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Urban Design Working Group

BICYCLE AND TRANSIT INTEGRATION:

A PRACTICAL TRANSIT AGENCY GUIDE TO BICYCLE INTEGRATION AND EQUITABLE MOBILITY

Abstract: This *Recommended Practice* provides guidance to transit agencies for integrating bicycles with buses and trains.

Keywords: advocacy**,** bike, bike share, bus, cycle, dockless bikes, innovation, multi modal, mode share, racks, ridership

Summary: This guide includes a series of recommended practices for transit agencies interested in addressing the growing demand for bicycle mobility and connectivity to buses and trains. The recommended practice covers a broad range of subject matter related to bicycles and transit including bike parking near facilities, onboarding procedures and other issues to enhance connectivity and grow ridership. Future recommended practices will explore onboarding policies and procedures and other issues to enhance

Scope and purpose: In addition to raising awareness about the challenges of bike/transit integration, this guide is intended as a tool to:

- Increase transit ridership
- Develop effective bicycle-related policies informed by transit agency best practices
- Identify barriers to bicycle/transit integration and strategies to overcome challenges
- Navigate the challenges of policymaking for multimodal transit connections
- Reduce congestion and promote positive community development practices
- Spur internal inspiration and education about the benefits of facilitating bicycle connections to transit
- Catalyze innovation and discourse in bicycle and transit integration

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Participants

The American Public Transportation Association greatly appreciates the contributions of the **Urban Design Working Group** and the **Sustainability and Urban Design Standards (SUDS) Policy and Planning Committee**, which provided the primary effort in the drafting of this document.

At the time this standard was completed, the working group for this *Recommended Practice* included the following members:

Dan Suraci, *Chair*

Louis Alcorn, *Capital Metropolitan Transportation Authority*
James Allison, *Capital Corridor Joint Powers Authority*
Steve Beroldo, *Bay Area Rapid Transit*
Robert Borowski, *Capital Metropolitan Transportation Authority*
Melanie Bowzer, *Association of Pedestrian and Bicycle Professionals (APBP)*
Jen Buison, *New Jersey Transit Corporation*
Jamie Carrington, *Washington Metropolitan Area Transit Authority*
Matt Childs, *Sportworks*
Sandra Clarey, *McMahon Associates and APBP*
Stacy Cook, *Cambridge Systematics*
Lee Cryer, *Regional Transportation District*
Paul DesRoscher, *Regional Transportation District*
Tony Drollinger, *Metro Transit*
Phillip Groth, *Massachusetts Bay Area Transportation Authority*
Tony Jusay, *LA Metro*
Ron Kilcoyne
Heath Maddox, *San Francisco Municipal Transportation Agency*
Ken McLeod, *League of American Bicyclists*
Laura Minns, *WSP*
Mostafa Omran, *Toronto Transit Commission*
Jeff Owen, *Tri-County Metropolitan Transportation District of Oregon*
Eric Rayl, *Sportworks*
Rebecca Roush, *Sound Transit*
Malva Slachowitz, *King County Metro*
Jacob Splan, *Utah Transit Authority*
Nancy Lyon-Stadler, *WSP*
Cyndi Steiner, *New Jersey Bike Walk Coalition*
Brent Tongco, *Cascade Bicycle Club*
Mike Viscardi, *New Jersey Transit Corporation*

Project Team
Zachary Smith, *American Public Transportation Association*

Introduction

This introduction is not part of APTA SUDS-UD-RP-009-18."

This guide represents a series of recommended best practices and solutions for facilitating bicycle integration with transit services and is informed by the experiences of a diverse variety of transit agencies across North America. The purpose of this document is to provide guidance to transit agencies and municipalities seeking to facilitate active first/last mile connections to transit, reduce congestion and promote healthy communities. Optimal strategies for integrating bicycles with transit are context-driven, based on an agency's mode(s), ridership, geography, regulatory environment and other place-based factors. To address this variability, each section of this document is organized with a common structure that includes a decision-making framework to guide planners and policy makers through the process of evaluating their specific conditions and tailoring strategies to meet those needs. Included are case studies, useful tips, tested strategies and definitions, as well

as recommended methodologies for data collection and other resources. Whether just beginning to address bicycle ridership or exploring options to increase existing service, every transit system is situated within a unique community and regulatory context. These differences require transit agencies to remain nimble in their approach to accommodating customers with bikes, and adaptive to the changing needs of both customers and the built environment. As such, each section of the document is designed to address specific issues related to bicycle and transit connectivity and can be used independently to meet a community's dynamic needs.

APTA recommends the use of this document by:

- Individuals or organizations that operate public transit systems;
- Individuals or organizations that contract with others for the operation of public transit systems; and
- Individuals or organizations that influence how public transit systems are operated (including but not limited to consultants, designers and contractors)

BICYCLE AND TRANSIT INTEGRATION

1. Why integrate bikes and transit?

The core mission of a transit agency is to provide equitable mobility to transit customers and to facilitate community connectivity. In today's changing transportation landscape, agencies need to look beyond conventional transit services and prioritize mobility from the customers' perspective to remain competitive and responsive to demand. Integrating bicycles with transit services can benefit transit agencies, communities and customers. The combination helps form a connected network of transportation options that fosters affordable mobility, equity, health and sustainable communities. Integrating bikes with transit has become standard practice among large and small agencies throughout the U.S. and Canada, although the degree of integration varies. Agencies are most successful at integrating bikes with transit when they clearly and unequivocally articulate their policies about why and how bikes support their system and community objectives. This customer focus requires planning for the complete trip, including the first/last mile connections to transit. Bicycling is a tool that transit agencies can use to enhance mobility for customers and to augment the scope of conventional services like bus, rail and ferries.

Bicycles are a useful mode of transportation for short trips (one to three miles), beyond a walkable distance but accessible without an automobile. Municipalities across North America are developing strategies to facilitate biking as a mode of transportation with a place-based mix of on-street facilities and bike-friendly policies. As these same communities leverage public transit assets in planning for development, it is critical for public officials, planners and advocates to recognize opportunities for active transportation connections to facilitate enhanced transit customer mobility, public health and economic development. Prioritizing bicycle routes to transit stops and stations, reducing traffic, and improving bicycle and transit integration (bike parking, bikes-on-board capacity) is essential to getting transit customers out of their cars and on a bicycle for the first or last mile of travel. Bicycle and transit integration strategies are context-driven based on the dynamic needs of individual communities.

Data paints a compelling picture of a rise in complementary travel modes. While there are few industry-wide numbers related to bicycle and transit integration, many agencies across the United States have noticed an increased demand for secure bike parking.

Despite a lack of abundant data on bicycle and transit integration specifically, agencies should focus on peer efforts (the case studies contained herein) and recognize the inherent vested interest in linking bikes with transit and a growing industry dataset to describe this trend.

According to APTA's 2017 Factbook, transit passenger trips fell 1.4 percent from the high of 10.75 billion in 2014. This could indicate increased competition in the transportation marketplace, underscoring the need for transit agencies to adapt to changing customer priorities and choices.

Bicycle ridership is increasing nationwide. According to the League of American Bicyclists, the United States saw a 62 percent increase in bike commuting between 2000 and 2013. The same survey of the 70 largest cities in the country revealed a 105 percent increase in bicycle commuting in communities designated as "bicycle

friendly" by the League. The increase in bicycle ridership corresponds to a decrease in vehicle miles traveled (VMT). In 2011, APTA reported a 1.2 percent decrease in nationwide VMT.

1.1 The benefits of bike integration

In addition to the naturally apparent benefits of cycling—low environmental impact, personal and public health, maximized capacity of street network, minimal barrier to entry, low costs, etc.—bicycle integration also benefits transit by:

- Creating safer and more convenient connections to fixed-route transit service
- Increasing transit ridership
- Producing healthier, safer and more livable communities around transit facilities
- Expanding the reach of transit
- Providing affordable mobility for underserved transit customers
- Creating goodwill with customers
- Helping to manage demand for car parking at park-and-rides and adjacent neighborhoods
- Potentially reducing drive-alone trips, when used as a tool in transportation demand management (TDM) programs

1.2 Emerging industry dataset

Relevant data helps transit agencies identify and respond to demand for bicycle integration. Despite a growing industry dataset on bicycle parking at transit facilities and linked bike share trips (those that include a connection to transit), there are still significant gaps within the full scope of core issues related to bicycle and transit integration, particularly regarding bicycles onboard transit vehicles. Without focusing on a specific core issue, transit agencies should seek to understand the following factors:

- Frequency of bicycle ridership to transit
- Frequency and duration of usage of bicycle parking facilities
- Barriers that prevent people from biking
- Barriers to using long-term storage (cost, lack of amenities, safety concerns, etc.)
- Mode of arrival at transit

1.3 Ensuring equitable mobility

Transit agencies are elevating awareness and priority for equity in delivering a full complement of services. This equity lens must be applied to safe and affordable access to transit, including active modes. While this naturally includes people who already bike, efforts should also focus on reaching populations who could bike to transit given the right combination of infrastructure, equipment, education and incentives.

When planning for active connections to transit, agencies should understand that data on existing cyclists may not capture disadvantaged populations. It is therefore critical to remain proactive in identifying opportunities and barriers for bike-transit connections for all transit riding populations. For example, traffic crash data, is a nonendemic transit dataset that might provide information on barriers and opportunities for first- and last-mile connections.

Vulnerable populations stand to gain many benefits from bicycle connections to transit in terms of health, safety and economics, but they are not necessarily represented in discussions on bicycling. These same populations may also be underserved by transit, making bicycles an ideal mechanism to add transit linkages without major capital investment. Similarly, the relatively low-impact nature of biking may make it an easier

choice than walking for some transit riders. Communities with aging populations, for example, should consider bicycle accommodations for riders with disabilities or impaired mobility.

Agencies can work with stakeholders to identify considerations related to bicycling for constituents who are low income, minority, limited English, women, seniors, youth and people with disabilities (e.g., use of adaptive bikes). These considerations may involve bicycling skills, cultural norms, bike ownership, ability to access bike share, sense of personal safety or security, and other factors.

2. Getting Started

What is driving bicycle integration with transit in your community—reductions in vehicle miles traveled (VMT), lower carbon emissions, reduced need for automobile parking, regional demand? When planning for bicycle integration, agencies must articulate the outcomes that will be achieved by prioritizing bicycling and how those outcomes will be measured. This guide outlines strategies, best practices and specific tactics that can help transit agencies proactively respond to increased demand for bicycling and increase their competitiveness in today's ever-changing transportation market.

2.1 Responding to demand for bicycling

Cities across the country are experiencing a surge in bicycling: This presents an opportunity to develop more holistic and integrated mobility networks in conjunction with transit. Proactive planning for increases in bicycling and opportunities for integration can drive increased transit ridership while minimizing conflicts and providing more connections.

2.2 Increasing competitiveness

Transit customers are faced with a dynamic variety of transportation options. Bicycling, car share, private automobiles, Transportation-Network Companies (TNCs) and other options offer a variety of alternatives for customers to consider as a supplement or replacement for conventional fixed-route transit.

2.3 Core considerations

- Bicycle parking
- Bicycles onboard transit vehicles
- Safe routes to transit
- Bike share
- Data collection
- Demand management
- Establishing bicycling dialogue with external stakeholders and customers
- Historic and emerging internal agency culture and prevailing organizational attitudes toward bicycle integration with transit

2.4 Moving forward with data

Transportation professionals are accustomed to having timely, accurate data to inform planning and decision-making. Data collection and analysis are built into transit systems to understand ridership, schedule reliability, customer comments and many other factors to measure performance and make appropriate adjustments. Decisions that are data driven are considered objective, responsible and arguably unquestionable.

In contrast, data about bicycle use in relation to transit use has been difficult to collect and may suffer from significant gaps. Often the best available data is collected sporadically as a snap-shot or is self-reported. The

absence of definitive data analytics may raise questions and thwart progress toward making improvements in bike-transit integration. This document offers ways to move forward while improving datasets.

2.4.1 Establish a databank

- Understand the purpose of data you may need. How will each metric be used to plan or make decisions?
- Gather and centralize available data from internal and external sources. Select formats and reporting functions that can be easily updated and provide sufficient compatibility to observe relationships among datasets.
- Use direct data when available. Identify inferences that might be drawn from indirect data.
- Identify gaps or limitations with internal data and identify alternate methods to address these metrics in the short term; develop an approach for capturing these data points in the long term.
- Partner with external sources to add or adjust survey questions, counts or methods to help fill data gaps. Considering working with other agencies, jurisdictions, advocacy groups, bike share providers; offer to assist in collections or funding.
- Establish a schedule for recurring data collection for current bike services and facilities, such as bike parking and bikes on board. Use methods readily available and feasible, while establishing more robust data collection methods. Identify how data collection will be funded and who will collect data (e.g., interns, transit drivers en route, injured transit drivers who can be assigned other work, agency research staff, volunteers among staff or community groups, consultants, university collaboration, automated methods).
- Maintain updates to external source data, such as demographics, local bike network improvements, bike commute survey data, bike share use, participants in bike programs or trip-reduction projects who log bike trips.
- Share methods and outcomes among other agencies. Use agencies commonly identified as peer agencies, as well as other agencies doing innovative projects.

2.4.2 Collaboration

- Look for opportunities to combine data collection with other agency projects:
- Shared-mobility/innovative mobility: Include biking and bike share in agency efforts to integrate new mobility options as a complement to transit, such as ride-hailing and car-sharing. Gather metrics specific to biking as part of the evaluation plan.
- Technology upgrades: If your agency is updating technology to count passengers, parking occupancy or other recurring metrics, look for opportunities to add in bike-rack-use technologies, mode of access data, etc.
- Agency surveys: Ask research and outreach staff to include mode of access to transit questions in all standard agency surveys and during community outreach for specific projects; provide “bicycle” as an answer choice.
- Car parking management: In agency efforts to manage car parking demand at park-and-ride facilities or in neighborhoods, include a bike element as a first/last mile alternative to driving and parking

2.5 Set the foundation

- Establish bike-transit integration as an agency priority based on its benefits in meeting other agency and community objectives, such as market relevance for mobility, managing car parking impacts, managing on-board space, sustainability and equity. Share those benefits with key stakeholders in the agency.

- Include language specific to bikes and access to transit in any strategic or long-range plan strategies.
- Reference the identified benefits and plans in each bike project and each effort to improve data collection and quality.
- Identify options to fund robust data collection methods, including test projects, as well as institutionalized procedures. Funding may come from internal sources, grants, partnerships or other external sources. Funding for bicycle-related transit improvements might also be folded into a related project.

2.6 Service and area context

This list of questions is not exhaustive but provides a basis to examine a transit agency's service context:

- What are the demographics in your area?
- What are the trends?
- Is bicycle ridership shrinking, growing or consistent?
- What is the mode share?
- How does bicycle ridership correspond to overall transit ridership?
- How are customers currently getting to transit?
- Who are the key stakeholders advocating for bicycle inclusion on your transit system?
- What are they asking for?

2.6.1 Know your context

The best approach to bicycle and transit integration is context-driven and depends on the dynamic attributes of the community. This includes an examination of:

- Land-use patterns, density and growth
- Topography
- Connectedness of the bicycle network and its proximity to transit
- Population and employment distributions
- Demographics (including age, income, education, race and ethnicity, language, gender)
- Transit ridership trends
- Bike ridership trends

2.7 Understanding current and future transit customers who bike

In 2006, the Portland Office (now Bureau) of Transportation released a paper entitled "Four Types of Cyclists," which categorized adult bicyclists into four groups: Strong and Fearless, Enthused and Confident, Interested but Concerned, and No Way No How. A 2012 study by Jennifer Dill and Nathan McNeil, entitled "FOUR TYPES OF CYCLISTS? Testing a Typology to Better Understand Bicycling Behavior and Potential Bicycle Users," suggests that these same categories can be used to describe cyclists across the country.

Transit should endeavor to reach all potential customers who bike, considering this spectrum and understanding what types of behavior to expect from each group. For example, an "Interested but Concerned" rider may be more likely to ride a bike for the first and last mile with the provision of a full suite of amenities, including a safe, protected route to transit, secure bike parking and shower facilities. In contrast, "Strong and Fearless" riders will ride regardless of street conditions but might be particularly concerned with secured parking to protect their bikes during the day.

Bicyclists of all types are more likely to bring bikes onboard transit vehicles in cases of unexpected inclement weather. Within this hierarchy, there may be transit customers who primarily ride for recreational purposes and have not considered cycling as a mode of transportation. Similarly, some riders may choose bicycles for short errands or other purposes. Transportation Demand Management (TDM) programs can educate and motivate people to try biking for short trips to location destinations and then, as their comfort and confidence

grows, extend their bike travel to transit connections. Beyond commuting, these customers may find tourism opportunities as an incentive to integrate bicycle trips with transit. TDM can provide an opportunity to bike one way and take transit back, or to take the bike to another region and back via transit. For bicycle commuters, on-vehicle storage is a way to accommodate longer commutes or take refuge in adverse weather or when their bicycle has a mechanical issue.

Other points to consider:

- "Enthused and Confident" and "Interested but Concerned" riders are more likely to ride in fair conditions, creating more demand in the spring, summer and early fall, depending on the local climate.
- Topography may also play a role in customer behavior, as bicyclists may choose transit to circumvent barriers such as large hills, bodies of water, bridges with no bike access or travel along busy roads.
- Transit agencies should analyze bicycle ridership near their facilities to understand the potential for how bicycles are used in relation to transit.

2.7.1 Four types of bicyclists

- Strong and fearless: will ride regardless of roadway conditions and take a strong part of their identity from riding a bicycle
- Enthused and confident: Comfortable riding on a road but prefer bikeways; appreciate efforts to improve bikeway infrastructure
- Interested but concerned: Curious about bicycling and like to ride, but are afraid to do so, do not regularly ride and will not venture onto the arterials
- No way no how: Not going to ride a bicycle for reasons of topography, inability, or simply a complete and utter lack of interest

2.7.2 Key questions to consider

- How does your agency define customers who bike? This is an important distinction, as it sets the tone for prevailing internal attitudes toward bicyclists, policy and external optics.
- What are the ridership patterns? Are bicycle trips unidirectional, riding transit to work in the morning and using the bicycle for a return trip in the afternoon; or are they round trips, biking both to and from destination with a portion of the trip by transit?
- Are riders using their personal bikes, bike share or a combination for the first/last mile?
- Are customers biking to transit, bringing their bikes onboard and then biking to their final destinations, or are they using secure bike parking?

2.8 Tools for integrating bikes with transit

A lack of safe routes to transit creates a potential barrier for customers considering bicycle use for their first- and last-mile connections to transit. While typically outside of a transit agency's jurisdiction, transit still has a role to play. Safe routes to transit are an important consideration for agencies to ensure that customers have easy access to transit. A transit agency's control over these routes is typically limited due to jurisdictional boundaries, but there are a variety of opportunities for agencies to take a leadership role in supporting bicycle connections to transit. Agencies should focus on understanding customer needs and clearly communicating those needs to the municipal authority. In some cases, transit agencies can take the lead on grant application or provide resources and cooperation to help develop safe bicycle routes.

Bicycle parking at agency-owned facilities is the most dynamic tool to facilitate bicycle connections, because of the transit agency's ability to control capital investments within their own property. Bicycle parking is also the most flexible tool for capacity-building in response to increased demand, and it can offset demand for bicycles onboard transit vehicles.

Bike share is another important tool for integrating bikes without affecting transit vehicle passenger capacity and provides a convenient option for users who do not own or do not wish to transport and store their bicycles. Transit agencies can leverage the use of their property to accommodate higher transfer volume among modes and to facilitate bike share operations. In some cases, transit agencies may control bike share operations, making it even easier to adjust bike share according to customer needs.

With bike parking and bike share availability as foundational resources, agencies should prioritize communications with customers to promote the concept of riding a bicycle to access transit and to ensure that information is readily available on how to store or bring their bike on transit.

Onboard transit vehicle storage for bicycles is an important consideration for customers with longer first/last mile connections and for bike tourism. Given transit vehicle capacity constraints, it is important that agencies manage demand to minimize conflicts among customers and to promote safety without precluding last-mile trips. Making bicycle parking and bike share more convenient with easily accessible information will help manage demand and minimize the risk of running over capacity transit vehicles.

2.9 Agency and partner roles

Transit agencies often have limited jurisdiction outside their immediate property and right-of-way. The interagency nature of bicycle integration with transit requires an understanding of core issues grounded in customer concerns, coupled with a roadmap of the dynamic, complementary roles and responsibilities that may involve numerous stakeholder groups. In addition to the transit agency, stakeholder groups involved in bicycle and transit integration projects may include the following:

- Nontransit public-sector partners: These partners may include metropolitan planning organizations (MPOs), municipal governments and local departments of transportation (DOT) or public works (DPW), county governments and state governments/DOTs. Transit projects often require collaboration with a municipal DOT for projects that fall outside of a transit agency's property. Other agencies such as MPOs may require inputs for broader transportation plans throughout an entire region. Additional partners may include schools and other higher-education institutions, the federal government, multijurisdictional authorities, park boards and airport commissions.
- Bike/transit advisory groups: Local bike coalitions, advocacy organizations and transit advisory groups can provide valuable insights into customer needs and can help gain access to populations at the grassroots level. Advocacy groups are an avenue for presenting bike/transit integration ideas directly to executives and management. This may also include transportation management areas (TMAs).
- Private-sector partners: Private entities can include small businesses, developers and employers. These stakeholders can serve as valuable partners, providing funding, land access and other resources. In some cases, particularly with developers, bike integration can be leveraged as an abatement tool to facilitate projects that benefit the public.

2.10 Inventory and leverage resources

Transit agencies should develop and maintain a complete inventory of bicycle-related amenities, including types and quantity of bike parking at each station, as well as a prioritized replacement schedule. This may include:

2.10.1 Data

Understand what data your agency collects about customers who bike:

- Do existing data collection methodologies include bicycles?
- What data can be leveraged to help understand bicycle ridership or potential for growth (bike parking utilization, manual counts onboard transit vehicles, surveys, etc.)?
- Can data on customers who bike be extrapolated from other nonendemic sources, such as commute trip reduction (CRT) data or generalized customer satisfaction/ market surveys?
- What customer service feedback exists related to bicycles?

2.10.2 Policy

Understand how bicycles are regulated on and around transit. An agency's policies and positioning of bikes can support or hamper the use of bikes with transit:

- Are policies related to onboard vehicle storage working?
- Are there frequent conflicts between other users and ADA requirements?
- Are there existing programs and/or policies in place at the agency to facilitate bicycle trips?
- Are any policies in conflict with one another regarding the integration of bikes with transit?

2.10.3 Assets

Agencies should have a complete understanding of assets that both formally and informally dedicated to bikes:

- What real estate is available for bikes?
- Do transit vehicles have bicycle-storage capabilities?
- What stations have bicycle parking?

2.10.4 Leadership

Agencies should take advantage of interdisciplinary, internal advocates within the organization to help inform conversations and provide feedback on service:

- Identify who commutes to work via bike within your organization and establish a committee; include bus and rail operators.
- What bicycle amenities are available for employees?
- How can the agency use itself as a test case for new programs?

2.11 Checklist: Setting goals and defining metrics

Decision-makers and planners must clearly articulate agency reasons to facilitate bicycling and for building capacity for bikes and transit. Examples include:

- Reduce automobile parking congestion
- Address high demand for existing bicycle parking facilities that are at or beyond capacity by accommodating bikes on transit vehicles
- Satisfy public demand for bicycle amenities on transit; meet the needs of customers
- Cultivate progressive optics for the agency

- Articulate how bicycle and transit integration fits into an agency's mission, vision and regional priorities, including regional and agency objectives for equity, sustainability and health
- Facilitate connections between modes
- Bridge key gaps in the transit network
- Identify how grant funding scoring prioritizes multimodal transportation

Planners must determine what data points are relevant to the agency's position on and prioritization of integrating bikes and transit. This can include the following:

- Bike ridership frequency to stations
- Onboard demand for bicycle storage
- Bike share transfer rate
- Incidents of bicycle collisions with transit vehicles
- Bike parking utilization

With data, programmatic and policy frameworks in place, the agency should query external stakeholders interested in biking, understand what their priorities are and how transit fits into that discourse. For example:

- Local bicycle coalitions and/or clubs may prioritize safe cycling, increased bicycle mode share or more access to trails and other bicycle facilities
- The municipal transportation agency may prioritize Vision Zero or other livability standards that inform decisions about bicycles

Based on available resources, transit agencies should integrate regular evaluations to track these data points.

2.12 Driving internal decision making and culture

Transit agencies should adopt an official policy for facilitating bicycle transportation within the scope of available transit services. The policy should:

- Clearly articulate that bicycle access to its facilities and services is encouraged and why.
- Set requirements for regular evaluation of bicycle use and demand (annually at a minimum).
- Develop mechanism for periodic review of policies to ensure they meet the changing needs of transit customers who bike.
- State intention to actively collaborate with other agencies to promote, design, fund and construct bicycle facilities. This could include cities, bike share operators, advocacy groups and developers.

Agencies committed to bicycle integration should establish an official program with a distinct charter. In outlining the goals and objectives of investments in bicycle integration, agencies can mitigate challenges resulting from any internal concerns related to bicycles. Once established, transit agencies should use this program to integrate bikes into existing agency documentation to ensure consistency. This includes:

- Operations and Maintenance (O&M) manuals
- Design guidelines
- Construction documents
- Human resources health-and-wellness materials

Agencies should advocate for an agency-wide strategic plan that includes integration of bicycles. They should develop a corresponding capital plan to guide future investment. This will:

- Establish clear goals and objectives for agency leadership to consider
- Help with internal advocacy and justification

- Provide forum to address any legal or liability issues up front
- Include a budget for communications expenses related to bicycles

2.13 Establishing a dialogue on bicycle integration

Meeting the needs of multimodal commuters does not begin or end with the installation of bike racks at transit facilities and onboard transit vehicles. Transit agencies should proactively facilitate and promote the use of bicycles for first/last-mile travel to and from their facilities. Empowering transit customers to bike the first and last mile requires clear communications with riders to not only promote, but also educate and inspire. Internal conversations on bicycles are critical to success, both to educate employees and to drive demand instead of playing catch-up to demographic trends. Both internal and external promotion are key.

2.13.1 Internal dialogue

Internal organizational culture could potentially be a barrier to expedited strategies for facilitating cycling. Operational issues in particular may prompt opposition from some internal stakeholders. It is critical that agencies ensure that communication about bikes is disseminated at all levels of staff to articulate the context and justification for bike/ transit integration.

- Identify an internal executive-level champion to advocate for bicycle improvements. Develop an internal, cross-disciplinary bicycle advisory group that consults on all aspects of bicycle integration.
- Leverage other bicyclists at the agency, including operators who bike, to spread the word about the benefits of bicycling for customers and for the agency. Deconstruct perceived barriers that commonly oppose these efforts.
    - Data is critical, especially for mitigating operations and maintenance concerns.
    - Precedent and peer agency experience, such as the case studies contained in this document, can be a valuable resource.
- Keep customer service informed of all bicycle improvement projects and concerns. This includes:
    - Modifications made at facilities for cyclists
    - Service impacts that will affect cyclists
- Construction project staff must think proactively about how their work may affect all users, including bicyclists, and use the proper channels to communicate those impacts.
- Communicate bicycling as part of the agency's wellness program
- Provide secure bicycle parking, showers and lockers.

2.13.2 External dialogue

Frequent, targeted communication that is informed by data (rider feedback, numbers, specific challenges) allows agencies to more precisely tailor their bicycle strategies. In addition to technical requirements, complex bike parking systems also require a marketing strategy to facilitate use. This may include:

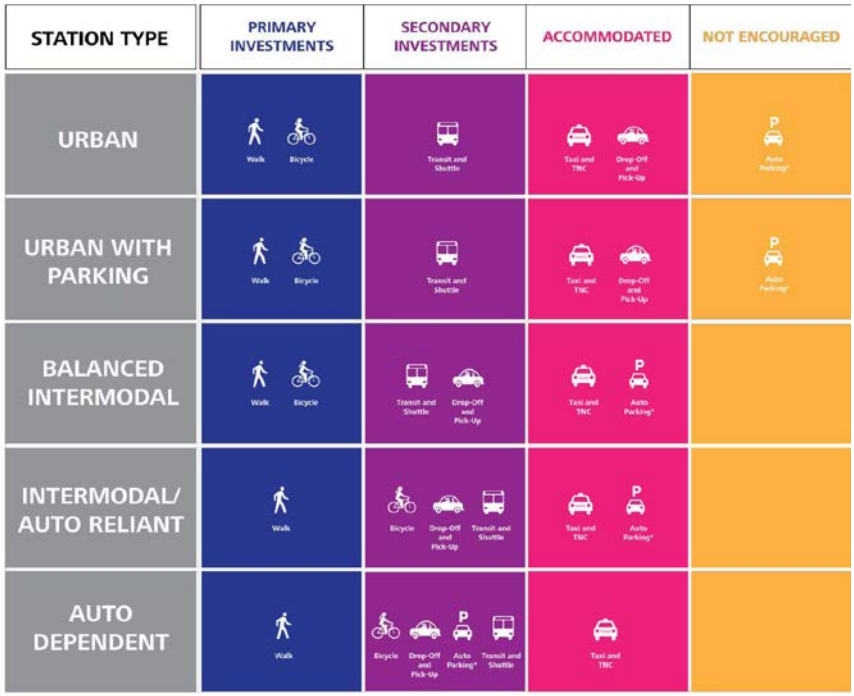
- A brochure for bicyclists that is distributed on vehicles, through customer service, at public events and other venues
- Social media
- Bicyclist wayfinding signage, showing nearby bike routes
- A robust website with an area for bicyclists that provides pertinent information about bicycle and transit use, policies and procedures
- A bicycling-specific email address that's monitored by customer service and/or bicycle program staff, such as bicycling@metro.bus, to swiftly respond to bicycle-related concerns

Agencies must adequately budget for communications activities. Transit agencies should work with local advocacy groups to develop consistent messaging and to ensure that transit understands and meets the needs of the bike community.

2.13.3 Case study: BART station access hierarchy

BART developed a Station Access Investment Framework to prioritize investment by station type and mode. Priority projects that best achieve policy goals and focus on safety and sustainability are primary investments. In these instances, BART prioritizes investments of funds and staff time, consistent with access goals and priority projects.

Figure 1 BART Station Access Hierarchy



2.13.4 Case Study: Sound Transit Employee Management

Each May for Bike Month, Sound Transit staff and consultants are invited to commute to work by bicycle for a fun competition. All abilities are encouraged. To promote cycling, the Sound Transit Bicycle Program does the following:

- Promotes an “Unofficial Bicycle Commuter Handbook” that’s updated each year and made available to staff. It provides advice on bicycles, clothing, weather, route finding and other useful information.
- Promotes a “Bike Buddy” map on Google Maps and asks experienced cyclists to volunteer to help less experienced ones with route planning. Employees can look on the map, find a co-worker who lives near them, and seek their guidance or company during their first few rides to and from work.
- Holds a “How to Look Professional After Cycling to Work” brown-bag lunch where experienced cyclists speak about the tools and tricks they use to arrive at their desks fresh as a daisy.
- Takes staff on a lunchtime field trip to a nonprofit bike shop to learn about how to shop for a bicycle.
- Maintains an internal web page about bicycling to work, which is updated throughout Bike Month.
- Holds a lunchtime bike repair clinic to teach basic bicycle maintenance.

2.14 Pilot programs

Small-scale pilot projects are a great way to test ideas and assess feasibility. Policy makers are likely to be supportive and less apprehensive about a pilot project verses a full-scale implementation because they provide a controlled environment in which to test new ideas. Documentation and evaluation are critical components of pilot projects, as data on these initiatives will serve as a key indicator of success. Data is necessary for the analysis and to build a foundation for expanding bicycle projects on a broader scale across the transit agency.

2.14.1 Case Study: New York City Bikes-On-Buses Pilot

New York City Transit does not currently have bicycle racks on buses system-wide.

Background

Advocacy groups have been strongly urging MTA Bridges & Tunnels to add a bike path to the Verrazano-Narrows Bridge. It is one of three bridges within New York City that cannot be biked; the others are the Throgs Neck Bridge and Whitestone Bridge. Although, adding a bike path to the Verrazano-Narrows Bridge is cost-prohibitive, adding bike racks to two local bus routes is a cost-effective way to provide bike access.

Utilization Data

The agency tested multiple rack/mount configurations from two manufacturers, Sportworks and BykRak. All the racks and mounts tested proved to be reliable and relatively simple to maintain. Based on feedback from the depot personnel, the Ten Second Bracket from Sportworks is the preferred mounting system, as it is more readily moved from one bus to another. As expected, rack usage is significantly higher during the summer months and minimal during January, February and March.

Next Steps

Bike racks are currently on 36 of the Orion 40-foot 2011 buses running on the S53 and S93 routes in Staten Island. Plans for expansion to two routes from Eastchester Depot in the Bronx are underway. The new routes are the Q50 and the Bx23. The Q50 runs over the Whitestone Bridge between the Bronx and Queens, and the Bx23 goes between Co-op City and Pelham Bay Park. These routes will be serviced by 24 Orion NG Hybrid 2009 buses.

3. Bikes at transit

Parking is a critical piece of a holistic bicycle integration strategy because it makes it easier to use bikes to access transit, and it instills confidence in the bikes' security. Both secure and open bike parking are significantly less expensive than automobile parking and occupy much less space for each transit rider. Agency design standards should provide appropriate type(s) and sufficient space for bicycle parking to meet the current and future demand. Secure bicycle parking allows riders to feel safe in knowing that their bikes will remain protected from theft, the elements and other potential damage while in storage. Conversely, a lack of adequate bike parking facilities will discourage and preclude potential riders.

Without adequate, dedicated bike parking, cyclists will naturally turn to informal parking solutions like sign posts, trees and street furniture. This creates an adverse effect on the streetscape, and potential conflicts with ADA access and pedestrian safety.

Bike parking serves an important operational function by decreasing demand for on-board transit vehicle storage. Transit agencies should invest in secure bike facilities to minimize conflicts with transit riders' onboard vehicles by reducing the number of bikes onboard and increasing access to transit. This can be achieved by using quality data (if available) to determine the type of parking to provide and how much space to allocate for bikes. When direct data on bike parking is not available, agencies may refer to nonendemic datasets to inform decisions.

3.1 Approach to decision-making

Agencies should strive for thoughtful design for bike parking rather than being subject to last-minute decisions to keep pace with demand. In addition to incorporating defined mandates for bike parking within established station design guidelines, agencies should consider the following hierarchy of questions when making plans to accommodate bicycles. This data-focused approach enables agencies to remain flexible and responsive to demands for added capacity and to enhanced technological solutions that may better suit the local market's needs.

3.2 Core considerations

Context, ridership and flexibility are core factors when considering the installation of bicycle parking at transit facilities. Agencies must remain flexible and responsive to demand; this requires a defined process and budget for installation of bicycle parking facilities. Agencies must consider what kind of parking is required as well as its location and operational impacts. As it relates to capacity planning, agencies should think in terms of the amount of space to allocate to accommodate existing demand and anticipated growth. These decisions should be informed by consistent methodologies for regularly gathering data on bike ridership.

3.2.1 How much space to allocate for bikes?

The capacity for bike storage at transit facilities is context-driven. Is the station stop in a new development zone or the central hub in a transit-oriented development? Is the station/stop located near a nonmotorized trail or bicycle corridor? These factors help determine the amount of space to allocate for bikes, and they provide insight into future demand for bike parking. In the absence of data specific to bicycle ridership, agencies can use a portion of transit ridership origin/destination data as a metric:

- Given the relative cost of bicycle parking compared to other amenities, transit agencies should provide as much bike parking as possible. Many transit agencies set a quantitative metric for bicycle parking based on peak transit ridership. These numbers typically include a factor for existing ridership and a percentage for anticipated growth. While this formula based on percent capacity plus percent for growth has been adopted across several North American transit agencies, the precise percentage of ridership should be tailored to match the station's context. If detailed data is available specifically for cycling to transit, that may be a better dataset to inform decision-making.
- All areas for bicycle parking should be noted in as-built station drawings.
- Capacity should not be added at the expense of user access. All bike racks, regardless of their type or configuration, require setbacks to mitigate overcrowding, facilitate efficient access and maximize capacity.
- Parking facilities that are over capacity and congested can be a detriment to transit customers riding a bike for their first/last mile.
- Agencies should proactively plan for growth and integrate bicycles into expansion plans.

Agencies with high demand for bike parking but limited space can combine different types of parking with different rack solutions (see Appendix B). For example, double-stacked racks can double capacity with vertical integration, and wall-mounted hanging racks can be used to add capacity in underused locations without space for an in-ground U-rack or hoop rack. These solutions should be used in conjunction with sufficient ground-level spaces for customers who would have trouble lifting a bike.

3.2.2 Configuring space for bikes

Many options are available to transit agencies and municipalities when selecting the type(s) of bicycle parking that best suits the community's needs. Each type has significantly different implications on capacity (how many bikes can be accommodated in a given space), budget, operations, customer service and security.

Agencies must consider risk tolerance for some of the more advanced technological parking solutions, such as smart racks versus a proven technology. The table in Appendix B lists general types of bicycle parking in use at transit stations across North America. Agencies should provide a range of options, including free and fee-for-service bike parking.

Bike racks may be supplemented with additional features, including canopies for weather protection, enclosed cages and valet service. Transit agencies should create messaging with reminders about safe locking strategies, even for bicycles in cages. Cage walls should be transparent and secure, such as aluminum mesh, but must deter vandalism. The cages should also be equipped with at least two doors for emergency exits. In addition to security-related design attributes, agencies should provide customer-facing messaging that educates and reinforces proper operations to maximize both safety and security.

The case studies in this section illustrate real-world applications of different rack types with additional services and amenities.

3.2.3 Data collection

Regular data collection at bicycle parking facilities is critical for planning and ongoing service. Many agencies conduct a frequent and regular inventory of bicycle parking spaces to provide a snapshot of demand for each type of bike parking at each station. That allows agency staff to assess the condition of bike parking facilities on a regular basis and to determine priorities for investment in expansion and/or upkeep. Agencies should not be paralyzed by gaps or ambiguities in the data, and instead look for opportunities to estimate the appropriate amount of parking for customers at a given facility. This can be accomplished using nonendemic data (not specific to bicycle parking utilization) or with anecdotal information from facility operations and customers.

3.2.3.1 Case Study: BART bicycle data collection

BART staff conduct an annual inventory of every bicycle parking space in the system, to obtain a snapshot of demand for each type of bike parking at each station and to confirm the accuracy of BART's records on the amount of bicycle parking available at each station. These inventories use a standardized methodology to ensure accuracy and consistency of records. In addition to a standard survey tool, staff follows this standard procedure:

1. Survey on one day per station between 10 a.m. and 3 p.m. on Tuesdays, Wednesdays and Thursdays in late September, a time expected to reflect peak demand for the system because it is during normal work and school hours, on BART's busiest days, and when Bay Area weather is typically still dry.
2. Compare the results at each station to the previous year's results. Where there are larger-than-expected changes, perform a second count to determine if the discrepancy reflects an actual fluctuation or a surveying error.
3. Interview the surveyors to find out what tools would help them do the most accurate job possible.

3.2.4 Bike rack placement and design guidance

- Agency strategic plans and station designs should prioritize bicycle amenities to facilitate first/last-mile connections (see Appendix B).
- Bicycle rack manufacturers have design specifications for their products, which agencies should use

as a baseline. However, this should be adaptable to meet customer needs.

- Bike parking should not impede pedestrian flow or ADA access in and out of station facilities and/or transit vehicles.
- Bikes should be located in high-visibility areas to enable both active (direct line of sight with station personnel) and passive (community visibility) security.
- Racks should be designed and/or oriented to allow for parallel parking.
- Multiple points of contact should be provided between the bike frame and the rack to enable riders to lock individual components.
- Agencies must consider station access as cyclists are navigating to parking facilities:
    - Is there a safe route to navigate through station property that minimizes conflicts with cars, transit vehicles and pedestrians?
    - Does the wayfinding system adequately facilitate wayfinding to bike parking?
- Different rack sizes and shapes can add additional capacity to open racks or enclosed parking solutions (such as bike cages).
- Mixing vertical racks with double-stackers or open U-racks is a simple way for agencies to maximize limited space.
- Bicycle program and/or other knowledgeable staff should inspect bicycle facilities before they are permanently installed to ensure adherence to design guidelines and that facilities meet customer needs.

3.2.5 Accommodating different bicycle types and customers

Transit facilities serving high volumes of aging and/or disabled populations may consider placing a limited number of priority spots located at strategic areas within or immediately around the entrance to a transit station. Racks should be specially painted and marked to indicate restricted use.

Agencies should proactively provide bicycle commuters with information on proper locking strategies to reduce the risk of theft and to instill rider confidence in transit parking facilities. Communities with high numbers of alternative types of bicycles such as adaptive bikes (such as those designed for people with disabilities), cargo and/or fat bikes may require wider spacing.

3.3 Security for bicycle parking

3.3.1 Monitoring

If available, CCTV should be directed at all bicycle parking areas to deter vandalism and theft and to increase chances of recovery. CCTV footage can be provided to cyclists if damage or theft occurs. This provision may present operational challenges, such as data storage space for video and staff time.

3.3.2 Theft and liability

Agencies should consult their legal counsel for guidance on liability related to bicycles that are lost, vandalized or stolen. This will serve as the framework for an official policy articulating the agency's responsibilities, as well as a clear procedure outlining steps that users and agency personnel must take in the event of a bicycle theft.

3.3.3 Rack design

Rack designs should enable customers who bike to independently lock any easily removable parts, such as wheels, seat posts or anything attached with a quick-release lever.

3.3.4 Lighting

Transit agencies should strive to meet APTA standards for lighting levels for interior and exterior spaces.

3.3.5 Customer education

Transit agencies should empower customers to maximize the security of their bicycles by following safe practices. These include the specific rules associated with proper operation of secured bike parking facilities as well as optimal locking strategies to maximize security, such as locking the frame and wheels independently.

3.4 Operations and maintenance for bicycle parking

3.4.1 Administration

Bike parking spaces should be integrated into the station's regular operations documentation and maintenance cycle for cleaning, inspection and replacement. Different types of bicycle parking present a range of unique operational considerations. While simple bike parking solutions, such as open racks, require only regular maintenance and cleaning, more complex parking solutions such as lockers, cages and smart racks, require transit agencies to establish a user registration system. Depending on the agency's preferred parking solution, transit operators may require specific user data, which must be collected by program staff or included as a core responsibility in a third-party contract.

Agencies should establish and publish clear operating rules that encompass procedures for lost, found and abandoned bicycles. These rules should be clearly articulated in an agency's operations plan and communicated to users at parking facilities. These policies should encompass the length of time a bicycle can remain in a parking facility before it is considered abandoned and the internal procedure for removal, as well as a means of customer recovery, as appropriate necessary based on an agency's global lost-and-found policy. Transit agencies should check their enabling legislation to determine if they are required to dispose of abandoned bicycles in a specific way, such as in a lost and found.

3.4.2 Lost, vandalized or stolen bicycles

Agencies should work with internal security personnel and/or local law enforcement to establish a reporting procedure for lost, stolen and vandalized bikes. This allows customers to react quickly if a bike is vandalized, lost or stolen. The policy should be clearly communicated to customers both online and at bicycle parking facilities.

3.4.3 Abandoned Bicycles

Periodic removal of abandoned bikes should be included in an agency's operations plan and be clearly articulated to customers at parking facilities. Removal of abandoned bikes keeps bike parking facilities clean and creates the perception of security.

3.4.3.1 Case study: TriMet abandoned bike policy

Bicycles left on TriMet property for more than 72 hours may be impounded. Bicycles that are parked illegally or found to obstruct, interfere with or impede the use of the transit system can be removed immediately.

Impounded bicycles must be stored for at least 30 days while the agency makes reasonable attempts to notify the owner of the impoundment and provides a description of how and by what date the bicycle must be claimed.

3.4.4 Enforcement and Monitoring

Enforcing policies may require different strategies depending on the type of parking. Valet services are regularly monitored and provide a built-in means of regular inspection and survey for bikes left beyond designated periods. Conversely, open-air and unmonitored secure bike parking facilities will require periodic inspections to ensure that bicycles are not left beyond a reasonable period.

3.4.5 Maintenance Considerations

Some underused spaces that might otherwise make good locations for bike parking could serve important operations and maintenance functions. For example, snow removal may require a designated space for dumping plowed snow. Similarly, emergency vehicles may require certain areas remain available for their use. It is important to collaborate with maintenance and emergency personnel to identify these critical uses and devise solutions that avoid conflicts.

3.4.6 Policy examples

Abandoned bike removal

- Bicycles will be marked with tag five business days before removal.
- Bikes considered abandoned will be cut free and donated to a local charity or turned over to law enforcement.

Facility usage rules

- Users must securely close bicycle lockers after retrieving their bikes; otherwise they will continue to be charged usage fees and/or lose access to the facility.

3.4.7 Case Study: BART modular bike parking facility

- BART has been developing a fully engineered, custom but modular bike station design. It can be constructed in multiple configurations to meet site and capacity requirements and has flexibility to serve as a parking-only facility or have a module that is set up for an attached retail/maintenance facility – with significant time savings, design savings and potentially construction savings.

3.5 Fee Structure

Fees are typically nominal or nonexistent for bike parking, but they can serve a variety of important administrative functions. Hourly rates are a way to mitigate clutter from long-term bike storage. Bike parking fees are typically nominal and should remain low to encourage use.

- Fees should not be considered as a source of revenue.
- As the cost of bicycle parking increases, its usage is likely to plateau or decline.

Bike parking policies should align with an agency's modal priorities (e.g., if an agency wishes to prioritize biking, the fees should be low in comparison with car parking). Agencies should always provide free bicycle parking options to accommodate visitors and spontaneous users.

Pros:

- Reduces clutter of little-used or abandoned bikes
- Discourages bike owners from storing their bike at the transit facility permanently instead of at home

Cons:

- Payment system must be operated and maintained, using agency resources.
- A requirement for payment may discourage use and reduce occupancy rates.

- Potential equity issue if bicyclists are charged, but drivers are not charged at auto park-and-ride facilities.

3.6 Bikes at Transit Innovations and Resources

3.6.1 Bikeeep smart racks

Bikeep locks the bike from the frame and from the wheel. Each station is equipped with sensors, loudspeaker alarm, distress signal forwarding and surveillance camera. Bikeep can interface with any system (mobile app, building access cards, transportation cards, bar codes etc.) that agencies have in place to make bike parking easy. These bike racks can be set up with restricted access by an app or an access card, so that only specific people can use it.

3.6.2 Cyclesafe app

CycleSafe is a bicycle rack and locker manufacturer. The CycleSafe bike locker management app allows users to find, reserve, rent and pay for bike locker usage on demand. With the mobile app, anyone with a smartphone can use the system.

3.7 Case Study: NJ Transit Wesmont Station

In May 2016, NJ Transit opened Wesmont Station, a new commuter rail station in Wood-Ridge, New Jersey, situated on its Bergen County Line. The new station is located adjacent to a significant, residential development built on an environmentally remediated 70-acre former industrial site.

Prior to the station's opening, NJ Transit's Capital Planning Department was asked to evaluate and select the most appropriate location at the station to install bicycle racks to accommodate anticipated demand while the adjacent commuter parking lot was under construction and to serve future needs. Capital Planning fulfilled this request by conducting a site visit to evaluate the site and perform a conditions assessment. The proposed bike rack locations were identified based on proximity to platform access points, pedestrian pathways and other considerations, including weather protection, lighting and camera security. After Capital Planning determined the preferred location for the bike racks, a sketch was prepared showing the racks' location. Spacing recommendations were included to facilitate full usage of all racks. The sketch was circulated to NJ Transit's Stations and Maintenance team to confirm that the rack placements would not conflict with station maintenance needs, and subsequently to the construction management team for installation.

Ultimately, four bike racks were installed beneath the main stairway leading up to the station's pedestrian overpass. The location under the stairway was chosen primarily for its convenient location (equidistant from the stair and elevator entrances) and protection from the elements. It is also close to the pedestrian pathway but does not obstruct it. The selected location has adequate lighting and security cameras for security.

The racks are standard-size staple racks with a crossbar and were ordered previously in bulk at a cost of approximately $140 each. For installation at Wesmont Station, four racks were taken from storage and delivered onsite to the construction management team.

One year later, the site selection appeared to have been successful, as the racks are being used nearly to capacity. The photo below was taken in August 2017. As of that date, the parking lot had been completed and made available to customers, and the bike parking in this location continued to be heavily used.

3.8 Case Study: LA Metro bike hub

Metro Bike Hub is the name of LA Metro's program offering high-capacity bike parking in a controlled access, secure facility to support bike trips to and from key transit stations. Metro also manages over 800 bike

lockers throughout the system. Where bike locker demand is high, the Metro Bike Hub technology and functions including access control, registration, user monitoring and interoperability will accommodate for retrofit to self-serve shelter designs.

Metro opened its first location in 2015 at the El Monte Transit station, which provides the flexibility to operate as self-serve bike parking and offer staffed services. Staffed hours are limited to test the business potential of bike commuter retail services. The Hollywood/Vine Metro Bike Hub opened in the spring of 2017 with similar operations. Both locations are designed within storefront retail space of approximately 1,000 square feet each. A third Metro Bike Hub location opened in the fall of 2017 at Union Station, which is designated as a "flagship" location operating out of the LA region's transportation hub. A fourth location at Culver City is scheduled to open later in 2018, which will accommodate 64 bikes. Both Union Station and Culver City are designed as free-standing facilities, with separate areas for bike retail/repair services.

These initial locations include staffed services as a strategy to offer face-to-face support and to educate transit patrons about bicycling. The locations evolved through leveraging various opportunities associated with financial support from station improvements, Metro joint-development property and grant programs emphasizing active transportation to help address needs at stations with high demand.

Table 1

	Bike Capacity	**Staffed**	**Approximate Tenant/Construction Improvement**
El Monte	56	7 to 11 a.m. weekdays	$635,000
Hollywood/Vine	64	7 to 11 a.m. weekdays	$560,000
Union Station	192	8 a.m. to 6 p.m. weekdays, 10 a.m. – 6 p.m. weekends	$2.5 million

Metro selected a vendor that provides access control, secure bike parking management and retail services for the El Monte, Hollywood/Vine and Culver City locations. The same access control and secure parking management is used at Union Station to allow interoperability. However, the bike retail and repair shops at Union Station are negotiated through a lease with a separate company. As Metro tests these operating models, it will allow for flexibility to support ongoing operations and provide staffing at key locations. With additional locations planned and opening, Metro Bike Hubs will offer more than just secure bike parking; they will also act as venues for access to mobility resources.

Customer registration for secure parking involves a carefully reviewed application process that includes photos of the applicant/user, state-issued license/ID card and bicycle(s). Memberships can be purchased annually ($60), monthly ($12) and weekly ($5), with discounts available for qualified individuals (seniors, students, Medicare recipients, etc.) Membership provides access to and use of all Metro Bike Hub locations. Free bike clinics are also offered to the public to educate the community about bike commuting, riding skills and repair tips.

3.9 Case Study: Regional Transportation District (Denver) Bike-n-Ride

The Bike-n-Ride shelter project was initiated with the award of Denver Regional Council of Governments' (DRCOG) grant in 2015. Bike-n-Ride shelters provide long-term, secure and weather-protected bicycle storage for commuters making connections to and from transit at RTD stations. Commuters can combine a bus trip and bike ride by keeping their bike in the shelter overnight or during the day and biking the first or final mile to or from a transit stop. Currently operated by Boulder County, Bike-n-Ride shelters are available at the following locations:

- Downtown Boulder Station (14th and Walnut)
- U.S. 36 and Table Mesa Station
- North Boulder (28th and Iris)
- Eighth and Coffman Park-n-Ride
- Superior (Eastbound McCaslin)
- Hover Street & Highway 119/Diagonal in Longmont

Bike-n-Ride Shelter Project Background and Timeline

June 2015: Two applications for Bike-n-Ride shelter projects at RTD stations were submitted for consideration in the federal Congestion Mitigation & Air Quality (CMAQ) grant program. RTD provided letters of support for these projects. The grant applications were submitted by:

- 36 Commuting Solutions (36CS) for two shelters along U.S. 36 at U.S. 36/ Broomfield and U.S. 36/Sheridan Stations
- Northeast Transportation Connections (NETC) and the city of Aurora for three shelters at Central Park, Peoria and Iliff stations on the University of Colorado A Line and R Line

September 2015: DRCOG awarded capital grants to both the Bike-n-Ride shelter projects. As is typical with capital grants, no funding was provided for the ongoing operations or maintenance costs associated with the shelters. The grants included funding for:

- Construction of the shelters
- Marketing-related activities to promote usage of the new facilities

May 2016: DRCOG informed RTD and the grant recipients that TMOs are ineligible grant recipients for capital infrastructure projects. RTD agreed to accept the grants on behalf of the TMOs with the following agreement on responsibilities:

- RTD will provide administrative support, staff time and electrical power to the shelter.
- Staff time will provide construction management of the project due to the federal requirements.
- RTD will not contribute any funding to the project; the total local match contributions will be made by the stakeholders (36CS, NETC, Aurora).
- RTD will own the shelters, in accordance with grant requirements.

January 2017: Planning staff began the process to formalize IGAs with the local governments as the first step to move forward with construction. As part of the IGAs, the stakeholders would be required to take on financial responsibility for all operations and maintenance costs associated with the shelters. RTD requested further information, including a detailed cost estimate, before the IGAs could be completed.

October 2017: RTD initiated design of the bike shelter pads and prepared an invitation to bid on the construction of the shelters.

Capital Budget and Estimated Construction Costs

A detailed internal cost estimate was developed for each shelter, including site prep, structure materials, installation and a contingency, resulting in an average cost per shelter of approximately $106,176. The table below provides a breakdown of the grant construction costs and remaining available funds.

Table 2

	Grant Amount	Capital Cost Estimate	Marketing Funds Remaining
U.S. 36 (two shelters)	$312,384.00	$212,351.92	$100,032.08
A/R Line (three shelters)	$362,363.00	$318,527.88	$43,835.12
Total (five shelters)	$674,747.00	$530,879.80	$143,867.20

The table below compares how the capital and O&M costs associated with the Bike-n-Ride shelters compare to both auto parking and bicycle lockers. The capital and O&M are in line with costs per space for other types of parking. For RTD, the cost per vehicle to accommodate auto parking is roughly ten times more than the cost per bicycle.

Table 3

	Auto Parking	Bike Lockers	Bike Shelters
Capital Cost per parking space	$10,000 - $24,000	$1,250 - $2,100	$1,500 - $18,000
Annual O&M cost per parking space*	$193	$100	$161
Current use rates at RTD facilities	60%	38%	45%

*Local Jurisdictions are paying O&M costs

4. Bikes on transit

Bicycle transport onboard transit vehicles is a vital component of a holistic bicycle access strategy and can be provided on the interior and exterior of transit vehicles. In some cases, the ability to bring bikes onboard may extend the first/last mile beyond the standard 1- to 3-mile station catchment area, allowing transit users to consider longer trips, as well as previously inaccessible routes, like bridges without bike paths and steep hills. Many transit systems allow access to bikes onboard transit vehicles to facilitate transit linkages. This both extends the reach of transit for commuters with longer first/last mile connections and facilitates regional bike tourism. Spatial constraints and competing uses like ADA access may hinder efforts to facilitate bicycling. Careful planning is necessary to both mitigate concerns and empower change.

In addition to expanding the reach of transit and potentially increasing regional ridership, successful onboard accommodations for bicycles can open new opportunities for regional tourism and provide commuters more flexibility by allowing more linked trips. Allowing transit customers to bring bikes onboard also provides a valuable safety net in the case of inclement weather or unexpected mechanical issues like flat tires. For transit operators, onboard bicycle storage can also serve to supplement fixed bike parking at stops and stations.

Onboard bicycle storage can be a divisive issue between agencies and bicycle activists, so it is important to understand the benefits and limitations of bicycle storage onboard transit vehicles from both the transit operator and user perspectives. The general areas include:

- Station accessibility and boarding
- Policies, procedures and regulations
- General design best practices
- Accommodations for alternative bicycle types
- Bikes on buses
- Bikes on rail

- Bikes on ferries and other transit

Bicycle design is a factor to consider when addressing bicycle integration onboard transit vehicles. The following recommended practices pertain to standard adult-sized bikes.

4.1 Boarding area access

Rail and bus stations present an additional challenge for riders intending to bring their bicycles onboard transit. How are people getting to the transit vehicle?

Transit agencies should consider the best route for customers with bikes to travel through stations and provide clear signage for bicycle entry and exit to minimize potential conflicts with pedestrian traffic.

Agencies must consider accessibility for bicyclists. This includes elevator access, platform ramps and bike channels on staircases. In addition, station design must also account for pedestrian safety by building in forced dismounting measures.

4.2 Stairways and escalators

Agencies generally prohibit bicycles on escalators for customer safety and to minimize conflicts with pedestrians. Stairways designated for bicycle usage can be enhanced by installing bike channels or runnels to make it easier for customers with bikes to get their bikes up and down stairways. They allow riders to roll bicycles up and down a smooth ramp instead of carrying them. Bike channels should be designed to avoid interference with the use of railings, and they should be mounted at an angle conducive to easy movement up and down the stairs.

4.2.1 Runnels

A bicycle stair channel, also called a runnel, a wheeling ramp or a bike gutter, is a channel that runs alongside a pedestrian stairway. It is intended for pushing a bicycle up or down as one walks along the stairway. Stair channel design varies widely but should generally prevent the pedals from getting caught in vertical posts, have a scratch-resistant finish, be free from gaps and include signage on both ends and require little or no maintenance.

4.3 Design best practices

The elements of a good bicycle rack for public transit vehicles apply to vehicle exterior and vehicle interior racks, except as noted.

- Does not place transit users in conflict: Space for bicycles onboard transit vehicles should be as separate as possible from ADA and passenger usage.
- Independent load and unload: Each bike position can be accessed while adjacent bike positions are occupied by other bicycles with a reasonable variety of handlebar widths and wheelbase lengths. Handlebars may overlap but should not become entangled. Pedals should not interfere with one another.
- Holds bike securely: Bicycles are retained and do not swing or sway excessively during normal vehicle motion or in minor to moderate crashes. The rack should not scratch or damage the bikes.
- Durable: The rack should require no routine maintenance. The rack should be appropriately corrosion resistant for its environment.
- Not prone to misuse: Misuse includes both accidental misuse as in loading a bicycle improperly and intentional misuse such as vandalism.
- Maximizes bike density: Holds as many bicycles as possible while leaving enough passenger space to avoid conflict.

- Safe: There are no pinch points between moving parts, no sharp corners or edges, no protrusions that may be at eye level either for children or adults, and no tripping hazards. Vehicle interior rack users are not vulnerable if the vehicle starts in motion during the rack loading process, especially for any rack that requires the bike to be lifted or oriented vertically.
- Fits a wide variety of bikes: Bike variables include wheelbase, handlebar style and width, wheel diameter, tire width, and frame geometry. Rack should fit bikes with racks, fenders and panniers, as well as electric bikes. Cargo bikes and tandems generally cannot be accommodated.
- Complies with ADA requirements: The bike rack areas should be separate from designated ADA seating and boarding locations.
- Fast and intuitive to load and unload: First-time users should be able to use the rack without instruction. Loading and unloading need to be accomplished quickly to minimize time at transit stops. Straps and buckles usually do not meet this standard. n loading a bicycle improperly and intentional misuse such as vandalism.

4.4 Tips on positioning

4.4.1 Exterior rack positioning

Exterior racks are mainly applicable to buses. Racks should be located in the front of the vehicle to allow operators full view of loading. Racks should be installed low enough so bicycles do not obstruct the operator's line of sight.

- Loaded racks should not interfere with vehicle lights, signals or windshield wipers.
- Racks should not impede bus washing equipment

4.4.2 Interior Rack positioning

Racks should be located near vehicle doors, with markings on the exterior of the vehicle to indicate where bikes should load.

- Bike rack storage should minimize the potential for transit customers to accidentally brush against the drivetrain components (chain rings, chain, sprockets).
- Bikes should not need to be turned around within the vehicle or backed into the vehicle.

4.4.3 Retrofit vs. vehicle replacement

- Transit agencies should plan ahead when considering onboard vehicle access. If vehicle replacement is imminent according to an agency's capital plan, it may be more economical to devise a short-term solution and include dedicated bicycle storage amenities on forthcoming vehicles.
- Solutions are available for agencies that wish to modify their existing fleets.

4.5 Accommodating different bicycle types

As bicycle ownership increases, manufacturers are responsive to changing needs and are developing a more diverse product line to accommodate different types of ridership. This presents a challenge to transit agencies, as bicycles may diverge from standard dimensions and weights. While transit agencies should make every effort to accommodate bicycles, limited space onboard bus and rail transit vehicles requires decision-making based on a broader set of factors, including customer safety, circulation, ADA access and crowding as a function of overall ridership. The combination of these factors may preclude some alternative bicycle types from being accommodated onboard transit vehicles.

Promoting the use of folding bikes is an excellent alternative for enhancing onboard vehicle service while preserving onboard capacity for full-sized bikes. Agencies should allow folding bikes onboard vehicles whenever possible and require them to remain in the folded position and with the user at all times. Geographies with extreme weather conditions (heavy snow, excessive rain) or hilly terrain may see higher numbers of fat bikes. Wider tires may not fit into standard onboard vehicle racks (both bus and rail), and longer frames take up additional space in transit vehicles. E-bikes, while often similar to standard bicycle dimensions, are significantly heavier because of additional mechanical components and the rechargeable battery. Battery removal may be necessary for these bikes to meet rack weight requirements.

Children's bikes may present challenges because they vary in size. The wheelbase is the best factor to determine ways to accommodate these smaller bikes. Balance bikes and wheel sizes of less than 16 inches tend to be too small for exterior bus racks and should be allowed onboard transit vehicles, either as luggage or within the same designated storage areas as standard-sized bicycles. Bikes with wheelbases 24 in. and above can be treated as standard bikes and placed on vehicle racks.

Customers should be discouraged from bringing bike share bikes onboard transit vehicles. Frame design on bike share bicycles may preclude proper securing on the exterior rack and take space that may be needed for a personal bike. Typical station-based bike share programs charge overtime fees to encourage short trips and turnover, which may serve as a deterrent to linking bike share trips with transit. It is critical to work with local bike share operators to produce consistent educational materials on the functionality of bike share and the proper way for customers to integrate bike share trips with transit.

4.5.1 Alternative bicycle types

- For external bike racks on buses, agencies must adopt and adhere to the manufacturer's prescribed weight limit (typically 55 lb. per rack position/space) into their customer policies.
- Agencies can restrict alternative bicycle types onboard transit vehicles but still encourage their usage by providing fixed bicycle parking at stations.
- Agencies operating rail vehicles with designated cars for bicycles may have more flexibility to accommodate alternative bicycle shapes.
- If allowed, bike trailers and children's tagalongs should be detached and folded (to the greatest extent possible) before placing bicycles onboard bus or rail vehicles. These accessories can be brought on and stored as luggage.
- If allowed, children's bikes (balance, 12 in. and 16 in.) can be treated as luggage, depending on the transit vehicle and be stored with customers, similar to folding bikes. This maximizes space for full-sized bicycles.

4.6 General policy implications for bicycles onboard transit vehicles

In addition to the administrative policies previously described, the agency's official policy guidelines should specify that transit vehicles will be designed to encourage and accommodate bicyclists while maintaining safety and balancing the needs of all transit riders. Onboard policies should also outline specific rules and regulations for users and mandate their public display. These rules will vary based on transit mode, service and ridership. With increasing transit ridership, concerns for passenger safety and a mandate to maintain on-time performance, it is natural for transit operators to impulsively regulate bicycle access onboard rail and bus vehicles. While policies are important, it is also important to be mindful of administration and to avoid heavy restrictions that cannot be regularly enforced. Overly restrictive policies that cannot be enforced create conflicts and reduce credibility among transit customers who bike. Policies should be reasonable and serve to deter negative behaviors through self-regulation among customers.

Many transit agencies that initially implemented highly restrictive policies for onboard access note an easing of limitations over time. Riders tend to self-regulate with good judgment based on the amount of space available on a transit vehicle. See “Bikes on Buses” and “Bikes on Rail” for specific examples of regulations in use by transit agencies on different modes. Customers tend to avoid boarding with bikes if a transit vehicle is crowded (in the case of a train) or if exterior racks are full (on buses). Agencies should focus on education and providing tools to help customers make sound decisions about bringing bikes on transit. Predictive trip planners can help customers anticipate which trains/buses will be full. If restricting access during peak travel periods is necessary, agencies should clearly label schedules with a bicycle symbol or other notation to indicate when bicycles are allowed onboard. Even more-restrictive policies should have flexibility for exceptions based on community needs. Capital Metro, for example, does not allow bicycles inside the bus unless it is the final run of the night, in which case operators may use their discretion.

4.7 Bikes on buses: Approach to decision-making

Excluding demand-response transit, conventional bus and bus rapid transit (BRT) compose the majority of public transit systems in the United States. Absent other transit options, bicycle transportation is an efficient means to extend the bus commute, and onboard storage gives users the ability to fill in gaps, an important amenity for commuters requiring a bicycle for both the first and last mile. The use of bus transit provides a significant opportunity to enhance bicycle accessibility and augment transit service by bridging the gap in the first and last mile for transit customers. Buses, while providing more flexibility than modes with dedicated ROW (BRT, light rail and commuter rail) are still subject to first/last-mile gaps for commuters, thus making active connections important for all types of transit. Despite increased flexibility, buses suffer from significant spatial limitations due to capacity constraints. Planners should consider stop-spacing, dwell times and passenger loads when deciding how to accommodate bikes onboard buses. BRT systems may provide opportunities to test interior racks, depending on the system’s features.

4.7.1 Core bus considerations

4.7.1.1 Capacity

Physical capacity limitations are a factor for bikes on buses. Bikes are difficult to store internally on intercity buses due to crowding and physical capacity constraints, making it difficult to program space for interior bike racks. In addition, bikes are difficult to stabilize without a rack because of the vehicle’s frequent starting and stopping. Exterior racks are an alternative and are available in configurations to store two or three bicycles.

4.7.1.2 Loading and unloading

The loading process for bikes typically takes less than 30 seconds. Loading/unloading is undertaken by able-bodied adults who are relatively familiar with bike rack operation. Lack of knowledge can be a significant barrier to entry for some users fearing delay of the bus and/or an inability to make the rack work properly. It is therefore critical that agencies spend time educating users on the operation of bus bike racks.

Bike loading/unloading at major stops causes only marginal (if any) delays to bus operations. At higher-demand stations/stops, bike loading takes place while other riders board and pay the fare, thus reducing delays and impacts on performance. Conversely, bikers exiting in dense areas tend to disembark as quickly as possible, in many cases reaching their bike as other riders disembark the bus, with minimal impact on bus dwell times.

Lower-demand routes may have fewer passengers boarding/alighting at any given stop, with less time spent loading/unloading riders and on fare payment. Although this places a greater share of dwell time burden on cyclists loading/unloading their bikes, these low-demand routes typically have excess time in their schedule due to less time spent on fare collection. Off-board fare collection may provide a solution to these issues.

Bicyclists may face difficulty loading bikes on bike racks if the outermost rack is occupied, forcing the rider to negotiate the space between other bikes and the front of the bus. Education can help mitigate this problem, by getting users to load from the innermost rack first. Ultimately this conflict is unavoidable in denser areas, as customers who bike will deboard the bus in different locations. Staggered racks may present a partial solution by leaving lateral space between the bikes. Agencies have varying approaches to this issue; it is essential to clearly define standard operating procedures for addressing rack loading to minimize confusion and optimize the customer experience. The following links provide examples from King County Metro in Seattle on teaching customers how to properly load bikes on bus racks and how the bikes should be positioned:

- General Loading Information: https://kingcounty.gov/depts/transportation/metro/travel-options/bike/loading-unloading.aspx#bike-loading-video-1
- Middle and Inside Position Information: https://kingcounty.gov/depts/transportation/ metro/travel-options/bike/resources.aspx#bike-loading-video

4.7.1.3 Customer education and engagement

Loading bikes on bus racks may seem unapproachable for some users. To mitigate fear, anxiety and any subsequent externalities (such as service delays or lack of trips), transit agencies should educate users about racks on buses before boarding. This includes:

- Collaborating with local advocacy groups to ensure instructions are included in educational materials they produce for bicycle commuters.
- Providing "practice racks" at key station facilities and public events. Some rack vendors have installation kits for medium- and light-duty vehicles for under $1,000.

Bike rack users should be engaged in the procurement process to ensure that the bus racks are "tested" for ease of use. Procurement officers must collect feedback from a variety of sources, including both bike-savvy transit users and the general public.

Communicating strategies and promoting usage ahead of time to eliminate surprises when riders attempt to load their bikes on bus racks will lessen any perceived operational impacts. Although data is limited, bike loading seems to minimally affect bus performance when riders are informed about how to do it. Wheelchairs, by comparison take significantly longer to load than bicycles.

4.7.2 Operations and maintenance considerations for bicycles on buses

4.7.2.1 Demands on Bus Operators

Consistent pressure to maintain on-time performance, minimize dwell times and supervise fare collection—all while ensuring vehicular safety on street—places a significant responsibility on bus operators during daily operations. Loading procedures (particularly agencies requiring operators to assist customers with loading upon request) and data collection should be structured in a way to minimize demands on bus operators. Additional demands placed on bus operators outside of fundamental roles and responsibilities may create challenges with labor relations. Plans and policies developed to accommodate bicycles on buses must be developed with input from bus operators to take advantage of their firsthand knowledge.

4.7.2.2 Bus Maintenance

Routine bike rack inspections should be conducted as part of bus maintenance and operator pre-trip procedures. Rack testing and lubrication must be checked during bus maintenance procedures. Vehicle storage is a common point of opposition from some transit operations and maintenance (O&M) staff resulting from the

additional length of a bike rack in front of the bus. When in the folded position, however, bike racks on buses produce a marginal increase in a bus's footprint and should not adversely affect bus vehicle storage.

4.7.2.3 Vehicle operation

Federal standards for bus operators relevant to bicycle interaction include knowledge of stopping distances for large vehicles, as well as visibility limitations for commercial vehicles. Some states mandate a 3 ft minimum passing distance for bicycles. Transit agencies must take a leadership role in mandating consistent and safe vehicle operating requirements for bus operators. Buses are large vehicles and carry with them a variety of challenges for safe operation, including:

- Visibility challenges (blind spots) that affect operator views of the street including other motorists and cyclists trying to maneuver around buses; Larger blind spots for the driver, especially toward the rear of the vehicle
- Potential wind blast effect when passing cyclists in close proximity
- Longer acceleration and deceleration times
- Frequent stops and turning maneuvers toward the curb
- Wide turns at intersections, which may be difficult for cyclists, motorists and pedestrians to accurately anticipate
- More time required to pass

The addition of bicycle integration with buses may appear to present additional challenges for bus operators including reduced visibility, wider turn radii and managing on-time performance with customers loading and unloading bikes. While there may be instances where these challenges ring true, in general, front-end bus bike racks are designed to fit within standard turning radii (as illustrated below at left). As noted, loading and unloading produces minimal impacts on on-time performance for both low- and high-demand routes.

Understanding these challenges and their true impacts can help offset concerns among bus operators and union leadership. Education and training are therefore crucial to addressing these challenges and optimizing safety.

4.7.2.4 Guidelines for effective operator training

- Integrate bicycle-specific information into agency training materials for bus operators, including:
    - Mandate a 3 ft passing rule for bus operators when passing bicyclists.
    - Provide illustrative examples of different types of street treatments and how buses, bikes and other users interact.
- Outline standard operating procedure (SOP) for bike rack operation and for interaction with customers who bike.
- Include information on the "door zone" (the space an open door on a parked car can extend into the street—typically 1 to 4 ft—posing a risk of unexpected collision with bicyclists) and how this can impact a bicyclist's movement on the road.
- Require practical, on-road training for bicycle-specific scenarios.
- Integrate SOP for bicycle interactions into operator recertification programs.
- Work with operators to understand, address and mitigate their concerns related to bicycle interactions with/on buses.
- Training programs should acknowledge a degree of unpredictability with bicycles and stress the need to slow down and/or stop in such situations.
- Training programs should provide an analysis of typical bicycle behavior and how this may affect a bicyclist's decision-making.

4.7.2.5 Case Study: Metro Transit bus practice rack

The Freewheel Midtown Bike Center in Minneapolis has two large bicycle parking bays, as well as bike sales, parts, repairs and rentals. The bathrooms, chilled drinking water and showers serve casual and commuting bicyclists. Freewheel Bike is a local bike shop responsible for the facility's operations. The Midtown Greenway Coalition houses their office in this space as well, enabling their mission to focus on community engagement. Metro Transit provided a fixed bus bike rack for education and training purposes.

4.7.2.6 Case Study: Capital Metro Mobile bus training rack

Capital Metro (Austin, Texas) outfitted operational vans with bike racks provided by BykRak and uses them as mobile education tools at public events. The rack includes a dashboard indicator that activates when the rack is deployed.

4.7.2.7 Case Study: Metro Transit bus operator training

In Minneapolis, Metro Transit trains bus operators to prepare for a variety of situations involving customers with bicycles, as well as bicycles in traffic. Trainers show new operators a video the day before they begin their field training. It begins with two operators, each of whom have at least 35 years of safe operating experience at the agency and describes their approach to safe driving. It then reviews agency guidelines and local laws governing bicycle operation. It describes the different experience levels of bicyclists in traffic and the different behaviors exhibited by each group, with tips for safe bus operation in their presence. It includes a video taken from an instance in which an operator did not follow the guidelines and was subsequently involved in a frightening crash. The final third of the video is dedicated to pedestrian safety.

Metro Transit's Safety Department conducts an annual safety campaign focused on bicyclists. The LOOK + SEE campaign reminds drivers to keep a 4 ft distance between the bus and bicyclists at all times; this goes beyond the state law, which requires at least a 3 ft distance. Aside from training and bulletins, a white bike (an old bike painted white to denote a cyclist killed in a crash) is placed near the entrance of each bus garage with a LOOK + SEE sign. Safety also organizes the annual bus Roadeo, a competition among operators. A challenge featuring a person loading a bike at one stop and unloading it at the next rotates in and out of the competition.

4.8 Bikes on rail

4.8.1 Approach to decision-making

The fixed nature of rail systems emphasizes the need for radial connections on alternate modes for the first and last mile of travel. Absent other transit options, bicycle transportation is an efficient means to extend the rail commute, and onboard storage gives users the ability to fill in gaps, an important amenity for commuters requiring a bicycle for both the first and last mile.

Rail vehicles may have higher capacity for onboard bicycle storage due to the size and number of cars in a trainset.

4.8.2 Operations and capacity

Rail systems that run multiple cars with larger interiors means the system has a higher capacity for bicycle storage onboard. With added capacity comes competing uses, such as passenger luggage, ADA compliance and general passenger volume. There are a few ways to manage onboard bicycle volume:

- Provide a designated "bike car" with additional capacity
- Provide bicycle racks in designated locations of each car
- Allow customers to stand with their bikes

4.8.2.1 Considerations for onboard storage strategies

Designated bike car:

- Minimizes conflicts with other customers and luggage
- Can provide higher capacity and ensure regular availability of space
- Is not difficult to ensure consistent placement within trainset (car may not appear in the same position in a train, making it difficult for customers to know where to board without clear signage)
- Should not create delays for routes with shorter dwell times, depending on demand for bicycle access
- Requires exterior markings for users to identify the correct car

Fleet-wide bicycle racks:

- Simplifies boarding for passengers by ensuring that all cars have the same bike parking amenities
- Reduces operational challenges with car placement
- Does not present higher potential for conflicts with other customers onboard trains
- Agencies must post messaging on alternatives if all racks are occupied

Time between stops: short run times between stops create more pedestrian movement around bicycles

Dwell time: short dwell times make it difficult to accommodate high volumes of bike demand

Car maintenance: trainsets tend to be rearranged depending on maintenance cycles and daily operational factors

Interior design:

- Bikes should be staged in areas with easy access to exits without impeding customers moving throughout the train
- Bicycle storage placement will differ for railcars with high versus level boarding

4.8.3 Loading and unloading

Railyard operations generally make it difficult to ensure that bike-specific railcars are always located in the same location on every train. There are a variety of formal and informal methods for handling this issue, including:

- Platform announcements can help to direct customers with bicycles to the correct boarding location.
- Education before riders board the train is critical to ensure that customers self-manage their activities appropriately, to the greatest extent possible.
- Decals on the exterior of designated bike cars can be helpful if a significant volume of rolling stock is capable of accommodating bicycles. Railcars should be consistently spaced in the trainset, so customers can predict where to board, when possible.
- Crowd-sourced methods such as Twitter may prove useful to transit agencies in communicating adequate data to customers.

4.8.3.1 Case Study: Bike smart on BART

In the San Francisco Bay Area, BART combines clear text and infographics onboard trains and at stations to provide customers with rules for bringing bikes onboard trains. These include:

- Bikes should avoid crowded cars.
- Bikes are not allowed in the first car of the train at any time.

- Bikes are not allowed in the first three cars during commute hours.
- Bikes should not block aisles, doors or seats.

These rules are designed to encourage self-regulation among customers through common sense behaviors

4.8.3.2 Case Study: Metro Transit platform boarding indicator

In Minneapolis, Metro Transit has installed bicycle boarding indicators on the Blue Line's 38th Street and 46th Street station platforms. These temporary markers indicate which train doors are closest to onboard bike racks, making it easier to board the train with a bike. This pilot project was promoted on Facebook and garnered a total of total of 3,590 post engagements (reactions, comments, clicks and shares), a higher than usual response for Metro Transit's social media interactions. The generally positive feedback and the level of engagement is a clear indicator of this pilot's success.

4.8.4 Policy and regulation

Customers should be encouraged to stay with their bicycles while onboard rail transit vehicles, even when a rack is present. This mitigates bicycle theft and enables operational flexibility throughout the route. It also helps encourage bicycle/transit users to police their own actions and gauge whether a car has capacity to board. Bicyclists who do not want to stand with their bikes may not wish to bring their bike onboard if there is no adjacent seating.

4.8.5 Data collection methodologies and strategies for bikes on rail vehicles

Tracking demand and utilization of bicycle integration with rail transit is a challenge due to the high passenger volume capacity, potential for congestion and staff bandwidth. Most data collected on rail/bike integration comes from passenger surveys. Additional data collection strategies include the following:

- Video analytics at stations and onboard transit vehicles
- Conductor training for manual bicycle counting (in designated areas at predetermined intervals)
- Bicycle-demand-focused questions included in regular passenger surveys

4.8.5.1 Case Study: Capital Corridor onboard bicycle survey

In 2012, the Capital Corridor Joint Powers Authority (CCJPA) in California was considering station-based solutions for bicycles (eLockers, folding bicycle rentals, and bike share support) and onboard solutions (more space, upgraded racks and loading/unloading procedures) for integration in the agency's bicycle access plan. To inform decision-making on these topics, CCJPA conducted a three-month "mode of access" survey of customers, with targeted questions for customers indicating cycling as an access mode. The survey was based entirely online; customers were handed a postcard with the survey link and encouraged to use the train's onboard Wi-Fi. CCJPA provided several incentives to encourage customer participation:

- A Brompton M3L folding bicycle as a grand prize
- A monthly pass
- A 10-ride pass
- A round-trip pass

Bicycle-focused questions included the following:

- Reasons customers choose biking (convenience, cost, exercise, schedule flexibility, environmental consciousness, necessity at destination, non-car owner, no car parking, speed/efficiency)
- Reasons for bringing bikes on train
- Percentage of racks open at home station on arrival

- Percentage of racks open at home station upon return
- Security rating for bike parking at home station
- Level of ease in locating bicycle parking at station

There were 950 survey responses, providing an excellent baseline for validating recommendations for bike upgrades for both access and onboard storage, as well as insights into parking.

4.9 Ferries and other transit

4.9.1 Ferries

Port cities and other municipalities intersecting with bodies of water can leverage ferry networks to provide enhanced bicycle access throughout the region. Ferries may also bridge geographical barriers where tunnels and bridges do not allow bicycles.

4.9.1.1 Getting on the ferry

Designate boarding areas for bikes to reduce conflicts with pedestrian traffic and allow for additional security measures, if needed.

4.9.1.2 Car maintenance

Bike parking should be easily accessible by rolling on and off the vessel and it should be located where bikes will be protected from weather (or salt spray).

- Multi-level ferries should have bike parking on the primary deck to facilitate roll on/roll off service
- Roll on/off service may not apply where there are points of access on multiple levels. For example, a dock-level deck for cars and an overhead pathway from a terminal that could have roll-on bike access with pedestrians or \where bikes roll on at the car level but then are directed to an upper ramp where there's more bike parking.
- Racks or tie-downs should hold bicycles securely in rough tides with minimal swinging.
- Racks should be designed to fit numerous types of bikes and accessories (fenders, racks, panniers, e-assist bikes, cargo bikes, different shapes/sizes of handle bars, etc.).

4.9.1.3 Getting to the ferry

Waterfront bike paths make ideal linkages for ferry transit.

- Path wayfinding should indicate ferry transit facilities.
- Provide clear bicycle wayfinding signage at the facility (which door do customers with bikes enter, where is the waiting area for bikes within the facility, etc.).

4.9.1.4 Case Study: King County Water Taxi

King County Water Taxi, operated by the Marine Division of the King County (Washington) Department of Transportation, provides passenger-only service on two short routes: between downtown Seattle and West Seattle (a peninsula neighborhood within the city of Seattle); and between downtown Seattle and Vashon Island. Each vessel holds 26 bikes of any type in racks located at the stern. There is no charge for bikes. During peak travel times, passengers with bikes use separate ramps from walk-on passengers.

4.9.1.5 Case Study: Washington State Ferries

Washington State Ferries (WSF), a division of the Washington State Department of Transportation (WSDOT), is the largest ferry system in the United States. WSF operates 22 vessels carrying vehicles and

passengers year-round on 10 routes across Puget Sound and adjoining waterways, including into British Columbia. WSF provides commuter service, as well as tourist service. Bikes are common on every sailing, from several bikes to several thousand bikes during major bike events. Passengers roll their bikes on and off the car deck as instructed by crew members. Bikes of any design tie up to rails along the sides of the vessels with ropes which are provided. Bikes park under the cover of an upper level of the vessel, protecting them from weather. After parking, bicyclists proceed to passenger areas while sailing, away from motor vehicles. Bicycles transit is free with passenger fare when paid with the region's ORCA fare card. Without an ORCA card, there is a small surcharge for bikes.

4.9.2 Private Shuttles

University campuses and private office parks may provide internal transit systems as a service to facilitate mobility. This could include full-scale bus systems and/or shuttle service. Shuttles may also be used to bridge arterial gaps for bicycle and pedestrian transit customers. For example, bridges without biking and walking paths may have a circulator service that allows customers to load bicycles on the vehicle, ride across the bridge or tunnel, and resume their bicycle trip on the other side.

As younger demographics gravitate to cycling as a mainstream mode of transportation, college campuses with transit systems can augment service by providing seamless linkages with internal transit amenities including racks on buses and vans.

4.9.2.1 Case Study: Puget Sound region

In the Puget Sound region (Seattle area), several employers and institutions augment public transit service for their commuters during peak times and to transport employees between multiple worksites or campuses. With bike racks on transit long established in this region, private services provide racks on their vehicles. These employers have comprehensive trip-reduction programs that includes strong support for bike commuting. Examples include the University of Washington Health Science Express; Children's Hospital and the Microsoft Connector. One type of van used by the Microsoft Connector hauls a trailer that can carry up to 12 bikes to cross a bridge that has had no bike access.

5. Bikes with transit

5.1 Bikeshare

Bike share is relatively new to the transportation world and presents significant opportunities for first and last mile connections to transit. Many agencies have woven bike share into their transit networks, adding convenient connections and customer services. The flexibility and responsiveness of bike share represents a useful tool to fill gaps in a service area. The USDOT's Bureau of Transportation Statistics reports that roughly 86 percent of bike share stations in the United States are located close to some mode of scheduled transit service; three-quarters of these locations are located within a block of a bus stop.

Bike share is a rapidly emerging industry. With new technologies, operating structures and competition, the bike share market is changing so fast that current assumptions and lessons may be too limited to anticipate exactly how transit agencies can and should plan to integrate bike share in the future. However, this section is designed to provide agencies with a basic understanding of the concepts which define bike share systems, technical resources for implementation and strategies for transit to leverage bike share as a tool to augment mobility for their customers.

As bike share systems continue to grow in use, it is important for transit agencies to facilitate connections to bike share and interoperability as feasible. The bike share market is evolving rapidly, with new technologies

and operational models. Transit agencies should follow market trends to adapt to changing conditions and innovations.

5.2 Smart docks vs. smart bikes and ownership structures

Most established bike share systems in North America and Europe operate under all or mostly public ownership, funding and control, with a single system in place for a defined geographic area. Customers go to designated docks to find and return bikes available from a fleet. Bikes are parked at "smart docks" where customers unlock the bike after paying with a credit card at a kiosk or using an app. Access may be integrated with a transit fare card. Given the usual single system under public oversight, transit settings are typical locations for bike share stations. Public entities work together to support the placement and infrastructure. Depending on local experience and perception, the public may or may not support the use of public funds or public space for bike share. Two newer elements are redefining the original bike share model, posing new opportunities and challenges for use with transit.

1. Dockless bike share programs use "smart bikes" that are self-locking; substantial infrastructure for an electronic station is not required. They are GPS-enabled so customers can use an app or website to locate a bike wherever it's parked. Biketown in Portland, Oregon has a single public system with designated labeled bike racks where bikes are can be parked but permits parking anywhere in the service area or elsewhere. The pricing structure offers incentives to park in the designated locations.
2. Private companies have surged into the market, offering to provide bike share equipment and services at no public cost. In this model, multiple companies can operate simultaneously in a competitive environment, much like car share and ride-hailing companies. The companies set their pricing, type of bike, distribution, and marketing. Cities, campuses and property owners establish the regulations, if required. They develop permit conditions to regulate safety, insurance, indemnification, maximum number of bikes, parking locations, data-sharing, expectations for responsiveness to problems, fees, and other matters considered in the public interest. Seattle is testing dockless bike share through a permit system after terminating a public station-based system. Other cities have added bike share through a simple business license. Several cities, including Washington DC, are supplementing a single station-based system with dockless bike share to extend the areas served.

5.3 Bikeshare models

5.4 Station placement for dock-based system

Bike share stations should be placed at or near transit facilities without impeding pedestrian flow, automobile or bicycle traffic. Agencies should proactively work with bike share operators to ensure that stations are placed in the best locations to capture transfer volume. In addition to their functional purpose as a connecting transportation mode, bike share stations help to foster urban context and sense of place. In addition to pedestrian flow and operational considerations, transit agencies should actively investigate ways in which bike share systems can support traffic calming and place-making opportunities around station facilities.

Real estate considerations may play a role in bike share station placement. Property values around transit agencies tend to be high, which may push bike share stations to the fringes of transit. This should be avoided by working with transit real estate departments to prioritize bike share proximity as a connecting mode. Bike share station placement guidance should be documented in agency design guidelines. Transit agencies and bike share operators should work with developers to prioritize the allocation of bike share stations proximate to transit. Bike share operators should keep in mind that proximity of bike share stations varies depending on the type of transit service. Rail and bus transit in urban areas tend to have shorter distances between stations, where heavy rail will operate regionally between municipalities. With shorter distances, bike share stations can remain proximate to transit and maintain density between stops. For heavy rail, especially in rural areas,

bike share should concentrate around transit stations to maximize transfer opportunities and encourage transit-oriented-development (TOD).

5.4.1 Dock growth and considerations

While station-based systems remain the most common form of bike share in the market, the number of dock-less systems are growing.

5.4.2 Incentivizing bikeshare

As bike share systems continue to flourish across North America, transit agencies should actively work to leverage the benefits of this alternative mode and plan for ways to facilitate bike share in their service areas. It is critical that transit agencies work closely with bike share operating authorities to ensure that connectivity is optimal and seamless for users. Transit agencies should work with bike share operators to incentivize bike share/transit connections where possible. For example, fare card interoperability enables seamless transfers from bus and rail transit to bike share.

5.4.2.1 Case Study: LA Metro TAP card

LA Metro's TAP card provides customers access to the Metro bus and rail system, plus 23 other TAP-enabled systems in Los Angeles County. Users can link a TAP card to a Metro Bike Share account online, allowing access to the bike share system.

TAP card users can also operate bikes from the separate Breeze Bike Share system in Santa Monica, California, but this requires a separate linkage with a Breeze Bike Share account. Plans for later phases of bike share expansion include a single account for all systems, as well as affordable transfer rates for a seamless rider experience.

5.4.3 Operational and maintenance impacts

High-volume transit stations should consider dedicating space for bike share operations to accommodate re-balancing needs during peak times. Those could be parking for bike share vehicles or a garage space for storing extra bikes and/or managing bike valet. Some bike share systems require hardwired connections for electricity and network access. Transit agencies should be aware of this when working with bike share operators to place their stations. This may also require additional capital costs, depending on power and network requirements.

5.4.4 Managing discussions with transit operations

Transit agencies must develop clear policies and procedures to govern the treatment of bike share in relation to transit services and facilities. These standard operating procedures (SOPs) should be created with transparency and consider impacts on transit operations and customer circulation. Once established, agencies must clearly communicate these policies and procedures to staff. The example from King County Metro illustrates a model for communication with bus operators, providing an overview of the landscape, descriptive definitions, linkages to existing agency documentation and procedures for different scenarios.

5.4.5 Case Study: Seattle dockless bike share pilot

In summer 2017 Seattle began testing dockless bike share through a pilot permit system after terminating a public station-based system. The former system operated for 2.5 years (until spring 2017) with 54 stations and 500 bikes deployed in several dense but somewhat disconnected locations. The transit agencies were closely involved in setting up the system, with bike stations located near transit stations. Under the new permits, the entire city is included in the service area, with bike parking limited to areas within the city's right-of-way (ROW). Three companies have been operating bike share services with more than 6000 bikes on the streets.

One company added e-bikes to its inventory in February 2018. With no designated stations, bikes are parked wherever customers leave them, which makes them widely available and sometimes located well outside the city or in odd places. Using experience and data from the pilot period, the city plans to create a permanent permit later in 2018. The revised permit is likely to designate some preferred parking places in busy areas to reduce clutter and address potential safety issues, including at transit, while allowing free-floating parking. The permit does not allow parking on transit agency property, but companies can request a special use permit from the transit agencies. Transit agencies have established procedures to deal with mis-parked bikes.

5.4.6 CDPHP *Cycle!* integration with CDTA

In July 2017, the Capital District Transportation Authority (CDTA) rolled out a bike share system with 40 station locations and 160 bicycles across New York's Capital Region, focused in Albany, Saratoga Springs, Troy, and Schenectady. The system is operated by Social Bicycles with local staff focusing on bicycle redistribution, maintenance, and safety. The program was dubbed CDPHP *Cycle!* in partnership with a local health care provider and is a success. More than 2,500 people signed up for the program resulting in more than 11,000 trips in just four months. In 2018, the system will double in size with 80 stations and 320 bicycles available for rent, covering much more of the bikeable area and adding to the region's environmental sustainability efforts.

CDTA focused on creating a system that would complement the region's existing transit network, including emphasis on locating bike racks near the largest transit service areas as well as gaps in service, particularly cross-town trips. The existing transit network was utilized as a baseline for travel to desired destinations and ideas for bike share system expansion.

Thanks to a partnership with Albany Public Library, CDPHP *Cycle!* was able to create a community-based location for bike share operations separate from the CDTA bus garage, allowing more flexibility and reach, and strengthening ties with a great community partner. This integration is the beginning of larger cooperation between the transit network and CDPHP *Cycle!* CDTA is working on integration to allow bike riders to rent bicycles with the regional transit smart card, Navigator, along with transit/cycling safety programs and loyalty opportunities.

In reviewing the first year of CDPHP *Cycle!* data showed high usage on weekends and evenings, pointing to customers utilizing the bicycles for leisure trips. A group of commuters began to emerge, allowing the program to begin redistributing bicycles insuring people choosing to ride them to or from work had a bicycle available for their return trip.

The CDPHP *Cycle!* system is the only one in the country comprised of four smaller systems, making bicycle distribution and system maintenance more challenging. The program focused on having systems in each city's downtown and at sufficient density, so customers felt comfortable riding from one location to another without concern of getting stranded.

Those attributes combined with a short first season of only four months has CDTA and the region excited for the future of bike share in Upstate New York.

6. Safe routes to transit

For many commuters to consider biking to transit facilities, they must have a network of safe, accessible bikeways and a clear navigation system or wayfinding. Achieving this requires varying degrees of interagency coordination and cooperation, as well as an understanding of transit's role in complete streets and Vision Zero guidelines.

Optimizing bicycle connections begins with providing safe routes and streamlined navigation systems for commuters to access transit facilities. Prioritizing bicycle routes to transit stops and stations is essential to getting potential transit riders out of their cars and onto a bicycle for their first/last mile of travel. Navigation is

another key element of a robust bike network, with clear and consistent wayfinding signage strategically placed at key decision points along major routes. The complexities of route planning and transit connectivity require interagency coordination among relevant stakeholders to ensure a consistent approach.

6.1 Bridging the jurisdiction gap

Bicycle networks, wayfinding and related accommodations typically fall outside the jurisdiction of transit agencies. Transit agencies should work with public-sector community partners- including municipal Departments of Transportation (DOTs), local elected officials, metropolitan planning organizations (MPOs) and transportation management areas (TMAs)- responsible for on-street infrastructure as well as pedestrian ROWs, to make recommendations for safe routes to their facilities. In addition, agencies should clearly communicate operational concerns affecting bicycle movement, so municipalities can provide more effective planning solutions (e.g., routing cyclists through one station to a particular entrance without impeding bus movement from a terminal). The regional nature of most transit systems necessitates cross-jurisdictional coordination with numerous municipalities to ensure a consistent approach to multimodal transit access.

6.2 Planning for non-agency owned facilities

Bike routes within the immediate vicinity of transit stops and stations are key factors that influences on a transit customer's willingness to connect via bicycle. Extending beyond transit property, bicycle facilities typically fall outside a transit agency's jurisdiction. In addition to bike routes, additional amenities should be considered, such as lighting, wayfinding and security. Agencies and prospective partners should establish a working relationship to ensure that customer needs are prioritized regardless of jurisdiction. In addition to public-sector entities, transit agencies should consider strategies for incentivizing private-sector stakeholders that may have a vested interest in transit connectivity, such as developers and property owners.

Agreements between parties should be simple to facilitate streamlined implementation of joint projects. This includes clear scopes of work and funding commitments. Transit agencies and municipal partners would benefit from a master cooperation agreement which states a general intent to work together. Shorter, project-specific agreements can be issued on a case-by-case basis. Transit agencies should be willing to take the lead in applications for funding if an opportunity presents itself. In considering implementation, transit agencies must evaluate internal expertise to assess the capacity for design and construction.

In addition to simplified agreements, transit agencies should consider funding mechanisms for inter-jurisdictional projects and budget for offsite improvements. Transit agencies can take on funding responsibility in conjunction with private-sector partners in some states.

6.3 Overcoming data gaps

The institutional agency culture may present obstacles to integrating bicycles with transit, with opposition and concerns often stemming from operations or maintenance. Despite an ultimate goal of increasing mobility for customers, this creates challenges for planners to advance new initiatives, especially without specific data to support them. Municipal partners are likely to have data that is not endemic to transit ridership such as vehicle crash data, bicycle ridership and mode share within its jurisdiction. In the absence of internal data on bicycle ridership, transit agencies can leverage nonendemic data from municipal partners to inform decision-making. Likewise, data endemic to transit (ridership, parking utilization, ticket sales, etc.) may help municipalities justify infrastructure improvements around transit that support bicycling.

6.4 Bicycle network infrastructure

Commuters will be more inclined to use bicycles as a mode of transportation if they are able to ride in a safe space on the street or off-road path to connect with a local transit stop or station. Bicycle facilities this concept can be provided in a variety of forms and levels of safety. Protected bike lanes and cycle tracks offer

greater protection than bike lanes by physically separating bicyclists from traffic, but they come at a higher cost for materials, installation, curbside parking capacity and road space.

Bike lanes rely on painted delineation to separate bicyclists from adjacent travel lanes, offering cyclists dedicated space and higher visibility than a non-marked street. Communities with rail-based transit systems should be mindful of conflicts with on-street bike routes and at-grade rail crossings. Bike lanes, routes and protected paths should be designed parallel to rails. Any bicycle facilities intersecting with a rail crossing should be designed to intersect at a 90-degree angle with the rails with route signage to warn oncoming cyclists. At-grade rail crossings tend to be pedestrian-focused, but they should also need to be considerate of the needs of cyclists. Gates are optimal, though expensive.

Bike routes should be placed near major transit facilities, providing direct access within a 1- to 3-mile radius, regardless of the specific facility type. While direct connectivity to transit facilities is recommended within the catchment areas, this is not necessarily feasible as distance from transit increases. New bike routes should focus on connectivity with more dense areas of the bike network where direct routes to transit are not possible.

6.5 Wayfinding

The complexity of navigation to a transit stop or other transit facility is a key factor in a user's decision to choose an active commute for the first/last mile. A properly signed route can alleviate stress and frustration before—and minimize anxiety during—the commute. Robust wayfinding will instill confidence in would-be cyclists, especially those who typically drive, and assist existing active commuters by providing a sense of seamless navigability and directing bikers to safer routes. When addressing wayfinding, agencies should consider the following guidelines for planning and design.

6.4.1 Wayfinding guidelines

Prioritized planning:

- Collect data using in-person surveys to understand how cyclists are currently navigating to transit facilities. This will help identify challenges from existing riders and provide insight into high-traffic routes.
- Prioritize major transit facilities with dedicated directional signs from thoroughfares.
- Provide directional markers to transit facilities at key decision points in the bike network.
- Ensure that wayfinding complements on-street bicycle facilities and lower-stress routes.
- Consider more frequent signage on complex routes.

Directionality through design:

- Use a unified and consistent design throughout the network so signs are easily recognizable. Transit agencies should integrate into existing municipal wayfinding systems (if present) rather than developing separate systems.
- Integrate bicycle symbols on wayfinding signs to ensure easy route identification for cyclists.
- Minimize competition with other street signage to allow wayfinding to stand out.
- Survey riders to understand what routes they are choosing and why.
- Consider where cyclists should dismount and how to communicate that information.

6.4.2 Case Study: Sound Transit Wayfinding maps

Sound Transit (Seattle) received an FTA grant for Bicycle Enhancements at Sound Transit (BEAST). This grant was used to install secure bicycle parking at numerous locations. The grant included $100,000 for bicyclist education, which was used to develop and install bicycle wayfinding signs at light-rail stations.

Initially, signs were deployed exclusively at bicycle parking facilities. Over time, the program advanced to the platform level in conjunction with existing customer information signage, to accommodate bike/ transit users bringing bikes onboard. Concentric rings were used to illustrate distances up to one mile around the stations. Because the light-rail line runs through multiple jurisdictions, each with different on-street bicycle facility nomenclature, Sound Transit was challenged to come up with common terms for types of on-street bicycle facilities around each station. Bike maps need to be updated frequently, because of frequent changes within the jurisdictions.

6.5 Rail right-of-way

Private freight operators own extensive active and inactive rail property in different parts of the country, which can be acquired and transformed for active transportation uses. Adapting unused rail right-of-way is a property question, making it a potentially divisive issue among owner, community and agency stakeholders.

While typically popular with community groups, property owners, especially freight railroads, tend to avoid conversion projects, as they often preclude future rail usage once the conversion occurs. New rail lines should endeavor to include dedicated space within the right-of-way (ROW) in the initial corridor plan.

6.6 Bus right-of-way

Bus ROWs have different challenges. Business access and transit (BAT) lanes function as on-street ROW for transit buses. These dedicated bus lanes are intended to bypass automobile traffic and allow transit vehicles to run faster and maintain schedules during peak travel periods.
On high traffic streets without bike lanes, cyclists may gravitate to BAT lanes for relative safety. While these lower traffic volume lanes (compared with open traffic lanes) may be attractive for cyclists, the presence of bicycles may interfere with on-time performance and bus operations. On-street separation of bicycles from BAT lanes is generally recommended but sharing BAT lanes may be appropriate in some instances, such as short connections with other bike routes, lower-frequency routes or other unique instances.

6.7 Case Study: LA Metro Measure M

In 2016, 71 percent of voting Los Angeles County residents approved Metro's Ballot Measure M. Officially titled the "Los Angeles County Traffic Improvement Plan," Measure M represents a half-cent sales tax increase and a continuance of the existing half-cent traffic relief tax to improve freeway traffic flow; expand the rail and rapid transit system; repave local streets; improve safety across both the transit and highway system; make public transit more accessible convenient and affordable; embrace technology and innovation; create jobs; reduce pollution; generate local economic benefits; and provide accountability and transparency. The resulting funding allocates $2.4 billion for bicycle and pedestrian connections to transit.

6.8 Case Study: Metro Connects

King County Metro's (Seattle) "Metro Connects" plan lays out a commitment to advancing projects that give customers better, safer access to Metro service, including "new and improved sidewalks; trails and lanes for biking and walking; carpool and drop-off spaces; and parking for cars and bikes." This plan prioritizes multimodal connections.

6.9 TriMet Gresham MAX Path

The Trail
In 2015 the City of Gresham (Oregon) opened a direct, 2-mile paved trail through the heart of the city. In addition to connecting the Ruby Junction MAX station in Rockwood with the Blue Line's eastern terminus in downtown Gresham, the MAX Path also provides access to Gresham parks, and direct connections to the

Springwater Corridor Trail and the Gresham-Fairview Trail. Features include 37 no-glare LED lights and signalized pedestrian crossings. The path features more than 200 native trees and shrubs. Today this path provides improved local mobility and regional connections.

Funding and Collaboration
The majority of the trail was paid for with an $890,000 Regional Flexible Funds allocation from Metro. The trail was designed within the existing light-rail right-of-way (ROW).

Key takeaways
- Comfort is a key consideration for bikers, pedestrians and transit customers.
- Benefits to community and station access outweighed initial agency concerns with sharing ROW.

6.10 Toronto Transit Commission Finch commuter lot multipurpose path connection

6.10.1 The Background

The Finch Corridor Trail, a popular 3-kilometer (1.8-mile) multiuse path (MUP) that crosses Toronto's north, is separated into two sections by the commuter parking lots for the Toronto Transit Commission's (TTC) Finch Station—a major municipal and regional transit hub. This created a two-block gap between Willowdale Avenue and Talbot Road that disrupts cycling journeys and disconnects the western section of the trail from the city's trail network, mainly the north/south Upper and Lower Don trails.

Initial plans to connect the trails by expanding the sidewalk of Bishop Avenue, or reducing traffic to a single lane, were met with a number of concerns:

1. Bus operations: The bus terminal is operating at capacity during peak periods. Each hour during the morning peak, approximately 72 buses, carrying 4,200 customers, enter Finch Station through Bishop Avenue. Removing one traffic lane would significantly impact this already-congested road.
2. Elimination of green space: The current sidewalk is lined with trees; widening the sidewalk would require their removal.
3. Residential area: The TTC commuter parking lot is separated from the residential area by a large fence. Building the MUP on the street side of the fence would generate unwanted traffic for the residents living along Bishop Avenue.
4. Congestion: The intersection of Yonge Street and Bishop Avenue is highly congested with buses, personal vehicles and a taxi stand. Adding a MUP would increase this traffic.

An alternate plan to move the trail connection inside the commuter lot by removing about 200 parking stalls was not implemented due to the negative impact on parking capacity and TTC revenue. A solution that worked for all stakeholders involved was required.

6.10.2 Stakeholder priorities

Table 4

Stakeholder	Main priorities for this project
Toronto Transit Commission (TTC), GO Transit and other regional transit agencies	• Ensure efficient and safe bus operations • Avoid parking revenue loss • Keep taxi stand at intersection of

	• Yonge/Bishop
City of Toronto Transportation Services	• Connect east and west trails • Minimize impact on residents
City of Toronto Urban Forestry Operations	Minimize impact on green space
Area Residents	• Ensure safety of residents • Minimize traffic and congestion • Maintain landscapes and green space

6.10.3 Solutions

The competing priorities of the various stakeholders briefly brought connection plans to a standstill, as none of the unilateral plans were acceptable to other parties (e.g., losing parking space or a street lane was denied by transit agencies). Through collaboration and by bringing all stakeholders together at the same planning meetings, a better solution was developed. Thinking about the issue from all perspectives allowed stakeholders to see
others' points of view, which in turn led to an acceptable solution for everyone.

Redesigning the parking lot curb and parking stall spacing enabled the TTC's engineering department to include the MUP within its boundaries while simultaneously minimizing impact on parking spaces, with a loss of only seven parking spaces. The city's Transportation Services group showed flexibility in trail width, reducing the required width from 12 ft to 9 ft in certain areas along the MUP connection to allow the TTC to retain parking spaces. Forestry Operations also supported the project by relocating some trees. The regional agencies worked together to ensure that the MUP crosses their terminal from behind the taxi stand, maintaining continuity of the connection to the Yonge/Bishop intersection without removing the taxi stand.

6.11 Case Study: Metro Transit and Hiawatha Path

Planning for the Twin Cities' first light-rail project, the Hiawatha line, began in the 1990s. The Metropolitan Council (the regional MPO that operates Metro Transit) had to acquire land for tracks and related support services. Various neighborhood groups, including local politicians, lobbied Metro Transit to dedicate some of the space not specifically needed for train tracks or related uses to a multiuse path. Until that time, Metro Transit had not provided dedicated bicycling facilities and was leery to include anything that didn't directly serve transit. However, the advocates ultimately persuaded the agency to build and maintain the 4.7-mile path.

With no experience in path engineering, there were problems with the original design. For example, the asphalt was too thin, resulting in plants growing through the surface of the trail. In addition, many aspects of managing the trail were not planned for, including adequate maintenance and signage. Over the ensuing years, the trail surface was replaced, signage was added and improved and new signs were added, and Metro Transit contracted with the City of Minneapolis to clear snow in the winter. The path opened at the same time as rail service: June 26, 2004. The Hiawatha Line was later renamed the Blue Line, but the Hiawatha LRT Path name remains. Although the path serves only a portion of the rail line, roughly between 46th Street Station and 11th Avenue South, just past Cedar-Riverside Station. The City of Minneapolis later lengthened the path past 11th, but Metro Transit was not involved in that project.

7. Customer empowerment and education

Bicycling presents a series of logistical and practical challenges for transit commuters considering the best mode for their first and last mile. Many of these challenges are addressed throughout this guide, including se-

cure bicycle storage, alternatives to personal bicycle usage and safe access to transit facilities. While infrastructure may present solutions to many of these challenges, customers must first feel confident in their ability to ride bicycles to transit facilities. Transit agencies should actively work with local organizations to provide consistent messaging on transit resources for cyclists and actively engage in education programs.

7.1 Communicating with customers

Transit agencies must develop strategies to incentivize, educate and promote the use of bicycles to connect to transit service. At a minimum, this includes a central online repository for information related to bicycle and transit integration across the agency's services, including:

7.1.1 Bicycle parking

- Locations, costs and rules for secured bicycle parking facilities
- Instructions for using secured bike parking
- Stations with free bicycle parking

7.1.2 Rules and regulations for bicycles onboard transit vehicles

- Instructions for bringing bikes on buses and trains
- Instructions on how to use the racks
- Instructions on rules and regulations for non-English speakers

7.1.3 Links to bike share resources and accessibility

- Local advocacy group websites
- Local and regional bike maps
- Local and regional bicycle events and training courses

Transit agencies should provide on-site information, including brochures, pamphlets and instructional posters. These materials and related activities should be included in the annual budget. See Appendix E for a list of available transit agency web pages for bikes.

7.2 Information strategies

Transit agencies should incorporate biking into imaging and messaging to reinforce how bikes and transit go together.

7.2.1.1 Use strong visuals with impact

For all photo shoots, use images of bikes on buses and people riding bikes near transit. Show bikes as part of the normal scene to reinforce that people use bikes and transit together. Use maps that show bike riding time to major destinations including transit stations.

7.2.1.2 Messaging

Biking does not have to be all or nothing. Partway or one-way, frequently or occasionally, any trip that incorporates bicycling and transit is valuable. Speak to all kinds of people and a variety of motivations. Incorporate a wide age range, abilities, cultural backgrounds, women and men, health and environmental benefits into messaging.

7.2.1.3 Promote bicycles as a service

Maintain a web, social media and print presence that fits with the agency brand and shows biking as an integrated part of the agency's suite of services. Place bike web pages prominently on the agency site. Show the

public services for combining bicycling with transit, covering essential information like how to load a bicycle on a bus and where to park a bicycle at transit facilities.

7.2.1.4 Promote local bike events

Promote challenges and events sponsored by the transit agency, partners and advocacy groups. Support Bike Month on social media, link back to the transit agency's bike page. Bring a demo bus bike rack to events.

7.3 Education as a planning tool

Transportation planners and policy makers tend to focus on bicycle infrastructure as the primary strategy for facilitating bicycle ridership and increasing on-street safety. While this approach has increased bicycling in communities throughout the United States, relative mode share for bicycles remains low. Achieving greater mode shift requires a series of integrated strategies in addition to infrastructure, such as prioritizing training programs programming for kids and adults as well as a realistic enforcement framework that includes education for police and other traffic safety professionals. Transit connectivity is a central element in a holistic bicycle strategy; both modes provide complementary transportation options that mutually serve to extend mobility. Despite this congruity, many transit customers may not consider the bicycle as a connecting mode. Transit agencies should proactively work to improve this perception by empowering customers to bike their first and last mile.

In addition to providing information on bicycle services at transit facilities, transit agency policies should provide information on safe cycling practices and specific rules for their communities. This will help encourage transit customers to bike by equipping them with additional information on the rules of the road and safe cycling tips.

Education is about more than providing information to customers. Agency staff should leverage relationships with advocacy organizations to gain insight on grassroots perspectives on cycling and understanding on the community cycling needs.

7.3.1 What can transit agencies do?

- Identify local bicycle advocacy organizations and program offerings.
- Provide materials that explain transit support and services for cyclists, including secured bike parking and pricing, and specific guidance on bringing bikes onboard transit.
- Work collaboratively with local bike clubs and advocacy organizations to develop incentivized opportunities to link bikes with transit (e.g., bike class attendees get one month of free secure bike parking at their preferred transit facility).
- Consider opportunities to sponsor bicycle events, such as bike rides and open streets days.
- Leverage institutional knowledge and grassroots contacts to collect information on needs of cyclists.

7.3.2 Case Study: LA Metro Education Partnership

L.A. Metro works with local non-profit bike organizations to offer free bike safety classes, community bike rides and other events such as Open Streets and Bike Month, with the goal of improving bicycling safety and encouraging mode shift. These efforts are designed to introduce the public to bicycling as a transportation mode by giving participants the tools to ride comfortably in an urban environment. The classes educate participants on bicycle safety on roadways, in and around Metro rail and bus facilities, and how to incorporate bicycle, Metro Bike Share and transit in their daily travels, through viable multi-modal transportation options. Community rides and other bike events offer participants opportunities to experience bicycling in group ride and car-free settings, helping to make bicycling part of their travel routines.

7.4 Collaborate with advocacy groups

Transit agency planners should actively pursue partnerships with bicycle advocacy and education organizations. These groups have the ability to lobby for change and influence public opinion. Their objectivity and engagement with diverse, underserved populations allow them to focus on equity and mobility, instead of operational barriers. Pending the launch of a bike program, external partners can provide cost savings through joint marketing. They can also provide venues for education on bicycle and transit connectivity and instructions on how to combine bicycling with transit. Advocates can also play an important role in operations and implementation of bicycle facilities.

7.5 Case Study: BART bike theft prevention outreach program

BART's Bike Theft Prevention Outreach program in the San Francisco Bay Area provides targeted outreach and information to customers via:

1. On-going theft prevention tabling at targeted stations
2. Surge outreach coordinated with the opening of new secure parking facilities
3. Bike share outreach coordinated with the deployment of new services/ facilities

BART partnered with Bike East Bay and provided funding for a coordinator to conduct outreach activities at stations in each Fall and Spring at stations. Outreach is prioritized by high levels of theft, on-board incidence and capacity of secure parking. Coordinators educate cyclists on secure bicycle locking techniques, operation of BikeLink (including registration assistance and smart card distribution), Bikeep and Bike Share guidance on purchasing U-Locks. The program is designed to mitigate high rates of bicycles onboard trains, developed in response to a survey of BART customers who bike. The results showed that about 25% of cyclists who take their bike on the train do so because they are not confident their bike is safe when parked at their home station(s).

7.6 Case Study: New Jersey bike depots

The New Jersey Bike Walk Coalition has installed Bike Depots for bikes that are safe, secure, bullet and shatter-proof, weather and theft-proof parking and include camera surveillance. Members sign up online and pay a monthly or annual fee for card-key access to the Bike Depots. They are currently located at New Jersey Transit train stations in Montclair, Bloomfield and Elizabeth train station. The Bike Depot Program was created by the NJ Bike & Walk Coalition. It is an earned income strategy that supports the Coalition's advocacy work around the state. NJBWC is responsible for design, development, installation and operation of Bike Depots. Grant funds provide the capital for purchase and installation. NJBWC has leases with the municipalities of Montclair, Bloomfield and Elizabeth for space in their parking decks. Future Bike Depots will be installed in Summit and Morristown. NJBWC has received grants to fund the program from Sustainable Jersey (through Montclair Township), the Partners For Health Foundation, and People For Bikes. The Depots, built by Duo-Gard in Canton, Michigan, complement existing bike parking at transit centers. They serve customers who are looking for secure bike parking, rather than traditional bike racks. Surveys of Bike Depot users indicate that they were not previously commuting by bike to reach transit.

8. Demand management

Transportation demand management (TDM) is a strategy for guiding decision-making among an ever-growing variety of transportation choices. Agencies must consider factors that drive customer travel choices and establish a framework to prioritize and incentivize strategies for facilitating bikes on transit. For transit agencies, TDM programs should provide tools and resources for local partners to implement programs tailored to meet specific community needs. Bicycling is a demand-management tool for advancing customer travel decisions on transit and it is a common element in most transit TDM programs. TDM strategies can typically align well with agency efforts to integrate bikes with transit. TDM programs are designed to make efficient use of transportation systems, managing demand for those systems by influencing mode choice and time of

travel. TDM programs typically promote all alternatives to driving alone by providing information, education, incentives, add trip-logging to establish new habits.

8.1 Agency engagement

Transit agencies should work actively with employers, cities, Transportation management areas (TMAs) and institutions to make biking with transit part of their commute programs. Transit agencies can including bike support with TDM tools like community-based social marketing when working with neighborhoods to reduce local congestion and/or build ridership on new or revised transit service.

8.2 TDM Management

Even without an established in-house TDM program there are ways an agency can apply basic TDM approaches by providing positive, high-quality information about bike services and facilities. The agency can help raise public awareness and encouragement as part of its messaging about reducing dependence on driving and choosing transit.

Table 5 Bicycle Related Data Collection Methodology Table

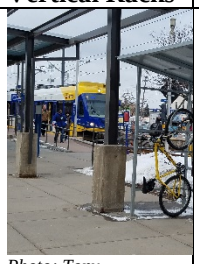
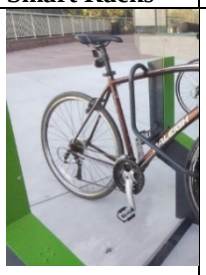
		Monthly	Bimonthly	Quarterly	Seasonal	Annual	Biannual	Triennial	5 Year	
Agency	***Survey Type/Name***									***General Description***
BART	Bike parking occupancy inventory					X				Filed count of occupancy of all bike parking conducted at peak bike parking time
	Customer Satisfaction Survey						X			On board, system-wide survey (sample approx. 6,000) used to determine access mode and onboard vs parked bikes.
	Station Profile Survey								x	Station level survey (sample 60,000) used to determine access mode at station level (44 stations)
SoundTransit	Screen line bicycle survey					X				Counts of bikes on board all mode and parked at facilities, fall each year
RTD	Customer Satisfaction Survey					x				
	Bikes On Buses Counts							x		Triennial count of bikes carried on board all buses in the region

	Bike Locker Lease Rates					x				
Metro Transit	Bike Locker Audit						x			Onsite survey of all bike lockers: check and lubricate locks, assess condition, inspect interior and surroundings. * *Will be annual in the future*
	Bike Locker Renter Winter Survey					x				Brief survey to find out which bike locker renters intend to ride throughout the winter. ** The list of locations with winter riders is provided to maintenance who prioritizes those sites for snow removal.*
	State of the Commute Survey						x			Agency-wide survey on rider habits and satisfaction. Includes questions on modal access to transit, including bicycling. ** Response among customers who access transit facilities by bike is generally low.*
Los Angeles County Metropolitan Trasportation Authority	Manual Bike Counts [Bus]	x								Bus operators enter bike rack transaction on their ATMS/ smart trip device to manually count bike rack use: on/offs/pass-ups. * Conducted once a month. Allows us to get estimates on number of bus patrons that use bikes throughout the service area. Bike on bus counting was initiated in 2013. However, adoption by operators takes time to develop due to other bus operation demands and responsibilities. Therefore this count should be cautioned and that undercounting could take place.

	LA Metro Bike Locker Inspections and Counts	x								Conduct Inspections/Manual Counts across all Metro ROW and count number of bikes parked in bike lockers at the time of inspection. * Difficult to establish routine counting timeframes as it is labor intensive. However, it allows our team to see the percentage of use divided by the number of bike lockers rented and provides data for overall system, by specific line, and by specific station.
	LA Metro Short-Term Bicycle Parking Usage			X						Conduct Inspections/Manual Counts of bicycles parked on bike racks across all Metro stations to measure bike parking usage. ** Labor intensive; Allows our team to see the percentage of use by the number of bike lockers in operation. Gives us data for overall system, by specific transit line, and by specific station.*
	Quality of Life Report					x				Study analyzing the most recent snapshot of how the agency is doing overall, with comparisons to previous years for reference. * Several observations about bicycle access and bike parking facilities. These include riders who bike to transit, number of bikeways, number of bike parking [Short and long-term], etc. (https://media.metro.net/docs/Metro-Quality-of-Life-Report_2016.pdf)

	Customer Satisfaction Survey (https://www.metro.net/news/research/)					x				General questionnaire for transit riders; includes 3 questions on bike ridership. * Provides a gauge on attitudes from nonriders and riders, as well as responses on whether they used a bike to get to their station or stop

Table 6 Types of Bicycle Parking

	Open U-Racks	**Vertical Racks**	**Stackable Racks**	**Keyed Lockers**	**Smart Racks**	**On-Demand Lockers**
		 *Photo: Tony Drollinger, 46th St Blue Line LRT station, Metro Transit*	 *Photo: Mostafa Omran, Toronto Transit Commission, Bathurst Station*			
The User Perspective	Easy access, low/no cost Best for short-term parking availability Immediately discernible	Easy access Low/no cost Requires users to lift bikes onto hooks	Easy access Low/no cost Require lifting bike for upper racks	High security Guarantees parking availability for users ahead of time Provides long-term storage for accessories, such as pump, tools, etc.	Increased security without the need to carry personal locks Ability to reserve racks Application functionality Bike sharing functionality	Guarantees parking availability for users ahead of time (depends upon vendor) Tap card or coded access (no need to carry extra keys) Typical daily transit commuters appreciate secure bike parking for all-day use.
The Transit Agency	Generally easy, quick to purchase and install Inexpensive, easily configured to space	Enables agencies to provide more parking with less space	Enables agencies to provide more parking with less space	Most security for individual bikes. Several configurations available to suit site (boxes, wedges).		Most secure for individual bikes. More efficient than keyed lockers because each locker can

Perspective	Can be covered for weather protection Allows agencies to offer first-come, first-served access to bike parking			Inherently weather protected.		be turned over to multiple users over time (day, week, month). Inherently weather protected. Potential for access via transit smart card with additional registration.
Relative Capital Costs*	$150–$200/per rack**	$150–$200/per rack**	$300–$500/per space	$1,200–$2,500/space	$1,000–$1,500/space	$3,410/space
Operational Costs						
Requires Power Connection	×	×	×	×	✓	✓
Requires Network Connection	×	×	×	×	✓	✓
Requires Preregistration	×	×	×	✓	✓	✓
Encourages	×	×	×	×	✓	✓

User Turnover						
On-going Involvement from Vendor (installation, customer service, maintenance, etc.)	×	×	×	×	✓	✓
Requirements	Needs enough space to be properly positioned to maximize capacity and security. Racks must be securely mounted to a solid metal or concrete surface. Important to select a design that's most secure and allows for parallel orientation to the bicycle. Avoid racks that encourage crowding of bicycles,			Needs sufficient flat space, lock mechanism, management of keys, customer service, maintenance Needs process to preregister or approve users and issue key Operational plans need to consider snow and ice removal to ensure continued access throughout all four seasons		Needs power and data conduit, or sufficient sunlight for solar and wireless If installed after facility is complete, will require breaking concrete to hardwire Requires level ground

	which causes damage. Best when used in proximity to high-traffic pedestrian areas for added security.					
Weather Protected	× ***	× ***	× ***	✓	× ***	✓
Operational Considerations	Least secure when out in open. Poor positioning or rack type often render racks virtually useless Can be inside fare gates of station for more eyes on site, for relatively more security but still vulnerable to quick thefts.			Use limited to one key-holder, with no turnover May require special approvals in landmark/design districts or crime deterrence considerations (potential for hiding behind locker) Must determine whether in-house or contracted management Snow and ice present challenges for users in colder climates. Takes up a lot of real estate. Stainless steel have longest life. Visually unappealing		Must weigh decisions about vendor services vs. in-house Snow and ice present challenges for users in colder climates Can require significant utility infrastructure and annual maintenance fees Operational plans need to consider snow and ice removal to ensure continued access throughout all four seasons

* These estimates include relative equipment capital cost based on a wide sample of transit agency experience. Costs can vary significantly depending on additional accessories (canopies, repair stands, etc.) and engineering (in-ground mounting vs. bolts). Does not include annual costs for ongoing operations and maintenance.
**Number of spaces will vary depending on rack shape and/or positioning.
*** Racks can be made weather protected with additional features, such as a canopy, or be placed inside a station facility.

Table 7 Federal Funding Sources

Program Title	Eligible Bicycle Activities	Link
Metropolitan & Statewide and Non-Metropolitan Transportation Planning	Planning for bicycle facilities in a state or metropolitan transportation network.	https://www.transit.dot.gov/funding/grants/metropolitan-statewide-planning-and-nonmetropolitan-transportation-planning-5303-5304
Urbanized Area Formula Program	Bicycle routes to transit, bike racks, shelters and equipment for public transportation vehicles	https://www.transit.dot.gov/funding/grants/urbanized-area-formula-grants-5307
Fixed Guideway Capital Investment Grants	Bicycle racks, shelters and equipment	https://www.transit.dot.gov/funding/grants/grant-programs/fixed-guideway-modernization- 5309-b2
Bus and Bus Facilities Formula Grants	Bicycle routes to transit, bike racks, shelters and equipment for public transportation vehicles	https://www.transit.dot.gov/funding/grants/bus-and-bus-facilities-5309-5318
Enhanced Mobility of Seniors and Individuals with Disabilities	Bicycle improvements that provide access to an eligible public transportation facility and meet the needs of the elderly and individuals with disabilities	https://www.transit.dot.gov/funding/grants/enhanced-mobility-seniors-individuals-disabilities-section-5310
TOD Planning Pilot Grants	Projects that facilitate multimodal connectivity and accessibility or increase access to transit hubs for pedestrian and bicycle traffic	https://www.transit.dot.gov/TODPilot

Related APTA standards

APTA SUDS-CC-RP-003-12, "Quantifying and Reporting Transit Sustainability Metrics"
APTA SUDS-CC-RP-005-18, "Social and Economic Sustainability for Transit Agencies"

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Capitol Corridor Joint Powers Authority (2013). Bicycle Access Plan: Supporting Bicycle and Capitol Corridor Intercity Passenger Train Travel. Oakland, CA.

Federal Highway Administration (2012). Bike Sharing in the United States: State of the Practice and Guide to Implementation. Washington, D.C.

National Association of City Transportation Officials (2017). Bikeshare Siting Guide. New York, NY.

Regional Transportation District (2015). Bicycle Parking and Accessibility Plan. Denver, CO.

Tri-County Metropolitan Transportation District of Oregon (2016). Bike Plan. Portland, OR.

Definitions

Bicycle facility: Infrastructure intended for the purpose of bicycling including bike lanes, protected routes, off street paths and racks for bicycle parking.

Bike lane: A portion of roadway delineated with painted lines and symbols intended for the use of bicycle transportation.

Business access and transit (BAT) lanes: On-street vehicle lanes that prioritize buses and other selected vehicles more efficiently through traffic

Greenway: A long, narrow ROW dedicated to shared use among bicycles, pedestrians and other nonmotorized uses.

Protected bike lane/route: A bicycle facility with a physical separation from vehicular traffic and other street uses.

Right-of-way (ROW): A type of easement reserved over land for transportation purposes.

Travel lane: A linear, delineated section of roadway intended for the movement of vehicular traffic.

Wayfinding: Signage, maps and other publicly available tools used for orientation and navigation.

Vision zero: A traffic safety project aimed to achieve a road system with no fatalities or serious injuries involving street traffic.

Abbreviations and acronyms

AC Transit	Alameda-Contra Costa Transit District
APBP	Association of Pedestrian and Bicycle Professionals
ADA	Americans with Disabilities Act
APC	automatic passenger counting
BART	San Francisco Bay Area Rapid Transit District
BRT	bus rapid transit
Capital Metro	Capital Metropolitan Transportation Authority (Austin, TX)
CRT	Commute trip reduction
DOT	Department of Transportation
DPW	Department of Public Works
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
LA Metro	Los Angeles County Metropolitan Transportation Authority
MBTA	The Massachusetts Bay Transportation Authority
MPO	metropolitan planning organization
MTA	Metropolitan Transportation Authority (State of New York)
MTA	Municipal Transportation Agency (San Francisco)
MTD	Metropolitan Transit District (Santa Barbara, California)

NATSA North American Transportation Services Association
NJ Transit New Jersey Transit Corporation
NJBWC New Jersey Bike Walk Coalition
NTD National Transit Database
RTD Regional Transportation District (Denver)
TTC Toronto Transit Commission
WMATA Washington Metropolitan Area Transit Authority

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