 40 km/h	≤ 6,000	≤ 600

DESIGN VEHICLE

Design for the most vulnerable street user rather than the largest possible vehicle. While designs must account for the challenges that larger vehicles, especially emergency vehicles, may face, these challenges must not override the safety or comfort of all other users. Assume that emergency vehicles can use the full right-of-way in both directions.

For most urban streets, the largest design vehicle should be a single-unit truck (SU-30) with a turning radius of 42 ft (12.6 m). Lane widths of 10 ft (3 m) are appropriate and positively impact a street's safety without impacting traffic operations.[2]

On streets that serve transit or have more than 10% heavy vehicle traffic, lane widths of 11 ft (3.3 m) may be used. While the SU-30 should remain the design vehicle on these streets, a WB-50 control vehicle may be used at relevant intersections.

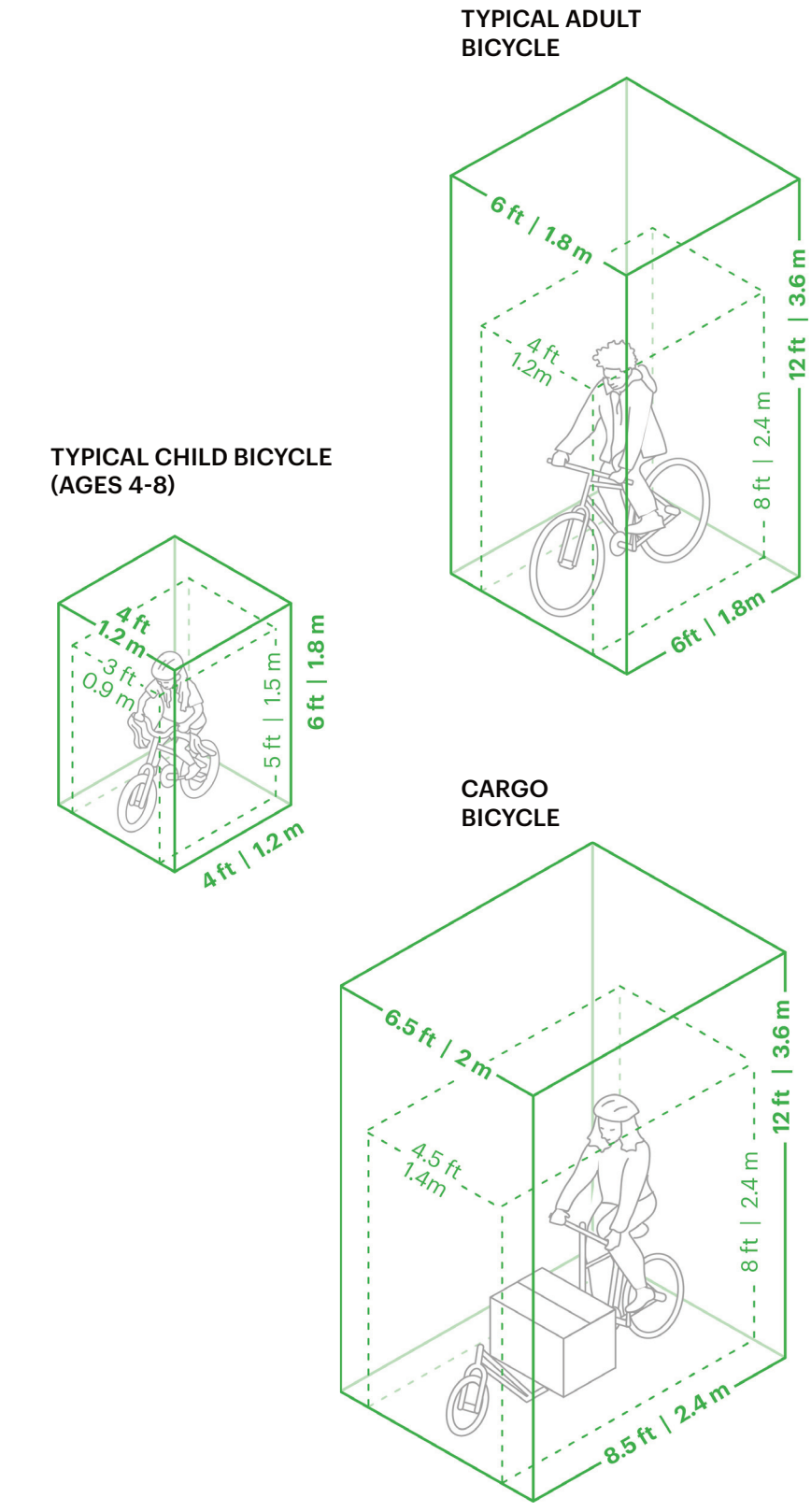
Increases in bikeway width or buffers, even of less than a foot, are noticeable to users and can provide significant benefits, while the same space assigned to a motor vehicle lane is often unnoticeable or even counterproductive.

BIKEWAY DESIGN VEHICLE

Bikeway use is growing in tandem with the diversity of devices, in size and speed, being used. This growth requires new thinking about street and bikeway design. When designing bikeways, the most common devices fit into one of four operational categories:

- → **Mini devices:** Electric and non-electric scooters, skateboards, rollerblades, and other devices under 20 in (50 cm) wide that are typically used while a person is standing upright
- → **Typical bikes:** Electric and conventional upright bikes and tricycles, as well as recumbent bikes, hand cycles, and any wheeled devices up to 2.5 ft (0.8 m) wide
- → **Cargo bikes:** Electric and conventional bikes and tricycles between 2.5-3 ft (0.8-0.9 m) wide that have an extended wheelbase or that are pulling a trailer
- → **Extra-large bikes:** large freight tricycles, pedicabs, and other devices between 3 ft (0.9 m) and typically up to 4.5 ft (1.4 m) wide

Devices from all of these categories should be expected in any bikeway. Designers should provide appropriate width and turning space for the longest and widest device possible.



DESIGNING FOR NON-VISUAL NAVIGATION

As designs shift–from mixing people on bikes with motor vehicles to providing a distinct network for bicycling–new points of interaction emerge between people walking and people on bikes. Some bikeway projects introduce specific design needs for pedestrians, but even when they do not, the design process typically reveals pedestrian needs that have gone unaddressed.

Accessibility is required on all streets. With or without bike-specific infrastructure, people with disabilities have specific design needs at mid-block crosswalks, skewed intersections, complex signalized intersections, and roundabouts. Many bikeway projects offer an opportunity to provide for people with disabilities, including the addition of non-visual navigation tools.

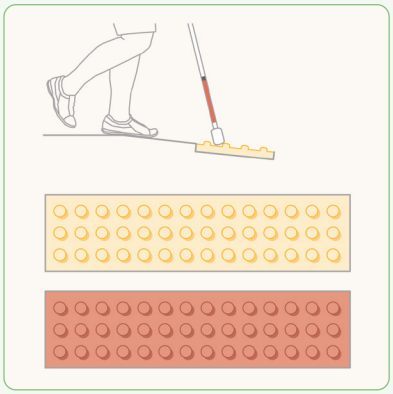
People who are blind or have low vision navigate the built environment by:

- **Aligning with a pedestrian pathway.** By using a combination of the edges of buildings, curbs, furnishings, and sounds, people are able to stay aligned with a sidewalk. In complex environments, Tactical Directional Indicators (TDI) can help indicate an unobstructed path of travel.
- **Aligning with a crosswalk.** Many people who are blind or have low vision use the sound of motor vehicle traffic running parallel to the crosswalk to place themselves in an intersection. Curb ramps should be aligned with a straight pedestrian path of travel and be marked with a Detectable Warning Surface (DWS). Crosswalk markings are often used by pedestrians to keep themselves aligned through the intersection.
- **Detecting a gap.** People who are blind or have low vision rely on their hearing to detect gaps between motor vehicles and determine whether a person in a car or on a bike has yielded to them. However, in most urban environments, they cannot hear bicycles or electric vehicles over typical background noise. Audible, vibrotactile indicators used at traffic signals and beacons and ahead of temporary pedestrian paths help pedestrians who are blind or have low vision better understand their physical surroundings. Such indicators make a low noise to help pedestrians find them and then offer a sound or spoken message that indicates how and when to continue traveling.

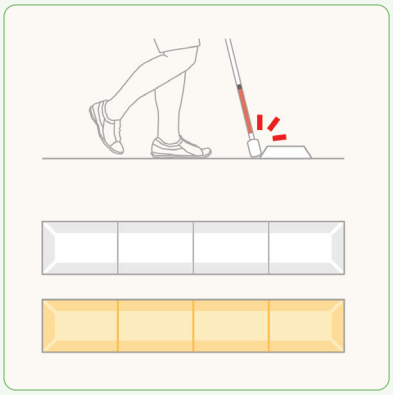
> Detailed design guidance for pedestrian accessibility can be found in the Public Rights-of-Way Accessibility Guidelines published by the U.S. Access Board.

DETECTABLE SURFACES TOOLBOX

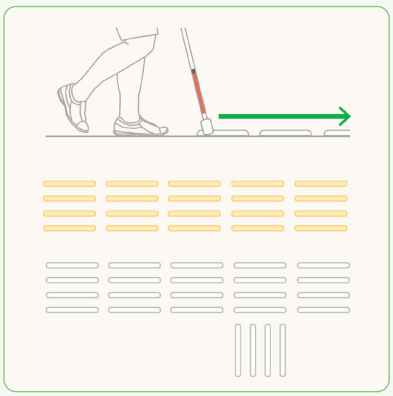
Tactile Walking Surface Indicators (TWSI) refer to a suite of walking surfaces that help pedestrians who are blind or have low vision navigate. All surfaces must contrast light-on-dark or dark-on-light with the surrounding surface.



Detectable Warning Surface (DWS) is a standardized surface comprised of truncated domes that warn of hazards on a circulation path. DWS is required at curb ramps and along transit boarding platforms that do not have screens or guards. Crossing islands that are at least 6 ft (1.8 m) wide should also have DWS.

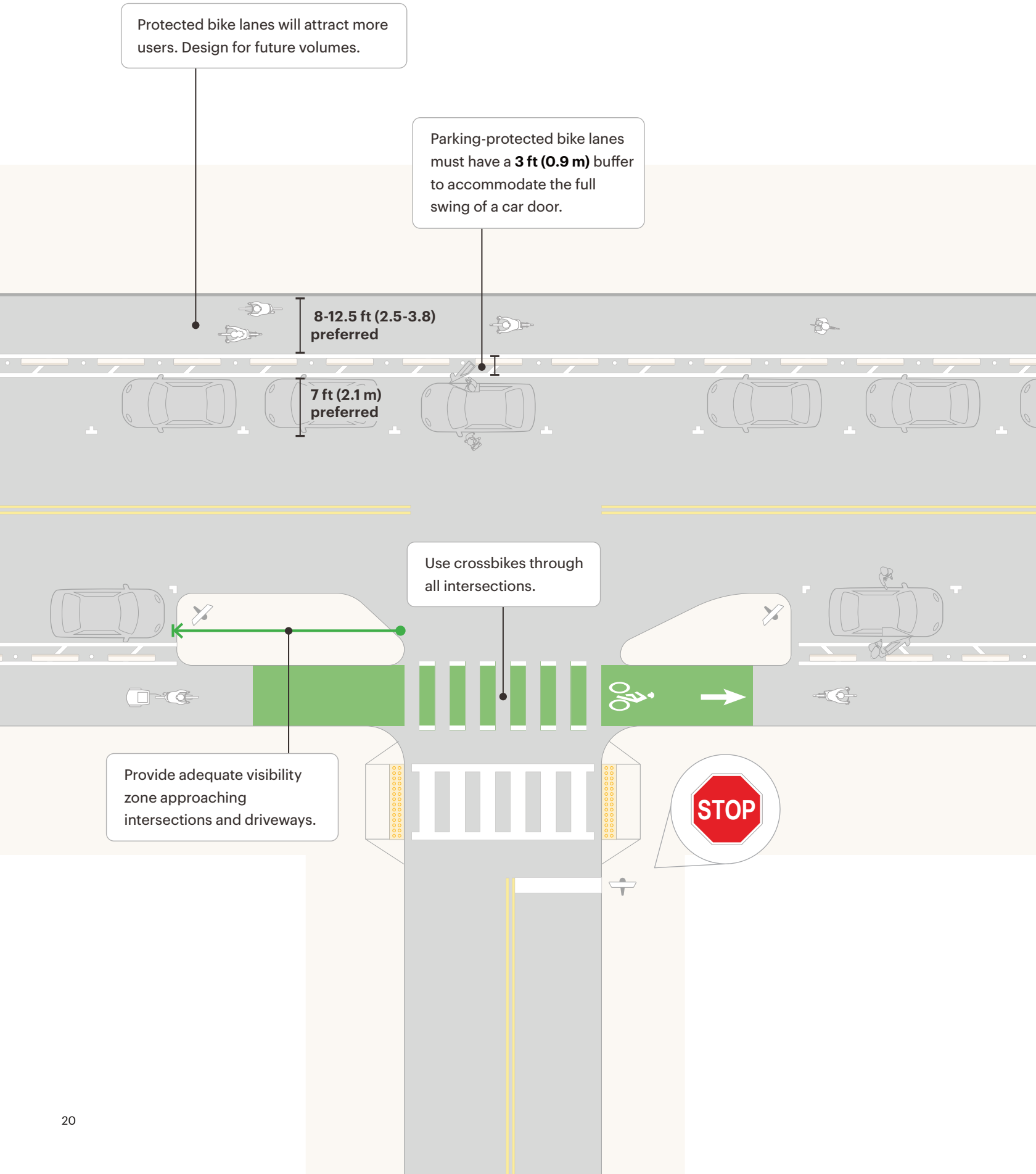


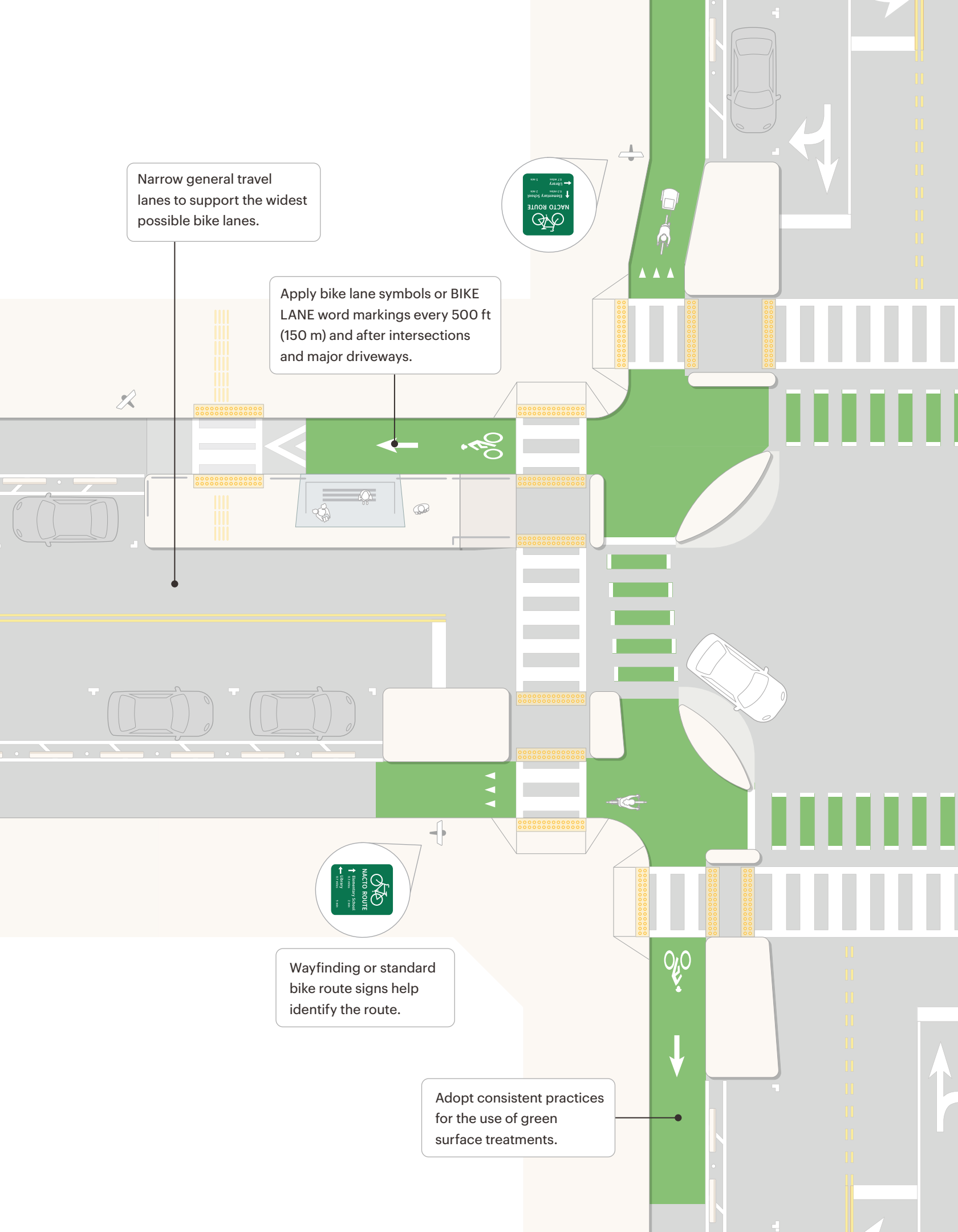
Tactile Warning Delineator (TWD) is a raised, trapezoidal surface that indicates the edge of a sidewalk or pedestrian route. TWDs warn of a hazard when crossed. TWDs are research-backed and becoming a recommended practice in North America. TWDs are used along the edge of a sidewalk-level protected bike lane and may be used to identify the edge of the pedestrian path in a shared street.



Tactile Directional Indicator (TDI) is a surface comprised of raised, parallel, flat-topped, elongated bars. TDIs are widely used internationally but are an emerging practice in the U.S. and Canada. In most cases, TDIs are installed parallel to the direction of travel and centered in the clear pedestrian route. Blind pedestrians and those with low vision understand that TDIs can normally be followed along either side. They also understand that TDIs may be crossed without encountering a hazard, as TDIs do not indicate a hazard or risk.

TDIs have a growing number of uses. TDIs are recommended for leading people to transit stops, aligning with street crossings, and identifying clear pathways in a shared street. Two-foot-wide strips of TDIs oriented perpendicular to the direction of travel are recommended to help pedestrians find and align with crosswalks. A similar layout can be used across a sidewalk to orient pedestrians to a transit stop.


Protected bike lanes will attract more users. Design for future volumes.
Parking-protected bike lanes must have a **3 ft (0.9 m)** buffer to accommodate the full swing of a car door.
8-12.5 ft (2.5-3.8) preferred
7 ft (2.1 m) preferred
Use crossbikes through all intersections.
Provide adequate visibility zone approaching intersections and driveways.
STOP


Narrow general travel lanes to support the widest possible bike lanes.
Apply bike lane symbols or BIKE LANE word markings every 500 ft (150 m) and after intersections and major driveways.
NACTO ROUTE
Wayfinding or standard bike route signs help identify the route.
Adopt consistent practices for the use of green surface treatments.

Geometric design and traffic control provide safe connectivity where bikeways cross streets without the assistance of traffic signals. Bikeway crossings over minor streets, driveways, and major streets present distinct opportunities to improve transportation safety and mobility for all street users. A comprehensive approach to intersection design includes these steps:

Step 1: Evaluate for lane reductions. Consider lane reductions for multilane streets that cross bikeways. Many streets have excess motor vehicle capacity at unsignalized intersections and midblock crossings that leads to high speeds and aggressive movements.[1] Limit the number of lanes at crossing points with a combination of medians, lane reductions with merge signs, and turn-only lane designations.

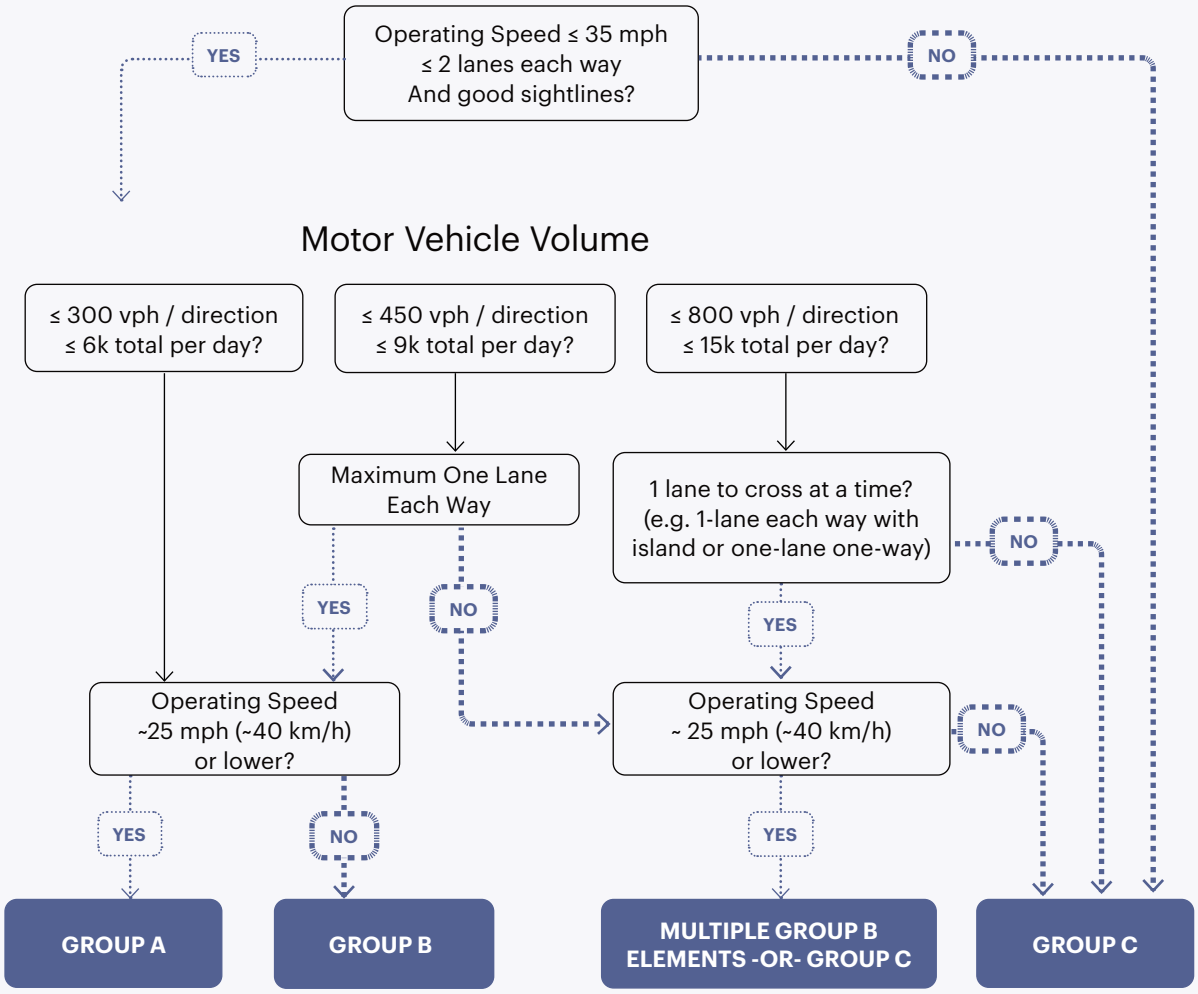
Step 2: Apply roundabout concepts. Roundabouts slow traffic and improve visibility, increasing safety and comfort of people walking, biking, or rolling and can be used in both small and large intersections. At small intersections, neighborhood traffic circles or mini-roundabouts are also appropriate. If a roundabout isn't possible due to project constraints, designers can still apply elements of roundabout design such as intersection setbacks and crossing islands.

Step 3: Reduce speed and volume. Manage motor vehicle speeds to minimize crossing difficulty. Improve the safety and comfort of the bikeway with traffic-calming measures along all streets approaching an intersection or volume management strategies to shift turning movements away from the crossing location. (See 3.1.2 Vehicle Speed and Volume Management.) At the intersection, consider methods to make yielding and turning safer, such as raised crosswalks, approach speed humps, crossing islands, parking restrictions, curb extensions, and appropriate lighting.

Step 4: Identify appropriate intersection control. Intersection control should generally be evaluated after speed reduction measures have been selected. Yield signs, stop signs, or red indications can be used to assign the right-of-way to people on bikes instead of allowing conflicting motor vehicle movements. In lower-volume and lower-speed intersections, assign priority to bikeways by placing stop control on streets crossing bikeways or by applying geometric designs to create all-yield conditions. More intensive traffic controls, such as half-signals or midblock signals, are appropriate when bikeways cross higher-volume or higher-speed streets.

Step 5: Use crossbikes and crosswalks. Crossbikes and high-visibility crosswalks should be used at bikeway intersections. Crossbike options include those with green bars with dotted white lines, green and white 'elephant's feet', and solid green. High-visibility crosswalks positively impact yielding behavior in low-speed, low-volume intersections of two-lane streets and should be considered at all uncontrolled crossings.[2]

DESIGNING SAFE, UNSIGNALIZED BIKEWAY CROSSINGS



GROUP A	GROUP B	GROUP C
→ Neighborhood traffic circle → Crossbike → Gateway treatment → Diverter	→ Raised crosswalk → Raised intersection → Approach speed hump → Gateway treatment → Hardened centerline / Lane line → Rectangular Rapid Flashing Beacon (RRFB) → Mini-roundabout → Corner island → Curb extension → Sidewalk extension	→ Stop control → Hybrid beacon → Half-signal → Roundabout

CONTEXTUAL GUIDANCE FOR PHASE SEPARATION

Signals along bikeways can operate with exclusive bike phases, protected bike phases, partially protected bike phases, or fully permissive phases with complementary motor vehicle and pedestrian movements. At higher-volume turn locations or along higher-volume bikeways, signal phasing techniques are used to separate the stream of turning vehicles from people biking, rolling, and walking. At intersections with relatively low motor vehicle turn volumes, geometric design is often sufficient to mitigate turn conflicts.

Not all turn movements at an intersection will get the same treatment for a single bikeway approach. For example, a bike phase may be fully protected for left turns but protected-permissive for right turns. Engineering judgment should be applied after considering vehicular turn volumes, visibility, grade, crash history, current and expected bike and pedestrian volumes, and the percentage of heavy vehicles moving through the intersection.

Portland, OR

RIGHT TURNS OVER BIKEWAYS

Right turns that operate concurrently with bikeway movements can introduce crash risks to people biking. These conflicts can be mitigated with geometric design strategies that reduce turn speeds and improve mutual visibility on the intersection approach.

Partially protected or protected phases are recommended when peak-hour vehicle right turn volume exceeds approximately 2.5 per cycle over unidirectional bikeways[12] and approximately 2 per cycle over bidirectional bikeways.

Phase separation should also be considered in intersections with large effective radii, channelized turn lanes, and downhill approaches.

Shorter cycle lengths minimize potential conflicts within a given phase, potentially mitigating the need for exclusive, protected, or partially protected bike phases.

HOURLY RIGHT TURN VOLUME ACROSS UNIDIRECTIONAL BIKEWAY

		25	50	75	100	125	150	175	200	225	250	275	300
Cycle Length (Seconds)	50	0.3	0.7	1	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2
	60	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.3	3.8	4.2	4.6	5
	70	0.5	1	1.5	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.3	5.8
	80	0.6	1.1	1.7	2.2	2.8	3.3	3.9	4.4	5	5.6	6.1	6.7
	90	0.6	1.3	1.9	2.5	3.1	3.8	4.4	5	5.6	6.3	6.9	7.5
	100	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	6.9	7.6	8.3
	110	0.8	1.5	2.3	3.1	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.2
	120	0.8	1.7	2.5	3.3	4.2	5	5.8	6.7	7.5	7.5	9.2	10

HOURLY RIGHT TURN VOLUME ACROSS BIDIRECTIONAL BIKEWAY

		25	50	75	100	125	150	175	200	225	250	275	300
Cycle Length (Seconds)	50	0.3	0.7	1	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2
	60	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.3	3.8	4.2	4.6	5
	70	0.5	1	1.5	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.3	5.8
	80	0.6	1.1	1.7	2.2	2.8	3.3	3.9	4.4	5	5.6	6.1	6.7
	90	0.6	1.3	1.9	2.5	3.1	3.8	4.4	5	5.6	6.3	6.9	7.5
	100	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	6.9	7.6	8.3
	110	0.8	1.5	2.3	3.1	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.2
	120	0.8	1.7	2.5	3.3	4.2	5	5.8	6.7	7.5	7.5	9.2	10

Permissive **Partially Protected** **Protected**

While every street needs ongoing maintenance, streets on a city's bike network need special attention. Bikes and micromobility devices—especially those with small or narrow tires and wheels—are more susceptible to debris, ice, potholes, large cracks, and other surface imperfections.

In many cities, bikeway maintenance practices will be iterative. It will take time to determine the best equipment for the local context, set the correct service levels, and solve coordination issues, such as with utility work, that change with the addition of bikeways. Collaboration and shared learning across teams is essential. Coordinate directly with maintenance crews inside and outside of the implementing agency to understand what tools, skills, and funding will be needed to keep the bikeway clear and rideable all year. City leaders should prioritize funding for maintenance and demonstrate a willingness to learn and adapt.

If possible, fold bike project maintenance into maintenance for other transportation infrastructure, such as sidewalks. Combining maintenance plans can help ensure that all street users feel respected and ease opposition to new bike facilities among those who do not ride bikes.

Maintenance concerns, while valid, are not a reason to stop a bikeway project or diminish an All Ages & Abilities design. It is perfectly acceptable to not have all of the answers at the design, or even implementation, stage. Cities across North America have found successful strategies and continue to innovate.

A bike network is a core component of the transportation system and needs to be accessible year-round. The accumulation of debris, snow, or ice in bikeways poses a significant safety risk and can discourage people from riding bikes. Design and policy decisions that prioritize regular bikeway clearing make it possible for people to access bike networks in all weather conditions.

Maintenance teams should be consulted and involved in the design of bikeways to help ensure that clear, smooth bikeways are available citywide. Designing bikeways that accommodate existing equipment for sweeping and snow clearing helps ensure bikeways are available year-round. In most cities, a 6.5-7.5 ft (2-2.3 m) minimum clear width in the bikeway is necessary. This width also supports All Ages & Abilities users by allowing space for platooning, passing, and riding side-by-side.

Formal maintenance agreements with private property owners, institutions, and other third parties can help enhance a city's ability to keep its bike network clear year-round. Such agreements should always be supplemental to existing maintenance activities and not used to absolve the municipality of bikeway maintenance. Bikeways should be designed to meet city standard specifications in case third parties are unable to renew agreements.

Seattle, WA

SIDEWALK AND BIKEWAY CLOSURES

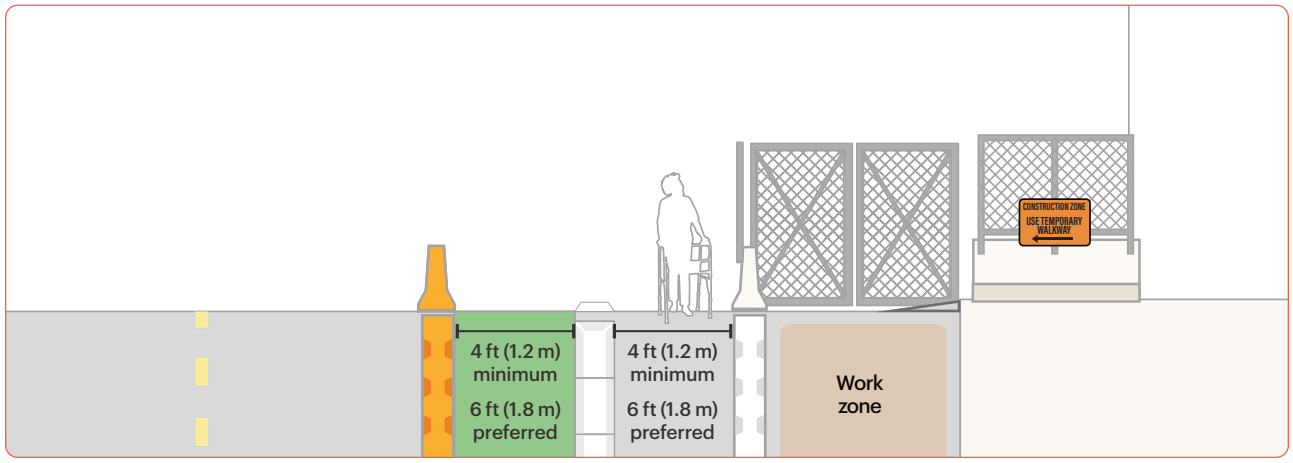
Where construction impacts both the sidewalk and the roadway, it is still feasible and important to preserve the bikeway. Aim to maintain separate facilities for walking and biking.

In the United States, the Public Right-of-Way Accessibility Guidelines specify requirements for alternate pedestrian access routes. If using a fence, cones, drums, or other barricade, it must be used for the length of the route, be no lower than 32 inches (815 mm), and no more than 2 in (51 mm) above the walking surface. Proximity-actuated audible signs or other non-visual means of conveying the alternate pedestrian access route and TDIs should be used.

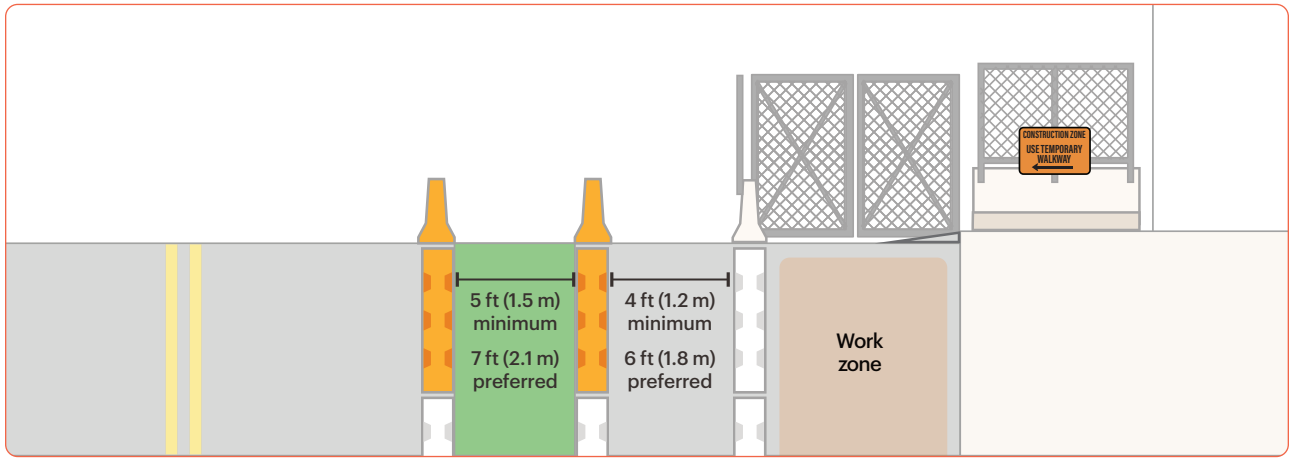
Bikeways may share space with the alternate pedestrian path, if necessary. During construction, the pedestrian path will become more difficult to navigate. Additional care should be given to encourage people on bikes to stay clear of the pedestrian path. Follow all accessibility requirements for sidewalk closures. Include signs, markings, and tactile warning delineators.

Washington, D.C.

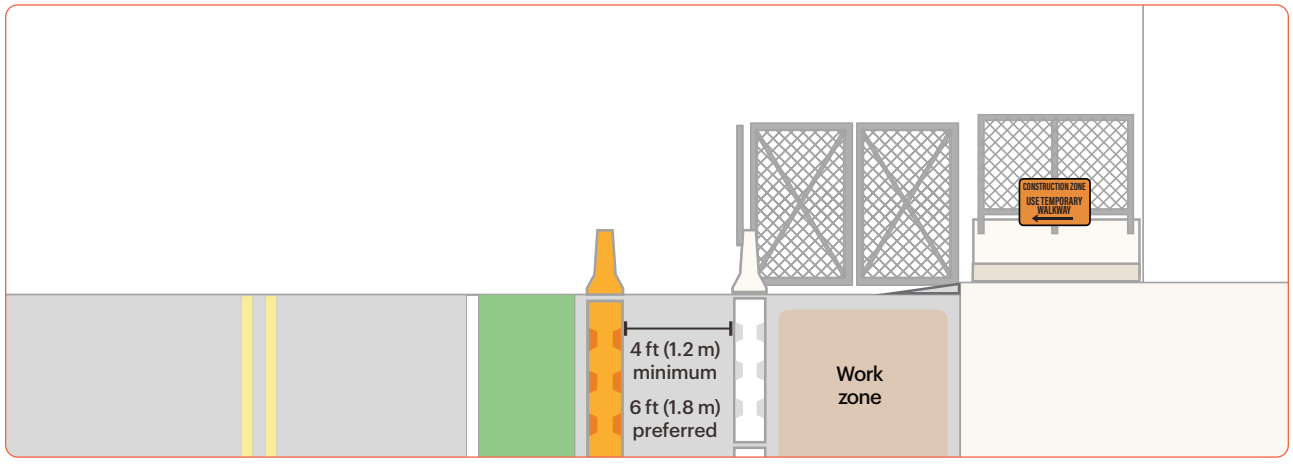
OPTION: SEPARATE WITH TACTILE WARNING DELINEATORS



OPTION: SEPARATE WITH CONTINUOUS BARRIERS



OPTION: DOWNGRADE TO CONSTRAINED BIKE LANE



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