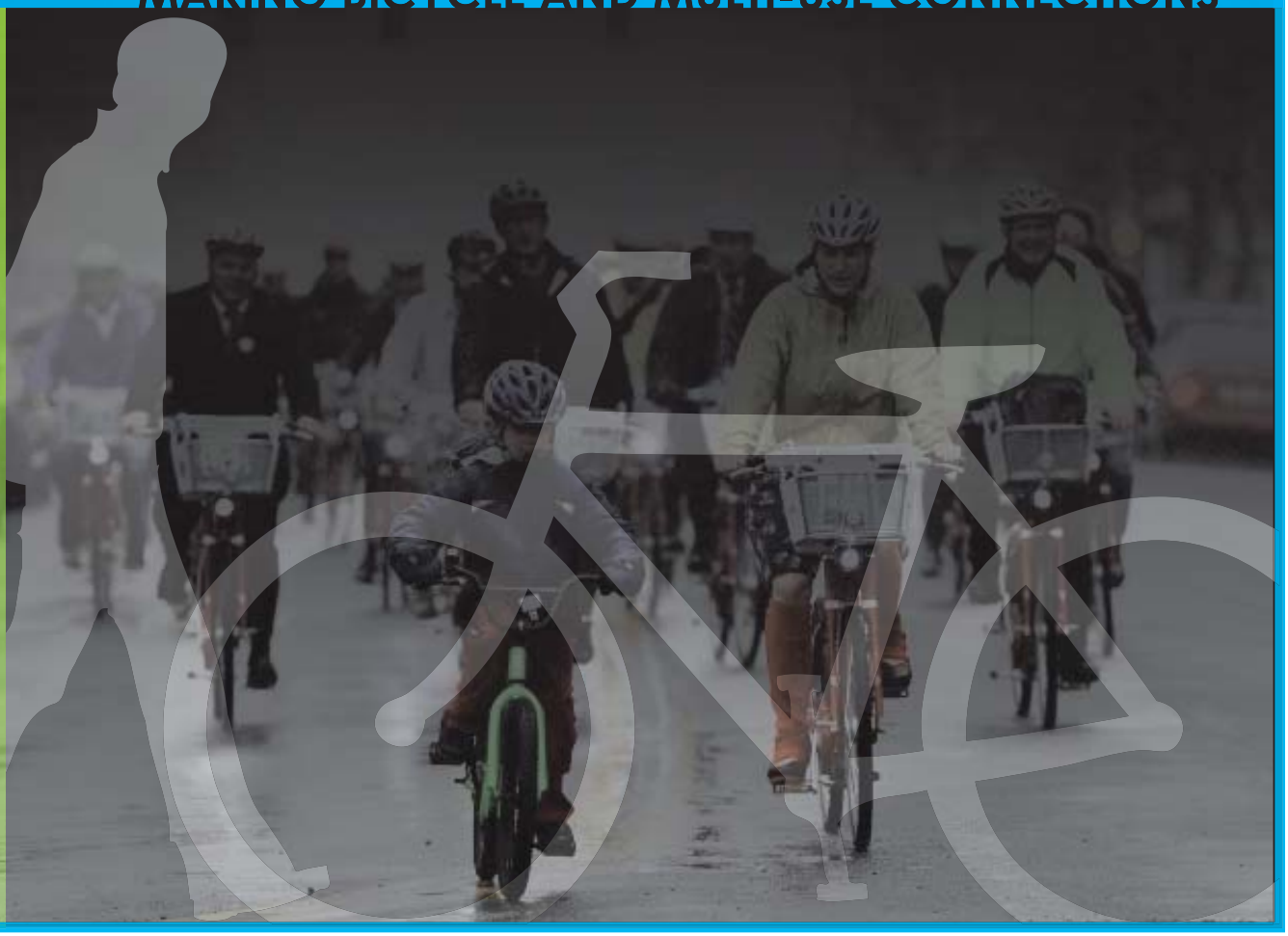
MAY 2011

DENVER MOVES

MAKING BICYCLE AND MULTI-USE CONNECTIONS



ACKNOWLEDGEMENTS

Denver Moves Citizens' Taskforce

John Hayden
Mayor's Bicycle Advisory Committee

Dick Gannon
Mayor's Bicycle Advisory Committee

Edward Done
Denver Parks and Recreation Advisory Board

Noel Copeland
Denver Parks and Recreation Advisory

Jennifer Draper Carson - Council District 1

Ben Blanchard - Council District 2

Shane Wright - Council District 3

Jack Green - Council District 4

Patricia Moran - Council District 5

Nicole Haag - Council District 6

Tim O'Byrne - Council District 7

Sylvia S. Smith - Council District 8

Michael Tavel - Council District 9

Lisa Cleary - Council District 10

Jesse Carter - Council District 11

Special Thanks

City and County of Denver Staff

Bike Denver

Denver B-cycle

REI Denver Flagship Store

Over 500 participants at 7 public events

Denver Parks & Recreation and Public Works departments jointly funded this project. The departments of Community Planning & Development and Environmental Health were supporting partners. Fehr & Peers, in association with Toole Design Group and Wenk Associates consulted on this project.

Mayor: Guillermo "Bill' Vidal

City Council
Paula Sandoval - District 1
Jeanne Faatz - District 2
Paul D. Lopez - District 3
Peggy Lehmann - District 4
Marcia Johnson - District 5
Charlie Brown - District 6
Chris Nevitt - District 7
Carla Madison - District 8
Judy H. Montero - District 9
Jeanne Robb - District 10
Michael B. Hancock - District 11
Carol Boigon - At Large
Doug Linkhart - At Large

City Staff
George Delaney - Acting Manager of Public Works
Kevin Patterson - Manager of Parks and Recreation

Emily Snyder, Public Works Project Manager
David Marquardt, Parks and Recreation Project Manager

Crissy Fanganello, Public Works
Gordon Robertson, Parks and Recreation
Karen Good, Public Works
Brian Mitchell, Public Works
Justin Schmitz, Public Works
Barbara Frommell, Community Planning and Development
Cindy Bosco, Environmental Health
Jennifer J. Wieczorek, Denver Public Health

Consultants
Jeremy Klop, Principal In Charge, Fehr and Peers
Carlos Hernandez, Project Manager, Fehr and Peers
Molly Veldkamp, Fehr and Peers
Bill Schultheiss, Toole Design Group
Nick Jackson, Toole Design Group
Bill Wenk, Wenk Associates
Nicole Horst, Wenk Associates

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Denver Moves will build a simpler multimodal system that integrates existing facilities and connects to destinations

1. EXECUTIVE SUMMARY

What is Denver Moves?

Denver Moves expands the vision for the non-motorized transportation and recreation system in Denver, identifying the next phase of priorities for making bicycle and multi-use connections in the Mile High City. A joint effort by Denver Parks & Recreation and Public Works, Denver Moves focuses on integrating the existing off-street and on-street networks to create safe, comfortable corridors that link neighborhoods, parks, employment centers, business districts, transit hubs, and other destinations in all parts of Denver.

Denver Moves is a physical and action-oriented plan. It builds upon previous planning efforts and the significant investment already made in bicycle and walking. Denver Moves presents a toolbox of bicycle and multi-use facility types and their consideration for use in Denver's non-motorized network. It examines the feasibility of these facility types, incorporates them into a comprehensive multi-use and bicycle network, and develops an implementation strategy for the future. Denver Moves is intended to be dynamic, able to respond to changing land-use and transportation needs. It serves as a guide for City staff, stakeholders, and the public interested in the development of the non-motorized network.

Goals

Denver Moves combines the biking and walking goals for proximity and comfort. The first goal states that Denver Moves will create:

> *"A biking and walking network where every household is within a quarter mile (5-minute walk or 2-minute bicycle ride) of a high ease of use facility."*

By building a simpler and more comfortable system, Denver Moves contributes to an increase in the non-motorized person trips. While this can be for all trips, the second goal focuses on the commute, or to-work trip because of available data and opportunity for measuring progress. Denver Moves lays the groundwork for the city to:

> *"Achieve a 15% bicycling and walking commute mode share by 2020."*

Objectives

Denver Moves objectives guided the outreach process, technical planning and design, and selection of recommendations. The objectives were set based on the recognition that, to achieve walking and biking goals, Denver Moves needed to attract a new generation of users. They reflect active living, transportation, recreation, and community needs. The four objectives established for Denver Moves are:

Objective #1 - Create a New Identity
Objective #2 - Build a Simpler System
Objective #3 - Embrace Innovative, Practical Ideas
Objective #4 - Include All Users

Network

Denver Moves incorporates a wide variety of facility types into the multi-use and bicycling network. It categorizes these facilities into an "ease of use," similar how the Colorado ski resorts represent their ski slopes. The "ease of use" is based on the degree of separation from motorized traffic and perceived level of comfort.

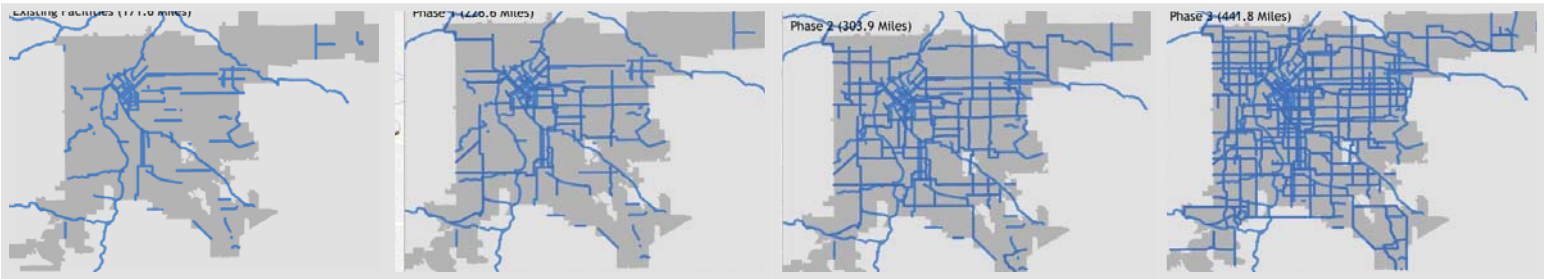
Denver Moves will add 270 miles of these facility types to the existing 172 miles of multi-use and bicycle facilities. The facility breakdown is shown below. High to moderate ease of use facilities comprise 80 percent of the final Denver Moves network.

Facility Type	Existing miles	Miles added with Denver Moves	Total network miles	Percentage of system
Multi-use (trails, on sidewalk)	107	24	131	30%
Separated in-roadway (cycle track, bike lanes—regular, buffered, climbing)	51	121	172	39%
Enhanced shared roadway (sharrow, party parking, pave shoulder)	14	63	77	17%
Bike Boulevards	0	62	62	14%
TOTAL	172	270	442	100%

Implementation

The estimated total cost of all bicycle and pedestrian improvements identified in Denver Moves is $119 million (2011 dollars). This includes $66 million in linear projects and $54 million in crossing improvements. Of the linear projects, the phasing plan breaks down to $16 million a phase for Phase I and Phase II and $33 million for Phase III. Project prioritization informed the phasing plan for Denver Moves' linear projects with each phase steadily increasing the amount of biking and walking facilities to the network. Crossing improvements will be prioritized as funding opportunities allow. The timeline for build out of the phases and projects will depend on available funding.

PHASE 1		PHASE 2		PHASE 3		CROSSINGS		TOTAL
$16 mil	+	$16 mil	+	$33 mil	+	$54 mil	=	$119 mil

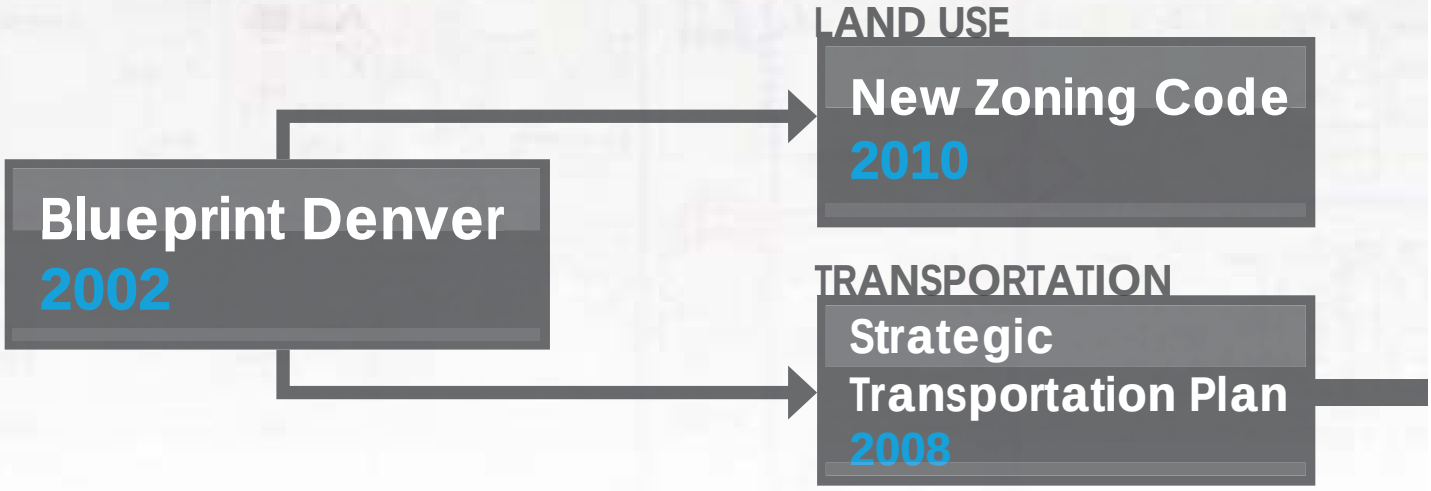


2. BACKGROUND

What is Denver Moves?

Denver Moves expands the vision for the non-motorized transportation and recreation system in Denver, identifying the next phase of priorities for making bicycle and pedestrian connections in the Mile High City. A joint effort by Denver Parks & Recreation and Public Works, Denver Moves focuses on integrating the existing off-street and on-street networks to create safe, comfortable corridors that link neighborhoods, parks, employment centers, business districts, transit hubs, and other destinations in all parts of Denver.

Denver Moves is a physical and action-oriented plan. It presents a toolbox of multi-use and bicycle facility types and their consideration for use in Denver's non-motorized network. It examines the feasibility of these facility types, incorporates them into a comprehensive multi-use and bicycle network, and develops an implementation strategy for future. Denver Moves is intended to be dynamic, with the ability to respond to changing land-use and transportation needs. It serves as a guide for City staff, stakeholders, and the public interested in development of the non-motorized network.



Need for an Update

Denver's existing multi-use trail, bicycle, and pedestrian network is the result of significant planning undertaken over 30 years. This planning and implementation during the past three decades has resulted in a bicycling and walking network of over 50 miles of bike lanes and sharrows, 250 miles of signed bicycle routes, 75 miles of multi-use trails, and 2,800 miles of sidewalk. It has contributed to Denver being recognized as Best Trail System in the United States from the National Recreation and Parks Association, a Silver Bicycle Friendly Community, and a Top Ten Cities for Cycling by *Bicycling Magazine*.

COMPLETED PROJECTS

ROLL

2001 Bicycle Master Plan Status

- All Downtown bike lanes installed
- Additional downtown bike lanes installed
- Many parks and trail connections completed
- Major missing links finished, funded or designed
- Route system updates funded and designed

WALK

2005 Pedestrian Master Plan Status

- High criteria projects finished or programmed

LIFE

2007 Game Plan Status

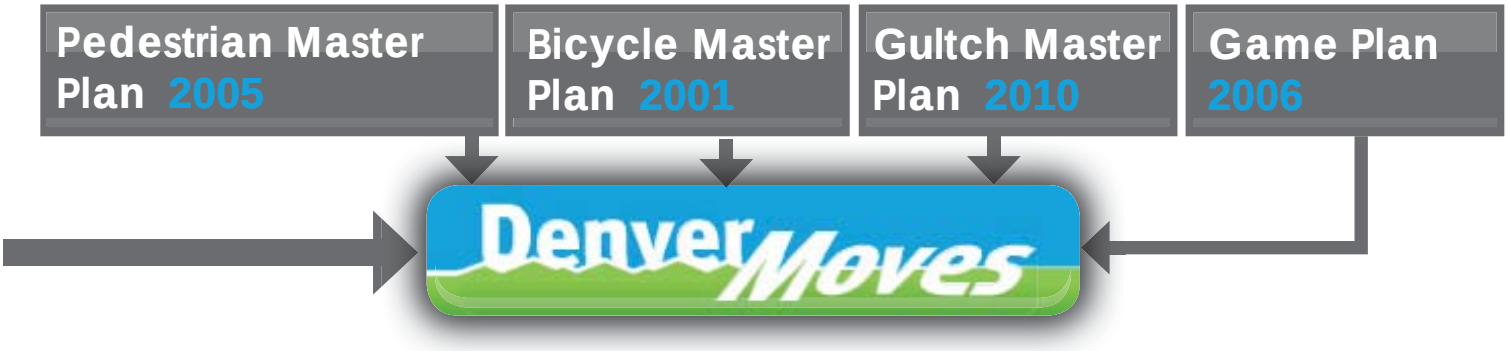
- Many off-street trail projects completed

Denver Moves builds upon previous planning efforts and the significant investment already made in bicycle and walking infrastructure. It reevaluates the existing biking and walking plans and recommendations given the City's progress towards their implementation, as well as incorporates the land use and transportation shifts that have occurred since their completion. Major influences on the biking and walking network include the passing of the 2007 Better Denver Bond Program, construction of the RTD FasTracks program, establishment of a citywide bike sharing program, growth of transit-oriented development, and the creation of a new zoning code.

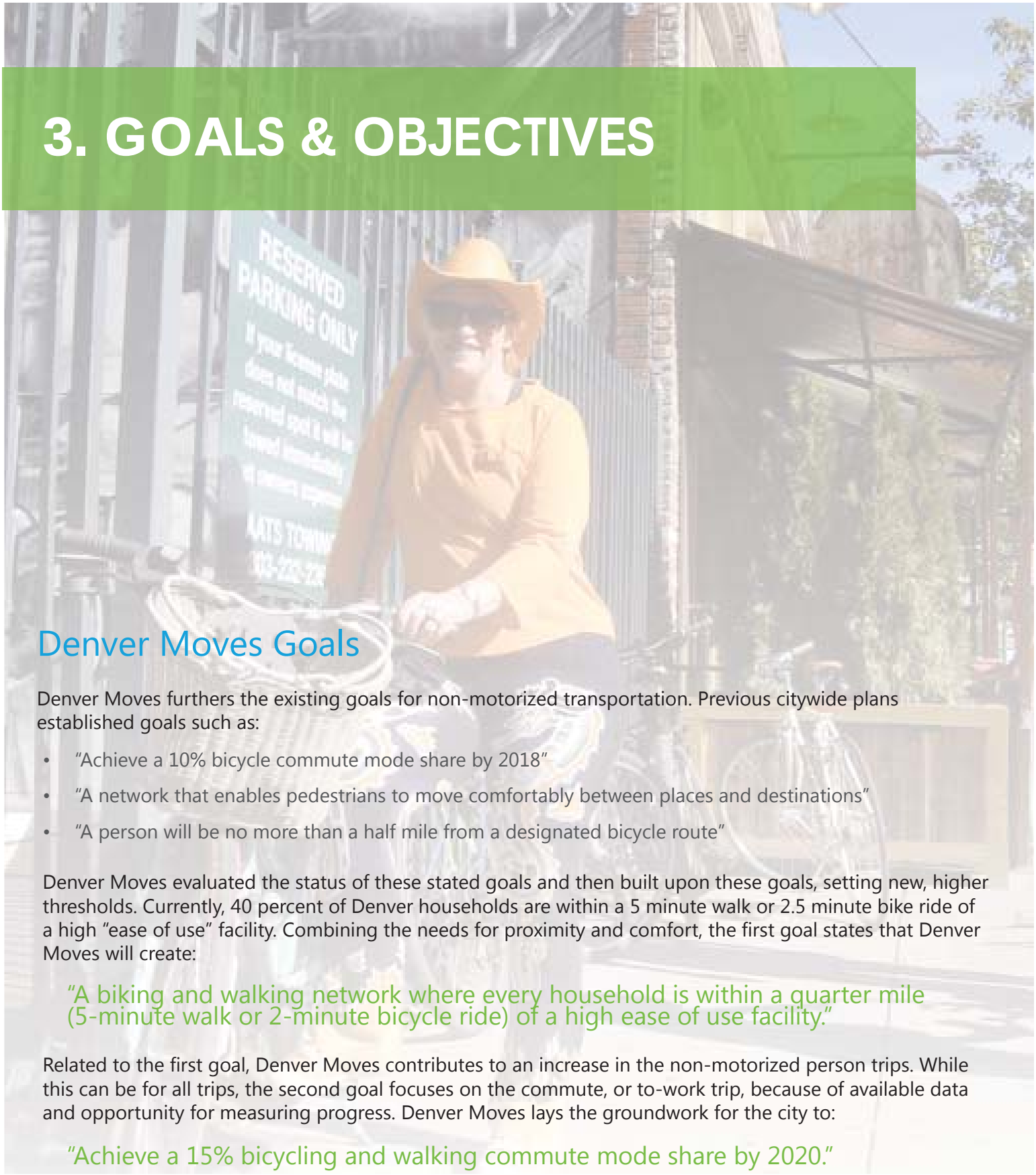
Policy Framework

Denver Moves translates citywide policy for multi-modal transportation and sustainability into specific projects to improve the multi-use trail and bicycle infrastructure. Blueprint Denver set the over arching vision for land-use and transportation into the future, stating "...residents will enjoy a greater variety of convenient transportation options and alternative mobility choices." Greenprint Denver, which aims to build a more sustainable city, supports this vision by recognizing the environmental benefits of non-motorized transportation options. Moving forward, the Strategic Transportation Plan (STP) establishes innovative transportation strategies to move people, not just cars. It limits the expansion of the public right-of-way, and instead focuses on improving the function and efficiency of the existing space to support all modes.

The STP states short- and long-term needs for investing City resources into multi-modal transportation projects. While the STP identified some bicycle and pedestrian projects, many of the recommendations for non-motorized modes remained more general. Denver Moves takes these recommendations and further evaluates their feasibility, developing each project with more specificity. Denver Moves is the biking and walking supplement to the STP.



3. GOALS & OBJECTIVES



Denver Moves Goals

Denver Moves furthers the existing goals for non-motorized transportation. Previous citywide plans established goals such as:

- "Achieve a 10% bicycle commute mode share by 2018"
- "A network that enables pedestrians to move comfortably between places and destinations"
- "A person will be no more than a half mile from a designated bicycle route"

Denver Moves evaluated the status of these stated goals and then built upon these goals, setting new, higher thresholds. Currently, 40 percent of Denver households are within a 5 minute walk or 2.5 minute bike ride of a high "ease of use" facility. Combining the needs for proximity and comfort, the first goal states that Denver Moves will create:

> "A biking and walking network where every household is within a quarter mile (5-minute walk or 2-minute bicycle ride) of a high ease of use facility."

Related to the first goal, Denver Moves contributes to an increase in the non-motorized person trips. While this can be for all trips, the second goal focuses on the commute, or to-work trip, because of available data and opportunity for measuring progress. Denver Moves lays the groundwork for the city to:

> "Achieve a 15% bicycling and walking commute mode share by 2020."

According to the 2009 American Community Survey, 6 percent of Denver's to-work trips are by non-motorized modes. Four percent of residents walk to work and 2 percent bike to work in Denver. While many factors influence people's travel choices, Denver Moves provides the strategic projects and implementation steps to reach these goals by focusing on the continued development of biking and walking infrastructure.

Denver Moves Objectives

Denver Moves objectives guided the outreach process, technical planning and design, and selection of recommendations. The objectives were set based on the recognition that, to achieve walking and biking goals, Denver Moves needed to attract a new generation of users. They reflect active living, transportation, recreation, and community needs. The four objectives established for Denver Moves are:

Objective #1 - Create a New Identity

- Find new ways to communicate how to use the current system
- Identify innovative treatments for new trails and existing streets
- Educate a large audience using social media

Objective #2 - Build a Simpler System

- Eliminate barriers for new users and regular users
- Integrate exiting trails and streets

Objective #3 - Embrace Innovative, Practical Ideas

- Identify potential citywide demonstration projects and near term improvement
- Increase safety, visibility, and usability

Objective #4 - Include All Users

- Balance the needs and skill levels of all user groups
- Develop strategies to increase usage and interest from a wide range of users

PREVIOUS GOALS

"Achieve a 10% bicycle commute mode share by 2018"
- Greenprint Denver 2008

"A network that enables pedestrians to move comfortably between places and destinations"
-2005 Pedestrian Master Plan

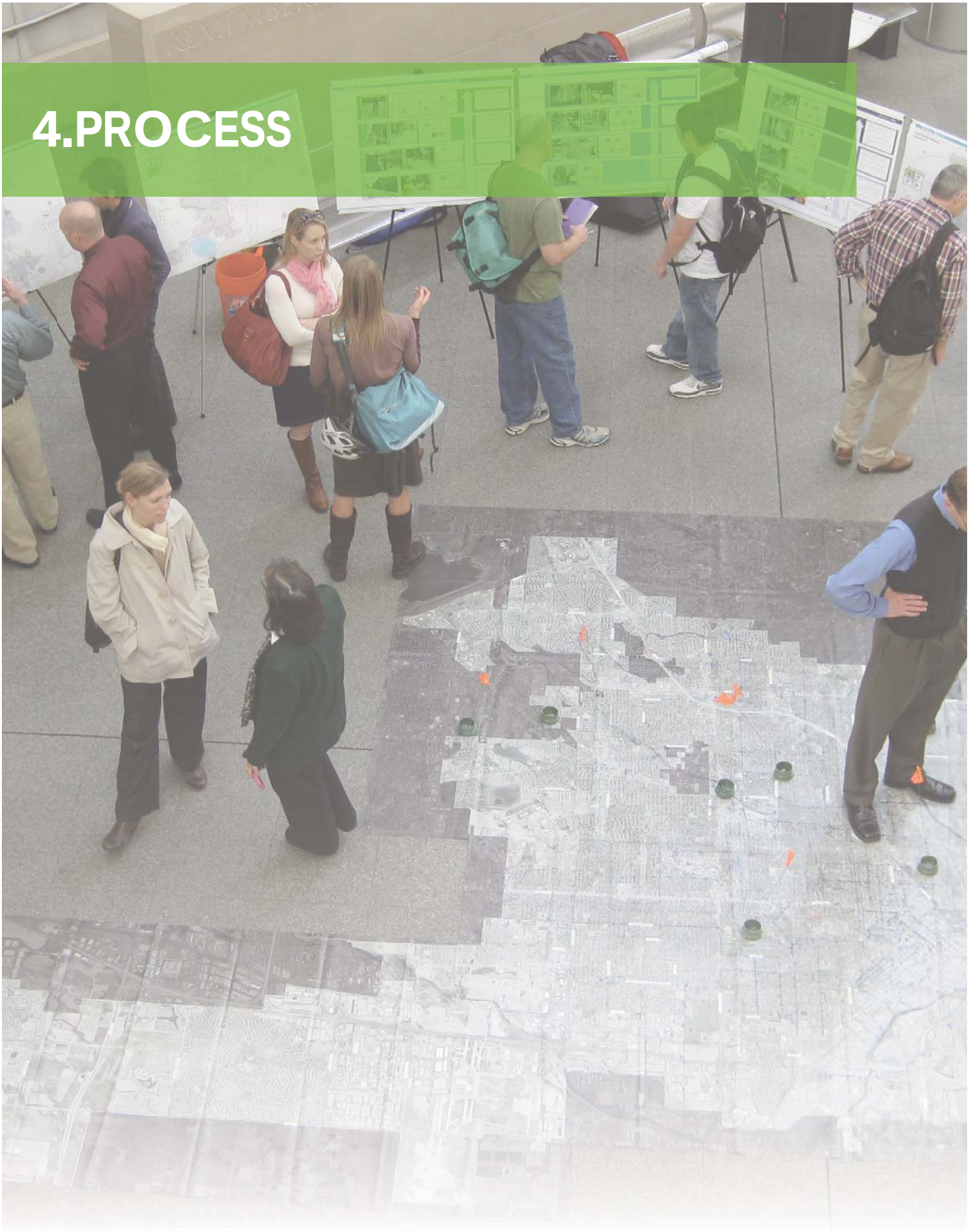
"A person will be no more than a half miles of a designated bicycle route"
-2001 Bicycle Master Plan Update

DENVER MOVES GOALS

"A biking and walking network where every household is within a quarter mile (5-minute walk or 2-minute bicycle ride) of a high ease of use facility."

"Achieve a 15% bicycling and walking commute mode share by 2020."

4.PROCESS



Listening to the Community

Denver Moves community outreach confirmed existing City policy on transportation and recreation. It further defined the needs for bicycle and pedestrian connectivity by facilitating discussion on a neighborhood level. Public involvement efforts were designed to engage the public in places and schedules that were convenient to their daily routines. This supported a transparent process that showed how the public's ideas about biking and walking were incorporated into the Denver Moves network and facility types. Public Involvement opportunities included the following:

Citizens Taskforce: Each council district recommended a citizen to participate in two workshops and review the draft Denver Moves document. The Citizens Taskforce meetings provided an opportunity to share ideas, address specific concerns, and confirm project direction.

Project Website: The project website included interactive mapping that allowed the public to identify favorite biking/walking routes, desired destinations, and infrastructure challenges on interactive maps. It was also used to collect public comment and obtain feedback on all draft materials for the project.

"Floor Aerial" Tour Stops: Denver Moves hosted six, four-hour community outreach sessions across the city using a "floor aerial" vinyl photograph. The public could walk on, draw, and discuss their ideas and comments for destinations, barriers, and potential connections.

- A sunny day at Confluence Park (July 10, 2010 - approximately 150 people)
- A produce fair at Rude Recreation Center (July 23, 2010 - approximately 25 people)
- A Denver Municipal Band concert at Southmoor Park (July 31, 2010 - approximately 25 people)
- Civic Center Eats at Civic Center Park (August 3, 2010 - approximately 50 people)
- A Jazz in the Park event at City Park (August 8, 2010 - approximately 100 people)
- A Denver Municipal Jazz concert at Bates & Hobart Park (August 20, 2010 - app. 25 people)

Draft Plan Workshop: Denver Moves held a day-long draft plan workshop to illustrate recommendations and to gain feedback on the proposed Denver Moves network and facility types. The "floor aerial" was used at this follow-up event to illustrate how public comments were addressed in the draft plan.

Identifying the Network

Denver's overall transportation and recreation network consists of 2,600 miles of streets and trails, which combined provide a strong foundation for the Denver Moves network. The city is fortunate to have a well-established street grid that distributes traffic throughout the city and contributes to a functioning street hierarchy of arterial, collector, and local streets. This grid creates many miles of local streets with low motor vehicle volumes and slow speeds that, by their nature, are conducive to walking and biking. The trails cut across the grid and often provide a more direct, non-stop route for bicycling and walking to destinations.

1. Mapping Previous Recommendations

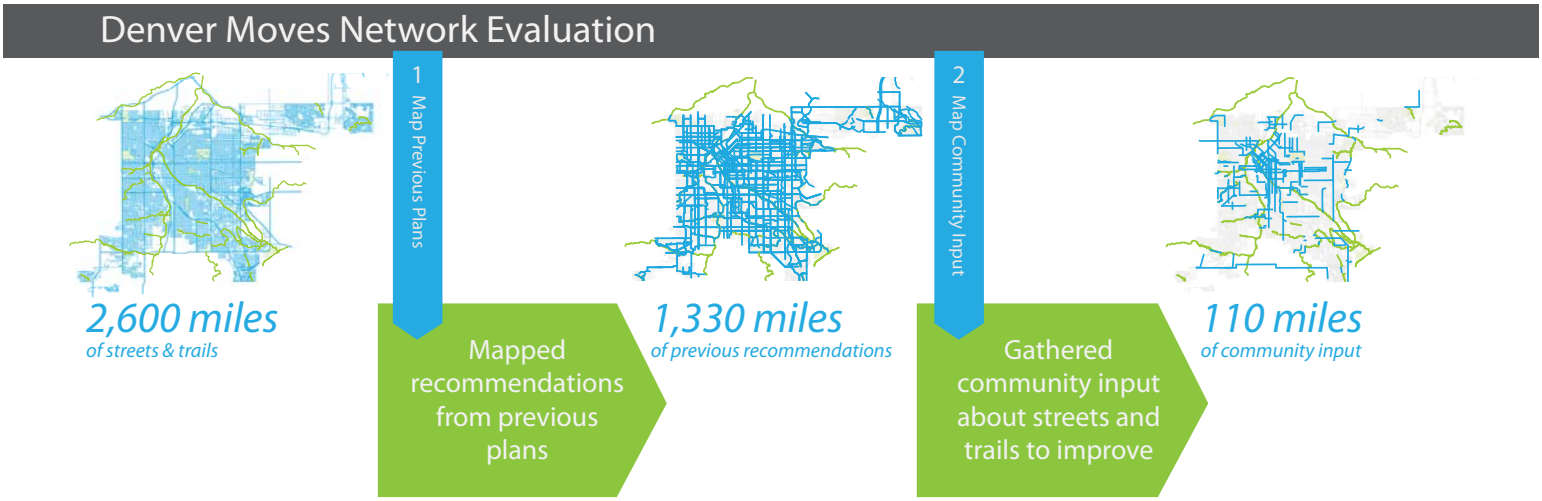
Denver Moves began with an effort to map all existing bicycle and pedestrian routes and recommendations described in previous City plans. The analysis provided overlapping priority corridors and citywide integration opportunities. It resulted in a total of 1,330 miles of existing and planned pedestrian and bicycle infrastructure.

- Denver Bicycle Master Plan (planned bicycle facilities and designated bike routes)
- Denver Pedestrian Master Plan (pedestrian focus areas and pedestrian routes)
- Parks and Recreation Game Plan (green streets)
- Denver Gulch Master Plan (planned trail improvements)
- Downtown Multimodal Access Plan (planned bicycle, pedestrian, and bike/bus facilities)
- Station Area Plans (planned bicycle and pedestrian facilities)
- Denver Eastside Mobility Plan (planned bicycle and pedestrian facilitie)

2. Public Involvement

Consistent with the Denver Moves objectives, the community outreach process embraced innovative techniques to gather public input, such as a large-scale aerial image of Denver and interactive website. It also messaged event information through social media outlets like Twitter and Facebook. Denver Moves adopted a strategy to reach people at established public events instead of creating another meeting for the calendar. The Denver Moves project team used the "floor aerial" to collect comments and was present at 6 tour stops (pg. 11) across the city.

Approximately 375 people provided input about walking and bicycling in Denver during these events. This was combined with approximately 75 comments from people via the project website. This effort resulted in approximately 110 miles of comments related to street and trail improvements for bicycling and walking. This information was taken to the Citizens' Taskforce for further refinement and to provide guidance about priorities for bicycling and walking in their represented districts.



3. Field Evaluation

The Denver Moves team synthesized the recommendations from previous plans and public involvement into a street network for field evaluation. Over a three-day period in September 2010, two teams conducted a field evaluation for over 200 miles of potential Denver Moves facilities. Each team included a transportation planner and transportation engineer with local and national expertise. Right-of way measurements, street configuration and geometry, traffic observations, and other transportation data were collected to assess the feasibility of constructing multi-use, bicycle or pedestrian improvements. The Denver Moves team used the objectives to guide this technical process by exploring opportunities to make connections to destinations, for integration between the on- and off-street systems, and for innovative treatments.

4. City Staff Review

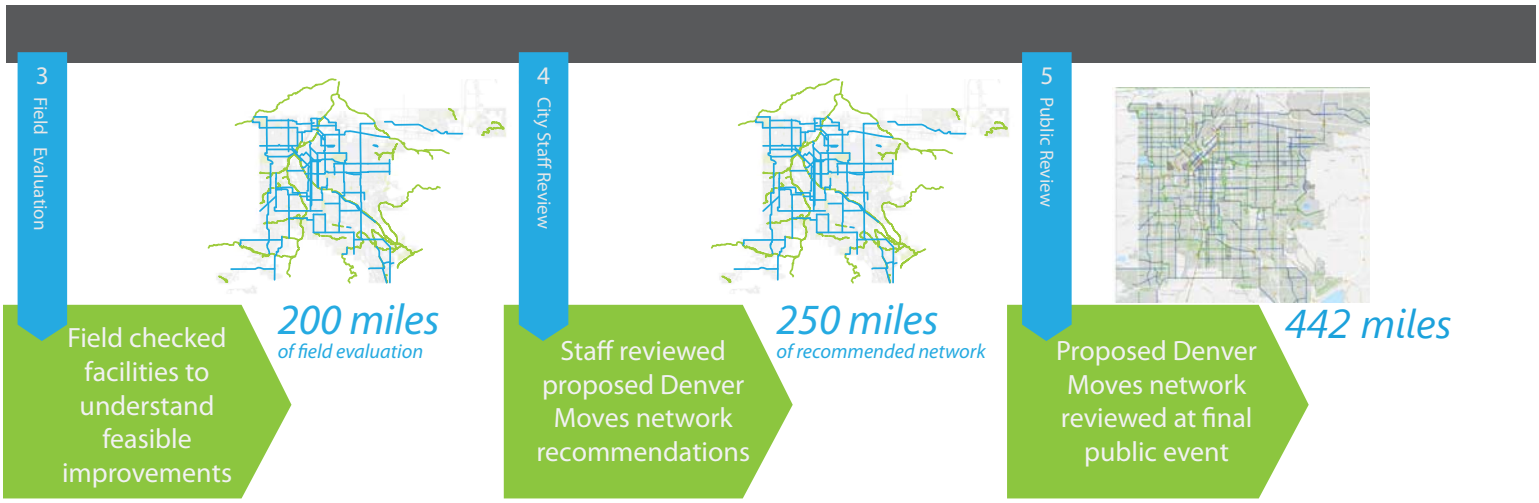
After the completion of the field evaluation, draft Facility and Ease of Use maps were created. The draft maps were reviewed with the Denver Moves team, the Citizens' Taskforce, and staff from various City departments at a day-long workshop in October 2010. The workshop enabled the Denver Moves team to talk with the City staff to ensure consistency with other planning efforts. It also allowed the Citizens' Taskforce to voice opinions about facility types and locations. Comments and input were incorporated into the maps after the workshop and expanded the network to 250 miles.

5. Public Review

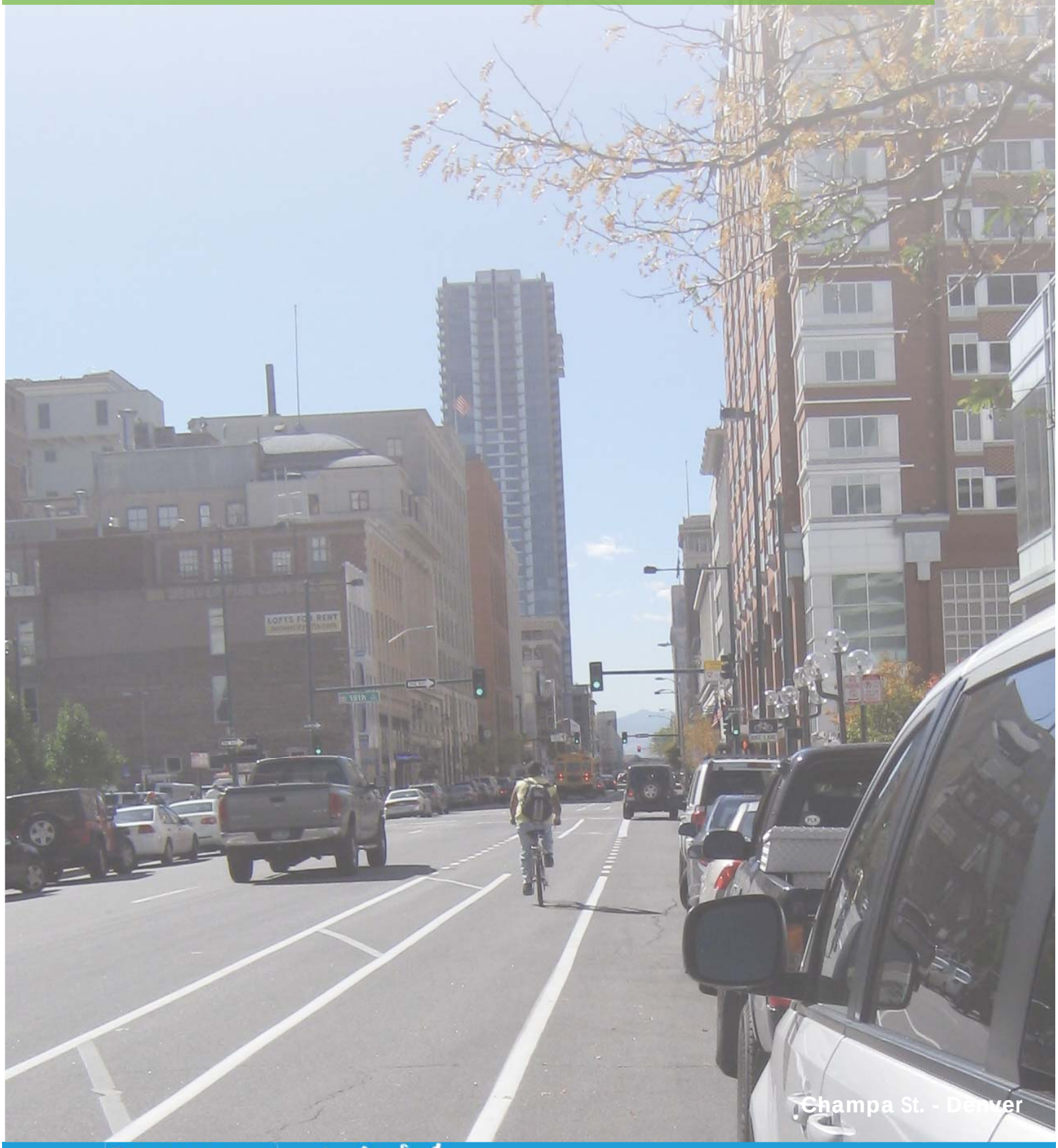
A final workshop was conducted in November 2010 to review the draft Ease of Use and Facility Network maps. This day-long workshop was held at a busy, central location (Webb Municipal Building) during the lunch and early evening hours to provide an opportunity for the public to review and discuss the proposed Denver Moves recommendations. At this event, comments were obtained to be further reviewed by the Denver Moves team for feasibility. Many of the ideas were incorporated for a final Denver Moves network of 270 miles.

Final Network

The total Denver Moves network is 442 miles. Denver Moves adds 270 miles of multi-use and bicycle improvements to the current network of 172 miles of trails, bike lanes, and sharrows. In many cases, it upgrades the existing signed, shared street connections with recommendations for specific facility types. It achieves the objectives by reducing barriers for beginning users and increasing options for current users, creating an overall multi-use and bicycle system that balances the needs and skill levels of all user groups.



5. NETWORK



Champa St. - Denver

Facility Types

The Denver Moves network incorporates a wide range of facility types based on innovations in multi-use trail, bicycle, and pedestrian facility design. This toolbox describes designs that accommodate a variety of user types and create opportunities for enhanced connectivity. Offering options for different roadway or landscape contexts, the facility types allow for flexibility without jeopardizing overall continuity.

Each facility type is categorized into relative "ease of use", similar to how Colorado ski resorts or the Western Slope mountain biking areas classify their trails. The ease of use designation is based on the degree of separation from motorized traffic and perceived level of comfort. The intent is to translate technical details into a simpler form to help users understand what to expect from the Denver Moves network.

Denver Moves identifies new off-street, multi-use trail connections. These off-street facilities are considered to have a high ease of use because of their full separation from motorized traffic. Denver Moves also recognizes bike boulevards as an innovative treatment with a high ease of use. Although motorized and non-motorized modes share space on bike boulevards, the selection of street and design gives preference to non-motorized modes.

Denver Moves also expands the toolbox of on-street bicycle facilities beyond the current bike lanes, signed routes, and shared street connections. It takes many of the existing signed shared street connections and recommends a upgraded facility type. Denver Moves offers more design options for in-roadway separation, meaning there is a designated space for bicycle travel. These facility types not only include the traditional bicycle lane, but also cycle tracks, buffered bicycle lanes, or climbing lanes (where the bike lane is only in the up hill direction). While some of the separated in-roadway facilities can be high ease of use, they are generally considered in the moderate ease of use category. Denver Moves also explores a variety of facility types for enhanced shared roadway conditions. Considered moderate to low ease of use, these facility types provide some accommodation for bicycle travel, but not a fully designated space in the roadway.

As previously mentioned, Denver Moves adds 270 miles of these facility types to the existing 172 miles of multi-use and bicycle facilities. The facility breakdown is shown below. High to moderate ease of use facilities comprise 80 percent of the final Denver Moves network.

Facility type	Existing miles	Miles added with Denver Moves	Total network miles	Percentage of system
Multi-use (trails, on sidewalk)	107	24	131	30%
Separated in-roadway (cycle track, bike lanes—regular, buffered, climbing)	51	121	172	39%
Enhanced shared roadway (sharrow, party parking, pave shoulder)	14	63	77	17%
Bike Boulevards	0	62	62	14%
TOTAL	172	270	442	100%

Denver Moves facility types are based on research and guidance from the planning, engineering, landscape design, and accessibility industries. Each facility type contains a general definition, an explanation of the comfort level for users, information on where the design is most appropriate, basic design parameters, and other considerations for implementation. These act as a resource to help staff, stakeholders, and residents understand where and how a particular design could be implemented on the Denver Moves network.

Bike Boulevard

Definition

Bike boulevards are streets designed to give priority to non-motorized users and discourage through-traffic by motorized vehicles. A separated space in the street is not necessary because non-motorized users preference is communicated through the roadway design, signage, and traffic calming measures.

Ease of Use

High. The comfort level for non-motorized users will generally be high as they will be operating within a shared lane with traffic volumes typically below 4,000 vehicles per day. Bike Boulevards are designed so that non-motorized and motorized users are traveling at similar speeds. This minimizes passing conflicts. Bike Boulevards also enhance pedestrian mobility by improving intersection markings and reducing motorized vehicles speeds via traffic calming.

Use

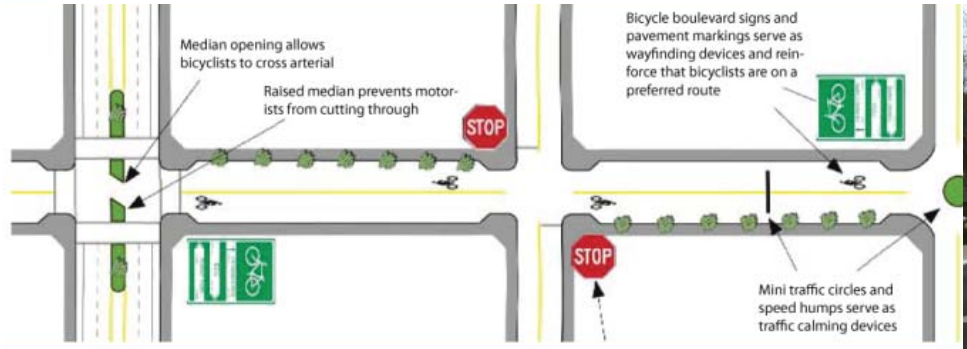
Bike boulevards should provide connectivity between neighborhoods and common destinations via low-volume streets. Bike boulevards are typically best accomplished in neighborhoods with a gridded street network where one street is chosen as the bicycle boulevard. They can also be created by combining a series of road and trail segments to form one continuous route. They are most effective on streets that currently have a high volume of bicycle and pedestrian use, documented crash history, or excessive motor vehicle speeds based on field studies.

Design Considerations

Bike boulevards should be designed to provide increased convenience for non-motorized users by minimizing stops and cross-traffic. Traffic calming devices help maintain low motor-vehicle speeds while allowing a consistent speed for non-motorized users. Signalization, median islands and curb extensions should be installed at arterial intersections to facilitate crossing.

The type of traffic calming devices used in each bike boulevard vary depending on adjacent lane use context and community desires. Careful consideration should be given to low volume street crossings of arterials. If inadequate gaps are available additional engineering treatments could be required to facilitate safe crossings of the arterial, otherwise the arterial may function as a barrier, limiting the local street's usefulness for non-motorized travel.

When possible, traffic calming measures should consider integrating progressive storm water management features and low maintenance vegetation to improve the visual quality of the Bike Boulevards.



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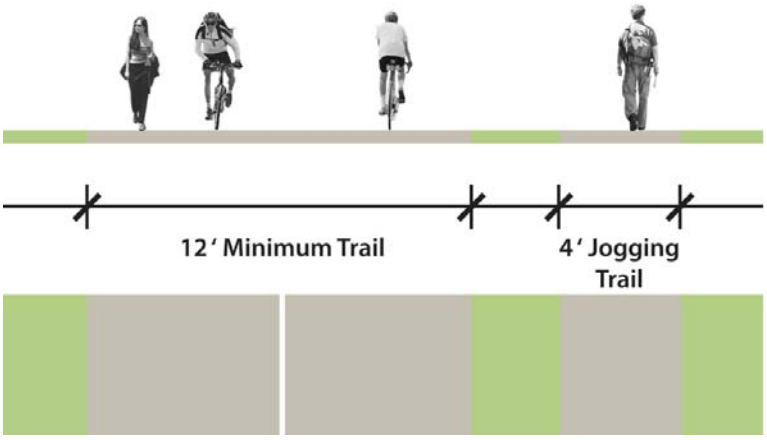


Definition

Regional trails are off-street facilities that are shared use for non-motorized users and provide connectivity within and beyond the city limit. They are typically located near a watercourse or greenway. Examples include the Cherry Creek Trail, S. Platte River Trail, Bear Creek Trail, Highline Canal Trail, and Clear Creek Trail.

Ease of Use

High. The comfort level for all users will generally be high as the users will be operating away from motorized vehicles and in some situations separated from adjacent trail users. The comfort level may be reduced significantly if there are a variety of speeds or a high degree of variation between wheeled users.

Use

The regional trails provide recreational opportunities and supplement the transportation emphasis of the grid bicycle route system. Regional trails are multi-purpose trails serving a variety of trail users.

Design Considerations

Regional trails should try to avoid crossing users at grade on streets and minimize diagonal crossings. Regional trails are designed for two-way travel and provide adequate width to allow safe passing for walkers, joggers, and other pedestrians. In the absence of available space for divided lanes, a single paved path is acceptable, provided that standard width noted below is used. In areas of heavy pedestrian traffic, specific lanes should be designated for each of the uses (see heels and wheels design).

The width for a two-directional regional trail should be 12 feet minimum. In substandard locations a parallel pathway can be constructed or the additional width can be added to the trail using the appropriate material for the location.

The criteria for placement of regional trails includes undeveloped parcels, drainage corridors or open space, Parks Department ownership or maintenance responsibility, and connectivity to existing trails or public facilities such as schools, libraries and community centers.

Denver Examples

- S. Platte River Trail
- Cherry Creek Trail
- Bear Creek Trail

Regional Trail

Heels & Wheels Trail

Definition

Heel & Wheel trails are designed to minimize conflicts between different speed users to reduce conflicts in highly used segments of trail corridors. There are several construction, signage, and striping techniques available to reduce conflicts between different users.

Ease of Use

High. The comfort level for Heels & Wheels users will generally be high as the different users will be traveling within a shared lane with users of the same speed. The relative comfort will also vary substantially according to the width of the facility, signed regulations, and volumes.

Use

Heel & Wheels trails should provide additional capacity to trail segments that have poor Levels of Service (LOS) based on the Federal Highway Administration LOS calculations. Heels & Wheels trails are typically best accomplished by adding a parallel trail, adding to the current trail, or reconstructing the trail. Parallel trails can be constructed in hard or soft surfaces depending on the user types and demands.

Design Considerations

Heels & Wheels should be designed to provide increased convenience for all trail users by minimizing conflicts between users with a speed differential of more than 10 MPH. Signage and ground markings should clearly identify where users should travel. Maximum and minimum speed limits should be posted, and where safety issues are identified, speed enforcement should be conducted.

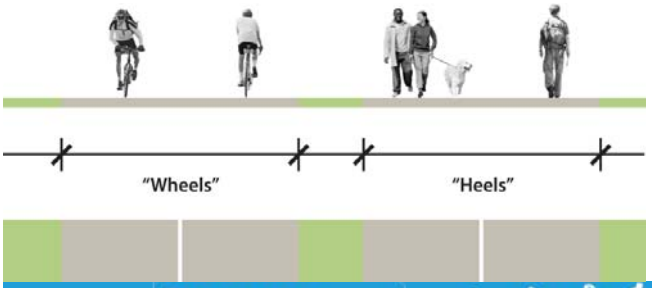
The dimensions and posted speed limits of the Heels & Wheels sections will vary greatly based on user levels and physical constraints. A single-direction wheeled travel path should have a minimum width of 5 feet. A single direction heeled section should have a minimum width of 5 feet. A two-way wheeled path should have a minimum width of 12 feet. A two-way heeled section should have a minimum width of 8 feet.

Heel & Wheels trails are necessary where documented safety issues and user levels warrant such treatments. The design of the Heel & Wheel should be carefully considered to maximize the safety and user adherence to the intended trail user separation. A key design and construction consideration should be the speed of users.

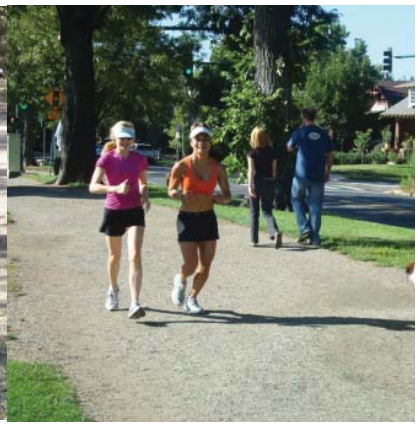
Denver Examples

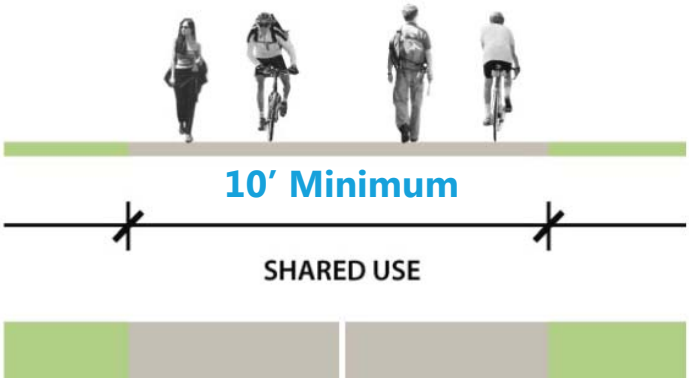
- Cherry Creek Trail (Downtown)

A common Heels & Wheels section provides separation for bicycles and walkers/runners. In some instances, families riding bicycles at slower speeds, inline skaters, long boarders, parents pushing strollers, or mobility impaired persons using a mobility device are uncertain where to travel. It will be critical to understand the unique travel requirements of each user of the corridor (vehicle width, clearance, top speed, braking, etc.) and apply the most appropriate designations between users. To minimize conflicts and provide an uninterrupted experience for users, it will be critical to designate speeds that are appropriate for the trail users in the corridors under consideration for Heels & Wheels treatment.



Cherry Creek Trail - Downtown





Definition

Minor & neighborhood trails are off-street facilities that are shared use for non-motorized users and provide connectivity to a regional trail or neighborhood destination. They are typically located in a park, open space, or near a low volume roadway.

Ease of Use

High. The comfort level for all users will generally be high as the wheeled users will be operating within their own space, separated from adjacent joggers and pedestrians. The comfort level may be reduced significantly if separation between wheeled and non-wheeled users are not designed to minimize potential conflicts between users.

Use

The off-street trails provide recreational opportunities and supplement the transportation emphasis of the grid bicycle route system.

Design Considerations

Minor & neighborhood trails should provide visible crossing at-grade on streets and minimize crossing high volume roadways. Minor & neighborhood trails are designed for two-way travel and are not designed to facilitate efficient passing in locations where there are a high volumes of walkers, joggers, and other pedestrians.

The width for minor & neighborhood trails should be 8 feet minimum. In substandard locations a parallel pathway can be constructed or the additional width can be added to the trail using the appropriate material for the location.

The criteria for placement of regional trails includes undeveloped parcels, drainage corridors or open space, Parks Department ownership or maintenance responsibility, and connectivity to existing trails or public facilities such as schools, libraries and community centers.

Denver Examples

- Harvard Gulch
- 5280 Loop City Park
- Washington Park

Minor Trail

Cycle Track

Definition

Cycle tracks provide an exclusive bikeway separated from motor vehicle and pedestrian traffic by a median, planter strip, and/or a parking lane. The cycle track may be designed at street level, sidewalk level or a height in-between the two to accentuate the separation.

Ease of Use

High. The comfort level for the bicyclist will generally be high as the bicyclists will be operating within their own space, separated from adjacent motorists and pedestrians. The comfort level may be reduced significantly if intersections are not designed to minimize potential conflicts between turning motorists, crossing pedestrians, and bicyclists.

Use

Cycle tracks are typically installed on streets with higher traffic volumes and/or speeds with long blocks and few intersections. Cycle tracks can either be one-directional, or two-directional, and can be provided on one or both sides of the street. They are useful on streets that connect to off-street trails since riders using trails often prefer to be separated from traffic.

Design Considerations

Cycle tracks should be a minimum of 7 feet wide to allow for bicyclists to pass one another. Curb extensions or bollards may be desirable at intersections to prevent cars from illegally parking and to ensure adequate sight lines. Cycle tracks are more appropriate for long blocks with limited alleys and curb cuts to reduce conflicts.

If a cycle track is buffered from traffic by on-street parking, a minimum 3 foot buffer should be provided between parking and the cycle track to reduce conflicts in the passenger-side "door zone."

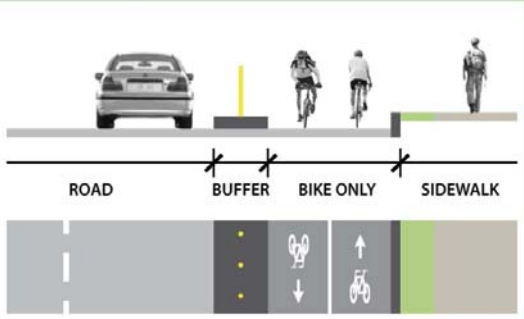
Denver Examples

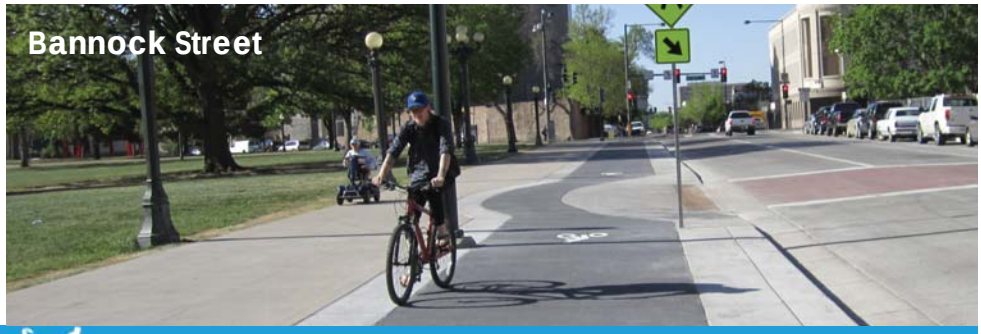
- Bannock Street (along Civic Center park)

Intersection design for cycle tracks is complex because of potential conflicts with pedestrians and turning vehicles. Parking restrictions are necessary at intersections in order to maintain visibility. Bicycle signals may be a useful treatment to allow signal timing that separates turning movements across the cycle track from the through bicycle movement.

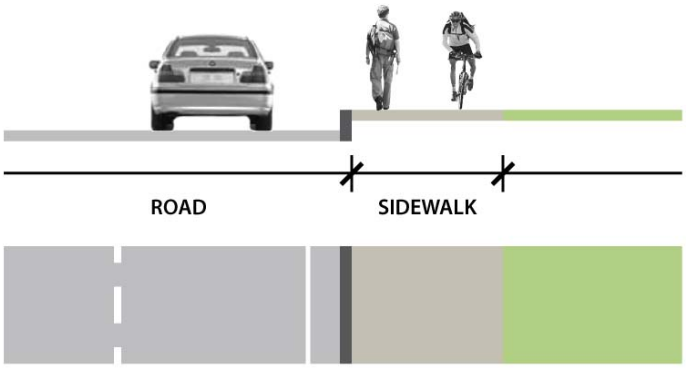
On streets with bus service, stops and waiting areas should be located on the cycle track median to reduce conflicts with bicyclists and pedestrians getting on and off of the bus.

Well-designed cycle tracks require detailed designs, property owner coordination, and special parking operation considerations. Cycle track projects should budget accordingly to ensure the designs are cost effective.





15th Street Underpass



Definition

Some sidewalks are designed for bicycle usage to avoid conflicts between single direction motor vehicle traffic. The facilities are designated on maps and have special signage to warn pedestrians and bicycles of the shared-use.

Ease of Use

High. The comfort level for all users will generally be high as the wheeled users will be operating within their own space, with designation from adjacent joggers and pedestrians. The comfort level may be reduced significantly if separation between wheeled and non-wheeled users is not designed to minimize potential conflicts between users.

Use

Pedestrians and bicyclists can legally share the space on the sidewalks to make connections between green facilities.

Design Considerations

When possible, sidewalks where bikes are permitted should be a minimum of 8 feet. These locations will include additional signage, ground markings, and special curb cuts to facilitate bicycle travel. Physical separation between wheeled and non-wheeled users is recommended to minimize potential conflicts between users.

The sidewalks designated for bicycle usage are interim solutions that connect two green facilities together. They should be used only when there is no immediate solution to resolve a connection between two high ease of use facilities.

Denver Examples

- 15th Street Underpass
- 20th Street Bridge
- E. Buchtel Blvd

Shared Use Sidewalk

Buffered Bike Lane

Definition

Buffered bike lanes are created by painting a flush buffer zone between a bike lane and the adjacent travel lane. Buffers may also be provided between bike lanes and parking lanes to demarcate the door zone to discourage bicyclists from riding closely next to parked vehicles.

Comfort Level

Moderate. Buffered bike lanes increase the riding comfort for bicyclists as they increase separation from vehicular traffic and/or parked vehicles.

Ease of Use

Buffered bicycle lanes should be considered at locations where there is excess pavement width or where increased separation is desired. The buffer provides a warning for motorists and bicyclists that the street is multi-purpose.

Design Considerations

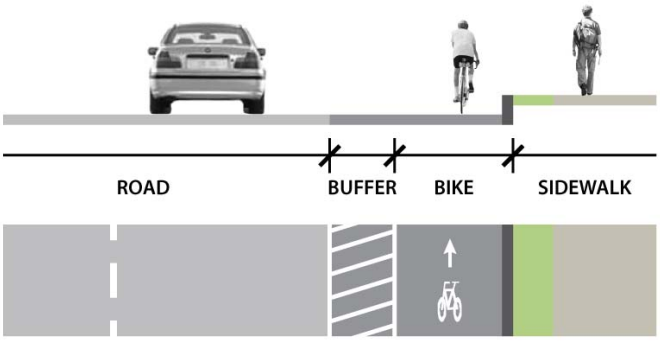
Buffers may be painted with solid white lines, parking "T", cross hatches, or gore zone markings per the Manual for Uniform Traffic Control Devices (MUTCD). Adjacent to parking, the buffer may extend into the bicycle lane up to three feet to delineate the area where a parked vehicle door may open into the bicycle lane.

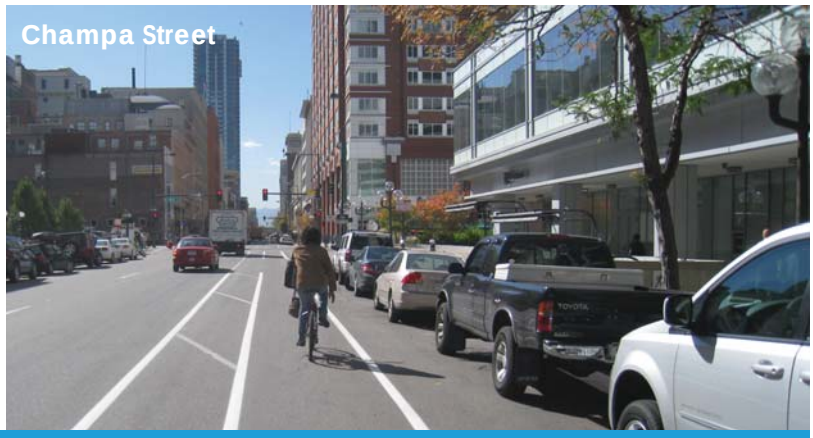
Buffered bicycle lanes may be accompanied by signs reminding drivers to "look for bikes" when opening their doors. The recommended minimum width of a buffer is three feet; however their width may vary depending upon the available space and need for separation.

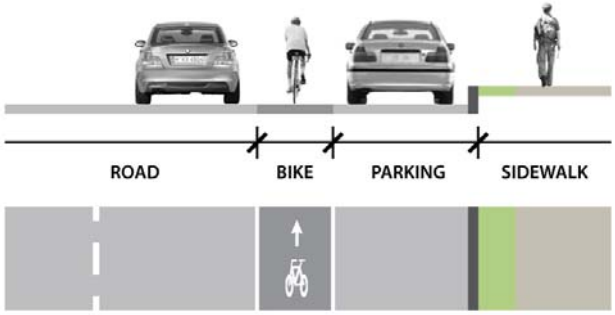
Where only one buffer can be installed on a constrained corridor with on-street parking, a parking turnover study should be conducted to determine where the buffer should be located. Buffered bicycle lanes may also be considered on steep roadways where higher downhill bicycle speeds can be expected and where more severe dooring crashes can occur.

Denver Examples

- Champa Street







Definition

Bicycle lanes are a portion of the roadway designated for preferential use by bicyclists. They are one-way facilities that typically carry bicycle traffic in the same direction as adjacent motor vehicle traffic on the right side of the roadway.

Ease of Use

Moderate. Bicycle lanes increase the riding comfort for bicyclists as they provide dedicated space from vehicular traffic and reduce stress caused by acceleration and operating speed differentials between bicyclists and motorists.

Use

Bike lanes provide the minimum standard for separate on-street bicycle accommodation. They are desirable on collectors and some arterials to improve rider comfort and safety where traffic volumes and speeds are higher.

Bicyclists are not required to ride exclusively in a bicycle lane when traveling on a street and may leave the lane as necessary to make turns, pass other bicyclists, or to position themselves for other necessary movements. Motor vehicles may temporarily use bicycle lanes to access parking spaces, enter and exit driveways and alleys, or move into turning lanes. Parking is prohibited within bicycle lanes.

Design Considerations

Bike lanes are typically installed by reallocating existing street space by narrowing existing lanes, removing travel lanes or parking lanes, and/or reconfiguring parking lanes.

Bike lanes should allow a bicyclist at least 4 feet of smooth operating space and be separated from adjacent motor vehicle traffic by continuous solid white line. Dashed white line should be marked at approaches to intersections or other locations where motor vehicles may merge into or across the bicycle lane. Bike symbols should be installed on the near side and far side of intersections and at intervals of 150-250 feet between intersections. The lanes may be supplemented by "BIKE LANE" signs. Colored paving within the bicycle lane may be used to highlight merging areas.

Wider bike lanes enable bicyclists to pass one another on heavily traveled corridors and increase separation from faster traffic or parked vehicles.

Bike lanes should generally be provided in each direction on two-way streets. On one-way streets and streets with wider medians, placing the bike lane on the left side may be appropriate to reduce friction with vehicle doors and/or transit stops.

Denver Examples

- 16th Avenue
- Larimer Street
- 22nd Avenue

Bicycle Lanes

Climbing Lane

Definition

Climbing lanes are hybrid bicycle facilities on roadways with steep grades. Typically, bicycle lanes are marked in the uphill direction and shared-lane markings are painted in the downhill direction.

Ease of Use

Moderate. Climbing lanes increase the riding comfort for bicyclists as they increase separation from vehicular traffic and reduce stress caused by operating speed differentials between bicyclists and motorists caused by grade changes in the terrain.

Use

Climbing lanes are used on streets with steep and/or sustained grades. The bicycle lane should be placed on the side of the street which is gaining elevation (uphill), with a shared lane marking placed in the opposite direction (downhill).

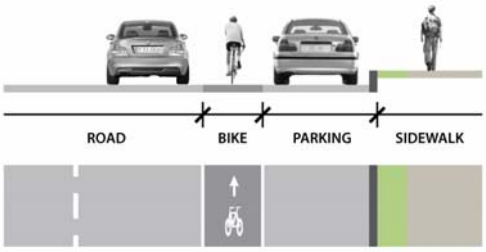
Design Considerations

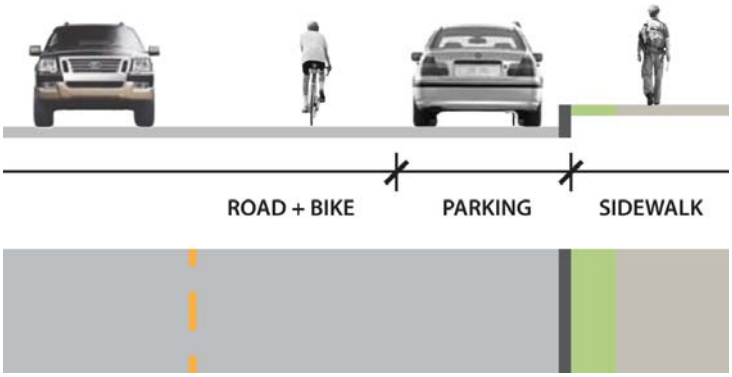
Climbing lanes are typically installed by reallocating existing street space by narrowing existing lanes, removing travel lanes or parking lanes, and/or reconfiguring parking lanes.

Bicyclists traveling in an uphill direction move at significantly slower speeds than adjacent traffic, and benefit from having a separated facility. Bicyclists traveling in a downhill direction pick up speed and can travel amongst motorists. Shared-lane markings are typically used in the downhill direction to alert motorists of faster-moving bicyclists traveling in the travel lane. Riding with traffic in the travel lane rather than in a bike lane place cyclists further away from parked cars, which helps reduce crashes at high speeds in the door zone.

Climbing lanes should allow a bicyclist at least 4 feet of smooth operating space and be separated from adjacent motor vehicle traffic by continuous solid white line. Dashed white line should be marked at approaches to intersections or other locations where motor vehicles may merge into or across the bicycle lane. Bike symbols should be installed on the near side and far side of intersections and at intervals of 150-250 feet between intersections. The lanes may be supplemented by "BIKE LANE" signs.

The downhill shared lane marking should be placed near the center of the lane on roadways with posted speeds below 35 mph. If on-street parking is provided in the downhill direction, it is particularly important to ensure that bicyclists are directed to ride in a location outside of the door zone, either by the placement of the shared lane marking, a buffer, or other means.





Definition

While bicyclists are considered vehicles and allowed on every roadway, shared streets are roads that have been designated as part of the bicycle system. Bicyclists operate with motor vehicles without any designated bicycle facility. There are no bicycle-specific designs or dimensions for shared lanes or roadways, but various design features can make shared lanes more compatible with bicycling, such as signage, good pavement quality, adequate sight distances, lower speeds and volumes, bicycle compatible drainage grates, bridge expansion joints, and railroad crossings.

Ease of Use

Moderate to high depending on traffic volume. The comfort level for the bicyclist will generally be high when a bicyclists is operating on a shared street with low speeds and traffic volumes. The comfort level will generally be moderate when a bicyclist is operating on a shared roadway with higher speeds and traffic volumes. The relative comfort will also vary substantially according to the shared lane width, with wider lanes providing more comfort than narrow lanes.

Use

Shared streets are signed routes that make short connections between facility types or two destinations. They are normally used where investment in a specific facility type may not be cost effective.

Design Considerations

Signage that designates the street has bicycle activity should be considered if it connects to another facility. Careful consideration should be given to crossings of shared streets with arterials.

Denver Examples

- W. 10th Avenue
- E. 20th Avenue

Shared Roadway /Signed Routes

Party Parking Lane

Definition

Party parking lanes are marked parking lanes which have a very low weekday utilization rate and/or few street facing residences. The parking lanes provide overflow parking for adjacent perpendicular residential streets or adjacent land uses such as churches, schools, or recreation facilities which have limited, but intense on-street parking needs. During periods of low parking use or restricted parking use the parking lane can operate as a de-facto bicycle lane or shoulder for bicycle use.

Ease of Use

Moderate to low. Party parking lanes increase the riding comfort for bicyclists as they increase separation from vehicular traffic and reduce stress caused by acceleration and operating speed differentials between bicyclists and motorists. The comfort level and safety will be diminished at locations where parking exceeds 5-10% of the block at any given time as the cyclist will be required to weave in and out of traffic, or stop for gaps in traffic to pass parked vehicles.

Use

Party parking lanes should be considered as bikeways under unique circumstances where the removal of parking lanes is not feasible due to high parking demands during specific times. Typically, party parking lanes are located on streets in residential neighborhoods with limited commercial activity. Streets with party parking lanes generally use about 5-10% of the block length for parking during off peak times.

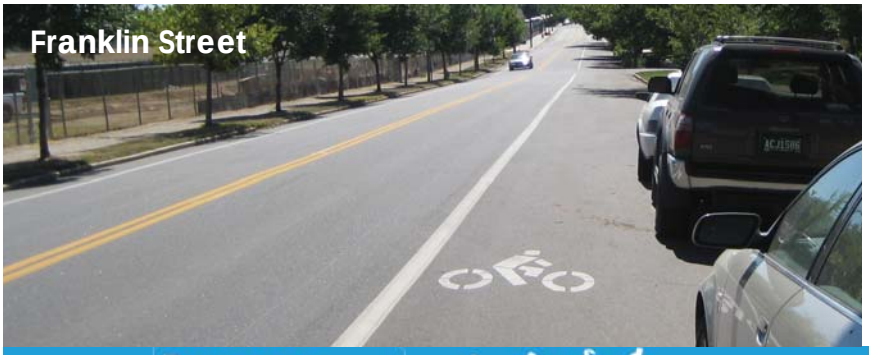
Design Considerations

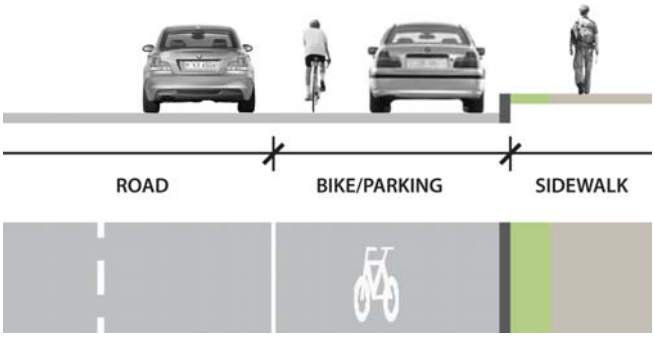
Pavement marking for party parking lanes should be striped as outer bike lane lines with or without bike lane symbols. Lane lines should be continuous across driveways and intersections, and not delineate individual parking spaces or taper towards the curb. Dashed lane lines should be marked at high volume driveways (>3 cars/day), and through intersections.

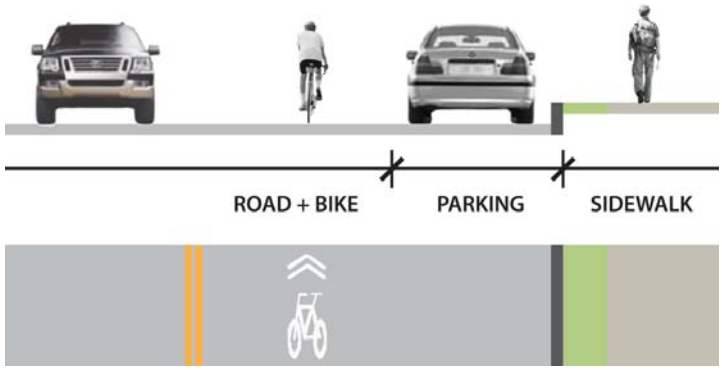
Restricting parking during times parking is not utilized should be considered, or positively allow parking only during times of high demand, i.e. Parking Allowed 7pm-7am M-S, All Day Sunday. Specified times for restriction should be considered based on the parking needs of the surrounding area.

Denver Examples

- Franklin Street
- Princeton Avenue
- Tamarac Avenue







Definition

Shared lane markings or "sharrows" are designed to provide guidance in situations where space is too narrow for a motor vehicle and a bicycle to travel side by side. It assists bicyclists with positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle, as well as alerts road users of the location bicyclists are likely to occupy within the traveled way. Sharrows also encourage safe passing practices and reduce the incidence of wrong-way bicycling.

Ease of Use

Low. The comfort level for the bicyclist will generally be low as the bicyclists will be operating within a shared lane with traffic volumes typically exceeding 4,000 vehicles per day. The relative comfort will also vary substantially according to the shared lane width, with wider lanes providing more comfort than narrow lanes.

Use

Sharrows are installed where there is insufficient space to allocate to a dedicated bicycle facility in the through travel lane. Sharrows are generally used on collector streets where dedicated space for a bicycle facility cannot be provided due to right-of-way constraints. They should generally not be used on streets with speed limits in excess of 35 MPH.

Design Considerations

On streets with an outside lane 13 feet in width or greater, sharrows are placed on the right-hand side of the lane. Adjacent to parking, the center of the marking is placed a minimum of 11 feet from the face of curb. The sharrow may be complemented by a "SHARE THE ROAD" sign assembly.

Sharrows can be used on the downhill side of a road in conjunction with climbing lanes where there is only enough right-of-way to create one dedicated lane. Sharrows may not be as effective on roadways with narrow lanes and high volumes of traffic which limit gaps for motorists to pass bicyclists comfortably resulting in bicyclists riding as far to the right as space allows and not over the sharrows as intended.

The use of "super sharrows" or "green sharrows" can also be considered in locations where traffic volumes are above 5,000 average daily vehicles or additional attention is warranted. Both treatments have sharrows inset to a green striped lane.

Denver Examples

- Water Street
- East 23rd Avenue
- Louisiana Avenue

Sharrows

Paved Shoulder

Definition

Paved shoulders are hybrid bicycle facilities on roadways where there is additional space between the outer travel lanes and the edge of the right of way. Typically, paved shoulders are marked with a solid white line.

Ease of Use

Low. Paved shoulders increase the riding comfort for bicyclists as they increase separation from vehicular traffic. However, they do not have ground markings at the intersections to resolve turning conflicts between bicyclists and motorists.

Use

Paved shoulders should be considered at locations where there is excess pavement width or where increased separation is desired. Signage should be installed to warn motorists and bicyclists that the street is multipurpose.

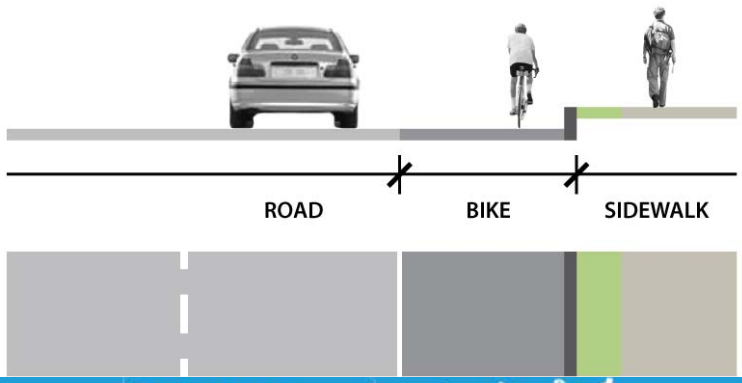
Design Consideration

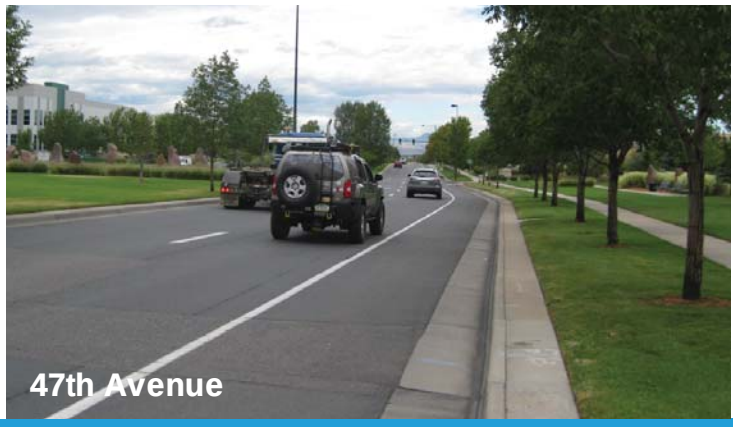
Paved shoulders should be an interim step to striping an on-street bicycle lane. Paved shoulders can vary in width depending on future geometry changes, pavement conditions, and right of way width. Paved shoulders should not be designated as bicycle facilities in situations where there is a paved shoulder less than 4.5 feet.

In commercial and industrial areas, the pavement conditions and maintenance policies should be considered before designated a paved shoulder acceptable for bicycle use.

Denver Examples

- Quincy Avenue
- 47th Avenue
- W. Jewell Avenue





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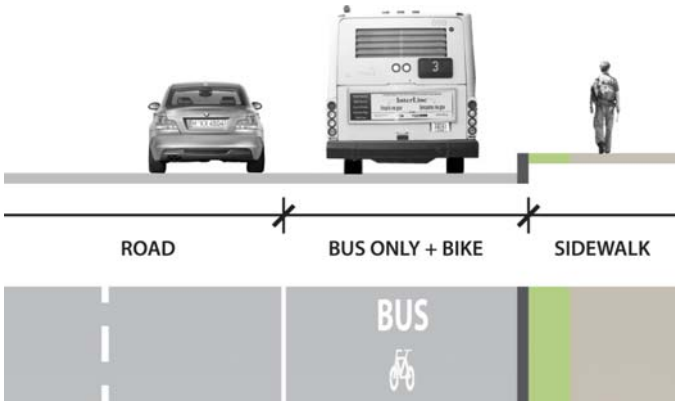


Definition

Bike/bus lanes provide guidance to bicyclists and buses in situations where separate bicycle facilities are not possible. The marking is intended to alert bicyclists and bus drivers that both uses occupy the traveled way. The designs encouraging safer passing practices (including changing lanes, if necessary).

Ease of Use

Moderate to low. The comfort level for the bicyclist and RTD drivers will generally be moderate to low as both users will be operating within a shared lane. The relative comfort will also vary substantially according to the shared lane width, with wider lanes providing more comfort than narrow lanes.

Use

Bike/bus lanes are typically located in arterial corridors where there are designed RTD routes and the need for on-street bicycle connections between destinations.

Design Considerations

Bike/bus lanes are restricted and have special ground markings to warn motorists of their presence. They include special stop designs to allow passing when buses are stopped. The lane width can vary depending on the traffic volumes, presence of on-street parking, and bus frequency. They can be designed for peak, off-peak, or exclusive use.

Bike/bus lanes require detailed designs that should be coordinated with RTD. The effectiveness of the bike/bus lanes will rely on enforcement and safety promotion. In situations where the RTD bus frequency is more than 30 minutes, bus bike lanes may not be warranted.

Denver Examples

- 19th Street

Bike/Bus Lane

Roadway Crossing: Grade Separation

Definition

Grade separations provide connection across streets and do not require pedestrians or wheeled users to interface with motor vehicles. Grade separations can include underpasses or bridges that are shared use.

Ease of Use

High. Grade separations provide additional connectivity and safety to the network by avoiding interactions with motor vehicles. Grade separations are designed to minimize approach and departure angles to make their use easy for all skill levels, including those in wheelchairs.

Use

Grade separations should be considered at locations where there are high traffic volumes, motor vehicle speeds, or where increased separation is desired based on accident history. Locations that have existing culverts or drainage channels that travel under the roadway, or are scheduled for improvements should be considered for grade separations.

Design Considerations

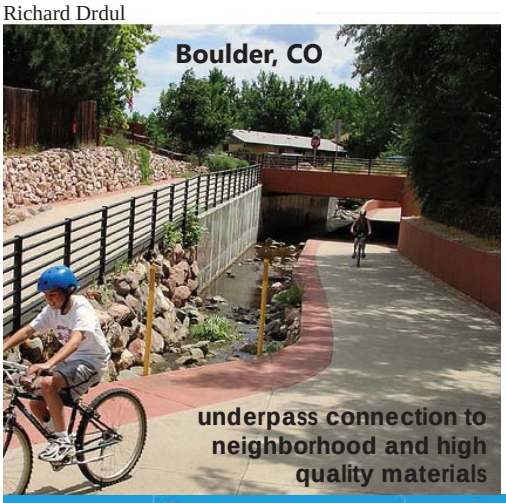
Grade separations should be designed to accommodate travel under or over a roadway. They should provide adequate connection to sidewalks, on-street bike lanes, transit stops, trails, and destinations within the roadway corridor. The grade separation design should accommodate connection to every direction of travel for pedestrians and wheeled users.

High quality grade separation could be constructed in conjunction with on-going efforts to implement the plans identified in the first section. Grade separations should include high quality materials that are not maintenance intensive. Consideration for public safety should be balanced with design aesthetics.

Denver Examples

- Cherry Creek Trail at Holly Street
- Highland/I-25

Richard Drdul



Denver Examples

- Yale Avenue at the Highline Canal
- Leetsdale Avenue at Kearney Street

Definition

Mid-block crossings provide connection between trails that are separated by a roadway. A mid-block crossing is located on a roadway between intersections. They can be located on local, collector, and arterial streets. They provide an enhanced crossing for pedestrians and wheeled users by employing several motor vehicle warning devices.

Ease of Use

Moderate to low depending on traffic volume. The comfort level for all users will generally be high when the mid-block crossing is on a roadway with traffic volumes below 4,000 vehicles per day. The relative comfort will also vary substantially according to the number of lanes crossed, ground markings, signage, signal control, and vehicles speeds.

Use

Mid-block crossings should be considered at locations where there are moderate traffic volumes, motor vehicle speeds, and where increased visibility is desired based on accident history. They can also be located on roadways where two adjacent land uses require a mid-block connection.

Design Considerations

Mid-block crossings should be designed to accommodate travel across a roadway and provide adequate connection to the roadway. This should include connections to sidewalks, on-street bike lanes, transit stops, trails, and destinations within the roadway corridor. The mid-block design should accommodate connection to every direction of travel for pedestrians and wheeled users. The use of high visibility striping, signage, median refuge, traffic calming, and simple drainage solutions is recommended.

Locations that have existing at grade crossings should be evaluated to determine if improvements are necessary. The design of mid-block crossings can vary depending the field conditions.

Roadway Crossing: Mid-Block

Intersection: Bicycle Treatments

Definition

Intersection bicycle treatments are a portion of the roadway designated for preferential use by bicyclists. They are designated facilities that allow bicycle traffic to make turning and thru movements at motor vehicle intersections.

Ease of Use

Moderate. Intersection bicycle treatments increase the riding comfort for bicyclists as they provide dedicated space from vehicular traffic and reduce stress caused by acceleration and operating speed differentials between bicyclists and motorists when turning at intersections.

Use

Intersection bicycle treatments are an enhanced standard to existing on-street bicycle facilities. They are desirable on collectors and some arterials to improve rider comfort and safety where traffic volumes and speeds are higher. Bicyclists are not required to ride exclusively in the intersection bicycle treatment when traveling on a street.

Design Considerations

Intersection bicycle treatments are typically installed by reallocating existing street space by narrowing existing lanes, removing travel lanes or parking lanes, and/or reconfiguring turn lanes. The treatments should be provided for all turn and thru movements at the intersection.

There are a variety of designs currently used across the United States. The appropriate treatment will depend on the traffic volume, roadway geometry, traffic signal timing, and demonstrated need.

Denver Examples

- 16th & Broadway

Washington D.C.

Broadway & 16th Avenue

Portland, OR

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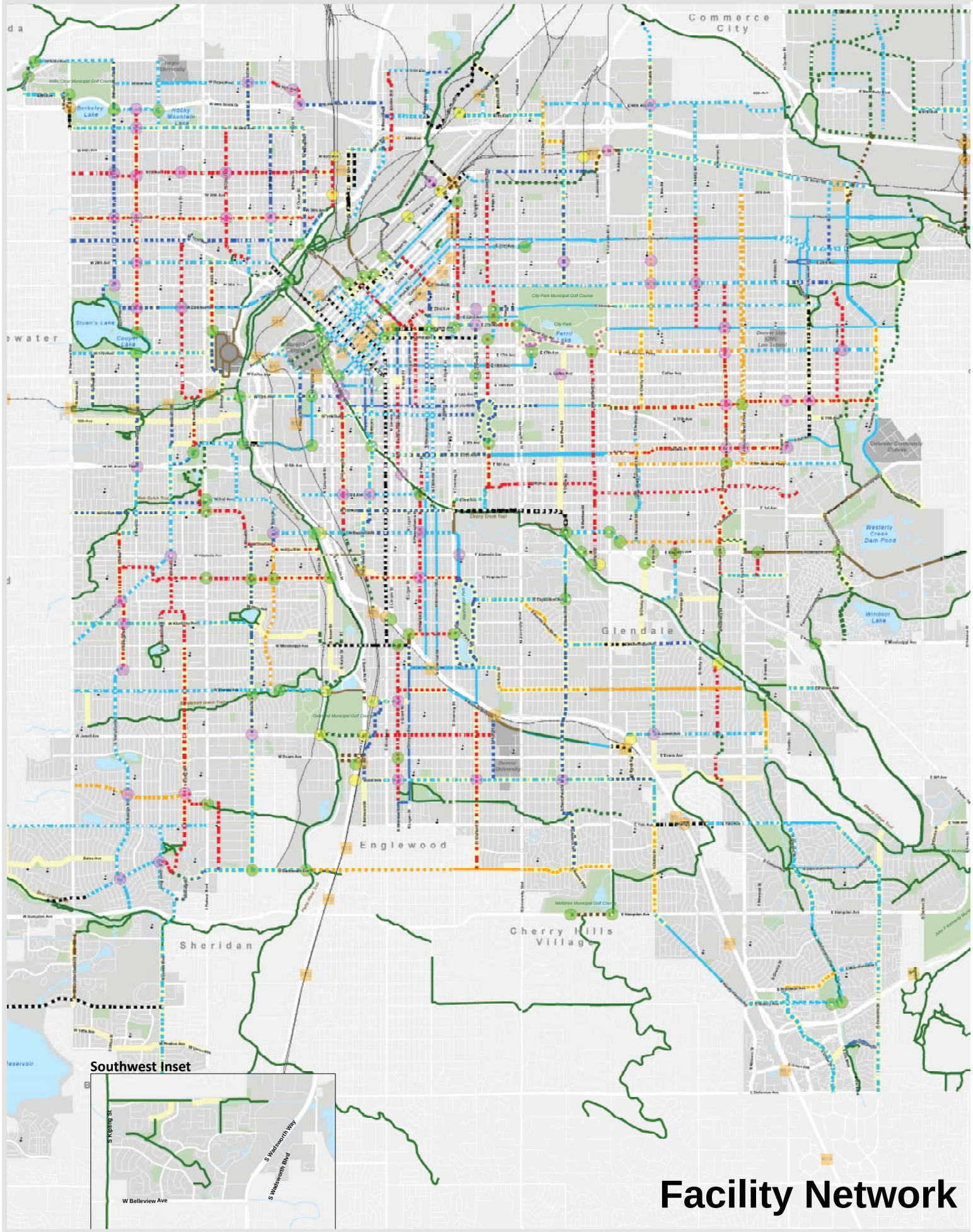
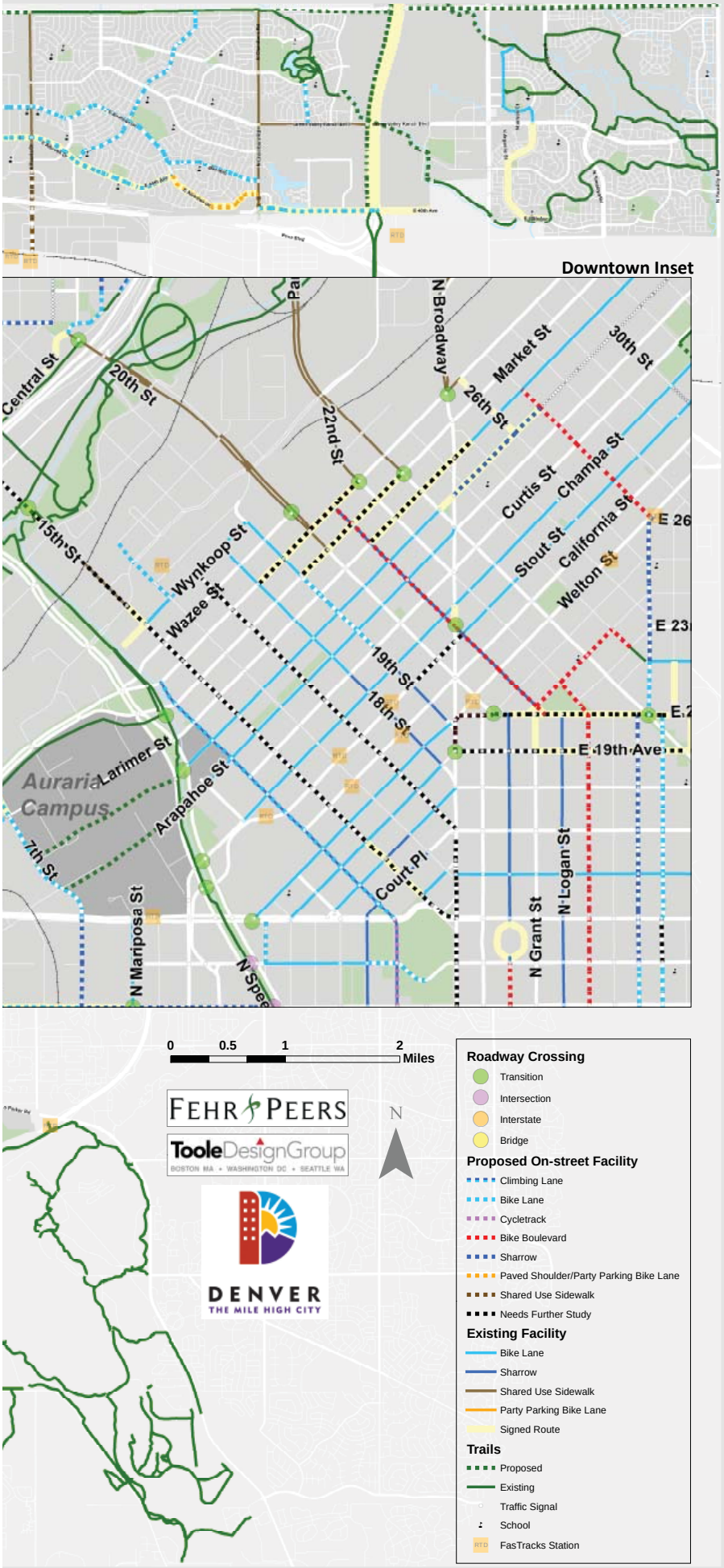


Facility Network



Facility Map

The Denver Moves Facility map illustrates where different facility types are recommended for implementation to create a comprehensive multi-use and bicycle system. The City is fortunate to have a well-established grid that distributes traffic and contriubtes to a functional street hierarchy. This grid creates many miles of residential streets with low motor vehicle volume and slow speeds. In may cases, these residential streets do not appear on the Denver Moves network because, by their nature, they are conducive to biking and walking. These streets provide opportunities to access the Denver Moves network and make longer connections citywide.

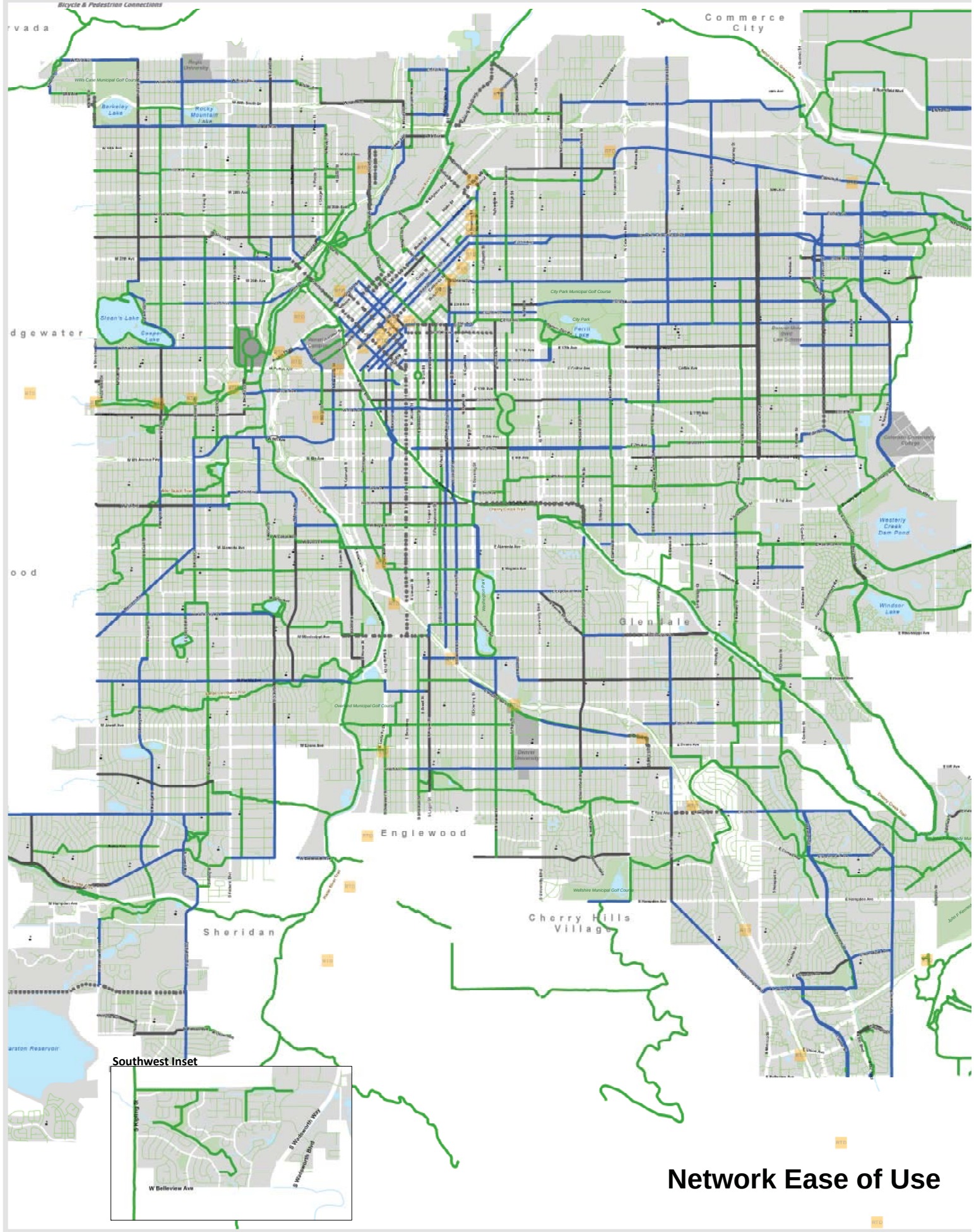
Any street or trail in the transportation network is available for bicycling or walking, but the Facilitly Map shows where investment will be focused to form an enhanced, connected network. It integrates off-street and on-street facilities, creates links to destinations, and takes into consideration adjacent land use patterns.

Facility recommendations are specific given existing right-of-way constraints, user levels, accident data, adjacent land use, and traffic volumes. There is currently no specific locations identified for cycle tracks and shared bike-bus lanes because design of these facilities is too complex to be evaluated at this planning level. However, there are several corridors marked for further study where these facility types may be appropriate. The corridors identified as"needed further study" require additional operational analysis to determine the appropriate facility type.

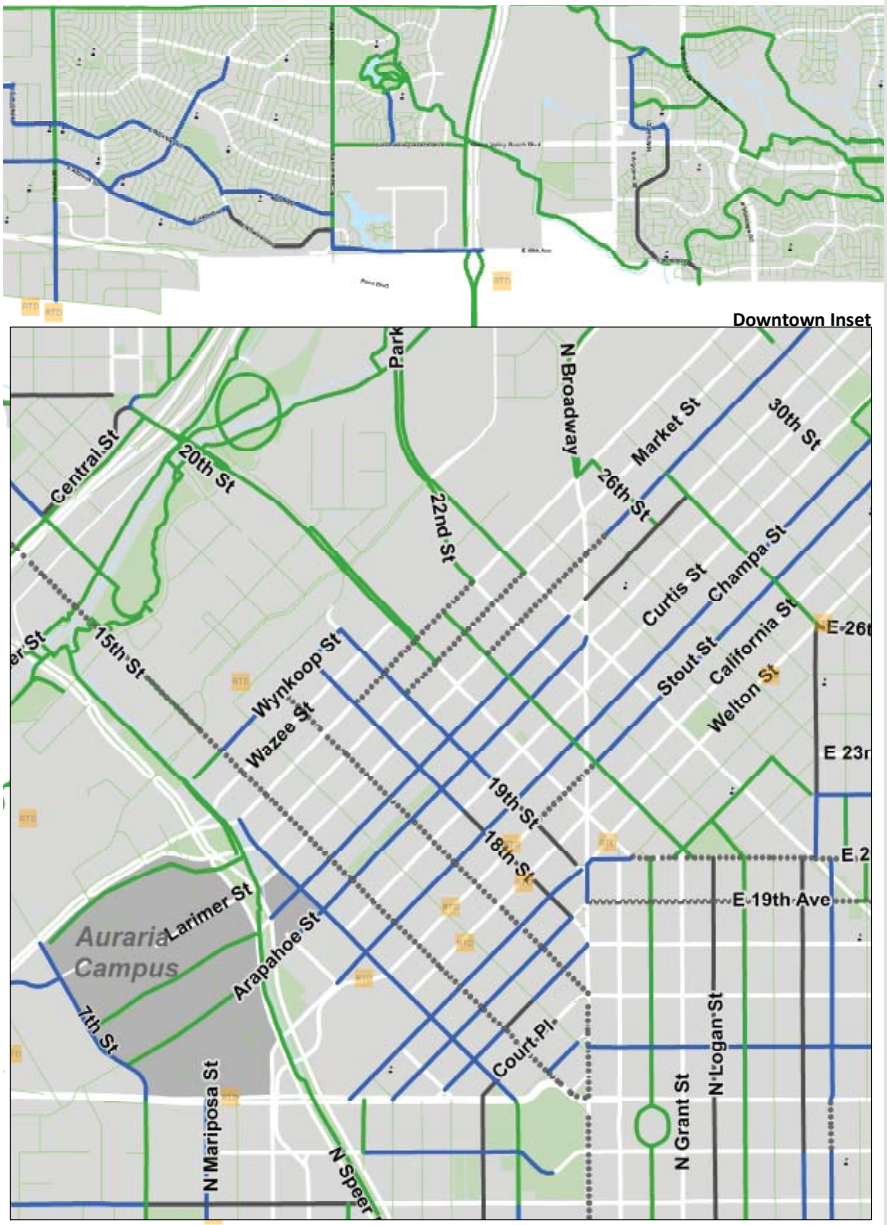
Denver Moves is intended to be dynamic, serving as a framework to guide future planning and development. Different facility types than what is shown may be implemented as a result of more detailed design. It will be necessary to revisit the facility recommendations as the city continues to change.

For a more detailed version of this map please click this link.

Or visit:
www.denvergov.org/bicycle_program



Network Ease of Use



Ease of Use Categories

High
- -Multi Use Trail
- -Shared Use Sidewalk
- -Sidewalk with Bikes Permitted
- -Cycletrack
- -Bike Boulevard

Moderate
- -Bike Lane
- -Buffered Bike Lane
- -Climbing Lane

Low
- -Sharrow
- -Shared Roadway
- -Party Parking Bike Lane
- -Paved Shoulder

Local Street (Not Evaluated)

Needs Further Study

FasTracks Station

School

Ease of Use Map

The Ease of Use map translates the facility recommendations into a relative "ease of use" hierarchy, similar to how Colorado ski resorts or the Western Slope mountain biking areas classify their trails. The ease of use designation is based on the degree of separation from motorized traffic. While any street or trail is available for bicycling or walking, a user can decide which facility is more appropriate, given their skills and level of comfort. The intent is to translate technical details into a simpler form to help users understand what to expect.

GREEN facilities in the Denver Moves network have the highest "ease of use" for bicyclists and walkers. The green facilities have a range of potential designs with full separation from motorized traffic. These may be more appropriate for novice users, desiring a high level of comfort. The green facilities are envisioned as the premium facilities to achieve the Denver Moves goals.

BLUE facilities in the Denver Moves network have a moderate "ease of use" and are focused on bicyclists. The blue facilities are focused on providing in-roadway separation, meaning there is a designated space for bicycle travel. These may be more appropriate for users who are comfortable riding in the street next to motorized traffic. The blue facilities are secondary facilities that help meet the Denver Moves goals.

BLACK facilities in the Denver Moves network have the lowest "ease of use" and primarily represent enhanced shared roadway situations. These may be more for experienced bicyclists and users comfortable sharing space with motorized traffic. The black facilities provide flexibility for connectivity, but should be used on a limited basis.

As mentioned earlier, many residential streets do not appear on the Denver Moves network because, by their nature, they are conducive to biking and walking. These streets are shown in light green.

For a more detailed version of this map please click this link.

Or visit:
www.denvergov.org/bicycle_program

6. IMPLEMENTATION

Implementation Principles

Denver Moves will begin implementation with the support of Public Works, Parks & Recreation, other City departments, developers, and Denver residents. Focusing on physical projects, Denver Moves shows where and how the City is going to concentrate investment on non-motorized transportation and recreation in the future. The following principles will direct implementation of Denver Moves:

Embrace a "complete streets" approach: pedestrian and bicycle safety, comfort and convenience will be incorporated into all projects - including those not on the Denver Moves network. Implementation of Denver Moves will be flexible and open to opportunities that further expand and enhance walking and bicycling throughout the city.

Facility designs will support the modal goals for the city and be attractive to a new generation of users. The Denver Moves network is the preliminary recommendation for multi-use bicycle and pedestrian facilities. Opportunities for providing a higher quality facility should be explored as projects are scoped and developed for implementation in order to improve the overall system's ease of use.

Priority recommendations will be designed and constructed as stand alone retrofit projects funded primarily with capital funds and grants. Denver Moves is action oriented: implementation will be led by a partnership between Denver Parks & Recreation and Public Works. Parks & Recreation, with the support of Public Works, will spearhead the construction and management of multi-use trails, while Public Works, with the support of Parks & Recreation, will take ownership of the on-street projects.

Recommendations will be incorporated into all new, reconstruction, and maintenance projects occurring on the Denver Moves network. Every effort will be made to make smart investments and share costs. As opportunities arise and implementation timelines change based on this entrepreneurial approach, the phasing will need to be adjusted.

Move forward on all 4 Es – Engineering, Education, Encouragement, and Enforcement - simultaneously. This will involve working together with a wide range of traditional and non-traditional partners including business improvement districts, law enforcement, schools, universities, public health, community development and others.

Project Phasing

Denver Moves identifies an extensive system of almost 442 miles of multi-use, bicycle, and pedestrian facilities, of which 172 presently exist. It examines project opportunities in a great deal of specificity to determine feasibility and facilitate rapid implementation. While some of the recommendations can be retrofitted to existing streets with minimal impact, many projects will require additional analysis and community outreach. It will be critical to embrace unforeseen opportunities and constraints in the bicycling and walking networks as they emerge.

Project Prioritization

Implementation over the following years must be achievable and realistic, given available resources. To manage this, Denver Moves has a phasing plan for the improvements. Prioritization criteria were developed and applied to recommended projects. This objectively determined an initial level of priority for projects based on ability to mitigate multi-modal conflict, inclusion in past plans, and proximity to key destinations. Prioritization also considered was overall implementation feasibility measured by community support, action or trade-offs required for completion, and cost of the project.

Scoring Criteria

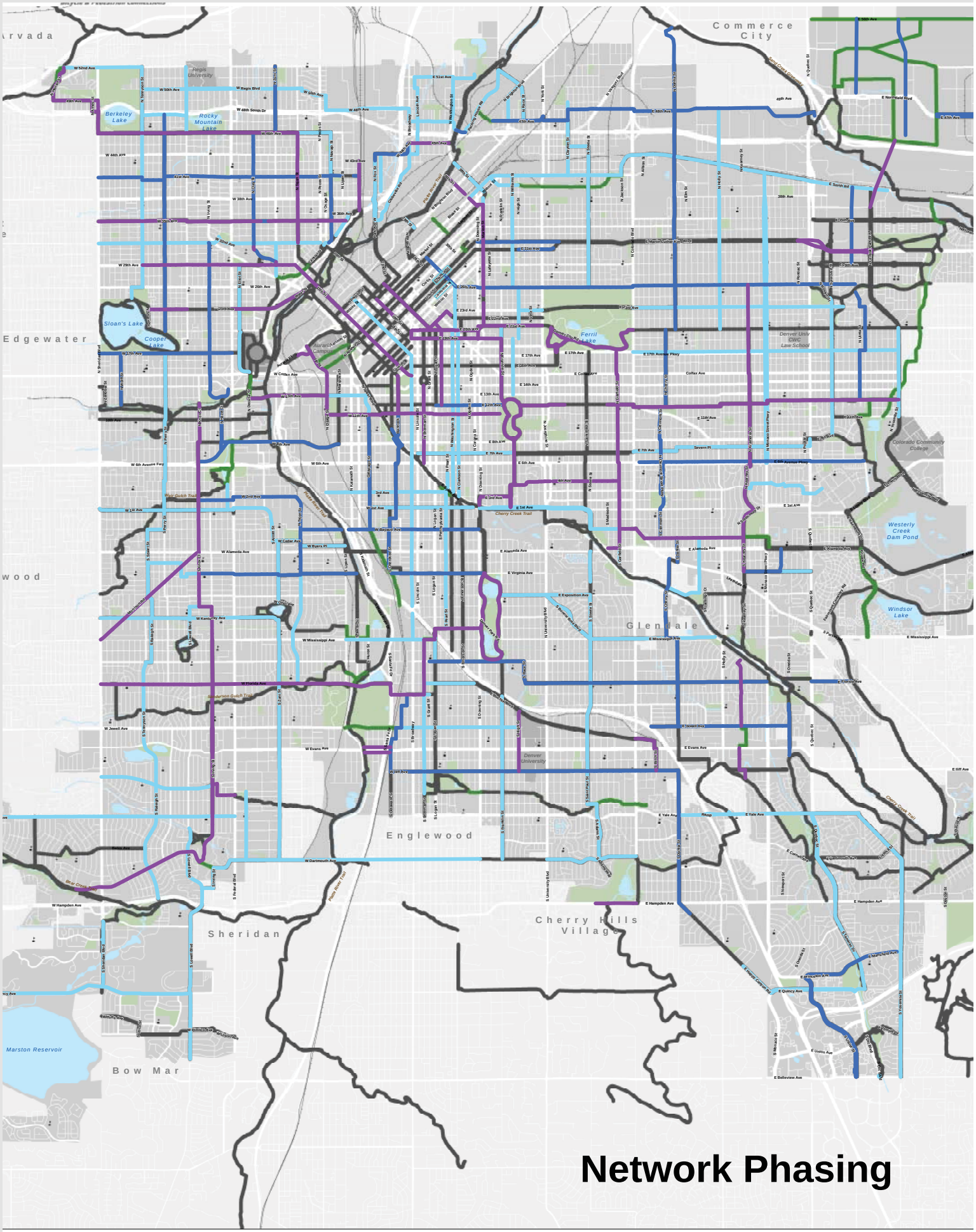
Proximity Criteria	Scoring
Mitigates pedestrian/bicycle/vehicle conflicts	***High=2 Medium=1 Low=0***
Connects off-street to on-street bike facilities or sidewalks (500' buffer around trail)	***Yes= 1 No=0***
Directly adjacent to a school (500' buffer around school)	***Yes= 1 No=0***
Within a ¼ mile of a park recreation center, or library	***Yes= 1 No=0***
Within a ¼ mile of a Living Street or Enhanced Transit Corridor	***Yes= 1 No=0***
Within a ¼ mile of a neighborhood destination	***Yes= 1 No=0***
Within 1/2 mile of a Denver TOD	***Yes= 1 No=0***
Fulfills recommendations in Bicycle Master Plan	***Yes= 1 No=0***
Fulfills recommendations in the Pedestrian Master Plan	***Yes= 1 No=0***
Fulfills recommendations in the Gulch Master Plan	***Yes= 1 No=0***
Implementation Feasibility	
Community support	***High= 2 Low=1 None=0***
Action (trade-off)*	***None=2 Medium=1 High=0***
Cost**	***Low=2 Medium=1 High=0***
Opportunity driven	***Yes= 1 No=0***

*High=Parking Impacts, Medium=Road Diet, Low= Lane narrowing (lane diet) No action needed, add striping/marking
**High=construct future facility, Medium= in-street improvement, pave existing shoulder, Low = add signage/striping

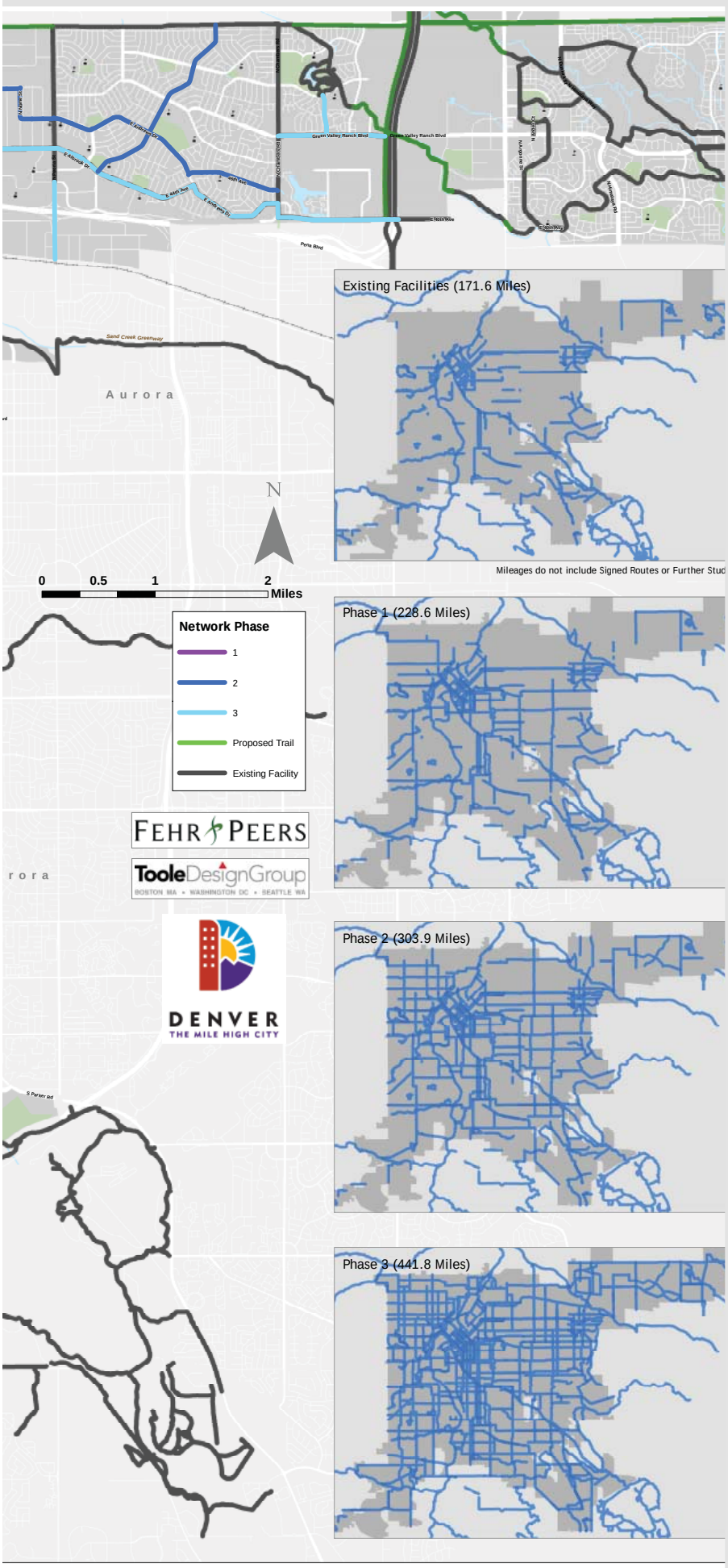
Phasing Plan

Project prioritization informs the phasing plan for Denver Moves with each phase steadily increasing the amount of biking and multi-use facilities in the network. Phase I consists of the near-term projects concentrated on making significant investment in the connectivity by closing gaps in the existing system, providing geographic equity of biking and walking corridors, and on-street facilities to linking regional parks and trails. Progress on Phase I has already begun with efforts to complete a cohesive downtown network and test new facility types. Phase II and III are considered for longer-term implementation to other key destinations. Each additional phase expands coverage and density of the Denver Moves network to achieve the desired goals. The timeline for build out of the phases and projects will depend on the available funding.

The phasing plan is focused primarily on project construction; however, it also incoporates the cooridors identified for "needs further study." These cooridors require additional operational analysis to determine the appropriate facility type, but the need for an improved connection is still prioritzed with the same criteria. The intent is that the operational or design study for selection of a facility type would occur as part of the project construction process.



Network Phasing



Phasing Map

The Phasing map shows the intended priority order for build out of the Denver Moves network.

Phase I consists of the near-term projects focused on providing significant investment in the connectivity by closing gaps in the existing system, providing geographic equity of biking and walking corridors, and on-street facilities to linking regional parks and trails. Progress on Phase I has already begun with efforts to complete a cohesive downtown network and test new facility types. Several Denver Moves improvements are already programmed for design and construction. These include:

- Pilot Bike Route Signage
- 23rd Avenue Sharrows
- 15th Street Bike Facility
- 14th Street Bike Lane
- Bannock Street Cycle track and Bike Lanes (Complete)
- Knox Court Bicycle Boulevard Design & Bike Lanes
- 46th Street Bike Lanes at Berkeley Lake
- West Florida Bicycle Lanes
- Widened sidewalks - Evans Avenue LRT station to Platte River
- 16th/Broadway/Cleveland Intersection Improvements (Complete)
- 12th and Colorado Intersection Improvements
- Leetsdale Drive at Kearney Signal
- Colorado Boulevard Bicycle and Pedestrian Bridge
- 38th and Inca Bicycle and Pedestrian Bridge

Phase II and III are considered for longer-term implementation to other key destinations. Each additional phase expands coverage and density of the Denver Moves network to achieve the desired goals. The timeline for build out of the phases and projects will depend on the available funding.

For a more detailed version of this map please click this link.

Or visit:
www.denvergov.org/bicycle_program

Estimated Cost

The estimated total cost of all bicycle and pedestrian improvements identified in Denver Moves is $119 million (2010 dollars).

This includes $66 million in linear projects and $54 million in crossing improvements. Of the linear projects, the phasing plan breaks down to $16 million a phase for Phase I and Phase II and $33 million for Phase III. Crossing improvements will be prioritized as funding opportunities allow.

The costs shown are intended to be general and used for long-range planning purposes and assume the projects will all be stand alone projects, not incorporated into other jobs. Recommendations for the type of crossing improvements were prepared at a preliminary level. Construction cost estimates were developed by identifying pay items and establishing rough per-mile quantities. A preliminary anticipated engineering fee was then included in total project costs depending on the amount and type of needed construction. This total amount also assumes projects are stand alone and not incorporated into other work efforts.

PHASE 1		PHASE 2		PHASE 3		CROSSINGS		TOTAL
$16 mil	+	$16 mil	+	$33 mil	+	$54 mil	=	$119 mil

Funding Strategy

The amount of funding secured for pedestrian and bicycle studies and projects citywide has increased over the past five years, with the historical average being approximately $6 million per year. This includes local Capital Improvement Program contributions, successful selection of Denver projects for federal and state funding, and grant awards. Future funding for Denver Moves projects will depend on the economic situation and political climate.

Parks & Recreation and Public Works will coordinate to implement Denver Moves projects. To fund these projects, the City will pursue a variety of funding options. This could include general fund program contributions, leveraging external sources (state, federal, and private) and preparation for future bond program requests. The various facility types identified in Denver Moves and their associated costs provide flexibility for funding. Denver Moves allows for both an entrepreneurial and opportunistic approach.

From an entrepreneurial standpoint, the Capital Improvement Program (CIP) includes both annual programs and discretionary funding. Annual programs may be more appropriate for less intrusive projects that require minimal design, property impacts, and construction. This includes routine trail maintenance, signage and striping projects like bike lanes or sharrows, curb ramp upgrades, signal improvements, or small intersection projects. Other less intrusive projects can be handled with annual program funding. For larger capital projects, such as construction of trails, cycle tracks, sidewalks, and major grade-separated crossings, it is necessary to pursue discretionary funds. From the CIP, the discretionary budget is small and very competitive based on the City's overall infrastructure needs. While it funds one or two bicycle and pedestrian related projects each year, it should not be relied on as a sole source of capital funding. Denver Moves will look to state and federal resources, as well as other grant opportunities to move projects forward.

An opportunistic approach means leveraging other projects to incorporate Denver Moves recommendations, such as taking advantage of resurfacing projects, utility work, or development. It is standard practice in Public Works to assess and implement bicycle facilities as part of routine street maintenance.

Denver Moves Network Cost Estimates

Linear Projects			
Facility Type	**Construction Cost/Mile***	**Facility Miles**	**Total Item Cost****
Bike Boulevard	$134,024	62.0	$12,422,685
Bike Lane	$102,270 - $124,446	112.4	$16,308,432
Buffered Bike Lane	$133,770	4.9	$743,306
Climbing Bike Lane	$102,270 - $124,446	1.0	$137,599
Cycle Track	$655,908	2.7	$2,877,796
Party Parking Bike Lane	$105,755 - $126,874	21.2	$2,645,854
Pave Shoulder	$102,270 - $144,384	4.0	$831,711
Shared Lane Marking	$23,182 - $31,667	38.1	$1,221,171
Shared Use Path	$791,909	21.2	$27,281,272
Sidewalk Bike Permitted	$246,757	2.8	$1,122,745
Subtotal		270.3	**$65,592,572**
Crossing Improvements			
Facility Type	Construction Cost/Item*	Number/Item	Total Item Cost**
New Bridge	$1,400,000	15	$21,000,000
Arterial Crossing Improvement		123	
New Signal	$200,000	37	$7,380,000
Geometric Modifications	$500,000	37	$18,450,000
Crossing Island and Active Warning	$50,000	49	$2,460,000
Interstate Crossing	$250,000	5	$1,250,000
Engineering Study (miles)	$35,000	25	$875,000
Facility Transition	$167,530	13	$2,177,890
Subtotal			**$53,592,890**
GRAND TOTAL: DENVER MOVES NETWORK			***$119,185,462***

* The range for construction cost/mile considers the various costs of different actions. Estimates do not include costs for right-of-way acquisition, extraordinary landscaping/aesthetics or low impact stormwater design treatments, major utility relocations, lighting, significant traffic signal modifications (unless specified), or future maintenance. Construction costs will vary based on the ultimate project scope (i.e. combination with other projects) and economic conditions at the time of construction.

** Total construction cost includes estimated contingency and engineering fee. A preliminary anticipated engineering fee was included in the cost varying from 8% to 25% of the anticipated construction cost. It is assumed the projects which would require significant construction may require engineering (i.e. trail and sidewalk widening projects).

*** The costs shown are intended to be general and used for long-range planning purposes and assume the projects will all be stand alone projects, not incorporated into other jobs .

Peer City Comparison

To maintain its position as a top city for bicycling and walking, Denver needs to keep pace with its peers. The peer analysis shows where Denver currently compares to other cities in mode share, staffing levels, planning, and programming.

Implementation of Denver Moves will continue to elevate the city's status as a bicycling and walking friendly community. It will also contribute to an increase in "person trips" to achieve the Denver's overall transportation transformation.

Measure	Denver, CO	Portland, OR	Minneapolis, MN	Washington, DC
Population	**584,563**	**551,226**	**358,896**	**588,373**
Mode Share (Bike Commute)	**1.59%**	**5.96%**	**4.27%**	**2.23%**
Mode Share (Walk Commute	**4.35%**	**5.24%**	**6.61%**	**11.80%**
Staffing Level	**2**	**7**	**6**	**7**
Funding & Planning Details	**270 new miles $120 million**	**680 new miles $631 million**	**50 new miles $500 million**	**300 new miles $45 million**
Bicycle Friendly Communities Rank	**Silver**	**Platinum**	**Silver**	**Bronze**

Monitoring Progress

With any visionary plan, it is critical to monitor progress. This includes tracking implementation of the plan against specific performance measures and peer cities. Consistent evaluation of Denver Moves can provide information to guide future transportation and recreation policy, gain support for future bicycling and multi-use investments, and provide transparency to the public.

Denver Moves will assess the following performance measures through annual reports. These annual reports will demonstrate progress toward the achievement of Denver Moves goals. The Denver Moves maps — Facility Map, Ease of Use Map, and Phasing Plan Map—will be updated on a yearly basis to reflect completed improvements, as well as incorporating any changes or additions to the network.

Performance Measures

Measure	Metric	Source
amount of bicycling	percent increase per year in locational counts	Denver Bicycle Counts
bike/walk share of commute trips	percent bicycle and walking mode share and walking mode share of all "to work" trips	American Community Survey, Annual Citizen Survey
bike/walk share of all trips	percent bicycle and walking mode share and walking mode share of all "to work" trips	American Community Survey, Annual Citizen Survey
pedestrian and bicycle infrastructure spending	amount secured for bicycle/ pedestrian projects	Budget Management Office
bicycle/pedestrian crashes	ratio of pedestrian/bicycle accidents per percent mode share of all trips	Denver Police Department crash reports
network completion	percent of Denver Moves network completed	Parks & Recreation, Public Works
geographic equity of network	percent of Denver Moves network miles per council district	Parks & Recreation, Public Works

This project moves on at:
www.denvermovesbikes.com