



TRANSITMATTERS

# MOBILITY HUBS TOOLKIT





# A NOTE FROM OUR DIRECTOR

Mobility is a fundamental human right, and for me it's personal. My love of public transportation doesn't come from a childhood of watching trains on my father's shoulder, but instead from a fascination with the ways in which great public transit systems connect us. They connect us to each other, but they also connect us to jobs, opportunity, education, healthcare, arts & culture, and so much more. I also think about how walking and cycling have been crucial for me in these difficult past few years. In the early days of COVID when public transit usage was discouraged and even through the first summer during the pandemic, walking and cycling opened up the region in new and exciting ways (and were therapeutic in many ways!).

Many of the best parts of transportation aren't the big flashy items. We don't often think about the magic of a journey that goes just right. We don't always notice when the bus stop is comfortable, when the information about the next trip is readily available, and when you're able to step directly onto the bus without much thought. Similarly, with walking or cycling, everyday residents don't always take note of when the sidewalk is in excellent shape and accessible ramps are present or take note of a separated bike facility. But we know that all of those things encourage transit ridership, walking, and cycling.

Our toolkit is all about empowering communities to implement these relatively low-cost solutions that can be scaled to fit an individual community's needs. This toolkit seeks to ground the vague notion of "Mobility Hubs" in four key elements: accessibility- covering both ADA access and access to mobility; safety/comfort- incorporating placemaking, lighting, and more; information- including wayfinding and trip planning tools; and lastly micromobility- bridging the last mile problem. These elements are at the core of equitable, safe, enjoyable mobility. Mobility hubs must get all of them right- and this toolkit provides a roadmap to incorporating them in a context-specific way.

This toolkit has been informed by both extensive research and on-the-ground experience. As mentioned earlier COVID has changed the mobility landscape and tools like Mobility Hubs are essential for the future of our cities and towns. Whether it's responding to the dramatic increase in walking

and cycling or addressing the issues that make transit a hassle to bring riders back- Mobility Hubs can play a significant role in making sustainable mobility work better.

We're thrilled to share this resource with you. It's intended for anyone who's interested in making positive changes to further sustainable mobility, be it neighborhood associations, regional and local governments, transit agencies, or private institutions, we hope this toolkit provides you with the tools to get started. Keep on movin' and best of luck!



Jarred Johnson  
Executive Director



## TRANSITMATTERS

TransitMatters is a 501(c)(3) nonprofit dedicated to improving transit in and around Boston by offering new perspectives, uniting transit advocates, and informing the public. We utilize a high level of critical analysis to advocate for plans and policies that promote convenient, effective, and equitable transportation for everyone.

# TABLE OF CONTENTS

<b>Introduction</b>	<b>6</b>
<b>Mobility Hubs User Stories</b>	<b>8</b>
<b>Corner Hub</b>	<b>9</b>
Janna	10
<b>Neighborhood Center Hub</b>	<b>12</b>
Carmella	13
Luis	15
<b>Gateway Hub</b>	<b>17</b>
Alex	18
<b>Advocating For Mobility Hubs</b>	<b>20</b>
<b>The Elements</b>	<b>28</b>
<b>Accessibility</b>	<b>29</b>
Sidewalks	30
Bus Level Boarding	34
Fare Vending Machines	37
Curb Management	41
<b>Comfort and Safety</b>	<b>45</b>
Bus Shelter and Seating	46
Street Lighting	50
Crosswalk Addition	52
Heating	56
Parklets	58
Public Art	61
<b>Information</b>	<b>64</b>
Countdown Clock	65

Real Time Information Kiosk	69
Wayfinding Signage	73
Public Wifi	77
<b>MicroMobility</b>	<b>79</b>
Bikeshare Station	80
Bike Racks and Cages	84
Electric Bike/Scooter Charging Station	87
Bicycle Repair Station	91
<b>Acknowledgements</b>	<b>95</b>

# INTRODUCTION

## What is a Mobility Hub?

Mobility Hubs are places that connect different modes of transportation (such as bus, subway, or bikeshare), making transfers between them easy and convenient. They are ideally located close to where people congregate to work, play, shop, and have fun. Whether you are walking, biking or ridesharing to your final destination, Mobility Hubs offer infrastructure that is accessible and user-friendly. Beyond connecting different transit options, Mobility Hubs improve the transit experience with elements such as bus shelters, information displays, and parklets. Mobility Hubs are a necessary component of a well-functioning transit system; they empower people with information and connections to move around freely.

### A Mobility Hub is:

- Safe. Riders are protected from weather and traffic while they wait. The area is well-lit, with accessible pedestrian crossings and well-maintained sidewalks.
- Informative. Countdown clocks let you know in real time when the next bus or train is arriving. Wayfinding signs direct people to nearby destinations.
- Pleasant. Mobility Hubs are clean and well-maintained, with trash cans, shelters and benches. Mobility Hubs include refreshing greenery and interesting public art.

## Why Mobility Hubs?

Mobility Hubs are the cornerstones of a great transit system. They improve the transit experience and make it easier for people to use transit. For example, wayfinding, countdown clocks, and shelters give riders what they need to make timely bus transfers in a safe and comfortable manner.

Mobility Hubs provide accessible public space for people to sit and chat, eat, or just take a break. They are near shops, parks and other destinations. Shelters and benches are available, and public art decorates the area.

Mobility Hubs are built with sustainability in mind. Most of the infrastructure that requires electricity is solar powered. Mobility Hubs encourage biking by providing elements that support them, such as bike racks, bikeshare stations, and electric bike charging stations. Most importantly, Mobility Hubs elements increase transit use, providing the public a sustainable way to get around easily.<sup>1</sup>

## Elements

Mobility Hubs are modular, composed of individual elements such as bike racks or bus shelters. Each element is useful by itself, but some elements complement each other especially well (such as bike racks and bicycle repair stations). Elements can be mixed and matched based on the needs of the community at the Mobility Hub, and the specific opportunities and constraints of the site.

---

<sup>1</sup> Kim, Bartholomew, Ewig. Another one Rides the Bus? The connections between bus stop amenities, bus ridership, and ADA paratransit demand.

# Types of Mobility Hubs

Mobility Hubs can range in size from a bus stop with a shelter and a bike rack, to a central station serving multiple rail lines and bus connections. Depending on its place in the transit system, riders, and connections, a Mobility Hub will have different elements built to serve the needs of its riders.



## Corner Hub

Corner Hubs are small stops near residential or small-scale commercial areas. This Hub is often a user's first stop (when they leave home) and last stop (coming back home) on their trips. They often have only basic amenities, such as a bike rack and shelter.



## Neighborhood Center Hub

Neighborhood Center Hubs are larger stops at important destinations in a neighborhood. Bus lines that serve the same neighborhood usually converge at the Neighborhood Center Hub. A Neighborhood Center Hub will have more Mobility Hub elements than a Corner Hub, such as rideshare pickup/drop-off areas, fare vending machines, and neighborhood maps.



## Gateway Hub

Gateway Hubs connect the area around the Hub to the rest of the region via rapid transit. This includes regional (commuter) rail stations and subway stations. Gateway Hubs are the largest and contain the most amenities, such as large bicycle cages, WiFi, and bicycle repair stations.

# About this Guide

This handbook is a guide to building Mobility Hubs in your community. Included are a list of elements, what they do, and what benefits they bring. After you've decided what elements you need in your Mobility Hub, the next section details how to advocate for building those elements.

This guide will show you how to find unmet needs for the Mobility Hubs in your community, and how to advocate for building great Mobility Hubs.

Imagine what your stop could look like.

# **MOBILITY HUBS USER STORIES**

How Mobility Hubs can improve transit is best shown through the following characters and their experiences with a new Mobility Hub in their neighborhood.

## **CORNER HUB**

**Janna**

## **NEIGHBORHOOD CENTER HUB**

**Carmella**

**Luis**

## **GATEWAY HUB**

**Alex**

# CORNER HUB



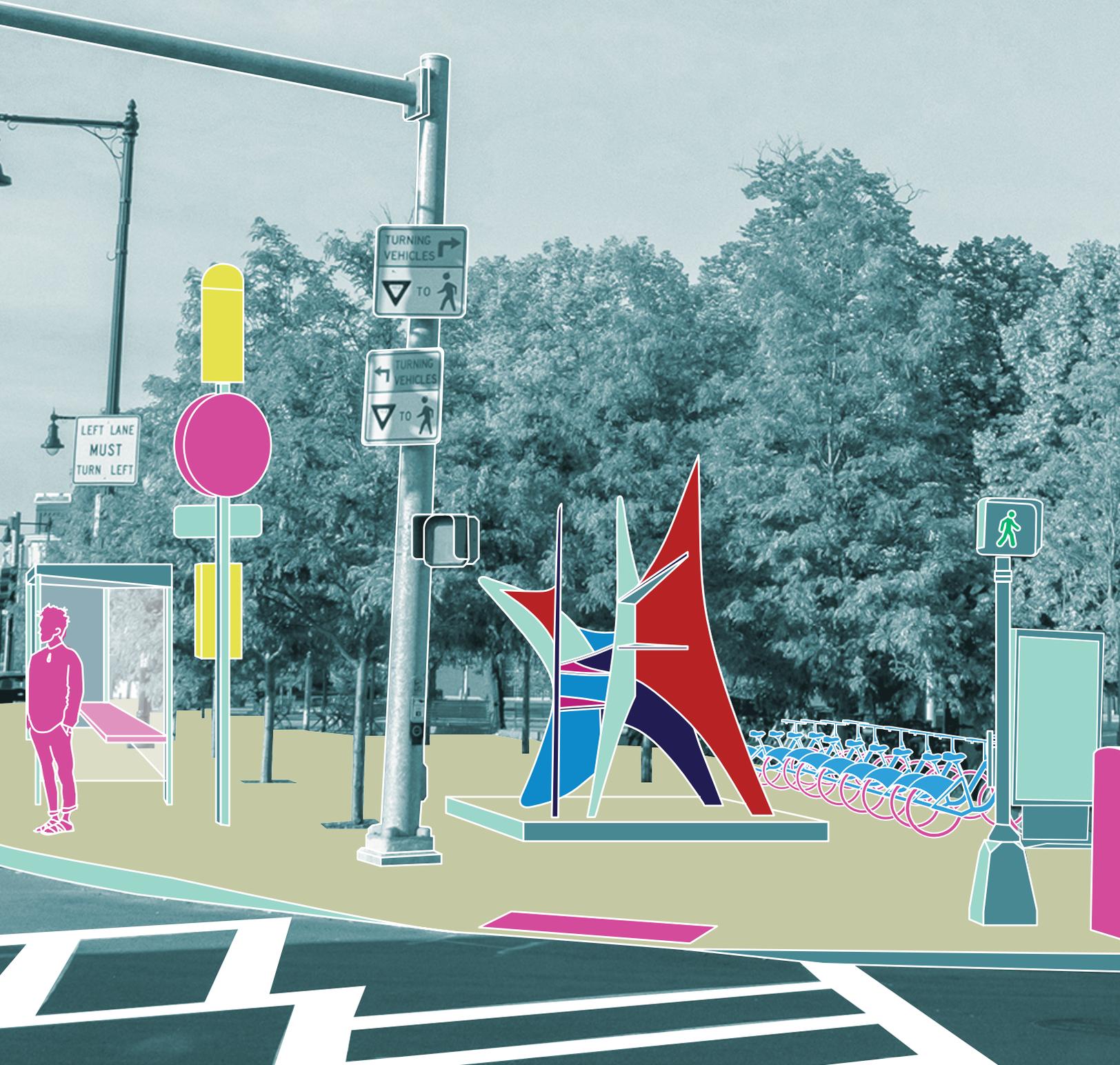


# JANNA

Janna uses a wheelchair and works the late shift downtown. Before the Mobility Hub was installed at her stop, the sidewalks were difficult to navigate. At night, poor lighting made it hard to see gaps in the sidewalk. In inclement weather, the lack of shelter at her bus stop meant she had to use a taxi to get to her job, increasing her transportation costs considerably.

Since the Mobility Hub was implemented, the sidewalks have been repaired, and a new shelter has been built. Janna feels comfortable taking the bus more often, decreasing her transportation costs. The addition of level boarding ramps has made it easier for her to get on and off the bus, getting her to her destination sooner. To Janna, the Mobility Hub's safety and accessibility has improved her commute.

# NEIGHBORHOOD CENTER HUB





# CARMELLA

Carmella is 78, and uses a cane for stability. Since her husband died, she depended on friends and family to take her grocery shopping. She wanted to do things on her own, such as visit the library or grocery store, but she was not sure how to access the bus system and was afraid to cross the busy streets near her house.

Since a Mobility Hub has been installed near her home, Carmella has experienced new opportunities. Pedestrian lights at a key crosswalk have made crossing easy for Carmella. New wayfinding signs and maps show her how to access transit. A new countdown clock tells her if she has enough time to stop for coffee before the bus arrives. The Mobility Hub has opened up her world and granted her more independence.



# LUIS

Luis moved to the neighborhood recently, and is eager to explore his neighborhood. The lack of wayfinding signs and maps in the neighborhood made navigation difficult. Luis enjoys biking, but bike lanes are few and far between. He's had a few near accidents with aggressive drivers, and is reluctant to take his bike very far.

With the installation of a new Mobility Hub in his neighborhood, signs have made it easy to find his favorite destinations. Luis now feels confident riding his bike to the library knowing he will not get lost. New bicycling facilities have made biking safer and more comfortable. He has even started to lock his bicycle in the new bike cage at his Neighborhood Center Hub before he takes the bus downtown. For Luis, the Mobility Hub has enabled him to navigate his neighborhood and access key destinations with confidence.

# GATEWAY HUB





# ALEX

Alex is a nurse who works at a hospital on the other side of the city. He commutes by car, but heavy traffic makes the journey long and stressful. While he was interested in using transit to commute to his job, the lack of nearby bus stops and biking infrastructure made commuting by transit impossible. A new bike cage at a nearby Gateway Hub means he can ride his bike to a train station and transfer to the subway. He uses a bike share on the other end of his journey to get to the hospital. When the weather is bad, he takes a bus instead, avoiding traffic in the dedicated bus lanes. With the new Mobility Hubs set up across the city, Alex gets to his job faster, saves money, and has a less stressful commute.

# ADVOCATING FOR MOBILITY HUBS



# USING THIS TOOLKIT AND ADVOCATING FOR MOBILITY HUBS

Now that you've seen the possibilities of Mobility Hubs, it's time to build your own. This section of the guide will show you how to advocate for Mobility Hubs in your neighborhood. This toolkit is intended for use by a broad range of people, from community members, to developers, to advocates. While much of the information in this toolkit is broadly applicable, our organization is immersed in an Eastern Massachusetts context and some of the information in this toolkit may be more or less applicable depending on where you are located.

## Determine Your Mobility Goals

What problems are you trying to solve with Mobility Hubs? Your own experiences with transit can be a guide to what to work on.

Ask yourself: What frustrations do you have with transit? What is preventing you from using transit? Is your stop accessible? Do you not know when the next bus or train is coming because there is no countdown clock? What was confusing about transit the first time you used it?

Imagine yourself as a user who has never been to an area before, or a user without a cell phone. Could you find your route and connections easily? Take a friend who is unfamiliar with transit and see how they navigate. Is it easy for them to make connections? Are they easily able to find their destinations? Are they able to easily read and understand the schedule?

## Gather Input

In addition to your own needs, you should also consider the mobility needs of your community. To get community input, you can do intercept surveys, where you and other surveyors directly interview riders. QR codes and links to your survey can be posted at stops to provide input without a surveyor.

When doing intercept surveys it's important for your survey team to be diverse and your respondents should be comfortable with the surveyor. Your survey should be short - keep the questions under 3-4 minutes. They should gather respondents at a variety of times of day and places. You should ensure your respondents reflect the diversity of your community, and you should conduct the survey in the languages people speak in the area you are surveying. You can also survey local businesses and community organizations to get an idea of why people aren't using transit.

Questions you should ask:

- What is the purpose of your trip?
- How do you get to your final destination from transit? (Walk, Rideshare, Bike, Bus, etc)
- Which of the following features would you appreciate the most? (List elements such as Shelter, Bike Rack, Maps, Schedule, etc)
- What other modes of transportation do you use if not using transit? How would you make this trip if the bus (or train) wasn't running?

You can also find more creative ways to gather input. In 2014, advocates in Boston set up a stand near the Four Corners station. Cups were attached to the wall of the stand, representing a different element, such as “wayfinding signage” or “wifi”. Visitors dropped popsicle sticks into the cups to vote for what elements they wanted, and also had the option to write their own suggestions. Experiments like these can engage the public at a low cost and solicit input from people unlikely to attend public meetings.

Based on what you learn, select the most important need from among the four categories below. Your mobility goals will help you decide what sites you choose to improve and what elements you select will be based on those goals.

## Accessibility

Accessibility elements aim to make transit open to all. Some bus stops are not wheelchair accessible, whether by not having a direct paved path to the curb or not having a sidewalk at all. Other items like multilingual fare vending machines help riders pay fares at the mobility hub.

## Comfort and Safety

Inclement weather or oncoming traffic can make using transit dangerous or unpleasant. Elements such as shelters, crosswalks and lighting make waiting for the bus safer and more comfortable.

## Information and Wayfinding

Transit agencies often believe that users understand the entire system, when riders do not know what services are available or when they come. Informative signs, displays and schedules give riders confidence to use transit. Countdown clocks and wayfinding signage can prevent people from getting lost, make existing riders more comfortable and raise awareness of transit options.

## Micromobility

Micromobility vehicles such as shared bikes and scooters allow users to quickly get to and from areas not served by transit. Elements such as bike share stations and secure bike parking provide a seamless connection for micromobility users.



## Identify Potential Locations

After selecting your mobility goals, next consider where to site your Mobility Hub. Identify centers and corridors where two or more transit routes meet and run frequently, or where rapid transit lines have stations. These areas are good places to consider for hubs of different scales, depending on the number of services and number of users that pass through the site. Did riders report in your intercept survey that a specific area could be better? There may also be existing initiatives in your city to improve a business district or neighborhood. Mobility Hubs can be integrated into an existing project easily.

Once you've selected a location, you should do a transit study of the area, an evaluation of what elements already exist, and what is missing. Print out maps of the area you are considering and do a walkability study. Walk along your target route and make a note of:

- Inaccessible sidewalks (cracks, no sidewalk, not wide enough)
- Inaccessible bus stops (no curb-cut or sidewalk to the stop)
- Amenities - stores, points of interests (Does it make the walk more interesting?)
- Locations for ridesharing
- Elements already in place
- Potential elements
- What stops are the most used
- Intersections (for wayfinding signage)
- Where are bike racks and cages? Are there important destinations without bike parking?
- Areas suitable for bikeshare?
- What stops have bicycle parking?

## Select the Elements

Using the map from the walkability study, write down elements that will solve each problem you've identified. For example, inaccessible sidewalks should be marked with the sidewalk repair element. Prioritize elements based on cost/benefit and your mobility goals.

Once you've selected the elements, add up the total costs of the elements to create an estimated budget.

## Build Community Support and Gather Feedback

After finding a site and selecting the elements, you will need help constructing the Mobility Hubs. You should reach out to others.

Local organizations that may also be interested in Mobility Hubs:

- Municipal transportation planners or agencies
- State transportation planners or agencies
- Your local transit authority's customer experience department and service planners
- Community Development Organizations (CDOs)
- Chambers of commerce
- Local business associations (Downtown/Main Street)

When reaching out, take the perspective of who you are communicating to, and emphasize the benefits Mobility Hubs bring to their cause. When talking to businesses, mention that Mobility Hubs can increase sales and customer traffic. Neighborhood associations may be more interested in how Mobility Hubs offer biking infrastructure and public art, while improving mobility options for residents; they may also need some convincing if parking might need to be removed. Transit agencies should hear how Mobility Hubs can improve ridership and customer experience. And transportation departments and planners will appreciate hearing how Mobility Hubs can help address existing transportation goals and needs and fulfill existing transportation plans.

## Identify the Jurisdictions and Implementers

Each element has a "jurisdiction" section identifying who is likely to be responsible in your area for setting up the element. Reach out to them and gather feedback about your ideas and how you can work together to implement it. Create communication channels you and other interested community members can use to reach out to local and/or state elected officials who can help push through your vision and/or help with funding.

Rendering drawings of the proposed elements will bring life to the Mobility Hub and allow people to picture themselves using it. Get feedback from the community and stakeholders. Are the elements solving the most important problems?



## Funding Sources

Many of the elements are inexpensive. A small fundraiser or local business may chip in to cover the cost. Advocates should educate local businesses on the commercial benefits Mobility Hubs provide. Mobility Hubs advocates can also apply for grants, to fund the purchase of elements. Some mobility hubs projects may fit into regional or local plans and projects; if it fits in with other initiatives, you may be able to fund it as part of another project.

## Pop - Up Elements

Another way to demonstrate the value of installing new elements is to install cheap/disposable replicas. If riders like the element, it will create buzz and the expectation that those elements will stay, boosting popularity. For example, installing wayfinding signage in one location can inspire demands to have it installed over the entire transit network. This should be done in partnership with the infrastructure owner - depending on the street or right-of-way, this may be the local transit agency, the municipality, the state, or even a private property owner.

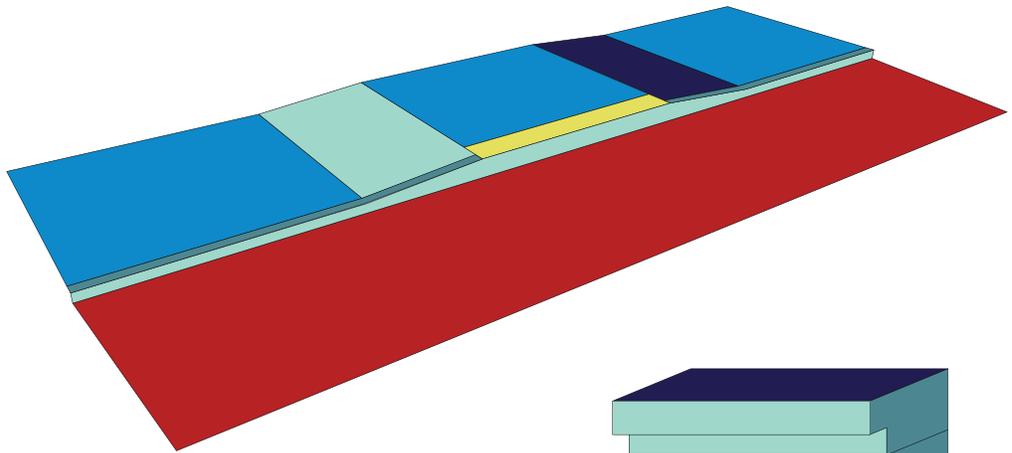
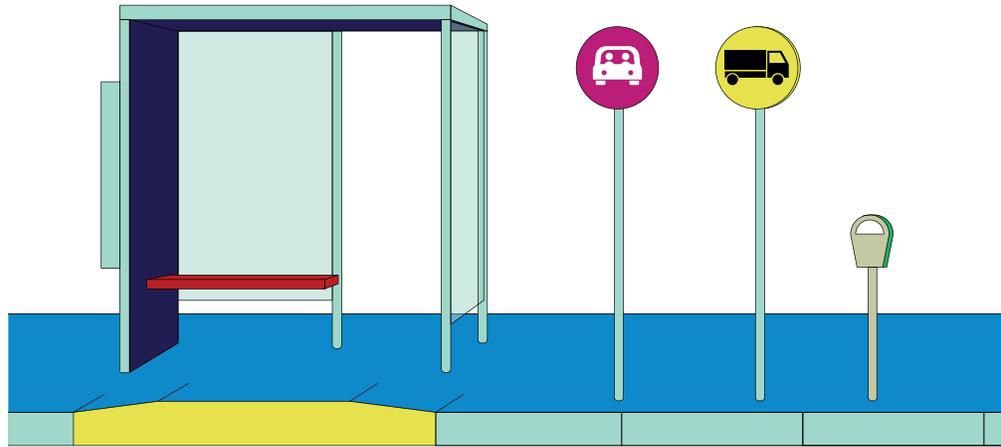


# THE ELEMENTS

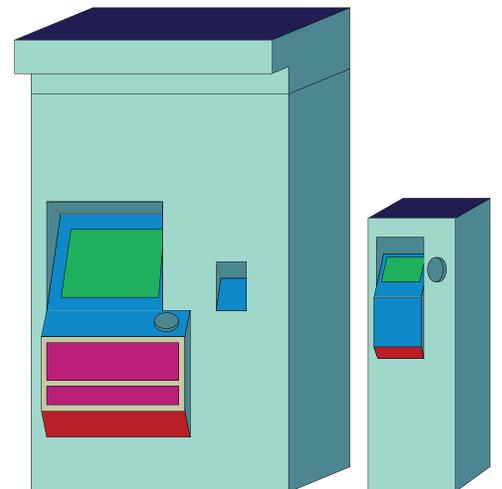
The elements are the building blocks of Mobility Hubs, and come in a variety of forms and functions. In the toolkit, the elements have been divided into categories based on their role at a Mobility Hub.

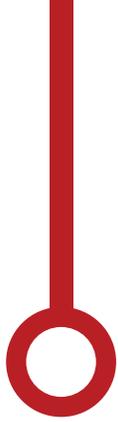
**ACCESSIBILITY**  
**COMFORT/SAFETY**  
**INFORMATION**  
**MICROMOBILITY**

# ACCESSIBILITY



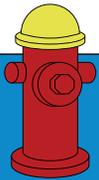
Accessibility elements ease the use of transit for everyone, especially those with disabilities. Elements such as level sidewalks and bus level boarding improve access and speeds up transit. Convenient fare machines ensure nobody is left without a ticket. Adding accessibility elements to your Mobility Hub ensures transit is open to everyone.





# SIDEWALKS

## ACCESSIBILITY



### Description

The sidewalk separates pedestrians from car traffic, and is the pathway to and from all businesses facing the street. Sidewalks are also a gathering place of their own! Benches, street vendors, outdoor dining tables, and stoops or porches allow people to use the sidewalk not only to move from one place to another, but as a pleasant place to interact with the built environment and each other.

However, as sidewalks age, they can impede mobility, especially for those with disabilities. Sidewalks are generally rated to last 25-30 years<sup>1</sup>, but tree roots and shifting ground can cause them to crack or change height sooner. Uneven sidewalks are a safety hazard—they are not traversable by wheelchair and can trip the unsuspecting pedestrian. Curb cuts may be missing at intersections, preventing wheelchair users from accessing a crosswalk. Many streets do not have sidewalks at all, forcing pedestrians to put themselves at risk walking in the road, or to take a more circuitous route.

This element is a critical part of any Mobility Hub.

<sup>1</sup> Transportation Research Board of the National Academies. Estimating Life Expectancies of Highway Assets Volume 1: Guidebook. [https://nacto.org/docs/usdg/nchrp\\_rpt\\_713\\_thompson.pdf](https://nacto.org/docs/usdg/nchrp_rpt_713_thompson.pdf)



## Benefits

Well-maintained sidewalks allow people on foot or with mobility impairments to travel along a street safely. Good sidewalk design can encourage walking by making it more attractive, improving public health and encouraging socialization.<sup>2</sup> A high-quality street environment is an economic benefit for commercial districts and a quality of life benefit for neighborhoods. Walkable places have higher land values, can support more amenities with less car traffic, and shorten the trip times of residents.<sup>3</sup> At Mobility Hubs, sidewalks center a station in its neighborhood by connecting it with the places immediately around it.

- Sidewalks should be at least 5 feet wide at all times, wide enough for two people to walk past each other or for a wheelchair to pass comfortably, with enough space around bus stops or other street furniture.<sup>4</sup>
- Curb cuts and crosswalks should be present at every intersection, built with a gentle slope and proper drainage so that pools of water don't form at the corners.
- In the winter, sidewalks should be cleared of snow, salt or other methods should be used to prevent ice from building up, and crosswalks should not be blocked.
- Cracks or pinch points severe enough to prevent a wheelchair user from getting around their community should be fixed.

## Things to Consider

### Siting

Every urban neighborhood street and arterial road should have sidewalks in order to provide people on foot or in a wheelchair a safe pathway around their neighborhood. If a street is missing sidewalks but connects important destinations, there will still be people walking along it - only they will be in constant danger of getting hit by drivers.

Sidewalks interface with every other element in this guide, and every bus shelter, street light, or bike rack needs to be placed so as not to block the sidewalk. The connectivity that underlies a Mobility Hub only functions if people can walk to and from the hub.

### Accessibility

The Americans with Disabilities Act (ADA) has detailed requirements for acceptable sidewalk conditions, including width, slope, and protocols for intersections. Some basic requirements include:

See the US Access Board Guide to the ADA Accessibility Standards for a technical description of ADA requirements.

<https://www.access-board.gov/ada/guides/chapter-4-ramps-and-curb-ramps/>

### Costs

Often, sidewalk projects are funded as part of larger street reconstruction projects, or sections are rebuilt as part of private developments on the adjacent street. For small spot repairs, estimates for repairing a 160 square feet sidewalk ranged from \$663 to \$2,057 with an average cost of \$1,352. Contracting repairs of a concrete sidewalk generally cost \$9 per square foot.<sup>5</sup> On a city budget level, small sidewalk repairs are relatively inexpensive! But in a city with many miles of broken sidewalks, the city's budget and attention is easily diverted toward flashier projects.

When building new sidewalks, costs can vary depending on the available space next to the street, the amount of utility infrastructure that needs to be moved, and features of the sidewalk such as street trees.

<sup>2</sup> National Association of City Transportation Officials, Urban Street Design Guide: Sidewalks.

<https://nacto.org/publication/urban-street-design-guide/street-design-elements/sidewalks/>

<sup>3</sup> Joe Cortright, Walking the Walk: How Walkability Raises Housing Values in U.S. Cities (Chicago: CEOs for Cities, 2009). [https://nacto.org/docs/usdg/walking\\_the\\_walk\\_cortright.pdf](https://nacto.org/docs/usdg/walking_the_walk_cortright.pdf)

<sup>4</sup> ADA Solutions LLC, ADA Sidewalk Requirements in 2020. <https://adatile.com/ada-sidewalk-requirements/>

<sup>5</sup> HomeAdvisor, How Much Does It Cost To Repair Or Resurface A Patio Or Walkway? <https://www.homeadvisor.com/cost/outdoor-living/repair-a-patio-or-pathway/>

## **Jurisdiction/Implementer**

Whoever owns the road is usually responsible for maintaining the adjacent sidewalk. Cities maintain their sidewalks through a Department of Public Works or similar department. In some places, abutting residents or homeowners' associations are responsible for maintaining and clearing the sidewalks in their area. Different elements on a sidewalk may be under different jurisdictions: trash cans, bus shelters, street trees, utility poles, and parking meters might all be controlled by different city agencies.

## **Equity Considerations**

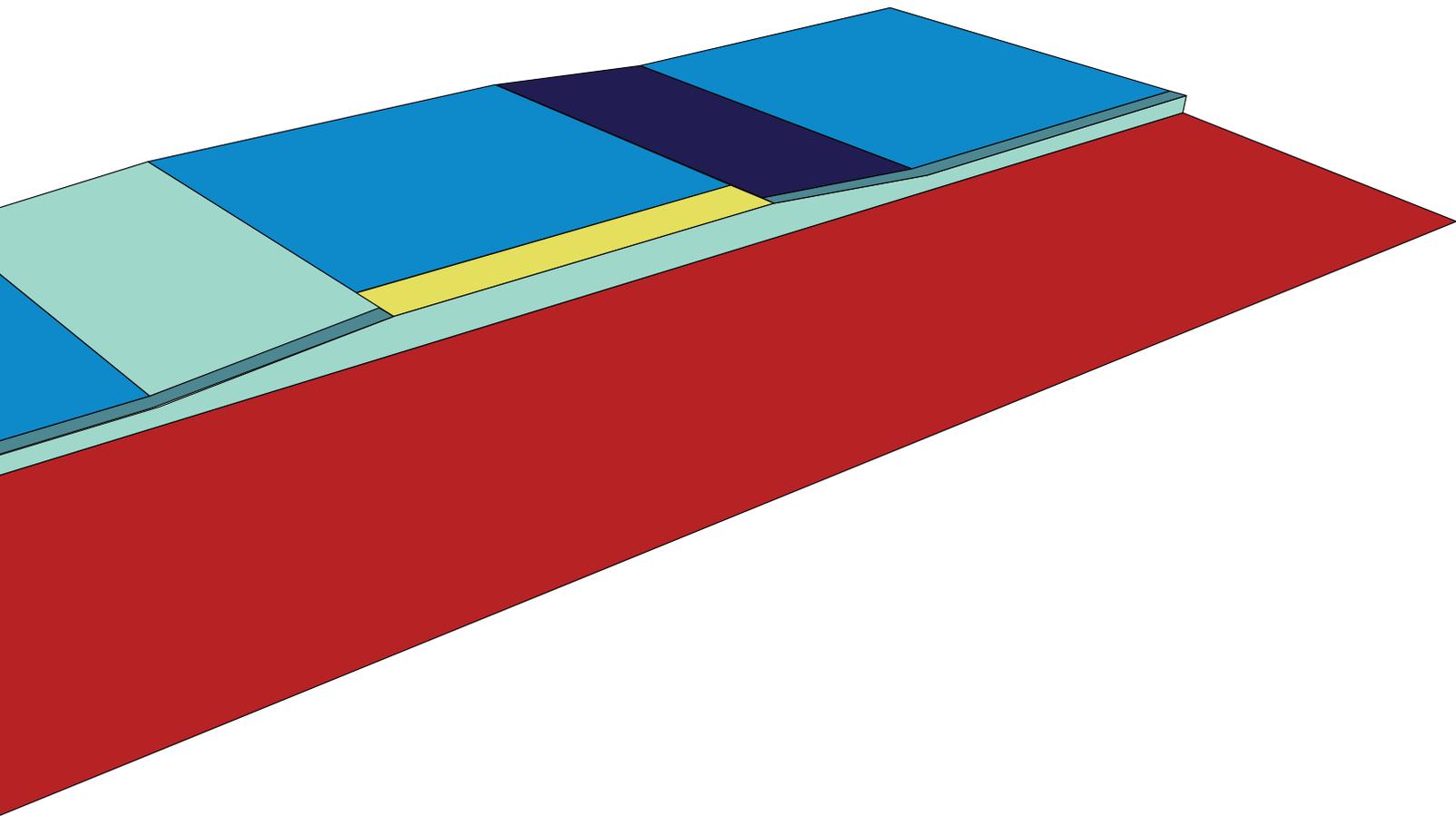
Low-income and minority neighborhoods are less likely to have consistently walkable sidewalks, crosswalks, and traffic calming infrastructure. In Boston, as of 2018, only 32 percent of the sidewalks in low-income Roxbury and Dorchester are in good condition, while 68 percent of the sidewalks in wealthier neighborhoods, such as downtown Boston and Back Bay meet that standard.<sup>6</sup> Investing to fix sidewalks will improve safety for those who need it most.

---

<sup>6</sup> Meghan Irons, "Boston's rich and poor neighborhoods show sidewalk repair disparity." The Boston Globe. <https://www3.bostonglobe.com/metro/2018/03/04/sidewalk-analysis-city-finds-inequality/qvnLJIMyVCfRxJKjKwrzYK/story.html?arc404=true/>

# BUS LEVEL BOARDING

## ACCESSIBILITY



### Description

Bus level boarding platforms are raised platforms that allow passengers to enter/exit buses without having to step up from the curb. Level boarding is an important element of Bus Rapid Transit projects, and implemented as part of a broader Bus Rapid Transit project.<sup>1</sup>

This element is found at all levels of Mobility Hubs.

<sup>1</sup> <https://nacto.org/publication/transit-street-design-guide/stations-stops/stop-design-factors/platform-height>

## Benefits

Level boarding enables wheelchair users to use the bus without using a mechanical lift. Level boarding enables faster boarding/ departing to and from the bus, decreasing the amount of time the bus is stopped in high volume periods. With less time stopped waiting for passengers to board or depart, the bus route becomes faster and less prone to delays. New York City implemented level boarding on four bus routes and found it saved an average of 36% on each bus route's time, and increased ridership by an average of 17% on each route.<sup>2</sup>

## Things to Consider

### Siting

Heights will vary with the floor height of the bus model being used.

- Near-Level boarding 8 - 11 inches
  - While this is not high enough to provide seamless boarding for disabled passengers, Near level boarding is close enough that a bridge plate can be used instead of a lift. 3 inches or less of step-up distance.
- Level boarding - 12 inches - 14 inches
  - True level boarding with no step up distance. Bus is able to pull up to within 2 inches of the curb.<sup>3</sup>

The level boarding platform should be at least 5 feet wide and 8 feet long.<sup>4</sup> Ramps should be at least 36 inches wide and have a slope of no more than 1:12 (1 inch change in elevation per 12 inches of ramp). They should not obstruct pedestrian travel.<sup>5</sup>

There have been some challenges to implementing level boarding. Some transit agencies, such as Chicago's CTA and San Francisco's SFMTA decided not to use raised platforms after testing, primarily because of difficulties docking buses to the raised platforms. Chicago did not have dedicated bus lanes, and found other vehicles blocking the platforms during operation.<sup>6</sup>

CTA and SFMTA also had fleets consisting of a variety of buses on a number of different routes using their new busway, meaning a raised platform could only be used with a single model of bus in their fleet. Chicago found sidewalks in the surrounding area would need to be adjusted to an extent that continuing to use bus-deployed ramps was easier than constructing level boarding on the sidewalk.<sup>7</sup>

Easy-to-install prefabricated platforms allow transit authorities to experiment with level boarding without investing significant funds into a Bus Rapid Transit project.

### Costs

Installing a prefabricated level boarding platform from Zicla costs \$50,000.<sup>8</sup> San Mateo's transportation authority, samTrans implemented level boarding for \$62,660 per platform, including the cost of a bench, shelter, lighting and removing the previous platform.<sup>9</sup>

### Jurisdiction/Implementer

Transit operators must make sure their fleets are compatible with the platforms. Municipalities must agree to construct a raised platform at the stop, and ensure the bus is not blocked by other vehicles.

2 [https://nacto.org/wp-content/uploads/2017/02/NACTO\\_Better-Buses\\_Boarding.pdf](https://nacto.org/wp-content/uploads/2017/02/NACTO_Better-Buses_Boarding.pdf)

3 <https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/transit-curbs>

4 <http://design.omnitrans.org/wp-content/uploads/2014/03/OmnitransDesignGuidelines-06.pdf>

5 <https://www.access-board.gov/ada/guides/chapter-4-ramps-and-curb-ramps/>

6 Alex Yamron. Personal Interview. Oct 2 2020

7 [https://sfenvironment.org/sites/default/files/agenda/attach/van\\_ess\\_brt\\_platform\\_height\\_rev\\_2.pdf](https://sfenvironment.org/sites/default/files/agenda/attach/van_ess_brt_platform_height_rev_2.pdf)

8 <https://www.bloomberg.com/news/articles/2018-03-12/prefab-platforms-make-building-bus-stops-a-snap>

9 [https://www.samtrans.com/files/samtrans/Assets/\\_Planning/BRT/SamTrans+ECR+BRT+Phasing+Plan+Study.pdf](https://www.samtrans.com/files/samtrans/Assets/_Planning/BRT/SamTrans+ECR+BRT+Phasing+Plan+Study.pdf)

For this reason, level boarding should be implemented as part of a broader BRT project with a dedicated bus lane.

### Equity Considerations

Level Boarding improves access for those with mobility issues and families pushing strollers. Even when buses are equipped with lifts, operators may not be trained or able to use it, a frustrating experience for disabled passengers.<sup>10</sup>

Example:

Level boarding has been implemented in Bus Rapid Transit projects in 15 countries in 40 different projects. Bogota, Colombia, Mexico City and Ottawa, Canada are prominent examples.<sup>11</sup>

### Further Reading

Transit Street Design Guide - Platform Height

<https://nacto.org/publication/transit-street-design-guide/stations-stops/stop-design-factors/platform-height/>

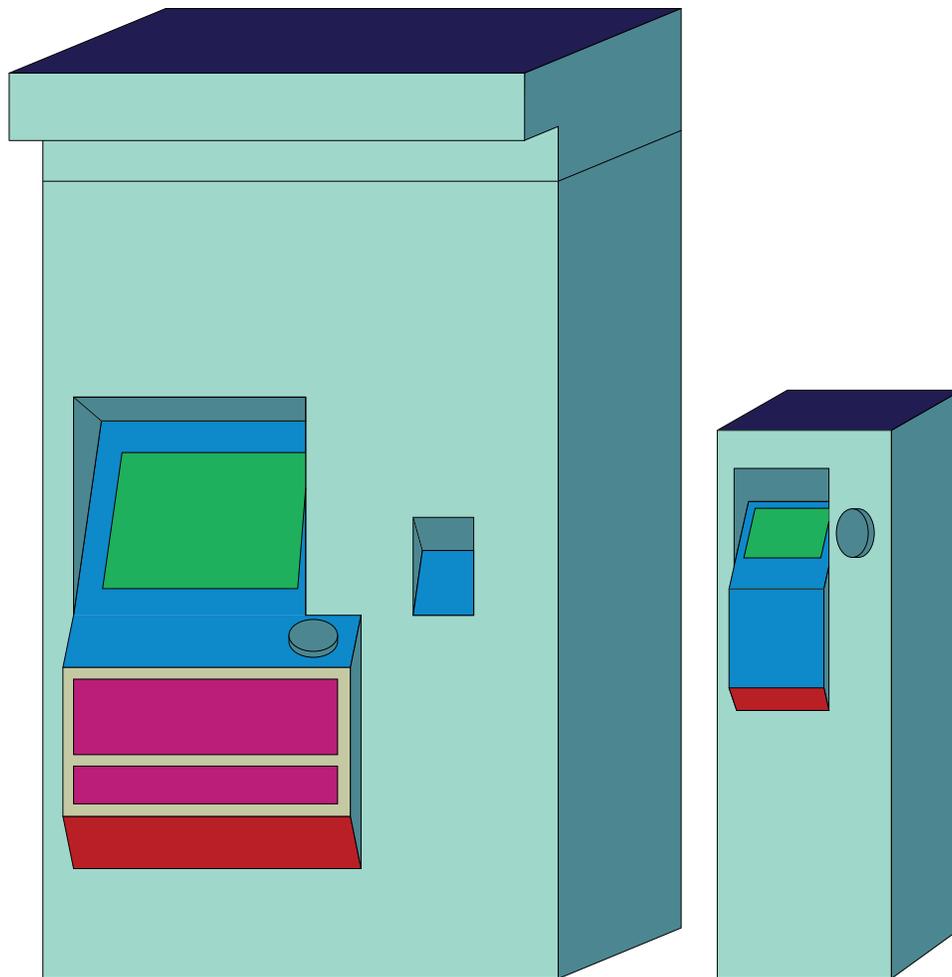
<sup>10</sup> <https://citylimits.org/2018/07/02/city-buses-are-wheelchair-accessible-but-disabled-riders-still-face-obstacles/>

<sup>11</sup> [https://brtdata.org/indicators/systems/station\\_boarding\\_level](https://brtdata.org/indicators/systems/station_boarding_level)



# FARE VENDING MACHINES

## ACCESSIBILITY



### Description

Fare Vending Machines (FVMs) are kiosks where riders can obtain fare cards and tickets, or add funds to their current reusable fare card. Some transit systems allow users to add money via a smartphone.

This element is found at Neighborhood Center Hubs and Gateway Hubs.

## Benefits

Fare machines provide riders with many different ways to pay for their fare. Having many convenient fare machines enables riders to pay for and use transit easily, even when they are away from where they normally reload their fare card. Convenient fare locations encourage riders to use transit more often, knowing that they can more easily reload their fare cards before each trip.<sup>1</sup>

## Things to Consider

### Siting

- Fare vending machines should be accessible from the Mobility Hub's entrances. They should not block entrances or curbs.
- To be wheelchair-accessible, the area in front of the fare vending machine should be at least 30 x 48 inches, flat, and clear of obstructions.<sup>2</sup>
- Fare payment purchase instructions should be clear, and in multiple languages. Machines should also include raised lettering or audible instructions, unless alternatives are available for visually-impaired passengers.
- Usually, fare vending machines are not waterproofed, so they must be sheltered from rain.
- There should be at least 2 machines per Mobility Hub entrance, in case one machine is broken.
- Ideally, there should be at least one place to purchase fare within 1000 feet of each bus stop.

### Costs

Fare vending machines may or may not accept and dispense cash and/or coins. Cash components take up a significant amount

of space and add extra maintenance costs. Machines that do not have cash components are called "light footprint" Fare Vending Machines, and have lower maintenance costs. However, users without access to electronic payment cannot use the light footprint machines.<sup>3</sup>

Vending machines also can dispense plastic fare cards or tickets. Dispensing plastic cards is harder on machines than dispensing tickets, and requires more maintenance to support.<sup>4</sup>

Costs will vary depending on features and vendors, but Houston Metro purchased fare vending machines at \$16,800 for a light-footprint machine and \$55,000 for a change-dispensing model. A light footprint machine was estimated to cost \$4,000/unit and a change-dispensing machine \$8,000/unit per year in maintenance costs.<sup>5</sup>

### Jurisdiction/Implementer

The transit agency that is collecting fares is responsible for placement and upkeep of fare vending machines. At some Gateway Hubs, where different transit systems overlap, agencies will have to coordinate to ensure users can easily transfer between the two fare systems.

### Equity Considerations

Many transit agencies are upgrading to modern fare systems that allow users to purchase fare on their phone and use a smartphone in lieu of a card. This will not eliminate the need for fare vending machines, as many people still use cash, especially unbanked riders.

Machines that take cash or change are more important to riders who do not have access to smartphones and/or banks. Areas where more users use cash rather than electronic

1 <https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/fare-vending/>

2 <https://www.access-board.gov/ada/#ada-305>

3 Lee Biernibaun, Personal Interview. 4 Nov 2020.

4 Lee Biernibaun, Personal Interview. 4 Nov 2020.

5 [http://ridemetro.granicus.com/MetaViewer.php?view\\_id=5&clip\\_id=781&meta\\_id=9524, 2](http://ridemetro.granicus.com/MetaViewer.php?view_id=5&clip_id=781&meta_id=9524, 2)

payments should be given priority for change-dispensing models, and backup units should be provided as well.

## Further Reading

Transit Street Design Guide - Fare Vending

<https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/fare-vending/>

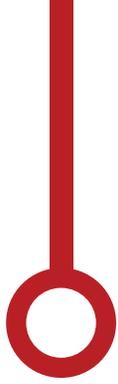
Pete Donahue. New York Daily News. MTA Going To Great Lengths to Stop Subway Scammers. 7 May 2012

<https://www.nydailynews.com/new-york/mta-great-lengths-stopping-subway-scammers-article-1.1073419>

Metropolitan Transit Authority of Harris County. Light Rail Fare Collection. February 2014.

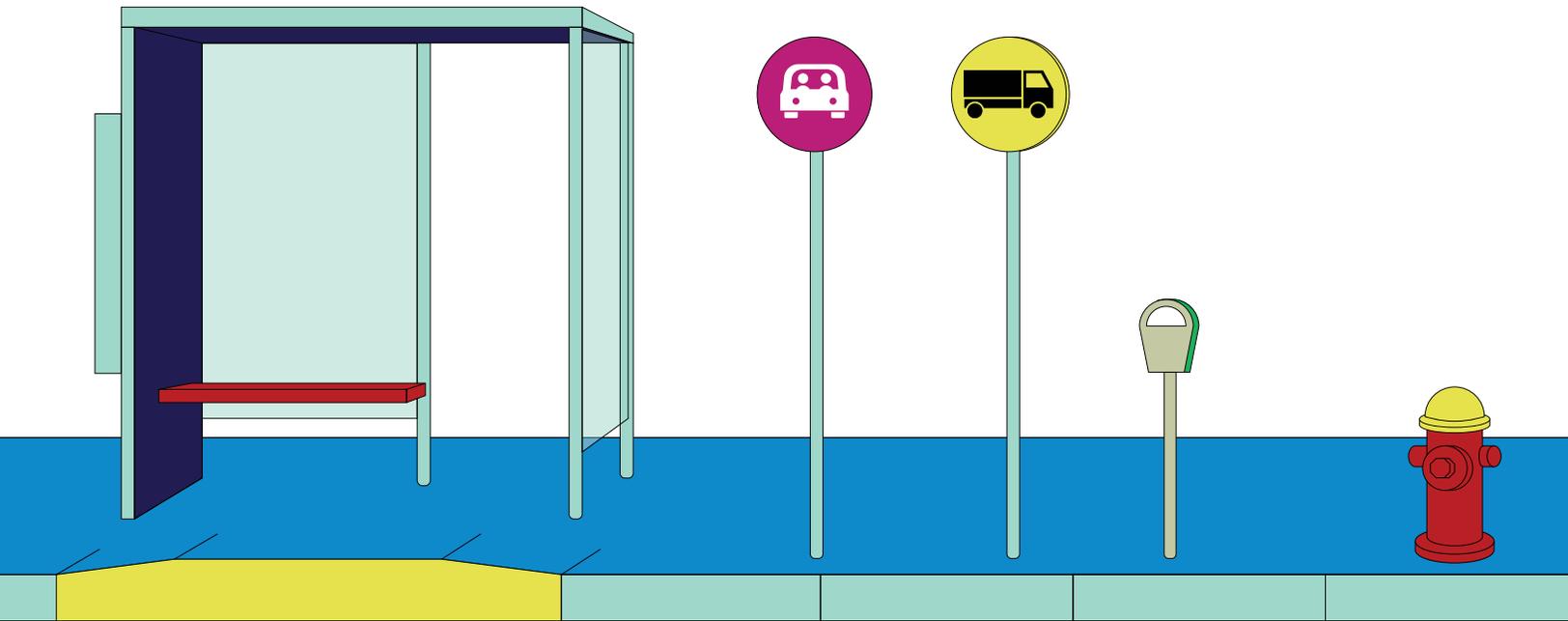
[http://ridemetro.granicus.com/MetaViewer.php?view\\_id=5&clip\\_id=781&meta\\_id=9524](http://ridemetro.granicus.com/MetaViewer.php?view_id=5&clip_id=781&meta_id=9524)





# CURB MANAGEMENT

## ACCESSIBILITY



### Description

Curb space is a limited resource in high demand at Mobility Hubs. At the curb, riders want to board their bus, rideshare drivers want to drop off and pick up their passengers, delivery drivers want to load and unload goods, and drivers want to park in the same area. Managing these competing interests to maximize curb efficiency is key to creating a great Mobility Hub.

Mobility Hubs commonly manage curb space by means of the following zones:

**Pick Up / Drop Off Zones:** Specially marked zones that allow cars to idle or stop only for short periods of time. They are a good solution for ridesharing services, whose drivers rarely leave the vehicle.<sup>1</sup>

**Bus lanes:** Road lanes restricted to buses, enabling them to avoid traffic congestion.

**Bus Queue Jump Lanes:** Curb-side lanes that allow buses to skip traffic at an intersection without requiring an entire lane dedicated to buses.<sup>2</sup>

<sup>1</sup> NACTO Curb Appeal: Curbside Management Strategies for Improving Transit Reliability, 3

<sup>2</sup> ITE Curbside Management Practitioners Guide, 25

**Loading / Unloading Zones:** Zones reserved for short-term use by delivery vans.<sup>3</sup>

**Smart Metered Parking:** Curb-side zones featuring meters that charge more when parking demand is high and less when it is low. <sup>4</sup>

**Flex Zones:** Zones whose usage changes across the day, or for special events. For example, during peak business hours, a zone could implement Smart Metered Parking, but be reserved for Loading/Unloading during off-peak times. Additionally, Flex Zones may provide spots that can be reserved in advance for a fee.<sup>5</sup>

This element is found at Neighborhood Center Hubs and Gateway Hubs.

---

3 NACTO Curb Appeal: Curbside Management Strategies for Improving Transit Reliability 2-3

4 ITE Curbside Management Practitioners Guide, 19

5 ITE Curbside Management Practitioners Guide, 11

## Benefits

Well-managed curb space allows a Mobility Hub to serve more users, improve traffic and increase safety.

- A block dedicated to parking can only serve 60 passengers per day, while a pick-up zone can handle 1,800 passengers per day, and a bus stop can accommodate 32,000 passengers per day.<sup>6</sup>
- In San Francisco's demand-parking pilot, drivers in the five pilot areas experienced a 43% drop in time required to find a parking spot. Double parking fell by 22%, speeding up bus trip times by 4-5% in the pilot areas.<sup>7</sup>
- Managing curbspace improves traffic flow and prevents double parking. Washington, DC found that double-parking and illegal U-turns by delivery vehicles decreased by 64% in and around the pilot loading zones.<sup>8</sup>
- Curb management encourages safe behaviors: Boston's pickup/drop-off zone pilot found a decrease in dangerous pickups in travel lanes after the zone was installed, decreasing such activity by 38% in one area.<sup>9</sup>

## Things to Consider

### Siting

Visit the proposed site and measure traffic that uses the curb. How many cars are parked, how many people use transit, how many deliveries and how many rideshare pick-ups and drop offs? Use data gathered from observations to decide where zones should be placed.<sup>10</sup>

Other considerations:

- Emergency services such as fire trucks must be able to access areas.<sup>11</sup>
- There must be room for pedestrian infrastructure, such as crosswalks.
- If there's a bike lane, make sure bikers have access to bike racks and bikeshare stations.

### Costs

Many curb management solutions involve no new expenditures beyond signs and paint. When operated efficiently, curb management solutions can even bring in revenue, through the use of reservations, meters and permits.

Maintenance and installation costs should be considered, of course. For example, the cost of installing a smart meter is roughly \$250-\$500 per meter.<sup>12</sup>

### Jurisdiction/Implementer

Parking is usually managed by the municipality it's located in. Talk to your town's transportation department to help manage your Mobility Hub's curb. Consider working with local businesses near the Mobility Hub to find the best times for them to receive deliveries - other times it can be used for other purposes.

### Equity Considerations

Better curb management can promote equity by diversifying the modes of transit available. When planning out the curb infrastructure of your Mobility Hub, make sure that curb uses support modes of transit most often used by low-income riders and those with disabilities.

When enforcing parking and bus lane violations, make sure fines are proportionate,

6 <https://www.planning.org/planning/2019/jun/curbcontrol/>

7 NACTO Curb Appeal: Curbside Management Strategies for Improving Transit Reliability, 8

8 CTPS. The Future of the Curb 13 <https://www.ctps.org/data/pdf/studies/other/Future-of-the-Curb.pdf>

9 City of Boston. Boston Pick Up Drop Off Pilot, 4, [https://www.boston.gov/sites/default/files/embed/file/2019-10/pudo\\_report\\_vf.pdf](https://www.boston.gov/sites/default/files/embed/file/2019-10/pudo_report_vf.pdf)

10 ITE Curbside Management Practitioners Guide, 12

11 The Future of the Curb, 3

12 <https://www.itskrs.its.dot.gov/node/209124>

clearly outlined and not disproportionately enforced against people of color. Financial burdens created by fines can be allayed by allowing those charged to take a class rather than pay a fine, as demonstrated by an NYC ticket diversion program.<sup>13</sup>

### **Examples**

The City of Boston launched a pilot pick-up zone in selected downtown areas in 2018.

Coord, a private company, is launching pilot curb management programs in 4 US cities. The transit technology company will provide Aspen with software for maintaining “smart loading zones”. Drivers will be able to use Coord’s app to reserve loading zones and make payments.<sup>14</sup>

## **Further Reading**

NACTO. Curb Appeal: Curbside Management Strategies for Improving Transit Reliability

<https://nacto.org/tsdg/curb-appeal-whitepaper/>

ITE. Curbside Management Practitioners Guide

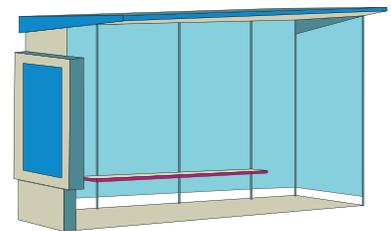
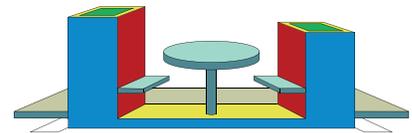
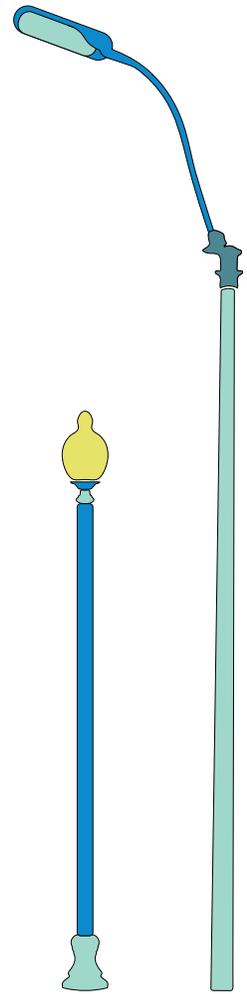
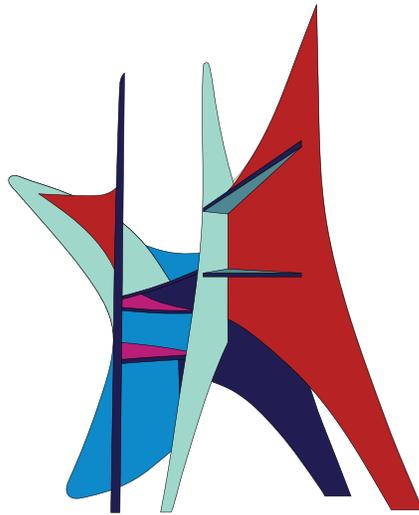
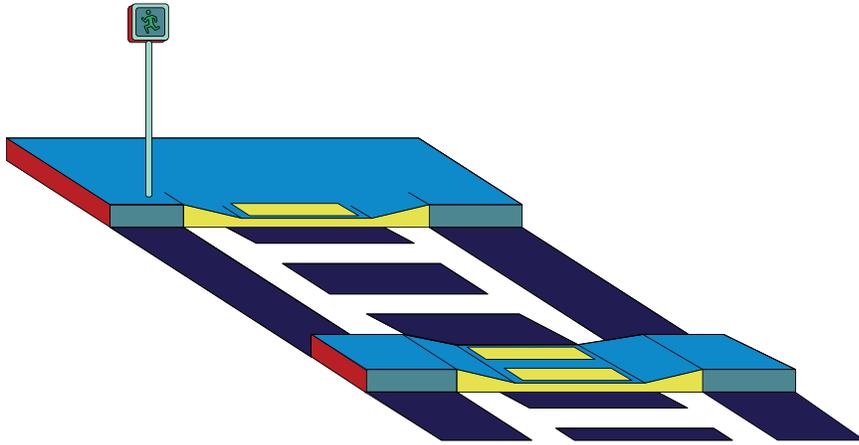
<https://www.ite.org/technical-resources/topics/complete-streets/curbside-management-resources/>

---

13 NACTO Curb Appeal: Curbside Management Strategies for Improving Transit Reliability, 9

14 <https://www.govtech.com/fs/data/curb-management-pilots-to-launch-in-several-us-cities.html>

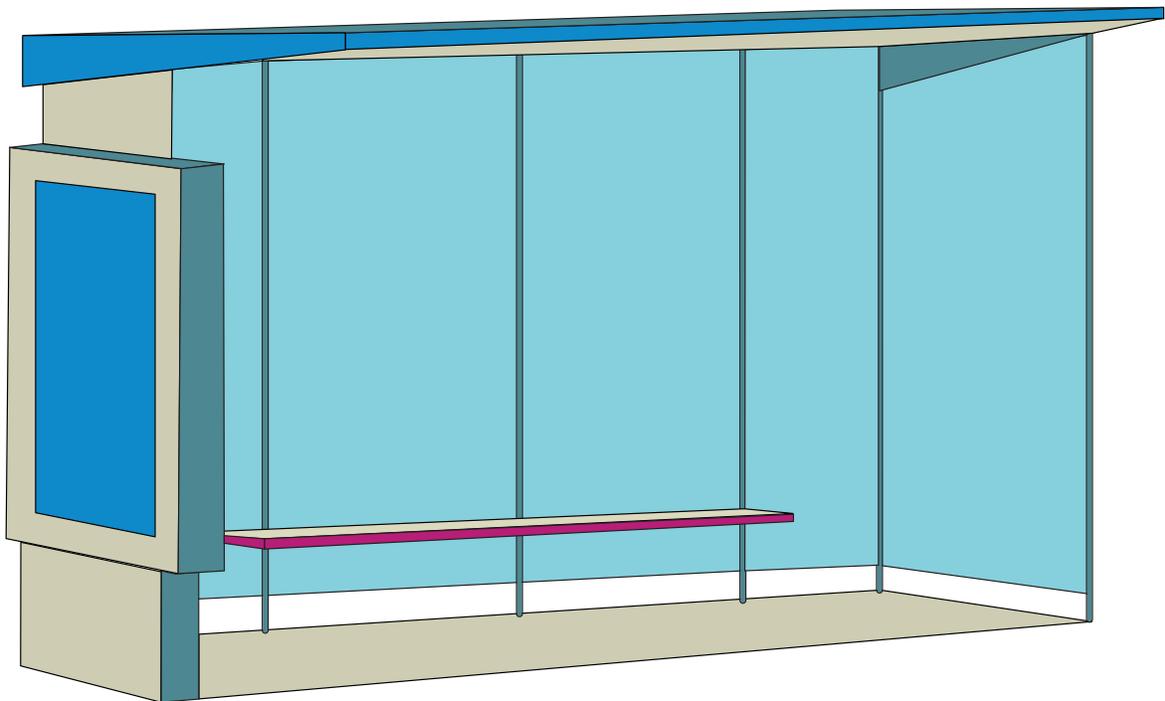
# COMFORT & SAFETY



Two of the most common features people ask for at a Mobility Hub are lighting and shelters. Safety and Comfort elements focus on making the Mobility Hub pleasant and safe to spend time waiting. Adequate lighting and shelters protect people from the elements, and pedestrian safety elements prevent crashes.

# BUS SHELTER & SEATING

## COMFORT & SAFETY



### Description

Bus shelters provide protection for passengers from inclement weather ( rain, snow, sun, wind and cold). They often have seating, allowing passengers to rest while waiting for a bus to arrive. These shelters may contain information such as maps of the transit system, schedules of buses that stop there, local neighborhood maps, and advertising from local merchants.

This element is found at all levels of Mobility Hubs.

## Benefits

Shelters provide protection from the weather, and are important to passenger safety, especially those without alternative transport. Shelters with seating also improve transit access for those with disabilities, seniors, young children and others who may not be able to stand for long periods of time. Shelters also improve riders' transit experience: Passengers at stops with no amenities perceive wait times to be 1.3 times longer than they actually are.<sup>1</sup> Shelters also increase ridership: Utah's transit system found that bus stops had 92% more ridership after constructing improvements to them.<sup>2</sup>

## Things to Consider

### Siting

Bus shelters with seating are most needed in neighborhoods where buses run infrequently, commercial areas with frequent service and high ridership, poorly-lit areas, neighborhoods where there is a high proportion of older adults or people with disabilities, and areas where inclement weather is common.

- A shelter should be at least 8 x 4.5 x 8 feet, with an unobstructed 2.5 x 4 feet area to accommodate wheelchairs.<sup>3</sup>
- The shelter should be set back at least 11 feet from the road, with an 8-12 feet pedestrian through zone behind or in front of the shelter in areas with high pedestrian traffic. It should not obstruct the sidewalk.

- A shelter must be constructed on an 8 x 14 feet ADA-compliant concrete pad.
- Maps, advertisements and interactive screens must have 4 feet of clear path for access to the element.<sup>4</sup>
- Bus shelters should be easily visible to bus drivers and passengers, well-lit, and have transparent walls.<sup>5</sup>
- Sites should be safe from flooding, traffic and other hazards.
- The proposed site should have access to sidewalks in good repair.
- Consider the design of the bus shelter - if there are gaps in the walls, rain can still get in to soak the passengers.
- Stops with high ridership should build multiple or larger shelters.<sup>6</sup>
- USB chargers for phones and other electronics are a popular amenity on public benches. They can be solar-powered or connected to an outlet.

### Costs

- Installing a bench costs \$1500<sup>7</sup>,
- Installing a shelter costs between \$2000 and \$15,000.<sup>8</sup> However in cities with higher costs, such as Boston, shelters can cost up to \$40,000.<sup>9</sup>
- Maintaining a bus shelter with a trash can costs approximately \$1000/year.
- Advertising or local business partnerships can defray the costs of maintaining a shelter. Long Beach, California estimated that they receive \$2,064/shelter per year from shelter advertising revenues.<sup>10</sup>

### Jurisdiction/Implementer

Installing a shelter requires the approval of multiple stakeholders: The municipality,

1 Fan, Guthrie and Levinson, 259

2 <https://rosap.ntl.bts.gov/view/dot/35670#:~:text=The%20analysis%20shows%20that%20the,to%20the%20control%20group%20stops>

3 Tri-County Metropolitan Transportation District of Oregon. Bus Stop Guidelines. July 2010.

4 NATCO, Small Transit Shelter

5 Florida Dept of Transportation, 29-30

6 NATCO, Large Transit Shelter

7 Escambia County, Estimated Costs of Bus Shelters and Benches Program 1

8 From Sorry To Superb: Designing Great Bus Stops, 12-13

9 <https://commonwealthmagazine.org/transportation/t-notes-bus-shelter-maintenance-price/>

10 <https://www.longbeach.gov/globalassets/city-manager/media-library/documents/memos-to-the-mayor-tabbed-file-list-folders/2014/december-18--2014---bus-shelter-advertising>

the state transportation department that manages the road, and the transit agency that operates the bus service.<sup>11</sup> Private investors also construct shelters for advertising. For example, agencies such as JCDecaux own half of all bus shelters in the Boston area.

Advocates who want to install a bus shelter can write to their city council and transportation agency to request a shelter. Some transportation authorities, such as Dallas Area Rapid Transit, have an online form that can be used to request a shelter.<sup>12</sup> Many cities consider ridership and street traffic when placing shelters. Advocates wanting to build shelters in areas underserved by cities' shelter criteria can apply for community grants to install a shelter.

### **Equity Considerations**

Shelters and seating enable access to transit for those with disabilities, seniors, and families. They also protect users who do not have alternative transportation arrangements in inclement weather. Consider dependence on transit and need when deciding on new locations for shelters and seating. Some transportation authorities, like Los Angeles Metro, require geographic equity between neighborhoods.<sup>13</sup>

## **Further Reading**

Transit Street Design Guide - Small Transit Shelter

<https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/small-transit-shelter/>

It's Time for Transit Agencies to Unlock the Power of Bus Shelters

<https://mobilitylab.org/2019/01/16/its-time-for-transit-agencies-to-unlock-the-power-of-bus-shelters/>

From Sorry to Superb: Everything You Need to Know about Great Bus Stops

[https://transitcenter.org/wp-content/uploads/2018/10/BusReport\\_Spreads.pdf](https://transitcenter.org/wp-content/uploads/2018/10/BusReport_Spreads.pdf)

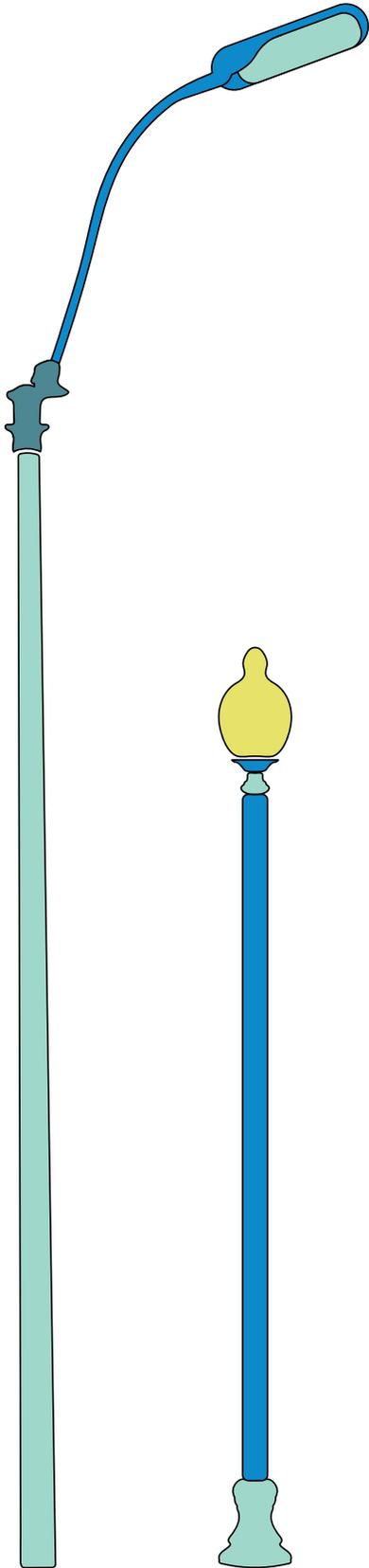
---

11 Transit Bus Stops: Ownership, Liability and Access, 3-4

12 <https://www.dart.org/webapps/busStopRequest/default.asp>

13 <https://thesource.metro.net/2019/12/16/what-it-takes-to-get-a-bus-shelter-installed/>





# STREET LIGHTING

## COMFORT & SAFETY

### Description

Street lighting is placed to illuminate the road and general area around the Mobility Hub at night. Street lights allow people driving to easily see people walking, provide a sense of safety to waiting riders, and ease navigation of the Mobility Hub at night. Bus shelters can also provide light via solar power.

This element is an essential part of any Mobility Hub.

## Benefits

Lighting improves auto and pedestrian safety. When street lighting is installed on the road, road accidents caused by auto drivers decreased on average by 30%.<sup>1</sup> At the Mobility Hub, proper lighting improves navigation, especially for riders unfamiliar with the area. Street lighting creates a sense of safety, deters anti-social activity and increases satisfaction with transit.<sup>2</sup> Lighting is a top priority when riders are asked what they want from a Mobility Hub.<sup>3</sup>

## Things to Consider

### Siting

- Light sources should be built near pedestrian crossings, footpaths and waiting areas. Items pedestrians interact with, such as fare machines, should be lit as well.<sup>4</sup>
- Pedestrian lighting should be around 13 feet in height and spaced every 50 feet. Street lighting should be 25-40 feet high and spaced every 125-150 feet.<sup>5</sup>
- Electricity service is required for street lighting, but can be installed by electricians as part of installing the light.
  - Solar power can be used to provide lighting where electricity cannot be wired.
- If installing a bus shelter at the Mobility Hub, ensure it is also lit inside.

### Costs

Pole-Mounted solar lights can be purchased for \$800. Purchasing a street light costs \$2000-\$3000, and installing a street light costs on average \$1000, though costs may vary.<sup>6</sup> Adding solar lighting to a bus shelter costs \$2500 more than a standard bus shelter, but can bring in revenue by generating electricity.<sup>7</sup>

### Jurisdiction/Implementer

Local governments generally provide street lighting on public roads and in public parks, though more can be added by private parties on their property. When possible, coordinate your Mobility Hub with existing lighting.

### Equity Considerations

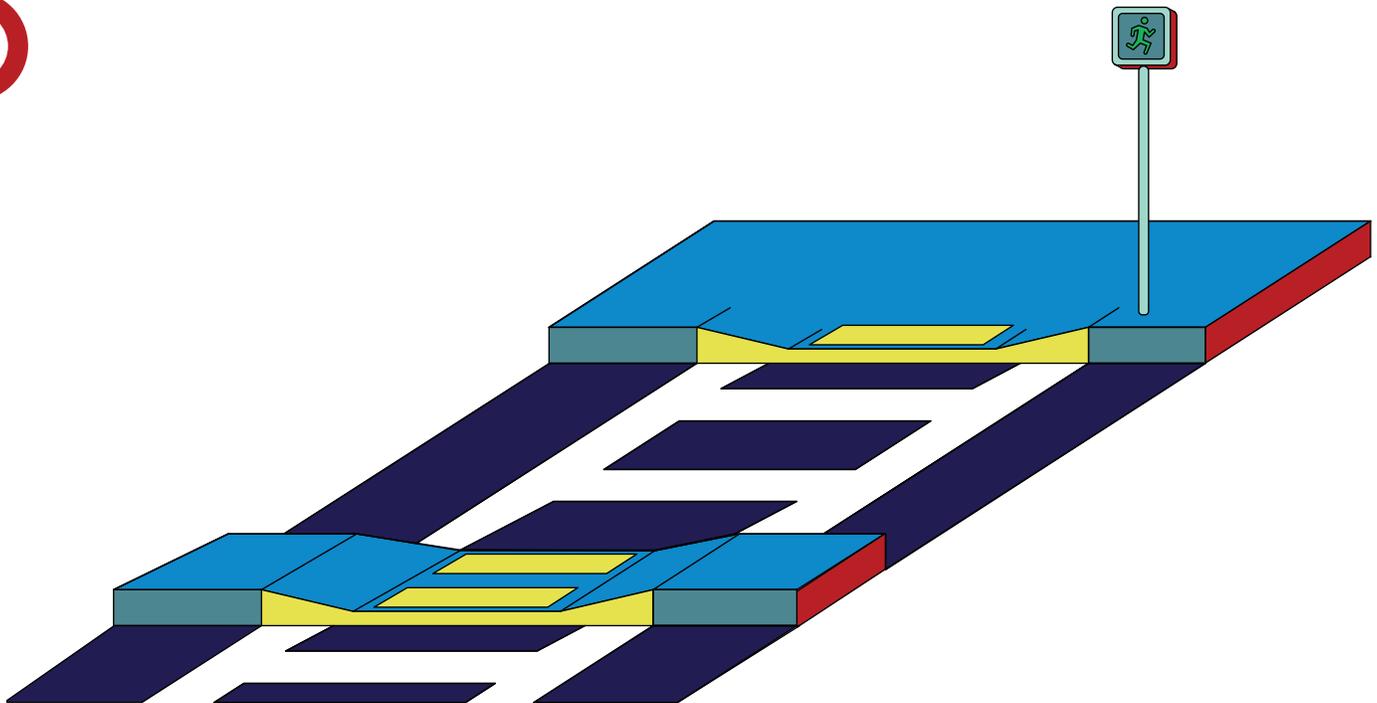
Street lighting creates a sense of security for vulnerable populations. A study found that wait times for women in poorly-lit transit stops were perceived to be almost twice as long as they actually were.<sup>8</sup>

---

1 Tomczuk, et al. Lighting Requirements For Pedestrian Crossings, 1  
2 American Public Transit Association. Security Lighting for Transit Passenger Facilities, 1  
3 Florida Dept of Transportation. Safer Bus Stops For Vulnerable Customers, 14,28  
4 American Public Transit Association. Security Lighting for Transit Passenger Facilities, 4  
5 <https://www.pps.org/article/streetlights>  
6 <https://www.lightmart.com/blog/how-much-do-street-light-poles-cost/>  
7 <https://www.greentechmedia.com/articles/read/solar-bus-shelters-from-gogreensolar>  
8 Fan, et al. Waiting time perceptions at transit stops and stations: Effects of basic amenities, gender, and security 261

# CROSSWALK ADDITION

## COMFORT & SAFETY



### Description

Adding a crosswalk near a Mobility Hub helps pedestrians safely cross streets with vehicle traffic. While painted lines on the road and intersections are the most familiar type of crosswalk, signals can also be added to a crosswalk to alert drivers to crossing pedestrians. Different types of crosswalks are recommended for the various types of streets that can be found in towns and cities.

This element is a critical part of any Mobility Hub.

# Crosswalks

## Signalized Crosswalks

- Uses the familiar Walk/Don't Walk signals to direct pedestrians. Some models display a timer showing how many seconds are left to cross.
- This crosswalk is controlled by a traffic signal to determine when pedestrians cross.
- These crosswalks are expected at intersections with high speed and/or high volume vehicle traffic.<sup>1</sup>
- In dense urban areas these crosswalks direct pedestrians to cross streets at fixed time intervals for traffic network organization and predictability.<sup>2</sup>

## Mid-Block Crosswalks

- If walking to an existing crosswalk is inconvenient or time-consuming, pedestrians will cross where there is not an existing crosswalk. Mid-Block crosswalks are placed where pedestrians want to go but there is a lack of support from the existing pedestrian infrastructure.<sup>3</sup>
- Mid-block crosswalks are often found at destinations pedestrians want to walk to and from like schools, parks, and Mobility Hubs.

## Signals

These signals can be added to crosswalks not controlled by traffic signals, such as mid-block crosswalks.

### Rectangular Rapid-Flashing Beacons (RRFBs)

- Rapid-Flashing Beacons (RRFBs) are installed at existing sidewalks and include two rectangular-shaped yellow high-visibility LEDs that flash rapidly when activated.
- RRFBs are particularly well suited to be placed at multilane midblock crossings with speed limits less than 40 mph.<sup>4</sup>
- RRFBs can be solar-powered.

### Pedestrian Hybrid Beacons (PHBs)

- Pedestrian hybrid beacons are stop lights for vehicles at pedestrian crossings. Unlike a traffic signal, a PHB's lights are dark until a pedestrian activates it via pushbutton or other form of detection. When activated, the beacon displays a sequence of flashing and solid lights that indicate the pedestrian walk interval and when it is safe for drivers to proceed.<sup>5</sup>
- Pedestrian Hybrid Beacons are best suited for midblock locations experiencing more than 9,000 vehicles per day and speeds of 40 mph or greater.

## Benefits

Adding crosswalks, especially crosswalks that are well-marked with lights and signage prevents vehicle collisions involving pedestrians. Installing Rectangular Rapid-Flashing Beacons on crosswalks uncontrolled by traffic signals can reduce crashes involving pedestrians up to 47%,<sup>6</sup> and installing pedestrian hybrid beacons can reduce crashes involving pedestrians by 55%.<sup>7</sup> Frequent and safe crossings help

1 <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/>

2 <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/traffic-signals/fixed-vs-actuated-signalization/>

3 <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/midblock-crosswalks/>

4 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=54](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54)

5 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=53](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53)

6 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=54](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54)

7 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=53](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53)

foster a feeling of walkability and can encourage more pedestrian activity.

## Things to Consider

### Siting

Crosswalks should be added at all intersections where they do not exist, and midblock crosswalks should be built where pedestrians frequently cross without crosswalks. Crosswalks should be painted at least 6 feet wide.<sup>8</sup> Curb cuts should be placed on both sides of the crosswalk, as well as any pedestrian islands the crosswalk crosses. Curb cuts should be at least 36 inches wide, with a slope of no more than 1:12. Any curb cut at a Mobility Hub should also have raised bumps to warn pedestrians they are entering a crosswalk.<sup>9</sup>

In the context of Mobility Hubs, it makes sense to include midblock crossings and signalization at the location of each Mobility Hub, regardless of particular vehicle volumes and speeds.

### Costs

The Federal Highway Administration pegs the capital cost of Rectangular Rapid-Flashing Beacons as ranging from \$4,500 to \$52,000 each<sup>10</sup> and estimates the installation of Pedestrian Hybrid Beacons as ranging from \$21,000 to \$128,000, with an average cost of \$57,680.<sup>11</sup> Price ranges vary due to the multiple conditions and environments the crosswalk enhancements are installed in.

### Jurisdiction/Implementer

Crosswalks and pedestrian safety enhancements are managed by the organization that has jurisdiction of the street. Crosswalks allowing access to and from Mobility Hubs in an urban area can be owned by a variety of levels of government. It is important to learn which level of government is responsible for a street to know who to make requests for a new or enhanced crosswalk installation.

### Equity Considerations

All pedestrians, including seniors and people with disabilities, should be able to cross an intersection in a single walk signal cycle, rather than two cycles, unless a street is segmented by a transit, bus, or pedestrian islands. Accessible curb ramps are required by the Americans with Disabilities Act (ADA) at all crosswalks.<sup>12</sup>

### Examples

Pedestrian Hybrid Beacons and Rectangular Rapid-Flashing Beacons systems have become widely used in the United States, with consistent reductions in pedestrian injuries and fatalities.

---

8 [http://guide.saferoutesinfo.org/engineering/marked\\_crosswalks.cfm](http://guide.saferoutesinfo.org/engineering/marked_crosswalks.cfm)

9 <https://www.access-board.gov/ada/guides/chapter-4-ramps-and-curb-ramps/#curb-ramps>

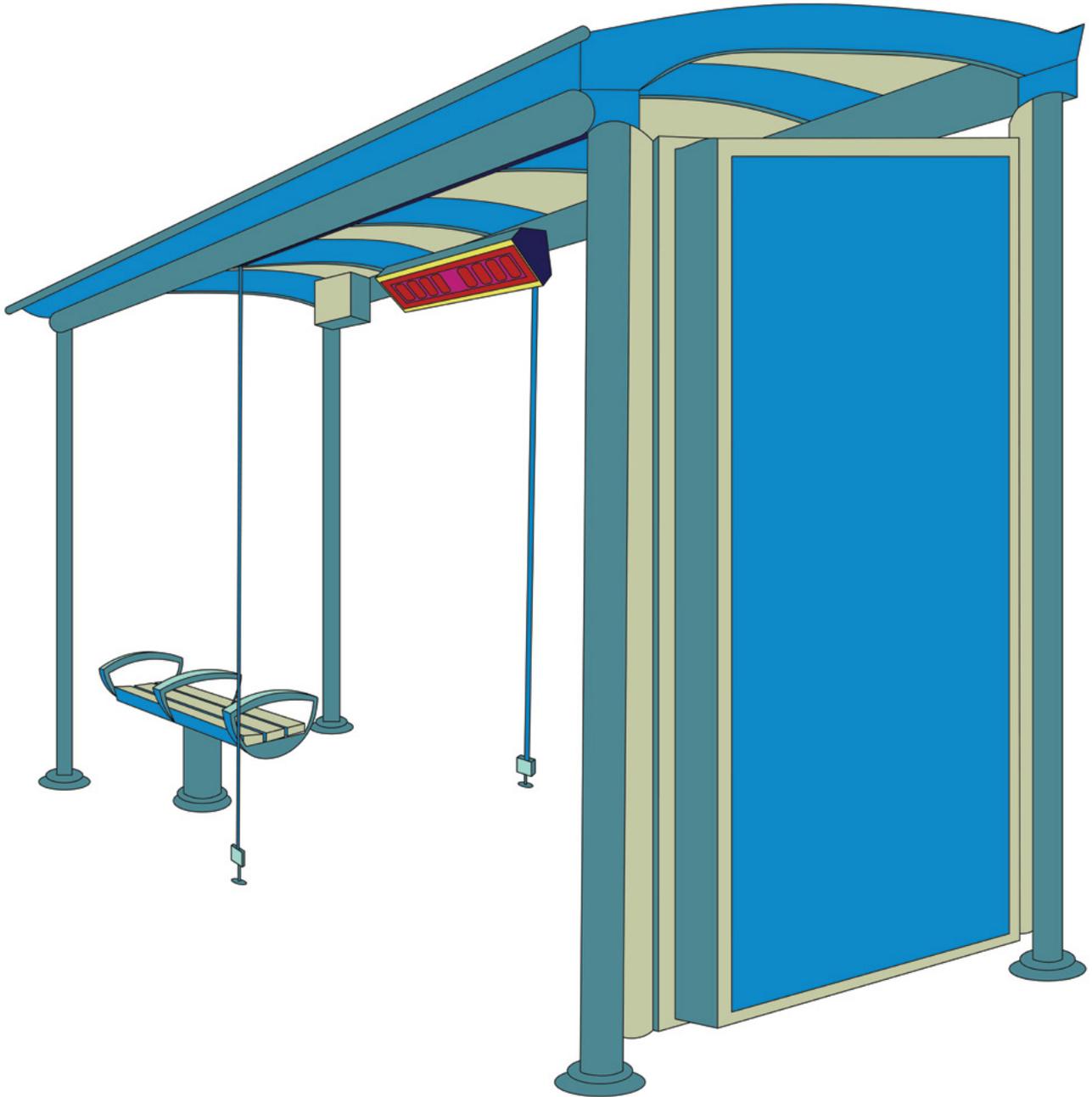
10 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=54](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54)

11 [http://pedbikesafe.org/PEDSAFE/countermeasures\\_detail.cfm?CM\\_NUM=53](http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53)

12 <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/conventional-crosswalks/>



# HEATING



## Description

In cold weather, heaters can be mounted to bus shelters and warm passengers waiting for transit.

This element is found at all levels of Mobility Hubs in cold climates.

## Benefits

Heaters make the wait for transit more comfortable and provide safety to transit dependent riders during extreme cold. Lack of heat can serve as a deterrent to riders not dependent on mass transit during the winter.

## Things to Consider

### Siting

- Heaters must be connected to the electrical grid.
- If a switch is used to activate the heater, it should be motion-activated to comply with ADA guidelines.
- Heaters can be installed in partially enclosed or fully enclosed spaces. Fully enclosed spaces trap the heat, allowing warmer temperatures and reducing energy costs. For example, enclosed shelters in Fort McMurray can raise the temperature 40° Fahrenheit (22° Celsius) while they are less effective in St. Paul, where shelters are not enclosed.<sup>1</sup>

### Costs

The cost of installing the heaters can vary significantly based on location. For example, St. Paul installed heaters at a cost \$10,000 to \$60,000 each, depending on the needs of a station.<sup>2</sup> Heaters also have ongoing energy and maintenance costs. Fort McMurray's bus heaters cost \$70/month per shelter, mostly in energy bills.

### Jurisdiction/Implementer

Heat lamps are installed and maintained by the owner of the transit stop. This can be the transit authority, the municipalities the route serves, or a private shelter operator.

Transit agencies require high ridership at a bus stop to consider it a candidate for installing heaters, usually 80 riders per day.<sup>3</sup>

## Equity Considerations

During extreme weather events, people using public transit are doing so because they have no other options. In extreme cold, heaters can save lives and prevent hypothermia/frostbite. This is especially important along less frequent bus lines.

### Example

Heaters are relatively rare compared to other elements and usually are only installed in colder climates. Cities such as St. Paul, Chicago and Fort McMurray have implemented heaters in their respective areas.<sup>4</sup>

---

1 <https://www.mprnews.org/story/2015/01/07/heated-transit-shelters>

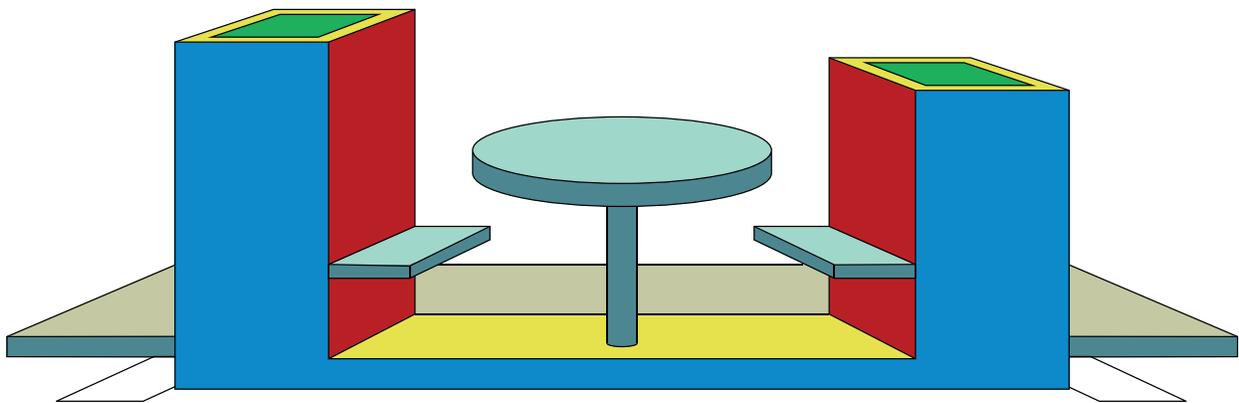
2 <https://www.mprnews.org/story/2015/01/07/heated-transit-shelters>

3 <https://www.greatermadisonmpo.org/planning/documents/BusStopAmenitiesStudy.pdf>, 23

4 <https://www.chicagotribune.com/news/ct-heat-lamps-met-0108-20150107-story.html>

# PARKLETS

## COMFORT & SAFETY



### Description

Parklets are parking spaces or street space converted to a seating area with chairs, tables, and greenery. Often, each parklet has its own artistic touches added to it. Parklets are public spaces that anyone can use to sit and rest, drink coffee, and chat while they wait for transit.

This element is found at Neighborhood Center Hubs and Gateway Hubs.

## Benefits

Parklets are a great way to turn a Mobility Hub into a vibrant community space. They bring life to the Mobility Hub by inviting people to stay, and make the wait more pleasant by providing open space, art and greenery. Local businesses benefit from parklets as well: The Green Line Café in Philadelphia saw a 20% increase in revenue after a parklet was constructed in front of the business.<sup>1</sup>

## Things to Consider

### Siting

- Parklets should be a minimum of 6 feet wide from the sidewalk, the width of a typical parallel parking space. Parklets generally convert one or more parallel parking spaces or 3–4 angled parking spaces, but may vary according to the site, context, and desired character of the installation.
- Railings should be no higher than 3 feet and be able to withstand at least 200 lbs of horizontal force.
- Parklets should have railings and bollards that are easily visible to oncoming traffic.
- To prevent parking cars from hitting the parklet, wheel stop barriers must be placed 4 feet from the parklet railings.
- For safety, parklets should be placed at least one parking spot away from intersections.<sup>2</sup>
- Parklets should be built on a slope of less than 5%. While it is possible to build a parklet on a steeper slope, it requires additional engineering work.
- To comply with the ADA, A 5 foot turning

circle for wheelchairs is required. Parklets must contain a ramp if there is more than a ¼ inch height difference between the parklet and the sidewalk.

- Parklets cannot block drains, manholes or other utility access points.<sup>3</sup>
- Consider building near existing trees, if possible, to provide shade and greenery.
- Personalize it! Parklets should reflect some of the community character. For example, you can invite local artists to decorate it.

### Costs - Permits

Constructing a parklet requires a permit from your city. Costs will vary from city to city, but San Francisco charges a permit application fee of \$791, and \$245 per year to renew the permit. Seattle charges \$1,300 for building a parklet and \$140 per year afterwards to renew the parklet permit.<sup>4</sup> Boston charges \$340/month to use 2 parking spaces.<sup>5</sup> In addition to permits, you may also be required to insure the parklet.<sup>6</sup>

### Costs - Construction

Once you've gotten the proper permits to build a parklet, you can build one on your site. Parklets can be built for as little as \$1000.<sup>7</sup> Companies like StreetDeck provide low cost methods for building them.<sup>8</sup> Constructing a custom parklet by an architect can cost \$5000 - \$15,000 based on design and materials.<sup>9</sup>

### Jurisdiction/Implementer

In order to set up a parklet, you must apply to your municipality for a permit. Some municipalities may not permit parklets. Generally, a private owner will sponsor a

1 Reclaiming The Right Of Way, 62

2 NACTO, <https://nacto.org/publication/urban-street-design-guide/interim-design-strategies/parklets/>

3 Seattle Department of Transportation Parklet Handbook, 12, 32

4 Seattle Department of Transportation Parklet Handbook, 14

5 <https://www.boston.gov/transportation/boston-parklets-program>

6 City of Santa Barbara Parklet Guidelines

7 <https://parkade.com/parklet-guide-and-how-to-build-a-parklet#parklet-construction-guide>

8 <https://www.archatrak.com/streetdeck-slashes-the-cost-of-establishing-a-community-parklet/>

9 San Francisco Parklet FAQ, 4

parklet's cleaning and maintenance, though they are public spaces open to all.<sup>10</sup>

Advocates looking to build a parklet at a Mobility Hub typically partner with nearby local businesses to maintain the parklet.

### Equity Considerations

Consider building parklets in places lacking amenities, greenery or existing furniture.

Example:  
Many cities have successfully experimented with parklets during the COVID-19 pandemic, from San Francisco to New York. Parklets provided an outdoor community space.

<sup>10</sup> San Francisco Parklet FAQ, 1-2

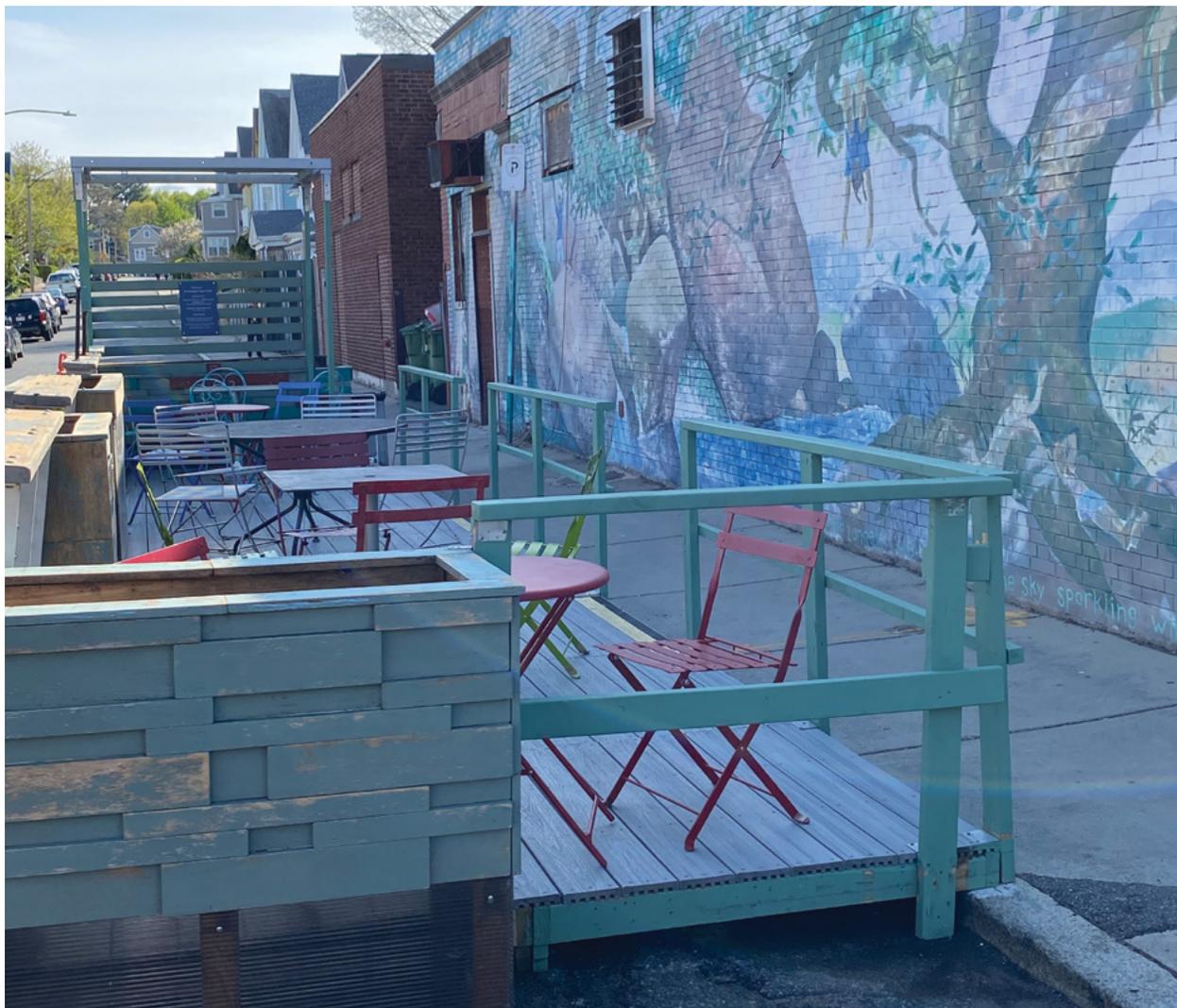
## Further Reading

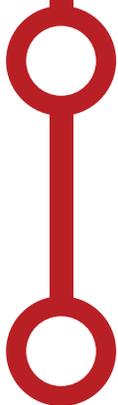
NACTO Urban Street Design Guide - Parklets

<https://nacto.org/publication/urban-street-design-guide/interim-design-strategies/parklets/>

A Guide to Building a \$1000 or Less Parklet

<https://parkade.com/parklet-guide-and-how-to-build-a-parklet#parklet-construction-guide>





# PUBLIC ART

## COMFORT & SAFETY



### Description

At its core, public art is art that is in public spaces. It is free, open to the public, and owned by the community in which it resides. When done successfully, it engages the community and creates a civic identity.<sup>1</sup>

Public art spans in scale from the size of a building to a small painting at a bus stop. At Mobility Hubs, the community can directly implement public art or provide a place for local artists to exhibit their work.

Public art comes in a variety of materials, forms and ideas. Chicago's "The Bean"<sup>2</sup> is among the most famous examples of public art in the US and has become a global identifier for the city. Mobility Hubs are an excellent place to engage the community in implementing public art that forms connections throughout a region, honors local culture, and generates economic activity.

Public Art is not just bronze statues of historical figures; it comes in a variety of materials, forms and ideas. Some of the most famous examples of public art in the world are the Eiffel Tower and the Space Needle. These examples are so well known they have become global identifiers of their home city.

However, public art does not have to be built on a grand scale by internationally renowned artists. Public art is unique among the Mobility Hub elements in that it can be directly implemented by the community. Many cities have implemented public art projects, known as Artbox, that employ local artists to beautify electrical boxes around the city. Other cities have graffiti tunnels where artists can create a continuously changing landscape of murals.

<sup>1</sup> <https://kinder.rice.edu/urbanedge/2020/05/15/civic-pride-slowing-traffic-public-art-public-good>

<sup>2</sup> Cloud Gate by Anish Kapoor

## Benefits

Public art has cultural, social and economic impact. A National Endowment for the arts study found that the arts added \$5.4 billion dollars a year to the Massachusetts economy, and provided over 140,000 jobs.<sup>3</sup> Public Art events, such as the New York City Cow Parade, brought the city \$1 billion in tourism spending. After the festival, New York City sold the sculptures used in the Cow Parade to raise \$1,351,000 for dozens of New York-based charities.<sup>4</sup>

Beyond economic value and employment opportunities, public art has the ability to humanize the urban landscape and invigorates public spaces. Great public art breaks up the mundane of everyday life and creates a strong sense of place, identity and community. When we visit a location its public art is often what cements it in our memory, for example the St. Louis Arch is what most visitors think of when they remember their visit to St. Louis, Missouri.<sup>5</sup>

Public art is a bridge between the community public transportation serves, and the infrastructure needed for public transportation to work. In the National Endowment for the Art's magazine public art issue they said "Perhaps a better term for public art would be community art—by, for, and of the community in which it is presented."<sup>6</sup>

Public art creates a sense of belonging in the community. For example, Boston's T has projects that span from traditional bronze sculptures, to art pieces on escalators rendered by professional artists at Porter Square, to engraved ceramic tiles made by students of a nearby school on the pillars at Broadway Station. Though different in scale, material, and professional quality all of these art projects help the local community feel connected to the train station that serves them. Adding art to your Mobility Hub can

bring a personalized touch to it, and foster a sense of ownership in the community.

## Equity Considerations

Public art is part of a Mobility Hub, but make sure it doesn't interfere with the operation of other elements or disturb pedestrian flow. If an element, such as a bench, is made into public art, make sure riders with disabilities can still use it.

Public art belongs everywhere, not just in downtown centers! Make sure that art resources are distributed geographically equitably. When sourcing art for your Mobility Hub, try to use a diverse array of artists.

It is important to remember that art is labor; make sure to pay artists a fair wage. Public art is most impactful when sourced from artists within the community where it will be located. Project managers should work with other community leaders to assess suitability and appropriateness of the proposed art.

3 <https://www.arts.gov/impact/research/arts-data-profile-series/adp-25>

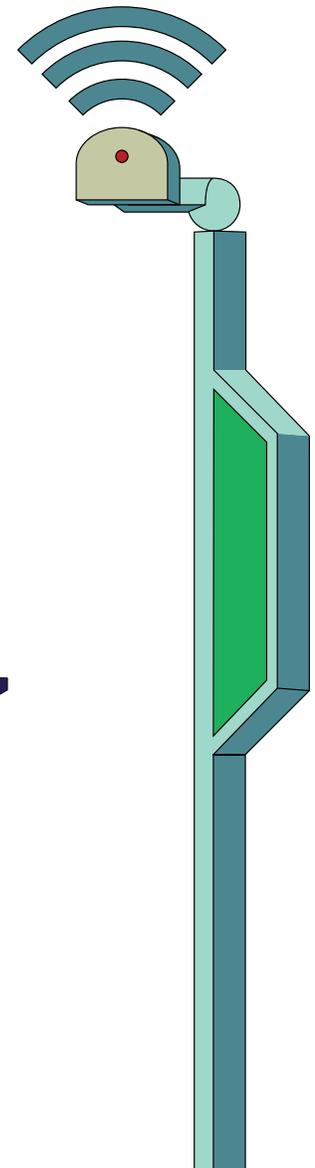
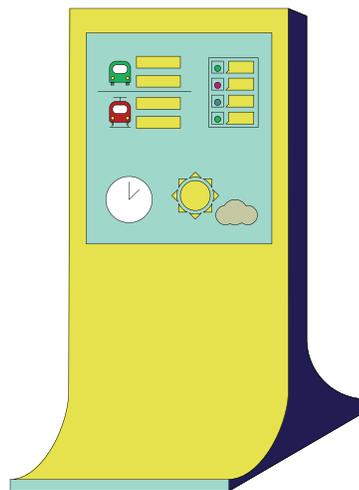
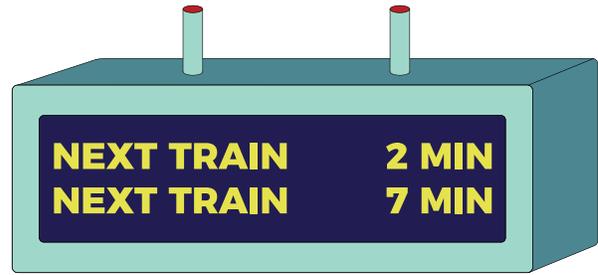
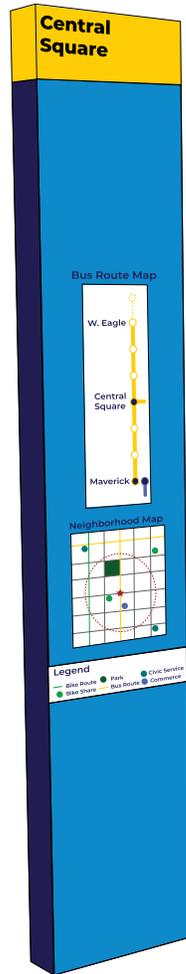
4 <https://www.pps.org/article/how-art-economically-benefits-cities>

5 [https://www.americansforthearts.org/sites/default/files/PublicArtNetwork\\_GreenPaper.pdf](https://www.americansforthearts.org/sites/default/files/PublicArtNetwork_GreenPaper.pdf)

6 [https://www.arts.gov/sites/default/files/nea\\_arts/NEA%20Arts%20No%20202%202018.pdf](https://www.arts.gov/sites/default/files/nea_arts/NEA%20Arts%20No%20202%202018.pdf)



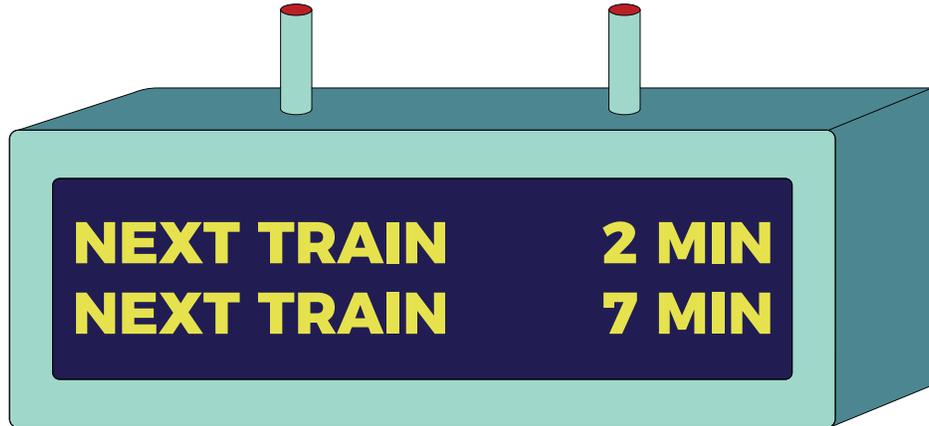
# INFORMATION



Information elements help riders use the transit system and navigate the Mobility Hub and its surrounding neighborhood. Countdown clocks and information kiosks show transit riders their options and let them know when the next ride is coming. Wayfinding signs point pedestrians to where they want to go. Adding these elements enables riders to use transit with confidence.

# COUNTDOWN CLOCK

## INFORMATION



### Description

Countdown Clocks are displays that show waiting riders the time until the next train or bus arrives at the station. This element can be found in many different shapes and sizes. Countdown clocks can be flat screen monitors, large LED signs found hanging in subway stations, or even small solar powered black-and-white displays mounted on poles.

Countdown Clocks can take many different shapes and forms. However, the most common forms are highly visible large station countdown clocks used in the Neighborhood Center Hubs and Gateway Hubs, and smaller solar powered clocks used at Corner Hubs.

## Benefits

Well placed countdown clocks let transit riders know when to expect the next arrival to the station or stop they are waiting at. This allows riders to understand how long they will be waiting and to estimate when they might arrive at their destination. Transit riders who have access to real-time transit information not only perceive their wait as shorter than it actually is, but they spend less time waiting for transit than people who don't have access to real-time information.<sup>1</sup> An accurately displayed wait time for a train or bus also allows transit riders to weigh if they want to wait for the next arrival or seek out an alternative way to get to their destination. Transit riders are more satisfied with transit when countdown clocks are installed. Boston subway riders reported a 15% increase in satisfaction after countdown clocks were installed in a station.<sup>2</sup> New York riders reported similar sentiment after the installation of countdown clocks.<sup>3</sup> Nearby businesses also benefit from a countdown clock - riders who know they have a long wait are more likely to grab a coffee.<sup>4</sup>

## Things to Consider

### Siting

#### Large Station Countdown Clocks

- Large station countdown clocks are usually mounted to two poles attached to the wall or ceiling, placed with high visibility in mind.
- This element can come in a variety of sizes but must be large enough to be easily read from various locations within the station.

- Countdown clocks require power connections to operate.
- Wired Internet access is also usually needed to provide the countdown clocks with up-to-date information on arrival times.

#### Small Station Countdown Clocks

- Small station countdown clocks are mounted on a metal pole, shelter, or other solid structure at eye level.
- A small station countdown clock needs to be small enough to be mounted securely at a variety of locations. The device should at most measure 10 inches across and 30 inches in height.
- Small station countdown clocks are often placed in outdoor stations, receive information via cellular internet and are powered by solar-charged battery.
- Newer small station countdown clocks use E-Ink displays for easy visibility under all types of lighting.<sup>5</sup>

### Costs

- The costs of a countdown clock can vary significantly based on the type being installed and the location it is being mounted.
- Displays need to be repaired or replaced when they are damaged.

### Jurisdiction/Implementer

Countdown devices are the companion element to the real-time information kiosk. Countdown clocks are physically found at transit stops and installed and operated by the municipal government or the regional transit organization. Funding for countdown clocks is often provided by the taxpayer. The transit agency operating the countdown

1 <https://www.zdnet.com/article/the-one-easy-fix-that-can-vastly-improve-public-transit/>

2 <https://www.bostonglobe.com/metro/2013/01/23/mbta-riders-give-higher-marks-after-countdown-clocks-installed-researchers-find/69dNdtvVCBvzmkU2totl0L/story.html>

3 <https://www.wsj.com/articles/BL-METROB-14153>

4 <https://www.bostonglobe.com/metro/2014/02/08/countdown-clocks-give-riders-extra-time-for-their-cup-joe/yEqx15k3R6x6AEq8WmbcOO/story.html>

5 <https://www.mbta.com/projects/solar-powered-e-ink-signs/update/solar-e-ink-signs-go-live-real-time-information>

clock is responsible for providing real-time arrival data to the countdown clocks.

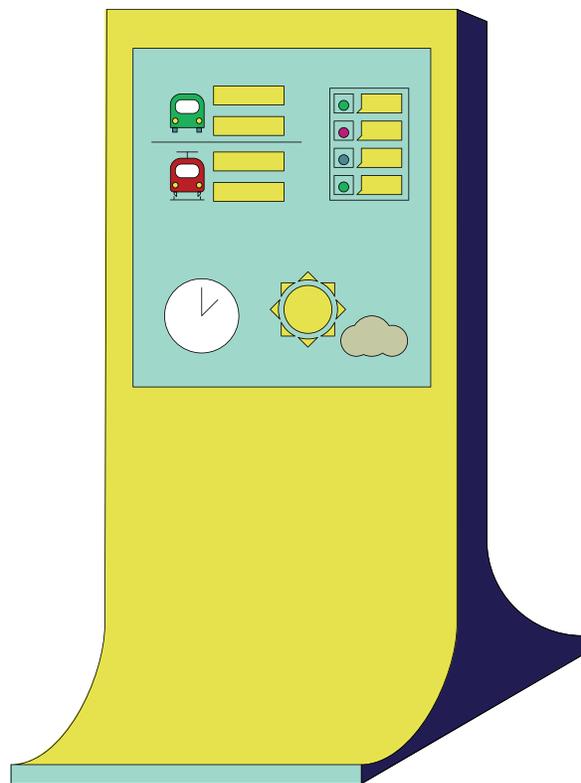
### **Equity Considerations**

All visual updates on the countdown clock should be spoken through a speaker at the station to accommodate people who are visually impaired. Important transit-related announcements announced over speaker should also be shown on the countdown clocks for people who are deaf or hard of hearing.



# REAL TIME INFORMATION KIOSK

## INFORMATION



### Description

Real-time information displays provide accurate information for transit routes arriving at the Mobility Hub, showing clearly the different lines, when the next arrival is, and its destination. These displays can display other information, such as the number of bikes available at nearby bikeshare stations, rideshare wait times, and traffic information as well. Real-time displays come in a variety, from large full-color displays, to black-and-white smaller screens. Some displays provide information beyond the transit times provided on countdown clocks, and show public service announcements, weather, and community events.

This element is found at Neighborhood Center and Gateway Hubs.

## Benefits

Real-time information kiosks help riders to find and compare nearby transit options and information quickly in a convenient way. Someone who has missed their bus can find the nearest bikeshare station and see how many bikes are available there. A display located in a building lobby or on a billboard could save people the time of walking to a station to check arrival times, as well as serve as an amenity for nearby businesses. One coffee shop in Seattle noticed a 33% increase in retail sales after installing a display from TransitScreen - when people saw they had a 5-10 minute wait for their bus, they bought coffee or a snack while waiting.<sup>1</sup>

## Things to Consider

### Siting

- The most important considerations for any real-time information display are visibility and legibility.
  - If the sign is meant to be viewed from far away, it needs to have clear view corridors, be free of glare, and the font size and style must be visible from a distance.
  - If the display switches between transit information and advertisements, the cycle time must be long enough for people to read easily, but not so long that they could walk by and miss the information entirely.
- Information about the line, destination, and arrival time must be clearly presented so that users with language barriers can comprehend it.
- Real-Time Information displays require a power source.
- Displays mounted to a wall should not stick out more than 4 inches. Displays should be mounted between 27-80 inches off the ground.<sup>2</sup>
- Standalone displays should not obstruct the path of travel.

### Jurisdiction/Implementer

There are a wide range of models for locating, implementing, and funding real-time information displays. Many businesses recognize the value that this information brings to their customers and will install displays at no cost to the public. At the same time, public agencies often use the same vendors to buy their own station displays. The transit agency will need to provide arrival time data according to the General Transit Feed Specification (GTFS) standard. Most agencies already provide this for their own countdown clocks, services like Google Maps, and tracking apps.

### Examples

- Captivate, a digital media display company with screens in the lobbies and elevators of over 1,600 buildings, partnered with TransitScreen to add transit information on its displays.<sup>3</sup>
- The city of Revere, MA partnered with Soofa to install 18 kiosks that provide transit information, ad space for local businesses, and a medium for PSAs, health guidelines, and local resources.<sup>4</sup>
- Orange Barrel Media, owner of an ad-supported billboard near Fenway Park in Boston, MA, partnered with TransitScreen to display local transit information in between advertisements to draw more viewers.<sup>5</sup>

1 Croft, Shareable interview: How TransitScreen has evolved into a global information network. <https://www.linkedin.com/pulse/shareable-interview-how-transitscreen-has-evolved-global-ryan-croft/>

2 <https://mvixdigitalsignage.com/blog/ada-compliant-digital-signage>

3 <https://www.bisnow.com/national/news/technology/captivate-reaches-partnership-to-bring-transit-information-to-its-screens-in-1600-office-buildings-100529>

4 Richter, The City of Revere Installs Signs to Push Out Urgent City PSAs to All Residents. <https://www.soofa.co/blog/city-of-revere-installs-soofa-signs-to-push-out-urgent-city-psas-to-all-residents>

5 Vaccaro, A big billboard outside Fenway Park to help you keep track of your train. <https://www.bostonglobe.com/business/2016/12/02/big-billboard-outside-fenway-park-will-tell-you-when-your-train-coming/pe8PDmq4aBGATitg5YF2jJ/story.html>

- The Redmon Group, headquartered in Alexandria, VA, has installed displays and software with a unified style for both public<sup>6</sup> and private<sup>7</sup> clients in the developing region.
- The Chicago Transit Authority (CTA) has a do-it-yourself system that allows anyone to access transit data and customize their own display.<sup>8</sup>

### Equity Considerations

Advocates and agencies should take a both/and approach to providing real-time transit information. Encourage public and private billboard and display providers to incorporate transit information, in ways that are publicly accessible and equitable. For example, a display in the lobby of an apartment building only serves residents and those who have cause to go into that building. Agencies need to preserve access for users with visual disabilities, as well as users who are unbanked or without smartphone access.

## Further Reading

Vanagas, Porlier, et. al. "Best Practices: Real-Time Information". MassTransit. 6 Jun 2017.

<https://www.masstransitmag.com/technology/article/12324156/best-practices-realtime-information>

Redmon Group

<https://www.redmon.com/transit-display/>

TransitScreen

<https://actionfigure.ai/screen/>

Soofa

<https://www.soofa.co>

---

6 Redmon Group, VDOT – Tysons Corner Center. <https://www.transitdisplay.com/>

7 Redmon Group, Washington Real Estate Investment Trust. <https://www.redmon.com/portfolio/writ/>

8 DIY Display beta. <https://www.transitchicago.com/developers/diydisplay/>



# WAYFINDING SIGNAGE

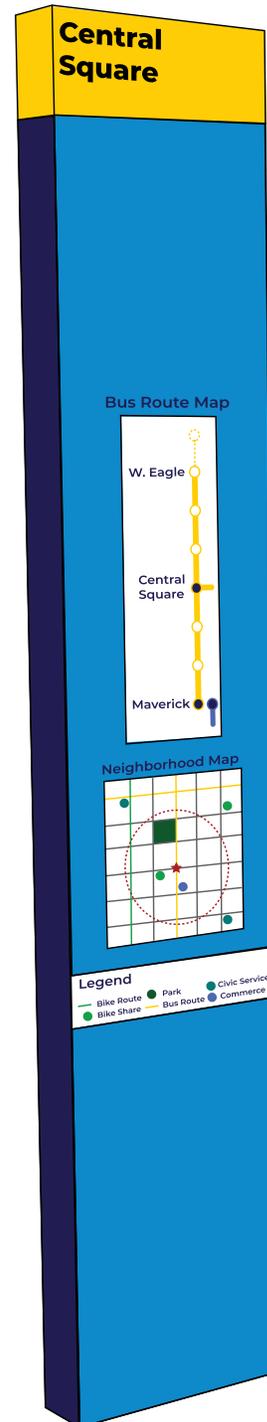
## INFORMATION

### Description

Wayfinding elements orient and direct people to their destinations. They can be placed at Mobility Hubs to guide users to attractions and businesses nearby. These elements can include maps of the surrounding location or signs pointing towards a destination with distances and estimated travel time.

A transit wayfinding sign should emphasize possible connections and destinations based on the modes being used. For example, bicycle-specific wayfinding map should be located near bike cages and other bike infrastructure, and should include bike paths and safe biking routes. A wayfinding map at a bus shelter should emphasize bus and other transit connections.

This element is found at all levels of Mobility Hubs.



## Benefits

Wayfinding information transforms a Mobility Hub from a transit stop into a gateway to the surrounding neighborhood.<sup>1</sup> With well placed wayfinding elements, travelers can quickly find their way and make informed decisions about traveling to their destination. Signs can include information about nearby transit-accessible destinations, transit connections, and bus stops, which is especially important where stops for opposing travel directions are not located immediately near each other.<sup>2</sup>

layouts, signage, and information systems within a transport network significantly improves the wayfinding experience.

### Other Considerations

- Wayfinding elements should not interfere with the path of travel.
- The bottom of the wayfinding sign should be higher than 48 inches and lower than 60 inches.<sup>4</sup>
- Wayfinding Signs should use 2" or 3" letters, depending on how far away the text needs to be read.<sup>5</sup>

## Things to Consider

### Siting

Wayfinding elements can take different shapes and sizes depending on their intended function. Wayfinding signs should be designed with these four principles:<sup>3</sup>

- Easy and Intuitive
  - Wayfinding elements should be designed so that customers can intuitively find their way.
- Consistent, Clear and Legible
  - Signage should be consistent, clear, and easily legible from a distance. Ingress and egress signs should be clearly differentiated.
- Extensive
  - Wayfinding elements providing route information, station layouts, and local destinations should be located all around the station and the surrounding Mobility Hub.
- Standardized
  - The use of standard station

### Costs

The cost of implementing wayfinding elements can vary depending on the scale of the project. The town of Manteca, California estimated that each sign cost between \$455-\$570, broken down into the following costs:

- \$400 for the sign
- \$5-20 for a Normal Pole, up to \$550 for a decorative pole with footing
- \$50-150 for labor<sup>6</sup>

Large scale wayfinding projects can be more expensive. The City of Waltham spent \$40,000 for the design fee and \$250,000 for sign fabrication and installation on its downtown wayfinding project.<sup>7</sup>

### Jurisdiction/Implementer

Both municipalities and transit agencies can implement wayfinding elements at or near Mobility Hubs. Municipalities can install wayfinding at Mobility Hubs that help guide people to city attractions and make

1 <https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/passenger-information-wayfinding/>

2 <https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/passenger-information-wayfinding/>

3 <https://brtguide.itdp.org/branch/master/guide/multi-modal-integration/integration-information>

4 <https://www.greendotsgn.com/wp-content/uploads/2021/06/THE-COMLETE-ADA-SIGN-REQUIREMENTS-GUIDE-2021-Edition.pdf>, 31

5 <https://cdn.mbta.com/sites/default/files/engineering/001-design-standards-and-guidelines/2015-03-01-wayfinding-training-guide.pdf>, II.28

6 [http://manteca-ca.granicus.com/MetaViewer.php?clip\\_id=65&meta\\_id=10163](http://manteca-ca.granicus.com/MetaViewer.php?clip_id=65&meta_id=10163)

7 <http://www.barharbormaine.gov/archivecenter/viewfile/item/96>

walking more pleasurable.<sup>8</sup> Transit agencies can implement wayfinding at Mobility Hubs to help guide riders to where they want to go via the transit system. Consider appealing to your local government or partnering with advocacy groups interested in walkable cities to start implementing wayfinding elements.

### **Equity Considerations**

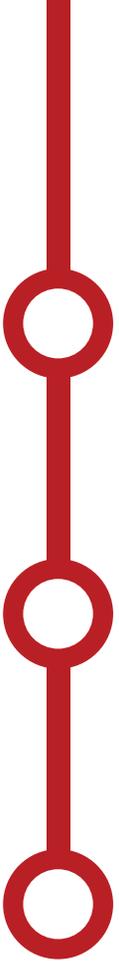
Consider implementing alternative ways to display wayfinding information for those with visual disabilities. Provide an alternative to visual display boards. Audible announcements are preferred over braille and other methods that require finding the wayfinding display.<sup>9</sup> In multilingual communities consider implementing wayfinding signage with text written in multiple languages.

---

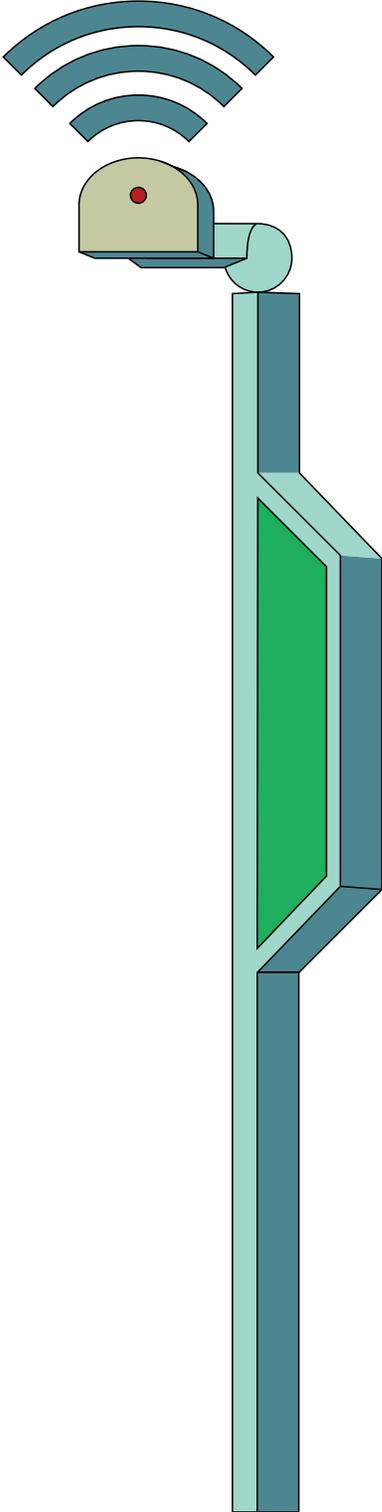
8 <https://www.boston.gov/news/new-pedestrian-wayfinding-signs-coming-south-boston-waterfront>

9 <https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/passenger-information-wayfinding/>





# PUBLIC WI-FI INFORMATION



## Description

Public Wi-Fi access at Mobility Hubs allows transit users with Wi-Fi enabled devices to connect to the internet while waiting at transit stops. Additionally, Wi-Fi availability at transit stops allows riders with a limited or no data plan to stay connected as they wait for their bus or train.

This element is found at Neighborhood Center and Gateway Hubs.

## Benefits

Mobility Hubs with Wi-Fi access points allow transit users the option of connecting to the internet to work, socialize, or seek entertainment while waiting for their ride without needing to use mobile data. Public transit users are increasingly using the internet to be more productive during their commute. In New York City, 70% of public transit commuters send email or SMS/IM messages during their commute.<sup>1</sup> Having Wi-Fi available for transit users at Mobility Hubs allows users to stay connected to the internet before, between, and after their transit rides.

Riders can also use public Wi-Fi to look up real time transit arrival times. Transit riders who have access to real-time transit information not only perceive their wait as shorter than it actually is, but they spend less time waiting for transit than people who don't have access to real-time information.<sup>2</sup>

## Things to Consider

### Siting

Public Wi-Fi networking equipment must be physically installed at the location that Wi-Fi will be available. It should:

- Have enough physical space for all needed equipment such as routers and Wi-Fi access points.
- Protected from extreme weather and curious animals.
- Inaccessible to malicious tamperers.
- Easily accessible by network technicians who service the equipment.<sup>3</sup>

### Costs

The costs for implementing Public Wi-Fi will vary based on the area being covered and the speed of the internet being purchased from an internet service provider. The one time cost of purchasing a single wireless access point can be from \$50-500 depending on the brand and quality being purchased.<sup>4</sup> Multiple wireless access points may be needed to cover a large Mobility Hub.

### Jurisdiction/Implementer

Municipalities or transit authorities are responsible for implementing Public Wi-Fi access points at Mobility Hubs located on city or transit authority property. Private companies can also offer public Wi-Fi access when Mobility Hubs are located on or near private property with free public Wi-Fi.

### Equity Considerations

Public Wi-Fi access points allow people with limited or no mobile data plans to access the internet. In one survey, 49 percent of U.S.-based respondents use public Wi-Fi when they can't get a cellular connection.<sup>5</sup>

---

1 <https://mb.cision.com/Public/15448/2245329/bd73b23bdb92cee9.pdf>

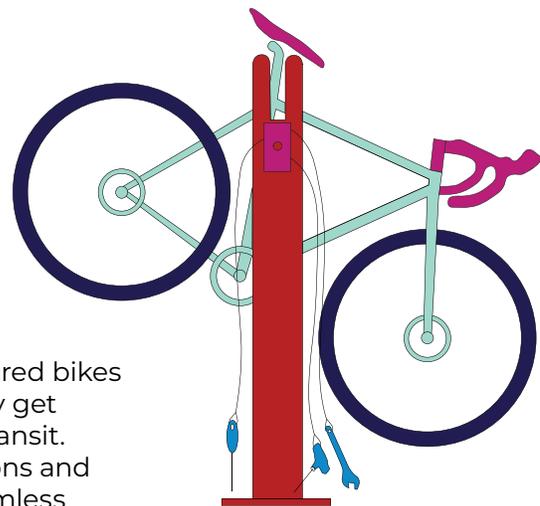
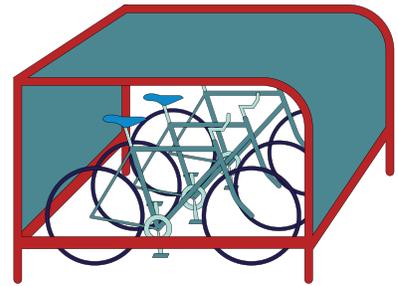
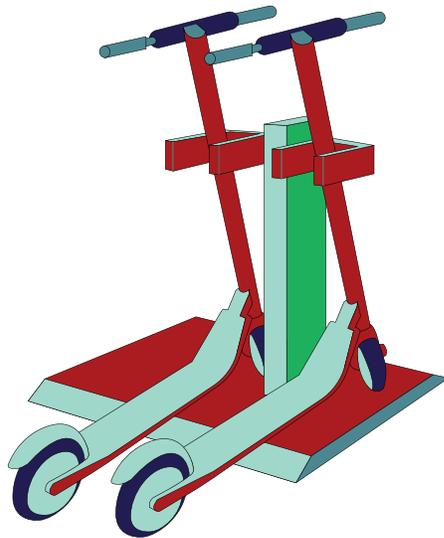
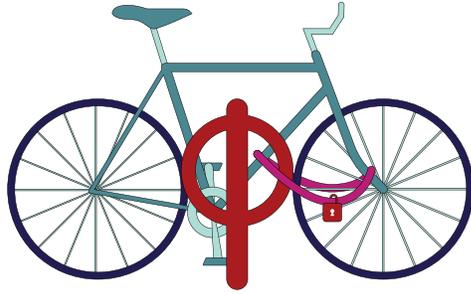
2 <https://www.zdnet.com/google-amp/article/the-one-easy-fix-that-can-vastly-improve-public-transit/>

3 [https://www.vtrural.org/programs/digital-economy/services/wifi/toolkit#\\_Toc404328640](https://www.vtrural.org/programs/digital-economy/services/wifi/toolkit#_Toc404328640)

4 <https://www.ciscopress.com/articles/article.asp?p=680821&seqNum=2>

5 <https://statetechmagazine.com/article/2019/10/how-cities-fulfill-demand-public-wi-fi-perfcon>

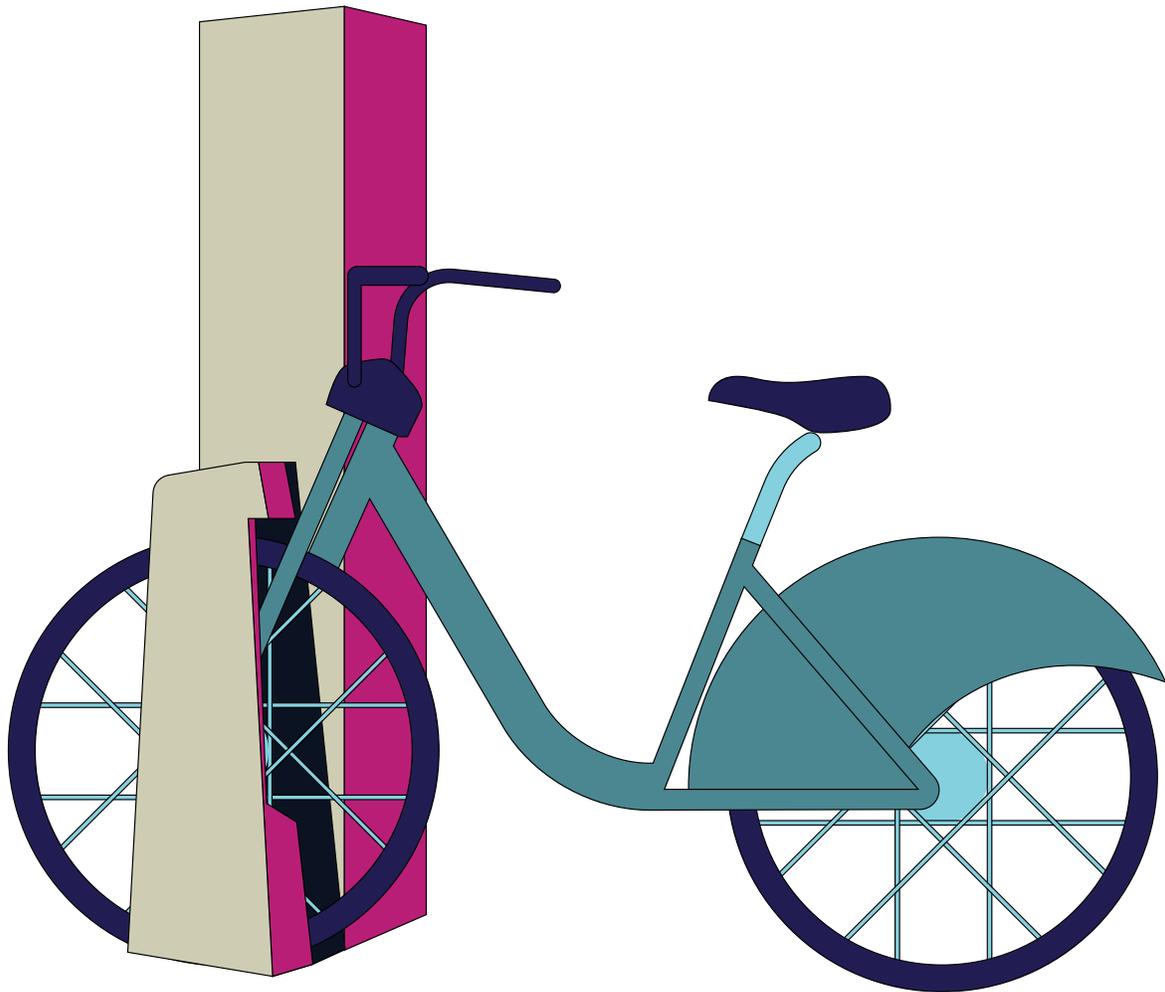
# MICROMOBILITY



Micromobility vehicles such as shared bikes and scooters allow users to quickly get to and from areas not served by transit. Elements such as bike share stations and secure bike parking provide a seamless connection for micromobility users.

# BIKESHARE STATION

## MICROMOBILITY



### Description

Bikeshare stations are bicycle racks with bicycles that can be rented and returned to any other bikeshare station in the network. The stations lock (“dock”) the bikes to the rack when they are not in use. Dockless bikeshare (or scooter) systems may have designated parking areas at a Mobility Hub. Maps of the local neighborhood are often included with the station to assist with neighborhood navigation and locating other network stations.

This element is found at all levels of Mobility Hubs.

## Benefits

Bikeshare stations allow people without their own bike to rent a bike for one-way travel to their destination without worrying about returning the bike to where they originally rented it. In 2016, the United States Bureau of Transportation Statistics found that 77% of all bikeshare stations in the US were located within one block of another public transit mode.<sup>1</sup> Bikesharing complements transit by providing riders a way to complete the last mile to their final destination, farther than they would otherwise walk. With a low barrier to use, bikesharing opens up more mobility options while also being healthy for both the environment and the rider.<sup>2</sup>

## Things to Consider

### Siting

- A typical 15-bike station measures 40 x 6 feet.
- To comply with the ADA, bikeshare stations located on sidewalks must be wide enough to contain both the station and at least 5-6 feet of space on the sidewalk.
- Bikeshare stations located on the street can be placed in parking lanes at least 8 feet wide and should be positioned so that the curb does not impede access to bikes.
- Bikeshare stations must allow access to utility access points like fire hydrants, sewer grates, and manholes.<sup>3</sup>
- Bikeshare stations are often solar powered and require a sunny location to properly function.

- Each station must be easy to spot from the street during both the day and night.

### Costs

Each bikeshare station typically costs \$40,000-\$50,000 in capital costs, plus operating costs.<sup>4</sup>

### Jurisdiction/Implementer

Bikeshare stations can be implemented and financed by private companies, municipal governments, or public/private partnerships. For example, the City of Boston owns the physical stations in Boston, while the private company Motivate provides operational support. In contrast, the Los Angeles County Metropolitan Transportation Authority owns and operates the LA Metro Bike Share that serves the LA region.<sup>5</sup> Companies like Uber and Lyft have bought private North American bikeshare operators Jump and Motivate respectively.<sup>6</sup>

### Equity Considerations

Bikeshare offers a less-costly alternative to owning and maintaining a personal bike, especially for first time and occasional riders. Bikeshare stations were first installed in more densely populated, higher income downtown neighborhoods, leading to criticisms that bikeshare systems were not serving city residents equitably. Few bikeshare stations or systems offer a payment option for those who do not have a debit or credit card. Bikeshare programs should consider creating a plan for installation of bikeshare stations in all areas of the city and an option to pay for rides in cash.<sup>7</sup> Bikesharing networks should not require a deposit; they can lead

1 <https://www.transformative-mobility.org/assets/publications/The-Bikeshare-Planning-Guide-ITDP-Datei.pdf> 10

2 <https://www.masstransitmag.com/alt-mobility/article/10724679/closing-the-gap-bike-shares-help-complete-the-last-mile>

3 [https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide\\_FINAL.pdf](https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide_FINAL.pdf) 12-14

4 <https://www.transformative-mobility.org/assets/publications/The-Bikeshare-Planning-Guide-ITDP-Datei.pdf> 80

5 <https://www.bicycletransit.com/our-current-programs/los-angeles/>

6 <https://archive.curbed.com/2019/12/16/20864145/bike-share-citi-bike-jump-uber>

7 <https://www.transformative-mobility.org/assets/publications/The-Bikeshare-Planning-Guide-ITDP-Datei.pdf> 50

to unexpected overdraft fees especially for low-income customers. Many bikeshare programs even include a discount option for low-income customers.

### **Example**

- Motivate, a private company owned by Lyft, operates the docked bikeshare programs in New York, Chicago, Washington DC, and Boston.
- The LA Metro Bike Share is a network of bikeshare stations operated by the Los Angeles County Metropolitan Transportation Authority

## **Further Reading**

Bike Share Station Siting Guide

[https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide\\_FINAL.pdf](https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide_FINAL.pdf)

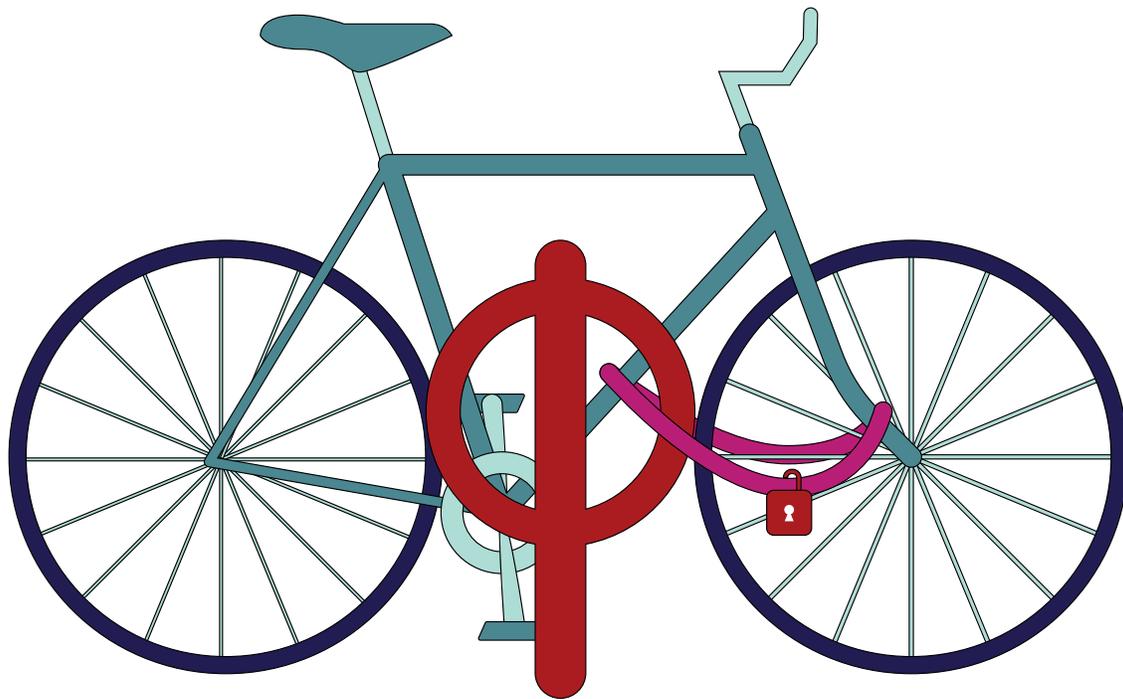
The Bikeshare Planning Guide

<https://www.transformative-mobility.org/assets/publications/The-Bikeshare-Planning-Guide-ITDP-Datei.pdf>



# BIKE RACKS & CAGES

## MICROMOBILITY



### Description

Bike racks are metal bars secured to the ground, allowing bikes to be locked while unattended. The simplest bike racks are a U-shaped metal pipe bolted to the ground, but others may employ artistic designs (though more complex designs do not necessarily mean improved capacity, ease of use, or security). More advanced bike racks may have a roof and walls built over them.

A bike cage is a fenced area that provides high-density storage for bikes. Racks inside the cage are placed closer together, and some cages can “double-stack” bikes. Bike cages can also control access by requiring a key or key card to enter.

Bike racks are found at all levels of Mobility Hubs. Bike cages are found at large Neighborhood Center Hubs and Gateway Hubs.

## Benefits

Bike racks and cages provide a convenient place for bikers to store and protect their bikes from theft. Sheltered bike racks and cages can protect bikes from rain while they are parked. Compared with car parking, bike racks can increase parking capacity by 400 to 800 percent, increasing customer traffic to local businesses.<sup>1</sup>

Bike racks are an essential part of transit. They encourage biking, which connects people to their destinations directly (biking A to B) or in combination with other transit modes (e.g. bus plus bike). Bike racks also benefit non-bikers; racks provide a designated spot for bikes so they don't block the path of bikers, pedestrians, or wheelchair users.

## Things to Consider

### Siting

#### Bike Racks

- Bike racks should not obstruct existing sidewalks and walkways.
- Bike racks should only be installed on a sidewalk at least 10 feet wide.
- Bike racks should be placed at least 2 feet from the curb, and 4 feet from other obstructions, such as light poles and electrical boxes.
- Bike racks on a sidewalk can be built either parallel (facing) the curb, or perpendicular (at a right angle) to the curb. If the sidewalk is less than 14 feet

wide, they should be placed parallel to the curb.<sup>2</sup> Alternatively, consider angling bikes 30 degrees so that they take up less of the sidewalk.<sup>3</sup>

#### Bike Cages

- A bike cage 20 feet wide by 35 feet deep can store 70 bikes, but can be expanded to accommodate more bikes.
- Bike racks or cages installed at a Mobility Hub should be convenient. At least one should be installed 50 feet or closer to the Mobility Hub entrance.<sup>4</sup>

#### Costs

- A basic 2-slot (U-shape) costs \$200<sup>5</sup>
- A rack with capacity for 4-8 bikes costs \$500 to install.<sup>6</sup>
- A corral holding 20 bikes costs \$3000.<sup>7</sup>
- A full cage holding 70 bikes was estimated to cost \$21,000. This does not include construction costs.<sup>8</sup>
- Boulder RTD estimated that maintaining bike shelters cost \$2,000/year per shelter.<sup>9</sup>

#### Jurisdiction/Implementer

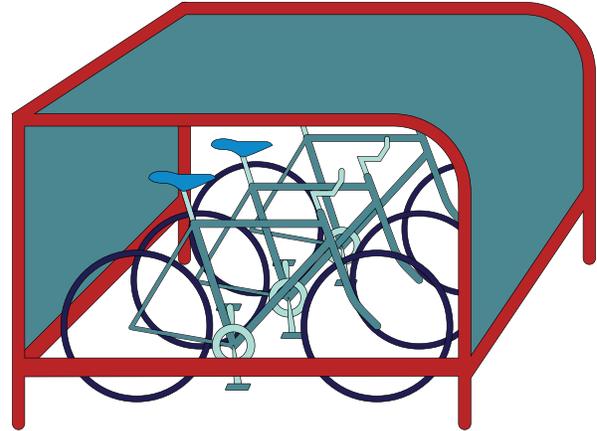
The bike rack's low cost and minimal maintenance requirements means that they can be installed as one-off, individual projects as well as part of a network planned by large institutions. Some are installed with funding from public sources, such as municipalities and transit agencies. Others are provided by businesses and universities.

---

1 <https://www.bicycling.com/news/a20024191/the-best-way-to-promote-city-riding-bike-racks/>  
2 [https://web.archive.org/web/20201114114504/https://www.cityofberkeley.info/uploadedFiles/Public\\_Works/Level\\_3\\_-\\_Transportation/Bike\\_Rack\\_Specs\\_Installation\\_Sept2008.pdf](https://web.archive.org/web/20201114114504/https://www.cityofberkeley.info/uploadedFiles/Public_Works/Level_3_-_Transportation/Bike_Rack_Specs_Installation_Sept2008.pdf) (Captured Nov. 14, 2020)  
3 <https://huntco.com/newsroom/2016/4/4/why-do-bike-corrals-look-like-that>  
4 <https://www.madrax.com/bike-parking-guide>  
5 Weigand, McNeil, and Dill. Cost Analysis of Bicycle Facilities: Cases from the Cities in the Portland, OR region. 36  
6 <https://www.theparkcatalog.com/grid-bike-racks>  
7 Weigand, McNeil, and Dill. Cost Analysis of Bicycle Facilities: Cases from the Cities in the Portland, OR region. 36  
8 Velodome Estimate  
9 Toole Design Group Memo to Boulder RTD. (Appendix C)

## Equity Considerations

Consider areas with low car ownership, and low first/last mile connectivity. If designing a decorative or non-standard bike rack, consider user experience. Two points of contact are needed to prevent bikes from falling over, and the design should be able to easily accommodate a U lock for a variety of bike sizes.



## Further Reading

Transit Street Design Guide - Bike Parking

<https://nacto.org/publication/transit-street-design-guide/station-stop-elements/stop-elements/bike-parking/>

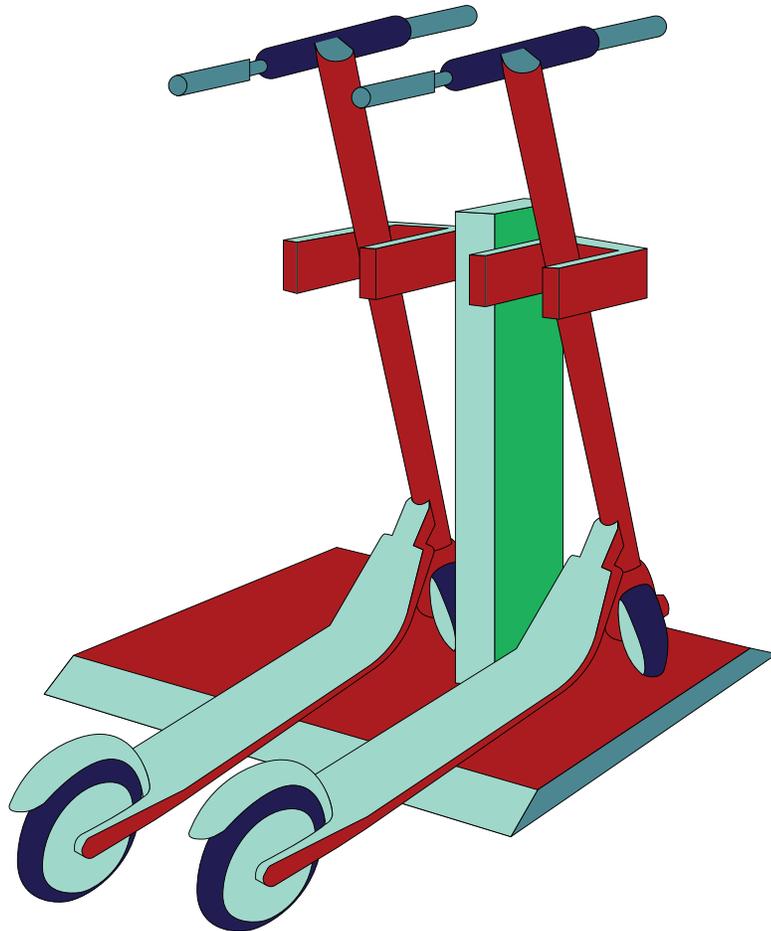
Essentials of Bike Parking

[https://www.apbp.org/assets/docs/EssentialsofBikeParking\\_FINA.pdf](https://www.apbp.org/assets/docs/EssentialsofBikeParking_FINA.pdf)



# ELECTRIC BIKE/ SCOOTER CHARGING STATION

## MICROMOBILITY



### Description

Micromobility transit, such as shared bikes and electric scooters, are an increasingly popular way for people to navigate US cities. In 2019, Americans took 136 million rides on shared bikes or electric scooters.<sup>1</sup> Electric micromobility charging stations are docking stations where electric scooters, e-bikes, and other micromobility electric vehicles can be safely stored, locked, and charged. Micromobility charging stations come in different varieties; some only allow system-owned electric bikes and scooters to dock. Other models allow both shared vehicles and compatible personal electric vehicles to dock and charge.

This element is found at Neighborhood Center Hubs and Gateway Hubs.

<sup>1</sup> <https://nacto.org/shared-micromobility-2019/>

## Benefits

Electric bikes and scooters are sustainable modes of transport. E-bikes and scooters are quieter, produce less emissions, and have comparable travel time on short urban trips to gas-powered cars.<sup>2</sup> Thoughtfully placed e-bike and e-scooter charging stations also fill gaps in a transportation network and are especially useful for riders trying to quickly get to their final destination after riding another form of public transportation.<sup>3</sup> A study in Nashville found that e-scooters, either on their own or when combined with other modes of transit, doubled the number of jobs accessible within 45 minutes.<sup>4</sup> Electric charging stations also can provide structure to dockless shared systems. Visible electric charging stations signal to users where to park and charge dockless scooters and e-bikes when they are done with their trip.

## Things to Consider

### Siting

The most common types of electric micromobility charging stations are solar powered and require a sunny location to properly function. Some models require an electrical connection or are battery powered for ease of placement or portability respectively. Every station must be easy to spot from the street during both the day and night.

- Electric charging stations come in different sizes but are usually smaller than a typical 40 x 6 feet, 15-bike station.
- Electric charging stations located on sidewalks require that the walkway be wide enough to contain both the station, charging bikes, and at least 5-6 feet of space on the sidewalk side to allow for ADA compliant sidewalks.

- Charging stations must allow access to utility access points such as fire hydrants, sewer grates, and manholes.<sup>5</sup>

### Costs

Electric micromobility charging stations often have multiple costs associated with their operation. These costs can include:

- The one-time capital cost of buying the station from a private vendor.
- Activation fee for each shared vehicle that will use the charging station.
- Usage fees based on volume.
- Operation costs, such as repairs and maintenance.

### Jurisdiction/Implementer

North American electric micromobility charging stations are currently implemented by private companies or public municipalities in partnership with private companies. In private/public partnerships the micromobility charging stations are purchased and managed by the public organization and all operations are performed by a private company. Private companies that fund and operate electric charging stations without public funding must also cooperate with city governments since their infrastructure and vehicles need access to public streets and sidewalks.

### Equity Considerations

Shared system e-scooters and e-bikes are accessible alternatives for infrequent users and users who cannot outright purchase a personal electric scooter or bike. Electric charging stations that only accept payment via smartphone or credit card can block unbanked riders and low-income riders from equitably accessing shared e-scooters and e-bikes. Implementers should consider including at least one low barrier rental

2 <https://thebikeadviser.com/how-much-co2-can-ebikes-save/>

3 <https://www.itdp.org/wp-content/uploads/2019/12/ITDP-The-Electric-Assist-Leveraging-E-bikes-and-E-scooters-for-More-Livable-Cities-Executive-Summary.pdf>

4 [https://www.itdp.org/wp-content/uploads/2019/12/ITDP\\_The-Electric-Assist\\_-Leveraging-E-bikes-and-E-scooters-for-More-Livable-Cities.pdf](https://www.itdp.org/wp-content/uploads/2019/12/ITDP_The-Electric-Assist_-Leveraging-E-bikes-and-E-scooters-for-More-Livable-Cities.pdf)

5 [https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide\\_FINAL.pdf](https://nacto.org/wp-content/uploads/2016/04/NACTO-Bike-Share-Siting-Guide_FINAL.pdf) 12-14

option such as accepting cash payments, and a discount for low-income customers. Like their non-electric station counterparts, charging stations are often first installed in more densely populated and higher income downtown neighborhoods. Implementers should consider making plans to equitably distribute electric charging stations around the city so they become useful transit tools for all residents.

### **Example**

Swiftmile is a private company that provides both physical charging station infrastructure and fleet management operations to private companies or public municipalities. Swiftmile currently only provides infrastructure for Swiftmile vehicles.

Kuhmute is a private company that provides physical electric charging station infrastructure for all types of electric vehicles smaller than a car. They allow for both shared system vehicles and private electric micromobility vehicles to be docked, locked, and charged.

## **Further Reading**

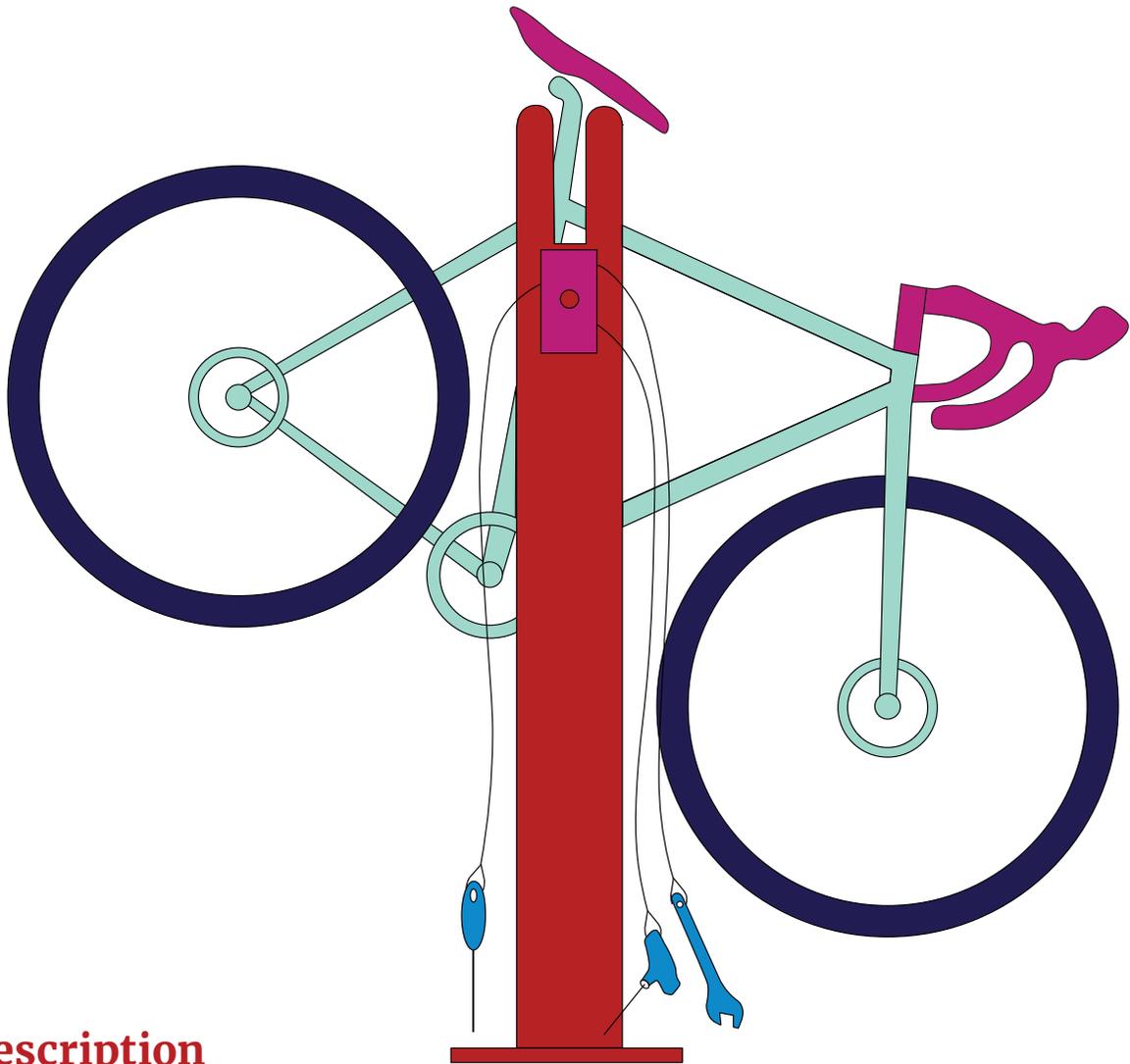
The Electric Assist: Leveraging E-Bikes and E-Scooters for More Livable Cities

[https://www.itdp.org/wp-content/uploads/2019/12/ITDP\\_The-Electric-Assist\\_-Leveraging-E-bikes-and-E-scooters-for-More-Livable-Cities.pdf](https://www.itdp.org/wp-content/uploads/2019/12/ITDP_The-Electric-Assist_-Leveraging-E-bikes-and-E-scooters-for-More-Livable-Cities.pdf)



# BICYCLE REPAIR STATION

## MICROMOBILITY



### Description

Bicycle repair stations provide a stand and tools for basic bicycle repairs, such as repairing a flat tire or adjusting the brakes. One of the most common bicycle repairs is simply adding air to tires, which can be easily done at a repair station.<sup>1</sup> Weather-resistant screwdrivers and wrenches are attached to the station with steel cables to prevent tools from being lost. Public repair stations allow users to fix problems without taking their bike to a shop, or owning their own equipment.

This element is found at Neighborhood Center Hubs and Gateway Hubs.

<sup>1</sup> Common Bicycle Repairs - <https://www.bicycling.com/repair/g20032398/how-to-do-these-five-common-bicycle-repairs/>

## Benefits

Cyclists can comfortably repair their bicycle in a designated area, without bringing their own tools. Instructions mounted on the pole can teach cyclists how to perform repairs. When located at Mobility Hubs, commercial establishments, and other public spaces, repair stations ensure that cycling is a reliable mode of transportation. The benefits of the repair station are enhanced when combined with other bike-focused Mobility Hub elements.<sup>2</sup>

## Things to Consider

### Siting

- Bicycle repair stations should be sited near bicycle parking and easily identifiable.
- The base should be mounted to poured concrete in order to provide a secure footing for the bike stand. This can either be a narrow column (36 inches wide and 4 inches deep) or a wider pad. (16 inches wide and 36 inches deep)
- To be ADA-compliant, there must be 60 inches of clearance between the station and the street. For repairs, 45 inches of clearance between the repair stations and other obstacles are required on at least one side of the station.<sup>3</sup>

### Costs

The most popular vendors of public repair stations are Dero and Saris. Stations range in price from roughly \$700<sup>4</sup> for the most basic versions, up to \$1000<sup>5</sup> for feature-heavy models, not including installation costs. Units are designed for durability, have

anti-tampering measures, and have minimal maintenance costs.<sup>6</sup> In the event that tools are damaged, replacements cost less than \$100.<sup>7</sup>

### Jurisdiction/Implementer

The repair station's low upfront cost and minimal maintenance means that they can be installed as one-off, individual projects or as part of a larger network. Some are installed with funding from public sources, like municipalities and park agencies. Other installations are provided by businesses and universities.<sup>8</sup>

### Equity Considerations

Low-income neighborhoods may not have nearby bicycle repair shops. Providing a repair station can enable riders to fix their bicycles without having to buy tools or pay for repairs. Bicycle infrastructure encourages cycling, enabling mobility for those without access to cars.<sup>9</sup>

Example:  
Public bike repair stations can be found in many cities, including Boston, Cambridge, and Somerville. The City of Cambridge awarded money through its participatory budgeting program for 8 repair stations in the city.<sup>10</sup>

## Further Reading

Boarnet, Giuliano, Hou, and Shin, "First/last mile transit access as an equity issue." Science Direct. 2017

<https://www.sciencedirect.com/science/article/pii/S0965856416302737>

2 <https://www.theparkcatalog.com/blog/bike-repair-station-ten-reasons-to-add/>

3 Dero Installation Guide - <https://www.dero.com/installation/fixit.pdf>

4 <https://www.sarisinfrastructure.com/product/public-work-stand>

5 <https://www.homedepot.com/p/Dero-Bike-Fixit-Station-FIXIT/206363158>

6 <https://cyclesafe.com/bike-parking/options/public-bike-repair-stand/>

7 <https://www.sarisinfrastructure.com/catalog/replacement-parts>

8 Northeastern Installs Bike Repair Station - <https://news.northeastern.edu/2013/01/18/bike-repair-station/>

9 <https://www.sciencedirect.com/science/article/pii/S0965856416302737>

10 City of Cambridge Participatory Budgeting Program - <https://pb.cambridgema.gov/pb4kickoff>

Dero, "Fixit Installation."

<https://www.dero.com/installation/fixit.pdf>

Westley, Lindsay, "How to Do These Five Common Bicycle Repairs." *Bicycling*. July 7, 2014.

<https://www.bicycling.com/repair/g20032398/how-to-do-these-five-common-bicycle-repairs/>



# ACKNOWLEDGEMENTS

The toolkit is sponsored by a grant from the Sasaki Foundation.

## **Mobility Hubs Toolkit Team:**

Jarred Johnson

John Branagan

Molly Dee

Armand Halbert

Aaron Kraemer

Matthew Petersen

Matthew Rice

Alex Yamron

## **Special Thanks To:**

Jim Aloisi

Noah Bell

Dunbar Carpenter

Najah Casimir

Jennifer DeBerardinis

Chris Dsida

Wila Halbert

Kirstie Hostetter

Mike Manning

Nick Neveux

Andrew Wiley



This book was printed by PrintSynergy Solutions on uncoated 70lb paper stock. The images in this toolkit were taken by Aaron Kraemer, Molly Dee, John Branagan, and Armand Halbert. The illustration in this book were designed by Aaron Kraemer, Molly Dee, and John Branagan using Adobe Illustrator and Adobe Photoshop. These pages were laid out in Adobe InDesign using the typefaces Montserrat, and Merriweather.



No Parking  
East Boston  
Permitted  
Parking  
From 8am  
Monday through  
Friday

