Go Speer Leetsdale
A Mobility Study and Vision for the Speer/Leetsdale Corridor
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Stakeholder Working Group
A geographically targeted task force to include representation from registered neighborhood organizations, educational groups, formal business/maintenance groups, Denver City Council, and transportation management associations located within the study area were invited to participate in the Stakeholder Working Group (SWG). Those in bold below participated in at least one SWG meeting:

African Community Center
Alamo Placita Neighbors Association
Archdiocese of Denver
Baker Historic Neighborhood Association
Belcaro Park Homeowners Association
Bike Denver
Bonnie Brae Neighborhood Association
Bromwell Elementary School
Capitol Hill United Neighbors
Carson Elementary School
Cherry Creek Area Business Alliance
Cherry Creek Chamber
Cherry Creek East Association
Cherry Creek North Business Improvement District
Cherry Creek North Neighborhood Association
Cherry Creek Steering Committee
Cherry Creek Shopping Center
Citypoint Church
Consulado General De Mexico
Country Club Historic Neighborhood
Cranmer - Hilltop Civic Association
PROJECT MANAGEMENT AND WORKING GROUPS

Crestmoor Community Association
Crestmoor Park Neighborhood Association
Crestmoor Park Home Owners, Inc. 1st Filing
Crestmoor Park Homes Association 2nd Filing
Cultural Arts Residential Organization
Daniel's Fund
**Denver City Council**
Denver Country Club
Denver Green School
Denver Neighborhood Association
Denver Urban Resident Association
Fairmount Cemetery
**Fans of Washington Park**
**Four Mile Historic Park**
Gates Tennis Center
George Washington High School
**Glendale City Council**
Golden Triangle Museum District
**Golden Triangle Neighborhood Association**
Graland Country Day School
Greek Orthodox Cathedral
Harman Neighborhood Association
Hill Campus of Arts and Sciences
Hilltop Heritage Association
Inter-Neighborhood Cooperation (INC)
La Alma / Lincoln Park Neighborhood Association
Lowry Community Master Association

Lowry United Neighborhoods
McMeen Elementary School
Merrill Middle School
Preservation of Residential South Hilltop Neighborhood Association
Robert E-Loup Jewish Community Center Denver
Second Cherry Creek Townhouse Corp.
South High School
**South Hilltop Neighborhood Association**
St. Johns Church and School
Steele Elementary School
**Transportation Solutions**
Virginia Village / Ellis Community Association
**WalkDenver**
Washington Park East Neighborhood Association
**West Washington Park Neighborhood Association**
Winston Downs HOA
CHAPTER 1: INTRODUCTION

Purpose of Study
Go Speer Leetsdale examines transportation connectivity and operational needs for all modes of travel within the Speer/Leetsdale corridor, a prominent local and regional travel route for those in both Denver proper and the southeast portion of the metro area. The study focuses on a piece of the larger travel movement connecting people east and west through the city from I-25 on the west to I-225 in the southeast.

The effort evaluates how to improve the way this corridor moves people between Broadway and East Mississippi Avenue through a variety of different transportation modes—including walking, biking, public transit, and driving.

The study also considers transportation facilities within approximately one-half-mile north and south of the main corridor to acknowledge the broader transportation network that influences Speer and Leetsdale.

Study Background and Funding
In 2008, Denver Public Works completed its Strategic Transportation Plan (STP) to study and to better understand the current and future transportation needs of Denver. Despite significant investments in light rail and commuter rail systems through FasTracks (the voter-approved regional transit expansion plan), the STP acknowledged the growing demand on the local transportation system. The plan also recognizes that the increasingly built-out nature of the City means that Denver must consider both the financial and opportunity costs associated with expanding the number of travel lanes needed to accommodate growing demand.

In light of these challenges, the STP explores ways to improve the function of the current transportation network to better accommodate people walking, biking, and riding transit.

The STP effort resulted in an innovative transportation philosophy for Denver. The STP calls for decision-making that enables a greater variety of convenient transportation options and alternative mobility choices. The ideas set forth in the plan build upon several previous planning efforts. Instead of relying on traditional problem-solving to relieve congestion, the STP advocates for actions that move more people, not just more vehicles. The STP also marked a shift in perspective with a new focus on “people trips” as the measure of corridor efficiency as opposed to “vehicle trips.” Investments in moving people by bicycle, foot, and through public transit affords significant capacity gains that could not be achieved by personal vehicles alone. This commitment to maximizing our existing roadway footprint through multimodal investments is the basis of the City’s vision to provide mobility freedom throughout the Denver area.

The STP identifies 12 travel sheds within the Denver boundaries. A travel shed was derived from the theory of a watershed. In the same way that an interconnected network of streams, rivers, and channels drain into a larger river basin; a collection of streets and mobility routes also feed into larger roadways that serve vital city centers, destinations, and popular travel movements.

Speer/Leetsdale, was identified as one of three major corridors in need of innovation and new investment to move people more efficiently. This study moves that conversation forward.
CHAPTER 1: INTRODUCTION

Study Area

The study area is shown on Figures 1-1 and 1-2. The STP defines the Speer/Leetsdale Travel Shed as the corridor between Broadway/Lincoln to the north, along 1st Avenue and Steele Street, to Alameda Avenue, to Leetsdale Drive east of Colorado Boulevard where it becomes State Highway 83, and on to South Parker Road to the south (referred to as the Study Area). The study area is considered part of a much larger travel movement that extends 11 miles from I-25 in Downtown Denver to I-225 in Aurora. Several arterial roads parallel to the main route are also considered part of this travel shed including 6th Avenue, 8th Avenue, Alameda Avenue, and Cherry Creek South Drive.

The study area spans 15 long-established neighborhoods, which were invited to participate in the project Stakeholder Working Group. It also runs parallel to the Cherry Creek trail system, which acts as a bicycle and pedestrian super-highway for the region. The corridor also extends through the City of Glendale and a small section of Arapahoe County.

Other Studies

Multiple studies have been conducted over the past 20 years that identify or reference the Speer/Leetsdale corridor as a place for improvements. A summary of these studies is provided below. These were referenced during development of Go Speer Leetsdale. The studies discussed here do not represent a comprehensive list but are those that have the greatest relevancy to this project.

Network Analysis of Potential Improvements to Bus Speed, Delay & Access (RTD 2016)

RTD identified opportunities to implement transit-enhanced corridors throughout the metropolitan area that will improve the overall transit experience via faster travel times, reduced delay, better access to service, increased reliability, and improved wait environment. Initial screening resulted in 30 corridors selected for second round screening, the Speer/Leetsdale corridor was among the 30 selected for additional screening but was not included in the top nine corridors identified as high priority candidates.

Denveright (Denver 2016)

This concurrent planning effort focuses on four key areas: land use and transportation, parks and recreation, pedestrian and trails, and transit. Efforts align with Go Speer Leetsdale to provide more transportation choices for people moving throughout Denver.

Cherry Creek South Drive - Phase III (Denver 2015)

Phase 3 of the Cherry Creek South Drive Master Plan includes adding parking, pedestrian crossings and traffic calming elements, including a landscaped median to Cherry Creek South Drive between Steele Street and Garfield Street. This project is currently under construction.
CHAPTER 1: INTRODUCTION

Cherry Creek District Zoning (Denver 2014)

Denver City Council adopted new zoning for the Cherry Creek North Business Improvement District area to enhance the “live-work-play” nature of the Cherry Creek area by promoting access to public open space, improving the pedestrian experience, and encouraging a diverse mix of land uses.

1st and Steele Alternatives Evaluation (Denver 2014)

Denver evaluated conceptual intersection improvements for the 1st Avenue/Steele Street intersection. The evaluation recommended an alternative with a more typical intersection configuration that improves the experience for bicycles and pedestrians by reducing the number of signals at the intersection from two to one and reducing the overall footprint of the intersection.

Feasibility Study for High Line Canal Crossings (Arapahoe County - 2014)

Arapahoe County evaluated roadway crossings for the High Line Canal at nine locations, including the crossing at Parker Road near the Mississippi Avenue intersection, the eastern terminus of the Speer/Leetsdale corridor. The High Line Canal Trail is heavily used as a commuter route to access the Cherry Creek Trail. The Parker Road at Mississippi Avenue crossing has a historically high number of reported bicycle and pedestrian accidents, and trail users often experience long delays at the intersection. The study recommends an underpass that has been funded; design is underway and construction is anticipated in early 2018.

Denver Union Station – Glendale – Cherry Creek Connector Study (RTD 2014)

RTD examined the importance of connections to local and regional travel between downtown Denver, Glendale and Cherry Creek. The study identified the current transit service as focused on the work commute to Downtown Denver and identified the corridor as a candidate for enhanced transit. It also developed an Enhanced Transit Corridor alternative envisioning a branded service along Speer Boulevard and 1st Avenue.

Cherry Creek Area Plan (Denver 2012)

This plan supports objectives to create pedestrian friendly environments and high degrees of multimodal connectivity in the Cherry Creek area. It emphasizes the need to continually seek ways to effectively balance transportation modes to address existing and anticipated demand.

Denver Moves Bikes (Denver 2016)

Denver Parks & Recreation and Public Works finalized an update to Denver Moves (2011), which continues to emphasize integrating existing-off-street and on-street bicycle and multi-use connections to create safe and comfortable corridors that link neighborhoods, parks, employment centers, business districts, transit hubs, and other destination locations throughout Denver. The newly updated recommended network of enhanced on-street bicycle facilities complements the bicycle facility recommendations included in Go Speer Leetsdale.

Metro Vision 2035 Plan (DRCOG 2011)

The plan defines a balanced and sustainable multimodal transportation system as one that includes rapid transit, a regional bus system, a regional roadway system, local streets, bicycle and pedestrian facilities, and associated system and travel demand management services, all of which support Go Speer/Leetsdale.

COMMON THEME OF RECENT STUDIES

Move the most people in the most efficient, safe way possible through multiple modes of travel.
CHAPTER 1: INTRODUCTION

Figure 1-1. West Study Area
Figure 1-2. East Study Area
CHAPTER 1: INTRODUCTION

Strategic Transportation Plan – Moving People (Denver 2008)

This plan identifies the Speer/Leetsdale Travel Shed as one of three “major investment corridors” within the City limits calling for innovation and new investment to improve the efficiency of the roadway. It emphasizes the importance of supporting the urban centers because they serve as nodes of commerce, employment, and multimodal transportation activity. It also identifies several potential improvements within the Speer/Leetsdale corridor, including increased bicycle and pedestrian connections, improved bus services, High Occupancy Vehicle (HOV) or transit bypass lanes, and fixed guideway transit systems such as light rail or streetcar.

Blueprint Denver (Denver 2002)

Blueprint Denver recognizes the clear tie between land use and transportation and focuses on the importance of multimodal streets and the ability to accommodate more trips by more people by improved transit, pedestrian, and bicycle facilities. An update to Blueprint Denver is currently in progress.

Cherry Creek Greenway Master Plan (Denver 2000)

This master plan is for the 8-mile portion of Cherry Creek between University Boulevard and the Cherry Creek Dam. It recommends improvements to the Cherry Creek Trail near the Denver Country Club, a pedestrian bridge at Clayton, improved crosswalks, and several roadway modifications to enhance traffic mobility.

Denver Comprehensive Plan (Denver 2000)

The comprehensive plan establishes a vision for a livable Denver both now and in the future and provides guiding principles and policies for goals and recommendations in subsequent Denver planning efforts.

Central Denver Transportation Study (Denver 1998)

The Central Denver Transportation Study evaluated reducing the number of travel lanes on several one-way couplets in the Capitol Hill, Speer, West Washington Park, and Platt Park neighborhoods. The project was initiated based on requests by the Central Denver neighborhoods to address multiple transportation issues such as speed and safety within the area.

Leetsdale Drive Reversible Lane Design Study Final Report (Denver 1996)

In 1996, The City and County of Denver completed a study evaluating a reversible vehicular lane on Leetsdale Drive between Cherry Street and Mississippi Drive. The project received funding in the late 1990s but was not implemented.
The Go Speer Leetsdale Corridor Conditions Report documents the existing and future conditions of the corridor regarding land use, the transportation system, and environmental resources. The information presented here highlights the key information used to develop and evaluate potential improvements along the corridor.

Travel Patterns
The Speer/Leetsdale corridor is one of the most significant east-west travel routes in Denver, providing connections for residents, commuters, and visitors both locally and regionally. The corridor is a popular alternative to the I-25 corridor for commuters traveling between southeast Denver or Aurora/Parker and Downtown Denver.

Study area travel patterns were examined to better understand mode choices and travel needs for users on the Speer/Leetsdale corridor. The 2015 and 2040 DRCOG Compass Travel Models were used to evaluate current and projected travel volumes and patterns along the corridor. While the model provides a look at existing and 2040 travel activity, this approach does not consider how growth rates vary between these two years; some periods experience intense growth while others experience slower growth.

The travel model indicates that approximately 53 percent of all trips on Speer Boulevard are traveling between Cherry Creek and Downtown Denver without stopping at interim destinations. By the year 2040, this percentage of pass-through traffic is projected to decrease slightly to 50 percent. This is a result of growth in population and jobs in Cherry Creek and Downtown Denver that allow people to live proximate to where they work.

Vehicular trips passing through the entire length of the Speer/Leetsdale corridor without stopping at interim destinations are currently estimated at approximately 8 to 10 percent of all vehicular trips. Demand for these longer-distance trips is expected to increase by the year 2040 to approximately 12 to 14 percent as a result of growth in population in the southeast quadrant of the region and growth in employment in Downtown Denver.

The American Community Survey Longitudinal Employer-Household Dynamics (LEHD) OnTheMap tool is an online reporting and mapping tool that provides high-level insight into commuting patterns by showing where people work and live. A ¾-mile buffer around the Speer/Leetsdale corridor was applied to evaluate commuting patterns for 2014—the most recent data available at the time of this analysis.

Approximately 69,800 (63 percent) of employees commuted from outside the corridor to work in the corridor; 5,600 (5 percent) of employees work and live within the corridor, and 35,800 (32 percent) of employees live in the corridor and commute to jobs outside the corridor.

The largest concentration of jobs within the corridor is in the Cherry Creek area and in Glendale.

Roadway Cross Sections
Figure 2-1 shows the corridor’s existing cross sections. As shown, the geometric characteristics of the Speer/Leetsdale corridor are highly variable, ranging from four to eight through-travel lanes.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-1. Existing Typical Cross Sections
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Traffic Volumes

Recent average daily traffic volumes (2011 to 2015) along the corridor range from approximately 60,000 vehicles per day (vpd) on the northwest (Speer Boulevard) portion of the corridor, to 50,000 vpd on the 1st Avenue portion, to approximately 40,000 vpd on the southeast (Leetsdale Drive) end of the corridor. Figure 2-2 and Figure 2-3 show the daily traffic volumes for the corridor (both directions of traffic).

Figure 2-4 and Figure 2-5 show traffic volumes for the AM and PM peak hours on a weekday (note: the year of data collection ranges from 2011 to 2015). Existing peak hour traffic volumes and existing intersection lane geometry were used to evaluate how effectively each signalized intersection along the corridor operates during the AM and PM peak hours. Vehicular traffic volumes on the Leetsdale Drive portion of the corridor are heavily directional in the weekday AM peak hour, with 67 percent westbound and 33 percent eastbound. The directional split is less pronounced west of Colorado Boulevard on 1st Avenue (55 percent westbound/45 percent eastbound) and Speer Boulevard (60 percent westbound/40 percent eastbound). There is also a less pronounced directional split corridor-wide during the PM peak hour. Leetsdale Drive and Speer Boulevard both experience a directional split of roughly 55 percent of vehicles traveling eastbound and 45 percent westbound; the result of a wider range of trip types and patterns that occur in the afternoon.

DRCOG’s 2040 adopted Compass Model traffic volume forecasts are shown on Figure 2-6 and Figure 2-7. Figure 2-8 and Figure 2-9 show 2040 projected AM and PM peak hour turning movement volumes based on DRCOG daily forecasts. The forecasts indicate that future traffic patterns along Leetsdale Drive will remain highly directional in the AM peak hour, similar to today. As with the existing volumes, the 1st Avenue and Speer Boulevard volumes are less directional than the Leetsdale Drive portion of the corridor.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-2. Recent Average Daily Traffic Volumes, Through-Travel Lanes, and Posted Speed Limits – West Corridor

SOURCE: City and County of Denver and Denver Regional Council of Governments

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CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-3. Recent Average Daily Traffic Volumes, Through-Travel Lanes, and Posted Speed Limits – East Corridor
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-4. Recent Average Weekday AM and PM Peak Hour Traffic Volumes – West Corridor
Figure 2-5. Existing Average Weekday AM and PM Peak Hour Traffic Volumes – East Corridor
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-6. 2040 No-Action Average Weekday Daily Traffic Volumes – West Corridor
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-7. 2040 No-Action Average Weekday Daily Traffic Volumes – East Corridor

SOURCE: Denver Regional Council of Governments, 2040 Regional Demand Model Preliminary Existing Conditions Assessment. Analysis/Results Subject to Change.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Figure 2-8. 2040 No Action Average Weekday AM and PM Peak Hour Traffic Volumes – West Corridor
Figure 2-9. 2040 No-Action Average Weekday AM and PM Peak Hour Travel Volumes – East Corridor
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Existing Transit Routes
RTD currently operates 13 bus routes that provide service along or cross the corridor.

The 83D/83L (Cherry Creek/Parker Road Limited) are the two primary bus routes considered in this study since they run the length of the study corridor and provide service between Civic Center Station and Nine Mile Station. At Quebec Street, Route 83D diverts away from the Speer/Leetsdale corridor and runs along Dayton Way to Nine Mile Station; the Route 83L branch travels via Leetsdale/Parker Road to the Nine Mile Station. Between University and Civic Center, the 83D/83L run with limited stops.

Recent passenger activity for the 83D/83L from Downing to Quebec is summarized in Table 2-1. As shown, during the AM peak period the westbound boardings (people getting onto the bus) are approximately three times higher than boardings in the eastbound direction, mimicking the directional priority seen in the vehicular traffic counts. For the PM peak period, boardings at stops along the corridor are more balanced; however, the alightings (people getting off the bus) are greater in the eastbound direction (18 eastbound/12 westbound).

Additionally, the 3L (East Alameda Limited) provides bus service between Broadway/Lincoln and the Alameda/Leetsdale intersection; continuing ast on Alameda Avenue; connecting Civic Center Station in Downtown Denver to the Centrepoint/Sable Bus Station in Aurora.

### Table 2-1. 83D/83L Bus Boardings and Alightings – Downing to Quebec

<table>
<thead>
<tr>
<th>Peak</th>
<th>Direction</th>
<th>Average Boardings</th>
<th>Average Alightings</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Eastbound</td>
<td>4.2</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>Westbound</td>
<td>13.1</td>
<td>16.2</td>
</tr>
<tr>
<td>PM</td>
<td>Eastbound</td>
<td>12.0</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>Westbound</td>
<td>14.1</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Source: RTD Tritapt data, route 83 August – December 2015

TRANSIT PUBLIC INPUT
- Add shelters and bike racks at bus stops
- Improve maintenance of bus stops
- Increase the number and frequency of buses
- Provide better sidewalk connections to transit stops
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Future Transit Conditions
Population and employment growth in the corridor is expected to increase transit travel demand through the year 2040 and beyond. It is expected that increasing roadway congestion could encourage drivers to switch to transit, increasing transit demand at an even greater rate than vehicular travel demand.

RTD conducted travel model runs using the latest version of the DRCOG Compass model to estimate projected transit growth within the corridor. Average existing (2015) weekday ridership is projected to increase by approximately 48 percent between 2015 and 2040 without service changes such as increased frequency, faster travel time or improved reliability, which would result in even higher growth in ridership.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Bicycle and Pedestrian Facilities

The Cherry Creek Trail, one of Denver’s most popular and utilized bicycle and pedestrian facilities, is used extensively seven days a week by recreational bicyclists, commuters, and pedestrians across the city. It runs directly adjacent to the western portion of the corridor and veers slightly south, away from the corridor, moving to the east. All told, this multiuse trail is 40-miles long and connects Downtown Denver and the Cherry Creek Reservoir. Regionally, the trail also connects to the South Platte River Greenway and Trail in Downtown Denver and facilitates connections to the Highline Canal Trail in southeast Denver.

The facility is a prized asset in Denver but its popularity can result in conflicts, particularly with the high volume of users and speed differences between pedestrians and bicyclists. The facility travels below grade for much of the study area and provides stormwater management; consequently, following heavy rains, the trail is often flooded and temporarily unusable.

The Speer/Leetsdale corridor naturally breaks into two distinctive corridors for people walking and biking; the western portion, which is well served by the Cherry Creek Trail, and the eastern portion (Alameda Avenue and Leetsdale Drive), which lacks a premium bicycle or pedestrian facility. While the trail serves as a good complement to the western portion of the corridor, it veers away moving east providing less direct support to cyclists and pedestrians who want to access Leetsdale. The segments below describe the trail.

Broadway to Downing Street

The western portion of the corridor is generally good for walking and biking. The Cherry Creek Trail anchors this portion of the study area. The 10-foot concrete trail is below grade and parallels Cherry Creek, offering a high ease of use facility for pedestrians and bicyclists of all ages and abilities.

There are no street-level bike facilities along Speer Boulevard and sidewalks are inconsistent and disjointed. Some access points have stairs but no ramps to accommodate bicycles.

Downing Street to University Boulevard

East of Downing Street, the Cherry Creek Trail rises to street level and runs adjacent to the Denver Country Club with no buffer between the trail and the roadway. A standard 5-foot sidewalk with an 8-foot buffer runs along the north side.

The existing shared-use sidewalk has a striped centerline and functions as a side path but is too narrow (8 feet) to comfortably and safely accommodate the high volumes and a mix of users and ability levels.

A significant number of comments and feedback from the public throughout this process confirm that users feel that the Cherry Creek Trail, in this location, is too narrow to feel safe and comfortable.

BIKE AND PEDESTRIAN GUIDELINES

The current Department of Public Works Standard Cross Sections indicate that for a six-lane arterial, the minimum width of the sidewalk shall be 8-feet with a 12-foot tree lawn.

The 1999 American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities states, “Under most conditions, a recommended paved width for a two-directional shared-use path is 10-feet. Under certain conditions, it may be necessary or desirable to increase the width of a shared-use path to 12 to 14-feet due to substantial use by bicycles, joggers, skaters, and pedestrians.”

University Boulevard to Mississippi Avenue

East of University Boulevard, the Cherry Creek Trail veers south of Speer Boulevard, crosses under University, and travels parallel to Cherry Creek North Drive (immediately south of the Cherry Creek Shopping Center). East of Colorado Boulevard at Cherry Street, the Cherry Creek Trail is located roughly ¼-mile south of Leetsdale Drive but it veers nearly a mile south of the corridor at Quebec Street. This means that users cannot easily access the trail as an off-street option to Leetsdale Drive with the same ease as users along Speer Boulevard in the western portion of the corridor.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Sidewalks can be found on both sides of Leetsdale Drive. However, the sidewalks lack buffers between vehicular traffic, are often obstructed or narrowed by the placement of utility poles, create safety issues due to the unobstructed access and proliferation of curb cuts, and generally feel uncomfortable for users. Public feedback indicated that the poor quality of the existing sidewalk on the Leetsdale portion of the corridor significantly detracts from the walkability and appeal.

Bike and Pedestrian Crossings

An inventory of existing bicycle and pedestrian facilities was conducted and noted the presence or absence of curb ramps, painted crosswalks, pedestrian waiting areas, potential points of conflict with turning vehicles (e.g., channelized free-right turns), etc. Several challenging bicycle and pedestrian crossings were identified throughout the corridor. Go Speer Leetsdale recommendations address these gaps.

BIKE AND PED PUBLIC INPUT

- Improve on-street connections to the Cherry Creek Trail
- Provide better signage, wayfinding, and lighting
- Mix of pedestrians/slower bicyclists and faster bicyclists causes friction and safety concerns
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

One or more crashes involving a bike and/or pedestrian were reported at the locations listed in Table 2-2.

Table 2-2. Bicycle and Pedestrian Crashes 2012 through 2014

<table>
<thead>
<tr>
<th>Bike/Pedestrian Crashes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Speer/Broadway</td>
<td>1</td>
</tr>
<tr>
<td>Speer/Lincoln</td>
<td>8</td>
</tr>
<tr>
<td>Speer/Grant</td>
<td>2</td>
</tr>
<tr>
<td>Speer/Washington</td>
<td>1</td>
</tr>
<tr>
<td>Speer/Clarkson</td>
<td>1</td>
</tr>
<tr>
<td>Speer/Downing</td>
<td>1</td>
</tr>
<tr>
<td>1st/Gilpin</td>
<td>1</td>
</tr>
<tr>
<td>1st/University</td>
<td>3</td>
</tr>
<tr>
<td>1st/Clayton</td>
<td>3</td>
</tr>
<tr>
<td>1st/Milwaukee</td>
<td>1</td>
</tr>
<tr>
<td>Steele/Ellsworth</td>
<td>3</td>
</tr>
<tr>
<td>Steele/Bayaud</td>
<td>1</td>
</tr>
<tr>
<td>Alameda/Colorado</td>
<td>1</td>
</tr>
<tr>
<td>Leetsdale/Cherry</td>
<td>3</td>
</tr>
<tr>
<td>On Leetsdale between Dahlia &amp; Elm</td>
<td>1</td>
</tr>
<tr>
<td>On Leetsdale between Locust &amp; Monaco</td>
<td>1</td>
</tr>
<tr>
<td>Leetsdale/Monaco</td>
<td>2</td>
</tr>
<tr>
<td>On Leetsdale between Monaco &amp; Niagara</td>
<td>1</td>
</tr>
<tr>
<td>Leetsdale/Oneida</td>
<td>3</td>
</tr>
<tr>
<td>On Leetsdale between Oneida and Quebec</td>
<td>3</td>
</tr>
<tr>
<td>Leetsdale/Quebec</td>
<td>5</td>
</tr>
<tr>
<td>On Leetsdale/Parker between Quebec and Mississippi</td>
<td>2</td>
</tr>
<tr>
<td>Leetsdale/Parker at Mississippi</td>
<td>7</td>
</tr>
</tbody>
</table>

Future Bicycle and Pedestrian Conditions

Due to population growth expected in the Denver region between now and the year 2040, projected demand for bicycle and pedestrian facilities is expected to increase. An increase in the number of pedestrians and bicyclists will create more congestion on multimodal facilities that are already in high demand. As a result, some trail users may decide to use an alternate route or forego their trip by foot or bike. The challenges present today including poor connectivity throughout the eastern corridor, challenging crossings, difficult trail-to-street connections, a lack of dedicated bicycle facilities along Leetsdale Drive, and missing and poor sidewalks, are all expected to persist and potentially worsen in the future.

Several projects within the study area are currently in planning or design phases independent of this effort and include bicycle and pedestrian improvements. These projects include:

- A bicycle/pedestrian underpass of the High Line Canal under Parker Road at Mississippi Avenue—planned for construction in 2018-2019.
- A Denver Moves Bikes recommended network of enhanced on-street bicycle facilities throughout Denver with numerous facilities that complement or connect to the Cherry Creek Trail.
- A shared-use path connecting Pulaski and Burns parks near the center of the corridor is recommended in the Cherry Creek Area Plan but funding for further planning, design, and construction has not yet been identified.
- A neighborhood bikeway and associated improvements along Garfield Street from 1st Avenue south to Dakota Avenue—planned for construction in 2017.
- Intersection improvements at 1st Avenue and Steele Street; funding has been identified for conceptual design but not for construction.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Travel Speeds and Travel Times

Travel times by travel direction during weekday AM and PM peak periods are illustrated in Figure 2-10 and described in the following section.

Figure 2-10. Existing Travel Time by Mode and Direction

Automobile

Automobile travel time data were collected using “floating car runs.” For each floating car run, a vehicle was driven the length of the corridor several times during the weekday AM and PM peak periods. Travel time and average speed were recorded using Global Positioning System (GPS) monitoring. Three to four floating car runs were recorded in each direction during each peak period. The average corridor auto travel time measured was 25 minutes in the weekday AM peak hour westbound and 29 minutes eastbound in the PM peak hour.

Bus Transit

Travel speeds for bus travel along the Speer/Leetsdale corridor were calculated using data collected on the RTD 83L and 83D buses. TriTapt is a software used by RTD to track and analyze its transit service performance. Onboard computers on RTD buses record travel times, delays, dwell times (time bus spends at bus stop boarding and alighting passengers), and ridership. The TriTapt data for the 83L and 83D were used to determine the average weekday AM and PM peak hour bus travel times and average speeds. Average corridor bus travel time was 28 minutes in the AM peak hour westbound and 42 minutes eastbound in the PM peak hour, reflecting the higher vehicle volumes and congestion present on the corridor in the afternoon peak period.

TRAVEL TIME PUBLIC INPUT

- Transit travel needs to be faster and more reliable
- Increased vehicular travel times may result in drivers searching out alternate routes
For bicycle travel times, it was assumed that bicyclists prefer riding on designated bicycle facilities where possible. If designated bicycle facilities are not present, it was assumed that bicyclists will gravitate toward logical routes on adjacent residential streets with lower traffic volumes and with limited out of direction travel and the fewest number of turns. Google Maps and the Strava Global Heatmap were used to identify the likely route preferences. The Strava Heatmap is illustrated in Figure 2-11.

Estimated on-street bicycle travel times were estimated at approximately 9 miles per hour (mph), and off-street/trail bicycle travel times were estimated to be approximately 13 mph. Pedestrian travel times were estimated to be approximately 2 mph, per the 2015 Transportation Research Board's paper titled, “Alternative Methods to Calculate Pedestrian Catchment Areas for Public Transit.” The estimated time to traverse the corridor by bicycle is 38 minutes whereas walking is estimated to take approximately 2 hours.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Crash Data Analysis

During the three-year study period (2012–2014), there were 1,525 total reported crashes on the corridor. Figure 2-12 illustrates the crash types. The majority (79 percent) were property damage only (PDO) crashes. In addition, there were 310 injury crashes and 6 fatal crashes.

Table 2-3 summarizes the locations where most crashes occur along the corridor and lists the most significant crash types at each location.

Table 2-3. Top 10 Crash Locations and Characteristics, 2012-2014

<table>
<thead>
<tr>
<th>Location</th>
<th>PDO</th>
<th>Injury</th>
<th>Fatal</th>
<th>Total</th>
<th>Significant Crash Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB Speer Boulevard &amp; Lincoln Street</td>
<td>37</td>
<td>8</td>
<td>1</td>
<td>46</td>
<td>No significant type</td>
</tr>
<tr>
<td>Lincoln Street &amp; 6th Avenue</td>
<td>61</td>
<td>6</td>
<td>0</td>
<td>67</td>
<td>No significant type</td>
</tr>
<tr>
<td>1st Avenue &amp; University Boulevard</td>
<td>64</td>
<td>16</td>
<td>0</td>
<td>80</td>
<td>SSD (19)</td>
</tr>
<tr>
<td>Steele St &amp; Ellsworth Avenue</td>
<td>50</td>
<td>8</td>
<td>0</td>
<td>58</td>
<td>Approach Turn (14)</td>
</tr>
<tr>
<td>Alameda Avenue &amp; Colorado Boulevard</td>
<td>53</td>
<td>6</td>
<td>0</td>
<td>59</td>
<td>Rear End (37), SSD (10)</td>
</tr>
<tr>
<td>Leetsdale Drive/ Parker Road &amp; Quebec St</td>
<td>72</td>
<td>15</td>
<td>2</td>
<td>89</td>
<td>Pedestrian (5), SSD (22)</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Alameda Avenue</td>
<td>50</td>
<td>8</td>
<td>0</td>
<td>58</td>
<td>SSD (21)</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Monaco Parkway</td>
<td>50</td>
<td>18</td>
<td>0</td>
<td>68</td>
<td>SSD (9)</td>
</tr>
<tr>
<td>Leetsdale Drive Between Oneida/ Quebec</td>
<td>44</td>
<td>10</td>
<td>0</td>
<td>54</td>
<td>No significant type</td>
</tr>
<tr>
<td>Leetsdale Drive/ Parker Road &amp; Mississippi Avenue</td>
<td>28</td>
<td>14</td>
<td>0</td>
<td>42</td>
<td>SSD (7), Bicycle (7)</td>
</tr>
</tbody>
</table>

Notes
SSD = Sideswipe Same Direction
PDO = Property Damage Only
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Bicycle and Pedestrian Safety Issues

There were 26 reported crashes involving pedestrians and 30 reported crashes involving bicycles on the corridor between 2012 and 2014.

Of the crashes involving pedestrians, there were 5 Property Damage Only (PDO) crashes, 16 injury crashes, and 5 fatal crashes. The intersection with the most crashes involving pedestrians was Leetsdale Drive/Parker Road/Quebec Street (5); there were 3 injury crashes and 2 fatal crashes at this location. The other pedestrian fatalities occurred at the intersections of 1st Avenue and Downing (1), Leetsdale Drive between Quince Street and Quebec Street (1), and Leetsdale Drive/Parker Road between Quebec and Mississippi (1).

For the crashes involving bicycles, 8 were PDO crashes, 21 injury crashes, and 1 fatal crash. The intersections with the most crashes involving bicycles were Leetsdale Drive/Parker Road/Mississippi Avenue (7) and at westbound Speer Boulevard/Lincoln Street (4). The fatal crash occurred at Speer Boulevard and Lincoln Street.

A bicycle/pedestrian underpass of the High Line Canal Trail at Parker Road/Mississippi Avenue at the southern terminus of the study corridor is funded and construction is anticipated in 2018-2019. This project will address bike and pedestrian safety at this intersection which experiences the highest volume of recorded bicycle crashes in the corridor.

Vehicular Safety Issues

The magnitude of safety problems on select sections of the corridor and intersections can be assessed using Safety Performance Function (SPF) methodology. SPF reflects the complex relationship between exposure (measured in Average Daily Traffic [ADT]) and the crash count for a section of roadway or intersection. The SPF models provide an estimate of the expected crash frequency and severity for a range of ADT among similar facilities.

Development of the SPF informs the Levels of Service of Safety (LOSS). The LOSS represents the degree of deviation from the expected crash frequency and the potential for correction:

• LOSS I – Indicates low potential for crash reduction
• LOSS II – Indicates low to moderate potential for crash reduction
• LOSS III – Indicates moderate to high potential for crash reduction
• LOSS IV – Indicates high potential for crash reduction

LOSS can be calculated at an intersection for both total number of crashes and number of injury and fatal crashes.

Nine intersections along the Speer Boulevard/Leetsdale Drive corridor were shown to have LOSS III or LOSS IV, indicating that they have a moderate to high or high potential for crash reduction. These intersections are listed in Table 2-4.
### Existing and Future Corridor Conditions

#### Table 2-4. Intersections with a Moderate to High or High Potential for Crash Reduction

<table>
<thead>
<tr>
<th>Location</th>
<th>Level of Service of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Avenue &amp; Gilpin Street</td>
<td>LOSS III for Total Crashes and LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>1st Avenue &amp; Clayton Lane</td>
<td>LOSS IV for Total Crashes and LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>1st Avenue &amp; Milwaukee Street</td>
<td>LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>Steele Street &amp; Ellsworth Avenue</td>
<td>LOSS IV for Total Crashes and LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Cherry Street</td>
<td>LOSS III/IV for Total Crashes</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Elm Street</td>
<td>LOSS III for Total Crashes and LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Niagara Street</td>
<td>LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
<tr>
<td>Leetsdale Drive/Parker Road &amp; Quebec Street</td>
<td>LOSS III for Total Crashes</td>
</tr>
<tr>
<td>Parker Road &amp; Mississippi Avenue</td>
<td>LOSS III for Injury &amp; Fatal Crashes</td>
</tr>
</tbody>
</table>

As previously mentioned, rear-end crashes were the predominant crash type on the corridor from 2012 to 2014, with several reported incidences along the Leetsdale portion of the corridor.

Leetsdale Drive is one of the narrower portions of the corridor. With a five-lane cross section, the corridor experiences significant congestion during the peak periods in addition to having a high number of private access points (curb cuts). These are all contributing factors to the high frequency of rear-end crashes. Due to the significant degree of traffic congestion on this portion of the corridor during peak periods, many of these crashes are PDO crashes because of the slow travel speeds and stop-and-go nature of traffic.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

Land Use and Populations

In general, land uses and related zoning west of Colorado Boulevard have a predominantly urban neighborhood context (Urban, Urban Center, and General Urban). Urban zone districts generally include more compact building forms, zero or small setbacks, larger building footprints on lot parcels, and lower parking requirements.

Land uses in the western portion of the corridor provide a gateway to Downtown and midtown areas of Denver. The frequency of retail and office properties increases with proximity to Downtown with a mix of building densities. The corridor is primarily lined with commercial buildings closer to Downtown and several multifamily buildings. Access is typically provided via side streets, and there is no on-street parking provided along the western portion of the corridor itself. The Denver Country Club and Cherry Creek Shopping District area are major destinations in the western area.

The eastern portion of the study area is a transitional area with a shift from urban to more suburban land uses. Commercial uses along the east side of the corridor reflect a suburban commercial corridor pattern, with buildings set back from the property line, intermittent vacant properties, and parcels used primarily for parking or other non-active uses. The areas adjacent to the corridor are primarily characterized by single family residential land uses, although there are blocks devoted to large-scale multifamily buildings.

Some properties south of Leetsdale Drive and east of Colorado Boulevard are within the City of Glendale and are primarily zoned as regional retail and urban neighborhood Planned Unit Development (PUD). The City of Glendale is within Arapahoe County and is a Home Rule Municipality with the majority of the space dedicated to commercial development with office and residential high rises. The recently constructed Infinity Park sports and entertainment complex serves as one of the major destination areas. The retail center, anchored by a Super Target, off the southeast corner of Alameda Avenue and Colorado Boulevard, is also a major destination.

Other major destinations on the eastern portion of the study area include the Jewish Community Center, the Greek Orthodox Church, and George Washington High School.

Socioeconomic Characteristics

Socioeconomic characteristics of the study area were reviewed to identify the prevailing characteristics of the neighborhoods along the corridor including minority, low-income, and aging populations. These characteristics and vehicular ownership patterns were reviewed to identify the likelihood of adjacent residents utilizing travel modes other than single occupancy vehicles. The analysis was completed using the 2014 Census data, the most recent data available when the analysis was complete. In recent years the Denver metropolitan area has experienced substantial growth that may shift these numbers in future years.

Minority Populations

Minority is defined as a person who is Black/African American, Hispanic/Latino, Asian, American Indian/Alaskan Native, or Native Hawaiian/Other Pacific Islander (FHWA 2012). Minority populations are defined as any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons who will be similarly affected by a proposed transportation program, policy, or activity.

Of the people living in the study area between 2010 and 2014 and as noted in U.S. Census data, 81.5 percent identified as White; 8.6 percent identified as African American; 9.6 percent identified as Hispanic; 4.0 percent identified as Asian; 2.6 percent of some other race, and 2.9 percent are of two or more races. There were no populations that identified as Native Hawaiian or Pacific Islander.

For consideration, during the period between the year 2000 and the 2010–2014 Census American Community Survey, the corridor’s non-minority population increased by 10.5 percent; the African American population increased by 91.9 percent; the Asian population increased by 27.1 percent; and the Hispanic population changed by 19.6 percent. Overall, the racial and ethnic composition of the study area is diversifying over time.
CHAPTER 2: EXISTING AND FUTURE CORRIDOR CONDITIONS

In general, the west side of the corridor adjacent to Speer Boulevard has between 10 and 30 percent minority populations. The composition of the minority populations changes to the east, with minority populations ranging from 31 to 60 percent between Eudora Street and Holly Street and between Monaco Parkway and Quebec Street. East of Quebec Street to the end of the study area, minority populations are greater than 60 percent.

Data also indicate that approximately 8,000 people or 14 percent of the population living in the study area are foreign born. Census defines foreign born as anyone who is not a US citizen at birth.

Low-Income Households
In 2014, the number of households in the study area was about 33,000. Toward the west end of the corridor, between Broadway and Downing, the low-income households per census block group ranged between 10 and 30 percent. Surrounding the Denver Country Club, less than 10 percent of households were low income. The areas around the Cherry Creek Shopping Center, University to Madison, ranged between 31 and 60 percent for low income. This is partly linked to the presence of a large retirement facility and several apartment buildings. As the study area extends to the east between Colorado and Quebec, low income populations ranged between 10 and 60 percent. At the very east end of the corridor (Quebec to Mississippi Avenue), low-income households are greater than 60 percent.

Zero Vehicle Households
As part of the analysis, households who do not own any motorized vehicles (zero vehicle households) by census block group were analyzed. The importance of evaluating zero vehicle households is to understand where the majority of such households occur because those populations would generally be more reliant on alternative modes of transportation such as transit, walking, or biking. Generally, the eastern portion of the study area had higher numbers of households that were classified as zero vehicle. This trends with the minority population and low-income households, which are also concentrated to the eastern portion of the study area.

Aging Populations (Age 65+)
Throughout the study area, nearly 13 percent of the population are ages 65 or older (65+), compared to approximately 11 percent in the City and County of Denver and nearly 12 percent in the state of Colorado. This shows that the study area has a slightly higher aging population when compared to the state as a whole.

Households with people older than 65 by census block group were analyzed. The importance of evaluating households with people 65 and older is to gain an understanding of areas where vehicular ownership may be less and where residents may travel by transit or walking at rates higher than other areas. Generally, aging populations are spread evenly throughout the study area, with a higher density of aging populations near the Cherry Creek neighborhoods, due to the presence of several retirement facilities.
CHAPTER 3: VISION AND PURPOSE & NEED

This chapter describes the vision for the corridor as well as the purpose and need. The vision and purpose and need statements were developed with input from the Project Management Team (PMT), Technical Working Group (TWG), Stakeholder Working Group (SWG), and from the public at the first project open house.

**Vision:** Statement on the aspiration, long-term role of the corridor.

**Purpose:** Describes the reason enhancements would be implemented along the corridor—typically to address the needs.

**Need:** Describes existing and future corridor mobility problems along the corridor that need to be corrected.

**Corridor Vision Statement**

The corridor vision statement was developed to provide a roadmap for transformative change for the entire corridor. This statement also provides a guiding framework for the statement of purpose and need.

The Speer/Leetsdale Corridor is a place where:

- Transportation systems and facilities contribute to “complete communities” by promoting choices for the comfortable and efficient movement of people and goods; inspiring sustainable urban development patterns; and providing convenient and safe access to jobs and other activities.

- There is a viable choice to leave automobiles at home and take advantage of an efficient, safe, well-maintained, comfortable, and seamless network of transit and accessible pedestrian and bicycle routes.

- Technology advances “out of the lab” and onto the street in support of an innovative and highly functional multimodal corridor.

- Regional and local agencies, businesses, and stakeholders partner to protect the environment and to design and help implement a corridor that is a source of community pride and healthy living.

**DEVELOPING A VISION**

The newspaper headlines below were created by members of the SWG to help illustrate mobility issues existing today (tan headlines) as well as aspirations for the future corridor (white headlines). These were used to inform the development of the corridor vision statement.
Purpose and Need

What is the Purpose of Go Speer Leetsdale?

Go Speer Leetsdale is a comprehensive strategy to implement a variety of transportation improvements along the Speer/Leetsdale corridor that can equitably and cost-effectively accommodate the corridor’s current and growing person-trip demand.

Improvements associated with Go Speer Leetsdale will help realize the vision statement by improving existing transportation options and providing additional mobility and access options for all individuals who use the corridor while improving quality of life and economic development opportunities.

What challenges do future improvements need to address?

Today it’s clear that the corridor serves a variety of users. The 2015 and 2040 DRCOG regional travel models (Compass) were used to analyze study area household and employment patterns. In 2015, there were approximately 81,570 households and 79,400 jobs located within ¾-mile of the corridor.

In the future, even conservative estimates anticipate a notable amount of growth along the corridor. For example, the regional travel model estimates indicate that the number of households and jobs in the study area will increase by 17,350 (18 percent) and 2,550 (3 percent) respectively. This growth is expected to increase travel demand throughout the corridor, add to current levels of congestion, and create mobility needs described below.

Bicycle Mobility

There is a need to address inadequate and disconnected bicycle facilities along the corridor.

• Along Speer, the Cherry Creek Trail runs below grade and can be difficult to access. In addition, some access points have stairs but do not offer ramps to accommodate bicycles.

• Along Leetsdale Drive, there is no designated bicycle facility and there are limited opportunities to connect to the corridor via existing bicycle routes.

There is a need to address congestion and perceived safety concerns for bicyclists along the corridor.

• While the Cherry Creek Trail provides a state-of-the-art bicycling facility, the trail is heavily used and at times is over capacity. Demand for this bicycle facility is expected to increase as the regional population grows, which will lead to more congestion along the trail.

• Along 1st Avenue, the Cherry Creek Trail is utilized by bicyclists and pedestrians as well as transit patrons waiting to board the bus. Demand exceeds the comfortable capacity of the facility and the trail’s proximity to the street reduces users’ perceived safety.

• There is a need to address numerous locations with documented bicycle safety concerns. There were 30 reported crashes involving bicycles on the corridor between 2012 and 2014. Most occurred at just two key locations (Parker Road/Mississippi Avenue and Lincoln Street/Westbound/Speer Boulevard). The number of crashes at Parker Road/Mississippi Avenue is considered statistically significant compared to other similar intersections.

Pedestrian Mobility

There is a need to address inadequate and disconnected pedestrian facilities.

• The corridor has multiple segments without sidewalks or that lack buffers between pedestrians and vehicular traffic. Public feedback indicated that the poor quality of the existing sidewalk network significantly detracts from the walkability and appeal of particular areas.
CHAPTER 3: VISION AND PURPOSE & NEED

There is a need to address the comfort and ease of use of some pedestrian facilities.

- The popularity of the Cherry Creek Trail results in conflicts for pedestrians, particularly with bicyclists who travel too fast.

There is a need to address numerous locations with documented pedestrian safety concerns.

- There were 26 reported crashes involving pedestrians and vehicles on the corridor between 2012 and 2014. The Leetsdale/Parker and Quebec Street intersection experienced five of these crashes and this volume was considered statistically significant compared to other similar intersections.

**Transit Mobility**

There is a need to address unreliable transit travel times and delays that result from vehicular congestion.

- Transit operations along the corridor are affected by significant peak period congestion, resulting in unreliable travel times and delays for transit users.

There is a need to address inadequate accessibility and low rider comfort at transit stops.

- Several bus stops lack basic amenities, such as benches, shelters, and sidewalks, resulting in a low level of comfort for transit users and low ridership.

There is a need to accommodate increased transit ridership.

- RTD projections indicate that ridership could increase by nearly 50 percent (up to 6,500 boardings per day) in 2040.

**Vehicular Mobility**

There is a need to address intersections and corridor locations with higher than expected crash frequency and severity.

- There were 1,525 total reported crashes on the corridor between 2012 and 2014. Nine intersections along the Speer Boulevard/Leetsdale Drive corridor were shown to have a moderate to high potential for crash reduction.

There is a need to address inefficiencies in traffic signal timing and operations at key intersections.

**Transportation Access and Equity**

There is a need to address limited convenient and cost-effective mobility options for all users of the corridor.

- In 2014, 47 percent of households in the study area had an annual income of less than $50,000 as compared to 42 percent of people in the state of Colorado.

- There are also segments of the corridor where there are a higher number of zero-vehicle households. These areas are found near the Cherry Creek Shopping Center, along Speer Boulevard, and at intermittent locations along Leetsdale Drive.

**Livability Needs to Address**

There is a need to address limited transportation solutions that support livability and a high quality of life.

- Current transportation options do not fully support typical livability criteria to provide convenient, accessible, healthy, low-cost alternatives for travelers to access economic opportunities, medical care, and social activities.
Recommended Alternative

The project team developed the Recommended Alternative using an extensive evaluation process as well as input obtained during public engagement activities conducted during this study. The Recommended Alternative strives to balance the previously identified corridor needs and public concerns.

The Recommended Alternative was identified as having the greatest potential to:

- Improve the person carrying capacity of the corridor
- Improve transit travel time and reliability
- Improve safety and operations for all modes of transportation
- Enhance economic development opportunities
- Address the overall project Purpose and Need

This chapter describes:

- Each improvement included in the Recommended Alternative
- Evaluation process and evaluation criteria
- Alternatives development and evaluation results

Figure 4-1 illustrates the main components of the Recommended Alternative. Projects are identified by type and number. Projects are color coded on the figure and in the subsequent text to differentiate modal improvements and between project types. Existing bicycle facilities are shown in dark green while Denver Moves Bicycle projects are illustrated in light green. These projects form the foundation of Denver’s bicycle network and are complemented by the bicycle and pedestrian capacity improvements (light blue) and new/improved projects (yellow) included in the Recommended Alternative. Transit components are illustrated in red.

Figure 4-2 and Figure 4-3 illustrate typical Recommended Alternative intersection layouts along 1st Avenue and Leetsdale Drive, respectively.

Recommended Alternative: Other Plans & Studies

Several transportation plans and studies include recommendations and projects along the Speer/Leetsdale corridor. The Recommended Alternative supports and is compatible with the following projects:

**Denver Moves Bicycle Projects:**

Several bicycle projects included in Denver Moves Bikes support the Recommended Alternative. These are included in the Recommended Alternative and illustrated on Figure 4-1.

**The Garfield Street Neighborhood Bikeway Feasibility Study**

The Garfield Street Neighborhood Bikeway Feasibility Study recommended signalizing the intersection and including bicycle detection, bicycle and pedestrian signals, pedestrian push buttons, bike boxes with passive bicycle signal detection, and bicycle specific wayfinding pavement markings.

**1st Avenue and Steele Street Alternatives Evaluation**

A separate study is already programmed to further the preferred intersection design concept identified in the 1st Avenue and Steele Street Alternatives Evaluation Study process (2014). This concept would return the intersection to a more typical design, reduce conflict points and crossing distances for pedestrians and bikes, and reduce overall delay for drivers and transit.
Figure 4-1.  Recommended Alternative
Figure 4-2. Recommended Alternative: Typical 1st Avenue Intersection Layout
Figure 4-3. Recommended Alternative: Typical Leetsdale Drive Intersection Layout
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Recommended Alternative: Transit Improvements

The transit component of the Recommended Alternative includes the reversible managed transit lane and “Buses and Right Turn Only” managed transit lane to provide transit improvements corridor-wide. Together, these improve travel time and reliability to allow Bus Rapid Transit service along the corridor.

**T1 - Managed Transit Lane**

On the western side of the corridor, from Broadway/Speer Boulevard to Steele Street/Bayaud Avenue, the outermost (right) lane would be repurposed to operate as a “Buses and Right Turn Only” managed lane, as shown on Figure 4-4.

While the Recommended Alternative suggests allowing right turns to use the lane in addition to buses, several other managed lane strategies could be used if the need or opportunity arises. These strategies include high-occupancy vehicle (HOV), toll, autonomous vehicle, or alternative fuel vehicle lanes.

**T2 - Reversible Managed Transit Lane**

On the eastern side of the corridor, between the Steele Street/Bayaud Avenue intersection and Parker Road/Mississippi Avenue intersection, the bus would operate in a reversible managed transit lane in the center of Leetsdale Drive. Private autos would be prohibited at all times.

The reversible managed transit lane would replace the existing two-way-left-turn-lane (TWLTL) on Leetsdale Drive. Signalized intersections would be reconstructed to provide new left-turn bays adjacent to the transit lane.

**Figure 4-5** illustrates the existing and recommended typical Leetsdale Drive cross sections.

Intersections within the managed reversible bus lane area will need to be designed to address the following elements:

- Bus stop location
- Interaction with the proposed shared use path
- Bicycle and pedestrian connections to all bus stops
Figure 4-5. Reversible Managed Transit Lane Cross Section – Leetsdale Drive

Figure 4-6 illustrates a typical signalized intersection design accommodating both the reversible managed transit lane and vehicular left-turn movements.

Because the reversible managed lane would replace the existing TWLTL, left turns from Leetsdale Drive would be restricted to signalized intersections only.

Median bus stops would accompany the reversible managed transit lane, at signalized locations, with far-side transit station platforms at signalized intersections to facilitate easy passenger access.

Passenger information would be added to each stop to inform riders about real time bus arrivals, the direction of bus service, and boarding location.
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Figure 4-6. Intersection Concept with Reversible Managed Transit Lane

Detached Sidewalk (future design will determine if sidewalk operates most efficiently on the north or south side of Leetsdale)

Westbound Median Bus Station

*Reversible Managed Transit Lane reflects “red” pavement treatment for illustrative purposes only.

Eastbound Median Bus Station

Shared Use Path (future design will determine if path operates most efficiently on the north or south side of Leetsdale)
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Recommended Alternative: Bicycle and Pedestrian Improvements

The following section summarizes the bicycle and pedestrian (BP) improvements included in the Recommended Alternative.

BP 1 - Leetsdale Drive Shared Use Path and Sidewalk

The Recommended Alternative includes an 11-foot shared use path on one side of Leetsdale Drive (see Figure 4-7) and a detached 6-foot sidewalk on the other side of Leetsdale Drive. These would replace the existing sidewalks currently on either side of the corridor. At intersections and select locations along the corridor, the shared use path and sidewalk width may need to be reduced to accommodate right-of-way constraints. Future study and design efforts will also determine if the shared use path operates most efficiently on the north or south side of Leetsdale Drive.

Figure 4-7. Leetsdale Drive Shared Use Path

Source: Toole Design Group, 2017

FUTURE EVALUATION OF THE SHARED USE PATH

Bicycle and pedestrian count data help to establish a better understanding of how people are using the public right-of-way. These data provide crucial information related to use patterns, trends, and crash rates that help planners, engineers, and decision-makers evaluate the performance of existing and potential facilities.

Count data can be used to explore access to Leetsdale Drive to better inform the alignment and design of the shared use path and determine high-priority locations for improved bicycle signal detection.

Additional short duration counts should be gathered throughout the corridor to supplement the continuous counts and to establish baseline ridership before implementing the bicycle recommendations included in this plan.

BP 2 - Capacity Improvements on the Cherry Creek Trail between Broadway and Downing Street

The Recommended Alternative includes capacity improvements on the Cherry Creek Trail between Broadway and Downing by widening the existing trail facility or building a parallel facility to separate bicyclists from pedestrians similar to the facility northwest of Colfax Avenue.

This stretch of the Cherry Creek Trail is one of the most heavily used sections in the corridor and users feel that it is at or over capacity. This was one of the most requested bicycle and pedestrian improvements heard during the Go Speer Leetsdale public outreach process.

BP 3 - Capacity Improvements Along 1st Avenue Between Downing Street and University Boulevard

The Recommended Alternative includes capacity improvements on the Cherry Creek Trail (shared sidewalk) between Downing and University. Additional width will provide more space to better accommodate the variety and high volume of modes that use this constrained section of the trail.
Any widening will require coordination with the Denver Country Club to acquire right-of-way or an easement.

**BP 4 – Capacity Improvements Along 1st Avenue Between University Boulevard and Steele Street**

The Recommended Alternative also includes capacity improvements along 1st Avenue between University Boulevard and Steele Street. A separate study, looking at bicycle and pedestrian capacity improvements, is being conducted in parallel with this study and is recommending a specific cross section for this portion of 1st Avenue. The cross section was not yet available during development of this report.

**BP 5 – New Bicycle Facility on 4th Avenue**

The Recommended Alternative includes a new bicycle facility on 4th Avenue between Washington Street and Williams Street. This project would be an extension of the proposed Denver Moves neighborhood bikeway on 4th Avenue between Williams Street and Garfield Street. This new facility would provide neighborhood connections to the Denver Moves proposed bike lanes on Washington Street and Clarkson Street in addition to providing a parallel route to the Cherry Creek Trail.

**BP 6 - Improve D16 on Exposition Avenue**

Signed bike route D16 currently provides a bicycle connection between Four Mile Historic Park and the Garland Greenbelt Trail along Kearney Street. Both connections provide access to the Cherry Creek Trail.

The Recommended Alternative includes making this route a more established, permanent bicycle facility. Options include adding pavement markings and/or designating a bike lane on the route.

**BP 7 - Improve D15 on Dahlia Street**

Signed bike route D15 currently extends north of Leetsdale Drive on Dahlia Street and south of Leetsdale Drive on Cherry Street. It is connected by a shared-use sidewalk on Leetsdale Drive.

The Recommended Alternative includes formalizing this route with physical improvements such as striping, in addition to the existing signing, to make drivers aware of the facility and the presence of bicycles.

**BP 8 - Improve Pulaski Park and Burns Park Connection on Alameda Avenue**

The Cherry Creek Area Plan recommends the creation of a signature multimodal street along Alameda Avenue to provide a safe and comfortable pedestrian and bicycle connection between Burns Park, Pulaski Park, and the Cherry Creek Trail. The recommendation includes:
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

- A bicycle/pedestrian connection on the north side of Alameda Avenue between Burns Park and Pulaski Park
- An improved crossing for pedestrians and bicycles at Garfield Street and Alameda Avenue
- A study evaluating the potential to reconfigure Madison Street, Alameda Avenue, and Cherry Creek North Drive

The study specifies that the concept requires further testing and design to determine cost and feasibility. Further evaluation and design of the recommendation from the Cherry Creek Area Plan could be completed simultaneously with the Leetsdale Drive shared use path location to ensure an efficient connection of the two facilities. Coordination with the reversible managed transit lane design would be required to ensure that improvements would not preclude the transit project.

BP 9 - New Marion Parkway and Dakota Avenue Trail Alignment

The Recommended Alternative includes an alternate bike route between Downing Street and University Boulevard to increase east-west capacity on a parallel route. This could be achieved by adding signing and/or striping along Marion Parkway and Dakota Avenue.

BP 10 to BP 22 - Sidewalk Improvements

The Recommended Alternative includes the construction or improvement of sidewalks in the following locations to eliminate gaps and improve safety and comfort of pedestrians. This study was completed in advance of the Denver Moves Pedestrians and Trails Plan but will defer to that document for final recommendations and prioritization of sidewalk projects in this area:

- **BP 10**: Complete the sidewalk on the west side of Grant Street north of 4th Avenue
- **BP 11**: Add a new sidewalk on the north side of eastbound Speer Boulevard, between Lincoln Street and Pearl Street
- **BP 12**: Add a new sidewalk on the north side of eastbound Speer Boulevard, between Washington Street and Downing Street
- **BP 13**: Connect the sidewalk on the east side of Downing Street, north of the Downing Street and Speer Boulevard bus stop, north to 3rd Avenue
- **BP 14**: Complete the sidewalk on the east side of University Boulevard, south of 1st Avenue to the Cherry Creek Trail
- **BP 15**: Improve the existing sidewalk on the north side of Cherry Creek South Drive, from the new pedestrian crossing at Steele Street and Cherry Creek South Drive, south approximately 1,000 feet to connect to the improved sidewalk
- **BP 16**: Complete a sidewalk network on the west side of Colorado Boulevard between 2nd Avenue and Cedar Avenue
- **BP 17**: Complete a sidewalk network on the west side of Colorado Boulevard, south of Alameda Avenue
- **BP 18**: Complete a sidewalk network on the east side of Colorado Boulevard between Bayaud Avenue and Cedar Avenue
- **BP 19**: Add a new sidewalk on the south side of Leetsdale Drive along Burns Park (between Colorado Boulevard and Alameda Avenue)
- **BP 20**: Complete a sidewalk network on the west side of Holly Street between Cedar Avenue and Exposition Avenue

PUBLIC INPUT ON THE CHERRY CREEK TRAIL

Stakeholders and the public made the following suggestions:

- Additional outreach and education to address comfort and behavior issues on the Cherry Creek Trail
- Improved lighting on the Cherry Creek Trail
- Improved wayfinding within the corridor, especially along the Cherry Creek Trail
- Facilities to include a physical buffer, when possible, between vehicles and bicycles/pedestrians to increase comfort and safety
- Re-introduction of a bicycle hub in the Cherry Creek Shopping Area
• **BP 21**: Add a new sidewalk on the north side of Cherry Creek South Drive, connecting the Glendale sidewalk and extending south to Kentucky Avenue and the existing pedestrian bridge across Cherry Creek that provides access to the Cherry Creek Trail
• **BP 22**: Extend the sidewalk on the east side of Quebec Street along Fairmount Cemetery (roughly between Alameda Avenue and Leetsdale Drive)

**Wayfinding**

Wayfinding includes route signage, regulatory signage, and warning signage for motorists, bicyclists, and pedestrians. The Recommended Alternative proposes conducting a pedestrian and bicycle wayfinding study along the corridor to improve wayfinding between major destinations along the corridor and the Cherry Creek Trail, Speer Boulevard, 1st Avenue, and Leetsdale Drive/Parker Road.

All markings should provide a high level of visibility, easy identification, and consideration of motorist, bicyclist, and pedestrian movements when placing signs. Decision signs can be used to mark the junction of two or more bikeways and inform bicyclists of access to key destinations (including distance and/or travel times).

Wayfinding signage can help overcome “barriers to entry” for infrequent or newer bicyclists and direct them to preferred routes.
Recommended Alternative: Vehicular Improvements

The following elements are included in the Recommended Alternative, as appropriate, throughout the corridor and are expected to be more fully defined in further studies of this corridor and recommended alternative.

Access Control on Leetsdale Drive

The Recommended Alternative includes development of an access control plan on Leetsdale Drive. The reversible managed transit lane provides indirect access management by removing the TWLTL and restricting left turns to signalized locations.

CDOT classifies Leetsdale Drive (also known as State Highway 83 and as Parker Road from south of Mississippi Avenue) as a Non-Rural Principal Highway (NR-A) for the purposes of determining access control. For this classification, the desirable standard for spacing of all intersecting public ways and other full-movement accesses is ½-mile. While achieving ½-mile spacing is unlikely given the adjacent land uses, identifying locations where accesses could be consolidated, combined, and/or redirected to local streets could improve traffic flow within the corridor.

Travel Demand Management (TDM)

TDM applies strategies and policies to reduce or redistribute travel demand. Strategies include policy and pricing incentives and disincentives to dissuade the use of the private automobile. The Recommended Alternative can support TDM measures by adopting managed lane policies that support transit use and carpooling. Private properties along the corridor are encouraged to adopt their own TDM programs to incent employees or residents to try alternative modes for commute or other trips.

Streetscaping

Streetscape elements are functional and aesthetic items that are traditionally located within the pedestrian realm and provide utility and amenity to all users. Elements include trees and planters (for aesthetics and stormwater management), lighting, benches, seating, bicycle racks, bollards, public art, wayfinding signage, etc. The Recommended Alternative will include streetscaping elements during preliminary and final design of intersection upgrades, bus stops, and the reversible managed transit lane.

PUBLIC INPUT ON ROADWAY MODIFICATIONS

Public comments requested consideration of reduced lane width and reduced/consistent speeds along the corridor.

Reduced lane width: Narrow vehicular lane widths can promote slower driving speeds, reduce the severity of vehicular crashes, reduce crossing distances, and provide additional space for sidewalks, buffer zones, protected bike lanes, bus access, and bulb-outs.

Along much of the corridor, current lane widths are narrower than 12 feet. During design, consideration can be given to narrower lane width to limit right-of-way acquisition and reduce speeds. However, bus travel lanes will typically need to maintain the full 12-foot cross section.

Reduced speeds: Public input cited the variation in posted speed along the corridor and that the slowest speeds should correlate with the highest pedestrian volume areas but currently do not.

A high-level cursory analysis of consistent speed limits along the corridor did not result in measurable travel time savings or mobility improvements. However, it is recommended that this be evaluated in more detail when a corridor signal optimization study is completed.
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Recommended Alternative: Intersection Improvements

In addition to the improvements illustrated on Figure 4-1, the Recommended Alternative includes intersection-specific enhancements along the corridor. These are shown on Figure 4-11 and are described in more detail in this section.

Operational Intersection Improvements

Signal timing, turn restrictions, and progression optimization can help increase safety, reduce emissions, and improve overall multimodal operations at signalized intersections. The Recommended Alternative includes a variety of operational enhancements at signalized intersections.

Transit Signal Priority

Transit signal priority provides transit vehicles preferential treatment at signalized intersections. Transit signal priority should be considered at the following locations:

- Eastbound Speer Boulevard/Logan Street: to aid in the Speer Boulevard lane drop transition.
- Eastbound Speer Boulevard/Corona Street & Downing Street: to aid in the transition between the 8-lane Speer Boulevard cross section to the 6-lane 1st Avenue cross section.
- Steele Street/Bayaud Avenue: to facilitate bus movements into and out of the reversible managed transit lane.
- Parker Road/Mississippi Avenue: to facilitate bus movements into and out of the reversible managed transit lane.

Coordinated Signal System/Adaptive Signal Control

Traffic management via traffic signal timing changes or adaptation based on real-time traffic demand could be used to increase vehicle capacity without additional lanes. These types of systems generally require extensive surveillance, often pavement loop detectors, and infrastructure that allow communication with the central and/or local controllers.

Early action items include conducting a corridor signal optimization study and potentially implementing consistent cycle lengths along the corridor.

Longer-term signal upgrades with adaptive signal control should be considered as equipment and controllers are replaced.

Leading Pedestrian Interval

The leading pedestrian interval (LPI) initiates the pedestrian WALK indication 3 to 7 seconds before motor vehicles traveling in the same direction are given the green indication. This signal timing adjustment allows pedestrians to establish themselves in the intersection in front of turning vehicles, thereby increasing visibility and safety. The Recommended Alternative includes LPI at the following intersections:

- Eastbound Speer Boulevard/Logan Street (6): crossing south leg of intersection in conjunction with the transit signal priority.
- Eastbound Speer Boulevard/Downing Street (15): crossing south leg of intersection in conjunction with the transit signal priority.
- All signalized intersections on Leetsdale Drive to accommodate users of the recommended shared use path. Evaluate viability and interaction with recommended lead-lag signal timing to accommodate left turns from Leetsdale Drive.

BICYCLE SIGNALS AND DETECTION

Bicycle signals provide a designated time for crossing while restricting conflicting vehicular movement. Bicycle signals can be used with bicycle detection to communicate the presence of bicycles at the intersection to the traffic signal.

Bicycle signals detection, combined with bicycle signals, can reduce delay for bicycle travel, increase convenience and safety of bicycling by establishing bicycling as a legitimate mode of transportation on streets and can discourage red light running by bicyclists.
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Turn on Red Restrictions

Use a NO TURN ON RED (NTOR) regulatory sign or signal to address conflicts between vehicles and crossing pedestrians/bicyclists.

The Recommended Alternative includes potential turn on red restrictions at the locations listed in Table 4-1.

Table 4-1. Potential Right Turn on Red Restriction Locations

<table>
<thead>
<tr>
<th>No Turn on Red</th>
<th>Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound left turn</td>
<td>Lincoln Street/westbound Speer Boulevard</td>
</tr>
<tr>
<td>Westbound right turn</td>
<td>Lincoln Street/westbound Speer Boulevard</td>
</tr>
<tr>
<td>Southbound right turn</td>
<td>Grant Street/westbound Speer Boulevard</td>
</tr>
<tr>
<td>Northbound left turn</td>
<td>Clarkson Street/westbound Speer Boulevard</td>
</tr>
<tr>
<td>Northbound right turn</td>
<td>Gilpin Street/eastbound Speer Boulevard</td>
</tr>
</tbody>
</table>

All signalized intersections on Leetsdale Drive to accommodate users of the recommended shared use path.

Transit Stop Improvements

The Recommended Alternative includes upgraded bus stops along the entire corridor. These are intended to build the brand identity of a system, foster local economic development, and ultimately attract more riders.

Bus stop amenities to be considered include:

- Shelters
- Benches
- Lighting
- Real time passenger information/wayfinding
- Bicycle racks

At a minimum, all transit stops along the corridor should be compliant with the Americans with Disabilities Act (ADA). ADA infrastructure includes boarding and alighting areas (minimum clear length of 96 inches and a clear width of 60 inches, connections to street sidewalks or pedestrian paths via accessible routes and slopes of the bus boarding and alighting area shall not be steeper than 1:48.

Stops at the locations in Table 4-2 have been identified for ADA improvements.

Table 4-2. Bus Stops Identified for ADA Improvements

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downing Street &amp; Speer Boulevard (RTD MyStop #13426)</td>
<td>Complete sidewalk access to stop, add level waiting area</td>
</tr>
<tr>
<td>Speer Boulevard &amp; Downing Street (RTD MyStop #2072)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>1st Avenue &amp; Downing Street (RTD MyStop #20378)</td>
<td>Add boarding and alighting area separate from Cherry Creek Trail</td>
</tr>
<tr>
<td>1st Avenue &amp; Lafayette Street (RTD MyStop #10448)</td>
<td>Add boarding and alighting area separate from Cherry Creek Trail</td>
</tr>
<tr>
<td>1st Avenue &amp; Gilpin Street (RTD MyStop #10430)</td>
<td>Expand boarding and alighting area to reduce conflicts between riders and Cherry Creek Trail users</td>
</tr>
<tr>
<td>1st Avenue &amp; University Boulevard (RTD MyStop #10481)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>University Boulevard &amp; Cherry Creek North Drive (RTD MyStop #16814)</td>
<td>Complete sidewalk access to stop</td>
</tr>
<tr>
<td>South Colorado Boulevard &amp; Alameda Avenue, nearside (RTD MyStop #33348):</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Forest Street (see Figure 4-8) (RTD MyStop #18866)</td>
<td>Formalize boarding and alighting area</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Holly Street (RTD MyStop #21420)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Hudson Street (RTD MyStop #24865)</td>
<td>Repair existing sidewalk connection and add boarding and alighting area</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Intersection</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monaco Parkway &amp; Leetsdale Drive (RTD MyStop #15550)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Oneida Street (RTD MyStop #19503)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Leetsdale Drive &amp; Quebec Street (RTD MyStop #25328)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Parker Road &amp; Quebec Street (RTD MyStop #25258)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Parker Road &amp; Quince Street (RTD MyStop #15779)</td>
<td>Add boarding and alighting area</td>
</tr>
<tr>
<td>Parker Road &amp; Quince Street (RTD MyStop #15782)</td>
<td>Add boarding and alighting area</td>
</tr>
</tbody>
</table>

Installation of bus stop amenities and upgrades will be coordinated with RTD and achieved through capital investments, the City and County of Denver's Transit Amenity Program, or adjacent property owner contributions to accommodate near-term and long-term transit service along the corridor.

Median bus stops along the reversible managed transit lane would be located at signalized intersections; midblock stops are not recommended.

Additional amenities, such as real-time passenger information and off-board ticketing, could increase the efficiency of corridor transit service and are recommended at major stations.

To ensure the most efficient transit service and bus stop locations, a stop consolidation study is suggested as part of the Recommended Alternative.

**Bicycle and Pedestrian Improvements**

Bicycle and pedestrian crossing and connection improvements included in the Recommended Alternative are intended to improve the ease of use for pedestrians and bicyclists, address locations with demonstrated pedestrian and bicycle safety concerns, and improve bicycle and pedestrian access to transit.

The Recommended Alternative includes intersection crossing treatments at the following intersection:

**Median Islands**

Median islands are raised to provide refuge for people walking and biking, while allowing for two-stage crossings.

The Recommended Alternative includes median islands at all signalized intersections on Leetsdale Drive and Alameda Avenue to support the reversible managed transit lane concept. Other specific recommendations include:

- **1st Avenue between University Boulevard and Speer Boulevard:** Providing improved pedestrian refuges in would promote pedestrian safety, comfort, and connections between Cherry Creek North and the Cherry Creek Shopping Center.
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- **Steele Street/Ellsworth Avenue**: The 1st Avenue and Steele Street Alternatives Evaluation recommended reconstructing the median at the location.
- **Alameda Avenue/Garfield Street**: The Garfield Street Neighborhood Bikeway Feasibility Study recommends raised center pedestrian and bicycle median refuges.
- All signalized intersections on Leetsdale Drive and Alameda Avenue.

**Trail to Street Connections**

These improvements include formalizing crossings or adding signage where trails rise to street level, redesigning ramp connections from the trail to street, and completing the sidewalk network. Trail to street connections focus on improving bicycle and pedestrian access to the Cherry Creek Trail. Locations identified for improved connections include:

- **Westbound Speer Boulevard/Lincoln Street**: Add warning and yield signage alerting drivers to the presence of bicycles/pedestrians and indicating permitted use of bicycles on sidewalks. Move stop bars farther back from intersections to improve visibility at pedestrian crossings on Lincoln Street.
- **Westbound Speer Boulevard/Logan Street**: Evaluate the potential to modify curb geometry and reconfigure the existing bridge wall on the southeast corner to improve the connection between the trail ramp east of the intersection and the sidewalk.
- **East of the eastbound Speer Boulevard/Logan Street**: Complete the sidewalk along the north side of Speer Boulevard to provide access between the intersection and the trail access. Add warning signage alerting drivers to the presence of bicycles and pedestrians rising to street level and add signage permitting the use of bicycles on the new sidewalk connection.
- **Westbound Speer Boulevard/Pennsylvania Street**: Close ramp and direct bicycles and pedestrians to connect to the Cherry Creek Trail at Washington Street or Logan Street.
- **Westbound Speer Boulevard/Downing Street**: Evaluate the potential to reconfigure the bridge wall at the southeast corner to better accommodate bicyclists and pedestrians traveling between the Downing Street side path and the Cherry Creek Trail. Add warning signage to alert drivers to the presence of bicycles and pedestrians and the permitted presence of bicycles on the sidewalk.

**Crosswalk Enhancements**

These treatments help to enhance the pedestrian experience while signaling to drivers that pedestrians have the right-of-way. The Recommended Alternative includes crosswalk enhancements at the following locations:

- **Westbound Speer Boulevard/Pennsylvania Street (7)**: Add high-visibility crosswalk markings along the north side of Speer Boulevard, across 4th Avenue to improve east-west pedestrian travel along Speer Boulevard.
- **Westbound Speer Boulevard/Emerson Street (11)**: Add high-visibility crosswalk markings across Emerson Street, on the north leg of the intersection, to improve east-west pedestrian travel along Speer Boulevard.
- **Corona Street/eastbound Speer Boulevard (13)**: Remove east-west crosswalk on north leg of the intersection to direct bicyclists and pedestrians to the best locations to access the Cherry Creek Trail.
- **1st Avenue/Gilpin Street (17)**: Add measures to improve crosswalk yield compliance and discourage vehicles from stopping in the crosswalk (e.g., raised crosswalk and/or RTOR restriction).
- **Steele Street/Ellsworth Avenue (25)**: The 1st Avenue and Steele Street Alternatives Evaluation recommended restriping the crosswalk and stop bars at this location.
- Add high-visibility crosswalk markings at intersections on Alameda Avenue to promote safe access to and from the median bus stops and for users of the shared use path.
- Add high-visibility crosswalk markings at intersections on Leetsdale Drive to promote safe access to and from the median bus stops and for users of the shared use path.
PUBLIC INPUT ON THE CHERRY CREEK TRAIL

Throughout the evaluation process TWG, SWG, and members of the public consistently vocalized their support for capacity improvements on the Cherry Creek Trail between Broadway and University.

Between Broadway and Downing, stakeholders expressed the desire to have separate but parallel facilities for bicycles and pedestrians.

Between Downing and University, stakeholders expressed the desire to widen the existing shared-use path and create a buffer between the travelway and the path to improve comfort and capacity.

These sections of the Cherry Creek Trail are some of the most heavily used. Stakeholders feel that these sections are at- or over-capacity. Improvements to the Cherry Creek Trail were the most requested bicycle and pedestrian improvements heard during the public outreach process for the Go Speer Leetsdale study.

DENVER’S COMMUNITY STREETS PROGRAM

The Denver Public Works Transportation and Mobility Community Streets Program looks to create an enriched pedestrian environment that promotes community building and enhances aesthetics through the installation of temporary projects such as artistic crosswalks, intersection murals, and graphics. The intersections or crosswalks chosen for these treatments are best suited near pedestrian destinations to help enhance the pedestrian experience while signaling to drivers passing through that the street is a public space. These projects are approved based on a specific set of criteria. Design guidelines are available at www.denvergov.org/communitystreets.

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Intersection Reconstruction Elements

The reversible managed transit lane will require full intersection reconstruction at the majority of intersections along Leetsdale Drive. Intersection reconstruction along the Leetsdale Drive portion of the corridor would be necessary to accommodate left turn movements with the reversible managed transit lane as described above.

Several additional bicycle and pedestrian intersection enhancements should be implemented when intersection are reconstructed. These include curb ramps, curb extensions, and reductions to corner turning radii.

Curb Ramps

Curb ramps transition pedestrians from the sidewalk to the street and ensure ADA compliance. Figure 4-9 illustrates curb ramps.

Figure 4-9. Conceptual Intersection with Curb Ramps


The Recommended Alternative includes adding or improving existing curb ramps at the following locations:

- Northwest corner of Lincoln Street/westbound Speer Boulevard
- Southwest corner of Lincoln Street/westbound Speer Boulevard
- Southeast corner of Lincoln Street/westbound Speer Boulevard
- Southeast corner of Grant Street/5th Avenue/westbound Speer Boulevard
- Northwest corner of Logan Street/westbound Speer Boulevard
- Southwest corner of Logan Street/westbound Speer Boulevard
- Southeast corner of Logan Street/westbound Speer Boulevard
- All corners of the Logan Street/eastbound Speer Boulevard intersection
- Northeast corner of Washington Street/westbound Speer Boulevard
- Northeast corner of Washington Street/eastbound Speer Boulevard
- Southwest corner of Clarkson Street/westbound Speer Boulevard
- Southeast corner of Clarkson Street/3rd Avenue/westbound Speer Boulevard
- Northeast corner of Clarkson Street/eastbound Speer Boulevard
- All ramps at Corona Street/westbound Speer Boulevard
- Northeast corner of Downing Street/westbound Speer Boulevard
- Southwest corner of Downing Street/westbound Speer Boulevard

In addition, curb ramp improvements are anticipated in conjunction with the recommendations from the 1st Avenue & Steele Street Alternatives Evaluation. Redesign of intersections on Leetsdale Drive and Alameda Avenue to accommodate the reversible managed transit lane and shared use path will include ADA compliant curb ramps.

Curb Extensions

Curb extensions are created by extending the sidewalk or curb line into the street at an intersection or mid-block crossing location to shorten the crossing distance for pedestrians. Curb extensions have a traffic calming effect by physically and visually narrowing the street. Figure 4-10 illustrates the curb extension concept.
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The Recommended Alternative includes curb extensions at the following locations:

- Northeast corner of Logan Street/westbound Speer Boulevard
- Southeast corner of Logan Street/westbound Speer Boulevard
- Southeast corner of Downing Street/westbound Speer Boulevard
- The Garfield Street Neighborhood Bikeway Feasibility Study recommended curb extensions (also known as bulb-outs)

**Figure 4-10. Conceptual Intersection with Curb Extensions**

**Corner Radii Design**

Smaller turning radii slow vehicle speeds and shorten the crossing distance for pedestrians. The Recommended Alternative includes corner radii redesign at the following locations:

- Alameda Avenue/Leetsdale Drive (34): Consider reconstruction of intersection and auxiliary lane configuration/design pending the outcome of the detailed traffic evaluation.
- All signalized intersections on Alameda Avenue and Leetsdale Drive identified for reconstruction to accommodate the reversible managed transit lane should consider reduced corner radii design.
- Steele Street/Ellsworth Avenue: The 1st Avenue and Steele Street Alternatives Evaluation recommended improving the curb radii at this intersection to further reinforce the existing no RTOR condition for southbound to westbound turning movements into the Cherry Creek Shopping Center.

**Mobility Hubs**

The Recommended Alternative identifies four locations for further exploration for mobility hubs. These locations could offer a wide variety of transportation options, including but not limited to B-Cycle, RTD service, car share, transportation network companies (TNCs), taxi, other shared-use mobility providers, bike parking, and real-time passenger information. In addition to bringing mobility options together, redevelopment strategies and zoning recommendations should be evaluated at these locations to ensure that land uses surrounding the mobility hubs complement and encourage efficient travel options and transit amenities.

The Recommended Alternative includes the following mobility hub locations:

- Speer Boulevard & Broadway
- 1st Avenue & University Boulevard
- Alameda Avenue & Colorado Boulevard
- Parker Road & Quebec Street
Intersection Improvements

The Recommended Alternative includes intersection improvements that promote the safety of all users. The Denver Vision Zero Action Plan articulates the City and County of Denver’s goal to achieve zero traffic-related deaths by 2030. The five-year Vision Zero Action Plan outlines projects, policies and programs to move more people, more efficiently and more safely on Denver’s street network and is available at www.denvergov.org/visionzero.

As part of this evaluation, nine intersections were identified as having a moderate to high potential for crash reduction. The Recommended Alternative includes the following safety intersection improvements.

**1st Avenue and Gilpin Street**

Comments from the public and discussions with Bike Denver indicate both safety and comfort concerns at this intersection and suggest that there may be near-miss collisions involving bicycles or pedestrians at this intersection that data do not show.

The Recommended Alternative includes implementing improvements to increase awareness of bicycles and pedestrians using the path; the specific recommended improvements include:

- RTOR restrictions
- Raised crosswalk on the south leg

**1st Avenue and Milwaukee Street**

At this location, the Recommended Alternative includes managed lanes (outermost lane for buses and right turns only). Separating right turns and through movement vehicles along this corridor segment can reduce friction between turning and through movement vehicles and potentially reduce the risk of rear-end accidents.

**1st Avenue and Steele Street**

The Recommended Alternative include recommendations made in the 1st Avenue and Steele Alternatives Evaluation study. This includes an intersection configuration that improves the experience for bicyclists and pedestrians by reducing the number of signals at the intersection from two to one and the time required to cross the arterial by reducing the overall footprint of the intersection.

**Steele Street and Ellsworth Avenue**

The Recommended Alternative includes implementing protected left-turn only phasing and/or intersection redesign to improve lines of sight.

A review of the intersection reveals that the north and south left-turn lanes are under protected-permissive signal control and are not aligned directly across from one another, potentially resulting in obstructed lines of sight.
Figure 4-11. Recommended Alternative Intersection Improvements – West Corridor
Figure 4-11. Recommended Alternative Intersection Improvements – East Corridor
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

**Leetsdale Drive and Cherry Street**

The Recommended Alternative includes restricting right turns on red to reduce the probability of crashes involving northbound right-turning vehicles from Cherry Street and vehicles traveling eastbound on Leetsdale Drive.

Additionally, the intersection reconstruction to accommodate the reversible managed lane will likely eliminate the existing northbound right-turn acceleration lane.

**Leetsdale Drive and Elm Street**

To reduce the potential for injury crashes at this location and to accommodate the reversible managed transit lane, the Recommended Alternative includes the elimination of left-turn movements at this unsignalized location.

**Leetsdale Drive and Niagara Street**

This intersection has experienced crash patterns like those observed at Leetsdale Drive/Elm Street; eliminating left-turn movements at this unsignalized location will help reduce the potential for this crash pattern and is necessary to effectively implement the reversible managed lane.

**Leetsdale Drive/Parker Road and Quebec Street**

The Recommended Alternative includes intersection reconstruction implementing median islands on Leetsdale Drive and necessitating protected left turns on all legs. Implementing protected-only left-turn phasing could occur prior to the reconstruction to accommodate the reversible managed lane. The intersection reconstruction will also provide a pedestrian refuge for two-stage crossing and improve vehicular and pedestrian safety.

**Parker Road and Mississippi Avenue**

The Recommended Alternative includes the planned bicycle and pedestrian underpass at the Parker Road/Mississippi Avenue project. This improvement is expected to address safety concerns and user delays at this intersection. Construction is anticipated in 2018.
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Recommended Alternative: Phased Implementation

Implementation of the Recommended Alternative could take many forms. The suggested phasing considers ease of implementation, potential benefit achieved, and public support.

Near-term, Low Cost Improvements

Near-term projects are those that are considered “low hanging fruit”—projects that provide a high benefit at relatively low cost and are easy to implement. High-priority projects for near-term implementation include:

- Add bus stop improvements and amenity enhancements, as previously discussed.
- Implement signal timing modifications, as previously discussed.
- Ensure ADA ramps are provided at all quadrants of study area intersections.
- Steele Street/Ellsworth Avenue – Study protected-only left-turn signal phase to reduce conflicts and address safety and mobility needs at this location. In the long term, consider intersection reconstruction to improve lines of sight for left-turn vehicles.
- 1st Avenue/Lafayette Street Bus Stop – Explore additional transit boarding and alighting areas separate from the Cherry Creek Trail. This improvement will require coordination with the Denver Country Club to acquire right-of-way or an easement.
- Managed Transit Lane Project – Restripe the outer lane of Speer Boulevard and 1st Avenue from Broadway to 1st/Steele Street to designate it as a “Buses and Right Turn Only” managed lane. Extend improvements south to the Steele Street/Bayaud Avenue intersection. This can also be tested in a demonstration project with key metrics such as travel time, congestion, and person trips collected before and during the demonstration period to inform future investments in the corridor.

Additional Studies and Plans

- Leetsdale Drive Access Control Plan – Conduct a study to evaluate the potential for consolidating access locations and/or restrictions of vehicular movements. Evaluate long-term recommended intersection turning movement restrictions for implementation before installing the reversible managed transit lane and shared use path.
- Wayfinding Study – The Recommended Alternative proposes conducting a pedestrian and bicycle wayfinding study along the corridor to improve wayfinding between major destinations along the corridor and the Cherry Creek Trail, Speer Boulevard, 1st Avenue, and Leetsdale Drive/Parker Road.
- Shared Use Path Study – Determine whether the proposed shared use path would operate most efficiently on the north or south side of Leetsdale Drive and identify high-priority locations for improved bicycle signal detection.
- Bus Stop Consolidation Study – Review stop spacing and activity at each stop and recommend opportunities to combine or remove stops to ensure the most efficient transit service.

Projects Identified in Other Studies

- Complete bicycle projects included in Denver Moves Bikes.
- Reconstruct the Garfield Street/Alameda Avenue intersection to provide signalization and include bicycle detection, bicycle and pedestrian signals, pedestrian push buttons, bike boxes with passive bicycle signal detection, and bicycle specific wayfinding pavement markings.
- Complete the sidewalk network at key locations within the study area where missing sidewalks are considered a high priority. These include sidewalks along Colorado Boulevard, Downing Street, Leetsdale Drive adjacent to Burns Park, and University Boulevard. Denver Moves Pedestrians and Trails, once completed in 2018, will dictate the prioritization of sidewalk projects.
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Interim Leetsdale Drive Improvements

While several safety and mobility enhancements are recommended on Leetsdale Drive, reconstruction needed along the corridor to accommodate the reversible managed transit lane and shared use path would ultimately impact the entire cross section. Therefore, near-term recommendations are more focused on operational improvements, and capital improvements are recommended for long-term implementation.

However, if the City determines that capital investment to improve critical safety and mobility issues along Leetsdale Drive are more than five years out, it is recommended that the following low-cost interim capital investments be included, as viable, in other projects along the corridor such as overlays or in conjunction with redevelopment.

- Add bus stop improvements and amenity enhancements.
- Maintain/repair existing sidewalks.
- Leetsdale Drive/Elm Street – Add high visibility crosswalk markings.
- Leetsdale Drive/Alameda Avenue – Provide appropriate landing space on crossing island on southeast corner.
- Leetsdale Drive/Cherry Street – Add directional curb ramps at southeast quadrant.
- Leetsdale Drive/Elm Street – Add high visibility crosswalk markings.
- Leetsdale Drive/Forest Street – Add directional curb ramps on all four quadrants. This is a priority location due to nearby housing and commercial density.
- Leetsdale Drive/Holly Street – Add directional curb ramps on all four quadrants. This is a priority location due to nearby housing and commercial density.
- Leetsdale Drive/Jersey Street – Add high visibility crosswalk markings.
- Leetsdale Drive/Exposition – Add directional curb ramps on the northwest, southwest, and southeast quadrants. This is a priority location due to access to George Washington High School.
- Leetsdale Drive/Oneida Street – Add directional curb ramps on the northwest, southwest, and southeast quadrants.
- Leetsdale Drive/Quebec Street – Modify signal timing to provide a protected-only left-turn signal phase (eliminate permissive left-turn signal phase) that could be implemented to reduce conflicts and address safety and mobility needs at this location.
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Recommended Alternative: Next Steps

Prior to implementation of the full Recommended Alternative included in this plan, some additional detailed analysis and design will be needed. These next steps are described below.

**Step 1: Detailed Operations Analysis**

Step 1 would include a micro simulation of the corridor to evaluate traffic and transit operations, pedestrian travel, and bicycle signal timing. Ideally a simulation would include conducting new peak hour traffic counts (counting all modes) at each major intersection along the corridor, developing an existing conditions TransModeler microsimulation model, calibrating the model to existing conditions, and creating a future “no action” model and a future model with the Recommended Alternative. The future model would refine signal timing, lane restrictions, transit signal priority, and bike signalization opportunities. Information collected during Step 1 will confirm feasibility and refine included recommendations.

**Step 2a: Preliminary Design**

During Step 2, survey and preliminary design would be completed along the corridor. This would be used to better identify right-of-way impacts, utility impacts, drainage and stormwater needs, and opportunities to implement Denver’s Ultra Urban Green Infrastructure Guidelines, urban design/streetscaping, and enhanced bike and pedestrian crossing treatments. During Step 2, more detailed construction cost estimates would also be developed.

**Step 2b: Benefit Cost Evaluation**

Implementation of the Speer Boulevard/Leetsdale Drive Recommended Alternative is consistent with the mobility goals identified by the City and County of Denver. As such, it will provide many benefits that can be quantified to determine the project’s overall benefit cost ratio. Benefits to be calculated could include but are not limited to noise reduction, vehicle miles of travel reduction, air quality improvement, emissions reduction, fuel reduction, and economic development.

**Step 3: Apply for Funding**

During Step 3, the City and County of Denver should continually seek funding for each step in the project development process. For construction funding, the City should actively seek and apply for grants to implement recommendations along the Speer/Leetsdale corridor. Funding could come from the Federal Transit Administration (FTA) New Starts/Small Starts program, RTD, Federal Highway Administration through DRCOG or CDOT, the City and County of Denver, or a variety of federal and local grants that focus on transportation, environment, and economic development. Step 4 would also include working with DRCOG to get the project into the fiscally constrained Long Range Transportation Plan to provide eligibility for federal funding through the Transportation Improvement Program (TIP) and other federal and state grant programs.

**Step 4: Environmental Assessment and Final Design**

Step 4 would include additional steps that need to be completed before construction such as final design and environmental clearance required by the National Environmental Policy Act (NEPA) for projects with federal funding or on a state or federal facility.
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Alternatives Evaluation Process

After developing a clear understanding of corridor needs, a comprehensive set of potential improvements was identified and evaluated. This section describes the improvements that were considered and the evaluation process that ultimately led to the packaging of improvements into the Recommended Alternative.

The evaluation process was rooted in the innovative transportation philosophy developed through Denver’s Strategic Transportation Plan (STP) that calls for moving more people through a variety of convenient transportation options. The plan focused on maximizing the person-trip capacity of the existing roadway and making multimodal investments that make transit and other alternative mode trips more competitive with private auto travel.

This section describes the three-stage evaluation process conducted to screen and package potential improvements into alternative packages.

Development of Stage 1 Evaluation Criteria

In Stage 1, each potential improvement was evaluated based on its ability to effectively address one or more of the study’s need statements. Improvements with the ability to substantially address the corridor’s identified needs were retained for additional evaluation. Improvements that could not address the purpose and need were eliminated from further consideration. Table 4-3 summarizes the questions used to evaluate improvements in Stage 1.

Improvements with the ability to address the purpose and need and address significant segment of the corridor were identified as primary improvements and advanced to Stage 2 evaluation.

Improvements unable to address a significant segment of the corridor but that had the potential to address a need at a specific location or were determined to support multiple primary improvements were identified as complementary improvements. Complementary improvements were retained for Stage 3 packaging.

<table>
<thead>
<tr>
<th>Table 4-3. Stage 1 Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle Mobility</td>
</tr>
<tr>
<td>Can the alternative improve safety, connectivity, convenience, and comfort of service for bicycle users along the corridor?</td>
</tr>
<tr>
<td>Pedestrian Mobility</td>
</tr>
<tr>
<td>Can the alternative improve safety, connectivity, convenience, and comfort for pedestrian along the corridor?</td>
</tr>
<tr>
<td>Transit Mobility</td>
</tr>
<tr>
<td>Can the alternative accommodate increasing person trip demand, reduce transit travel time and increase transit travel time reliability, safety and overall level of service along the corridor? Can the alternative increase accessibility and rider comfort at transit stops and stations?</td>
</tr>
<tr>
<td>Vehicular Mobility</td>
</tr>
<tr>
<td>Can the alternative improve existing and future traffic operations? Can the alternative improve identified safety problems along the corridor?</td>
</tr>
<tr>
<td>Livability</td>
</tr>
<tr>
<td>Can the alternative increase access to a diverse range of transportation options? Can it enhance economic development opportunities? Can it contribute to the concept of “complete communities”? Can it inspire sustainable urban development?</td>
</tr>
<tr>
<td>Transportation Equity</td>
</tr>
<tr>
<td>Can the alternative provide convenient and cost-effective mobility options for all users of the corridor?</td>
</tr>
<tr>
<td>Transportation Access</td>
</tr>
<tr>
<td>Can the alternative improve the ability of all users to access community facilities across and along the corridor? Can it enhance access to adjacent communities?</td>
</tr>
</tbody>
</table>

Development of Stage 2 Evaluation Criteria

Stage 2 developed high-level quantitative criteria for the primary improvements retained in Stage 1 to determine how well each addressed the project Purpose and Need relative to one another. Table 4-4 lists the Stage 2 evaluation criteria.
<table>
<thead>
<tr>
<th>Ranking</th>
<th>Additional Daily Person Trip Capacity along Corridor</th>
<th>Vehicular Travel Time Savings (mins)</th>
<th>Bike Travel Time Savings (mins)</th>
<th>Transit Travel Time Savings (mins)</th>
<th>Potential to Improve Vehicular Safety</th>
<th>Potential to Improve Bike/Pedestrian Safety</th>
<th>Potential to Negatively Impact Environmental Resources</th>
<th>Supports Livability Initiatives</th>
<th>Supports Transportation Access &amp; Equity</th>
<th>Potential ROW Requirements</th>
<th>Ease of Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2,000</td>
<td>&lt;1 min</td>
<td>&lt;1 min</td>
<td>&lt;2 min</td>
<td>Increase crashes or number of conflict points</td>
<td>Low/no potential to improve bike/ped safety</td>
<td>High potential to negatively impact environment</td>
<td>Low potential to support development of complete communities</td>
<td>Increases access to cost-effective mobility at spot locations on the corridor</td>
<td>High ROW requirements</td>
<td>Options that are high cost, controversial or require substantial ROW</td>
<td></td>
</tr>
<tr>
<td>2,000 - 4,000</td>
<td>1-2 min</td>
<td>1-2 min</td>
<td>2-5 min</td>
<td>No/minimal change in crashes/ number of conflict points</td>
<td>Moderate potential to improve bike/ped safety</td>
<td>Moderate potential to negatively impact environment</td>
<td>Moderate potential to support development of complete communities</td>
<td>Increases access to cost-effective mobility along and across only a segment or segments of the corridor</td>
<td>Moderate ROW requirements</td>
<td>Options that are low to moderate cost, publicly supported but require some ROW</td>
<td></td>
</tr>
<tr>
<td>&gt;4,000</td>
<td>&gt;2 min</td>
<td>&gt;2 min</td>
<td>&gt;5 min</td>
<td>Decrease crashes/ number of conflict points</td>
<td>High potential to improve bike/ped safety</td>
<td>Low potential to negatively impact environment</td>
<td>High potential to support development of complete communities</td>
<td>Increases access to cost-effective mobility along and across the entire corridor</td>
<td>Low ROW requirements</td>
<td>Options that are low cost, publicly supported and require little or no ROW</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Alternatives Development and Stage 1 & 2 Evaluation

This section describes improvements considered and the results of Stage 1 and Stage 2 of the evaluation process.

Road/Automobile Improvements

Additional General Purpose Lanes (new Right-of-Way)

Add one travel lane in each direction along the entire corridor. These general purpose lanes would be available to all vehicles as illustrated in Figure 4-12. This improvement would require the acquisition of new right-of-way along most of the corridor.

Stage 1: Eliminated. All corridor-long widening projects were eliminated due to substantial ROW requirements that deemed the project largely infeasible and generally lacked public support.

Stage 2: Eliminated. Limited ability to increase person carrying capacity along the corridor and negligible travel time savings. The improvement has the potential to increase the eastbound capacity on Alameda Avenue west of Colorado Boulevard and more efficiently use the existing capacity on 1st Avenue. However, the improvement would shift a significant vehicular demand to northbound Colorado Boulevard (between Bayaud Avenue and 1st Avenue). The projected increase in demand negates the capacity gains.

Burns Park Vehicular Couplet

The Burns Park couplet improvement would seek to alleviate some of the congestion along the Alameda Avenue segment of the corridor by converting segments of Leetsdale Drive, Alameda, 1st Avenue, and Steele Street to one-way streets as shown in Figure 4-13.

Stage 1: Retained.

Stage 2: Eliminated. Limited ability to increase person carrying capacity along the corridor and negligible travel time savings. The improvement has the potential to increase the eastbound capacity on Alameda Avenue west of Colorado Boulevard and more efficiently use the existing capacity on 1st Avenue. However, the improvement would shift a significant vehicular demand to northbound Colorado Boulevard (between Bayaud Avenue and 1st Avenue). The projected increase in demand negates the capacity gains.

Figure 4-13. Burns Park Couplet Concept
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Access Control on Leetsdale Drive

Create an access control plan on Leetsdale Drive to reduce conflict points and improve comfort and safety for all travel modes. The access control plan would need to evaluate the consolidation of access locations and/or restrict vehicular movements at existing access points.

Stage 1: Retained.
Stage 2: Retained. High potential to improve vehicular safety, moderate potential to improve bicycle and pedestrian safety, low right-of-way requirements and moderate potential for travel time savings.

Alameda Improvements from Cherry Creek North Drive to Colorado

Denver’s STP called for the widening of Alameda Avenue from Steele Street to Colorado Boulevard to increase throughput and reduce delay along Alameda Avenue and through the Colorado Boulevard/Alameda Avenue intersection.

Stage 1: Eliminated. A vehicle-focused widening option would not provide sufficient space for bike and pedestrian enhancements or meet the desired livability concepts. Was not supported by the public.

Coordinated Signal System/Adaptive Signal Control

Traffic management via traffic signal timing changes or adaptation based on real-time traffic demand could be used in increase vehicle throughput without additional lanes.

Stage 1: Retained as complementary.

Managed Lanes in New Right-of-Way

Managed lane techniques include, but are not limited to, high-capacity transit, HOVs, variable tolling, electric vehicle or hybrid vehicle priority, or other lane use restrictions to improve traffic flow and person throughput. Lanes can be managed full time or during only peak periods to achieve desired goals.

Stage 1: Eliminated. Widening to provide a managed lane was eliminated due to substantial right-of-way requirements and general lack of support from the public.

Managed Lanes in Existing Right-of-Way

Managed lane techniques include, but are not limited to, high-capacity transit, HOVs, variable tolling, electric vehicle or hybrid vehicle priority, or other lane use restrictions to improve traffic flow and person throughput. Lanes can be managed full time or during only peak periods to achieve desired goals.

Stage 1: Retained. Project would repurpose existing travel lanes as managed lanes to improve mobility.
Stage 2: Retained. Repurposing existing lanes as managed lanes has the potential to increase person carrying capacity and improve transit travel times and reliability.

PUBLIC INPUT

A Citizen’s Petition in 2012 successfully removed vehicular lane widening on Alameda from Steele Street to Colorado Boulevard from the MetroVision 2035 Fiscally Restrained Regional Transportation Projects making it ineligible for federal funding available through the DRCOG Transportation Improvement Program (TIP).

Raised Median on Leetsdale Drive

Add a raised median along Leetsdale Drive. This improvement could complement an access control plan on Leetsdale Drive. A median would restrict access to designated locations and has the potential to create a crossing refuge for pedestrian and bicyclists; thereby improving safety.

Stage 1: Retained.
Reduced Lane Width

Narrow vehicular lane widths could promote slower driving speeds; reduce the severity of vehicular crashes; reduce crossing distances; and provide additional space for sidewalks, buffer zones, protected bike lanes, bus access, and bulb-outs.

Stage 1: Retained as complementary.

Intersection Improvements

Intersection-specific improvements can enhance the safety of all users and/or reduce congestion. Intersections with identified safety or perceived comfort challenges were evaluated for intersection-specific improvements. Improvements evaluated included reducing the crossing length and exposure time with curb extensions and median refuge islands. Such improvements could be included as “complementary” to other elements of the Recommended Alternative.

Stage 1: Retained as complementary.

Streetscaping

Streetscape elements are functional and aesthetic items traditionally located within the pedestrian realm and that provide a buffer between street traffic and the sidewalk, improved air quality, and a more comfortable space for people walking and using mobility devices.

Stage 1: Retained as complementary.

Travel Demand Management

TDM strategies are intended to reduce reliance on single occupancy vehicles for all trips via incentives and educational strategies. Example TDM strategies include bus passes, vanpool and carpool programs, parking management strategies, flexible work schedules, and telecommuting.

Stage 1: Retained as complementary.

Bicycle and Pedestrian Alternatives

Sidewalk Improvements

Construct sidewalks where gaps exist in the network or repair broken or substandard sidewalks to improve the comfort, accessibility, and safety of pedestrians.

Stage 1: Retained as complementary.

Capacity Improvements on the Cherry Creek Trail between Broadway and Downing

Increase the capacity of the Cherry Creek Trail between Broadway and Downing by widening the existing trail facility or building a parallel facility to separate bicycles from pedestrians.

Widen Existing Trail/Route on 1st Avenue in Existing Right-of-Way

a. Narrowing the existing median on 1st Avenue between Downing Street and University Boulevard to widening space designated for bicycle and pedestrian travel.
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Stage 1: Eliminated. Impact to historic median between Downing Street and University Boulevard and limited potential additional capacity.

b. Narrow the existing median on 1st Avenue between University Boulevard and Garfield Street to widen space designated for bicycle and pedestrian travel.

Stage 1: Retained.
Stage 2: Retained.

Widen Existing Trail/Route on 1st Avenue in New Right-of-Way

Widen the Cherry Creek Trail adjacent to the roadway between Downing and University. This improvement requires coordination with the Denver Country Club to acquire right-of-way or an easement along 1st Avenue.

Stage 1: Retained.
Stage 2: Retained.

New Downing/Marion and Dakota/Alameda Trail Alignment

Develop an alternate bike route between Downing Street and University Boulevard to add east-west capacity on a parallel route as shown on Figure 4-14.

Stage 1: Retained.
Stage 2: Retained as complementary. While parallel routes could provide additional capacity, this alternative would not sufficiently address the capacity deficiency along 1st Avenue.

High Ease of Use Bicycle/Pedestrian Facility along Leetsdale Drive

A high ease of use bicycle facility (such as a separated bike lane or shared use path) combines a comfortable and an accessible user experience by providing a facility that is physically separated from motor traffic.

Stage 1: Retained.
Stage 2: Retained.

Figure 4-14. Proposed Alignment

On-street Connections to the Cherry Creek Trail and Parallel Routes

On the eastern end of the corridor, this alternative would build on the Denver Moves: Bikes plan to implement key north-south and east-west routes to improve connectivity between study area neighborhoods, Leetsdale Drive, and the Cherry Creek Trail.

On the western end of the corridor, public input indicated a desire for more east-west bikeways, connecting into Cherry Creek North and better north-south connections to the Cherry Creek Trail.

Bicycle accommodations at intersection crossings should be consistent with Denver Bikeway Design Guidelines.

Stage 1: Retained.
Stage 2: Retained as complementary solution.

Capacity Improvements to the Cherry Creek Trail (east of Colorado Boulevard)

Increase the capacity of the Cherry Creek Trail east of Colorado Boulevard by widening the existing trail or constructing a parallel facility to separate bicyclists and pedestrians.

Stage 1: Retained.
Stage 2: Eliminated. Limited ability to address pedestrian and bike mobility deficiencies since the Cherry Creek Trail diverges from Leetsdale Drive to the south. The SWG and stakeholders expressed general support for this alternative but not as a solution to the bicycle and pedestrian mobility needs along the Leetsdale Drive corridor.

Crossing Improvements
Address substandard intersection crossings by implementing geometric and signal timing changes. Treatments such as marked crosswalks, median islands, ADA compliant curb ramps, leading pedestrian internals, and signal timing modifications, etc., promote safe and comfortable crossing by people of all ages and abilities.

Stage 1: Retained as complementary.

Wayfinding Improvements
Improve wayfinding and route signage for motorists, bicyclists, and pedestrians. All markings should provide a high level of visibility and easy identification. Decision signs can be used to mark the junction of two or more bikeways or key pedestrian routes to inform people walking and biking of key destinations (including distance and/or travel times). Wayfinding signage is one form of encouragement to foster greater levels of active transportation in the corridor. Figure 4-15 illustrates an example of existing wayfinding along the corridor.

Stage 1: Retained as complementary.

Grade-Separated Bicycle/Pedestrian Facilities
Pedestrian bridges/underpasses can facilitate pedestrians and bicycle travel separate from vehicular travel. Along the corridor, Cherry Creek provides a natural north-south barrier to all travel modes but particularly for people walking and biking. Providing more bridges or crossings along Cherry Creek could increase connectivity and provide more direct travel routes for people walking and biking the corridor.

Stage 1: Retained as complementary.

Trail to Street Connections
Connection improvements would be focused on improving bicycle and pedestrian access to the Cherry Creek Trail through a variety of treatments such as formalizing crossings where trails rise to street level and redesigning ramp connections from the trail to street.

Stage 1: Retained as complementary.

Figure 4-15. Wayfinding Signage
**Transit Alternatives**

**Connectors and Neighborhood Circulators**

Provide small-vehicle, neighborhood-focused circulators that could operate within each major activity center; could be fixed-route (like the Lone Tree Link) or demand responsive. The purpose is to provide high-frequency, convenient non-single-occupancy vehicle movement throughout the neighborhoods for residents, employees, and visitors. Connectors could extend beyond the activity center to provide connections to light rail stations that “feed” the local neighborhoods. This service could either be fare-based or “fare-free” to provide connectivity between activity centers.

*Stage 1: Retained as complementary.*

**Local Bus Improvements**

Improve existing corridor transit service by increasing the frequency of existing service, adding new routes, adding limited service routes, providing regional transit service or connections, and/or consolidating existing stops.

Limited bus services operate on a route identical or similar to one or more local bus routes but only serve certain stops, skipping others.

The goal could be to increase service frequency, improve reliability, and/or improve overall travel times for longer commutes.

*Stage 1: Retained as complementary.*

**Regional Transit Connections**

Regional bus services generally traverse distances between 20 to 60 miles in length and are designed to serve people who need to travel long distances to access government services, medical trips, employment centers, or other key destinations. Consider a regional connection traversing the greater travel shed between I-25 and I-225 with connections to Downtown Denver.

*Stage 1: Retained as complementary.*

**Enhanced Bus**

Localized improvements at key intersections could promote improved transit travel times and reliability at major intersections with improvements such as transit signal priority, bus bulb-outs that allow the bus to stay in the travel lane for boarding and alighting, and/or queue jumps that provide the bus-only lane that enable the bus to bypass a vehicular queue at a signalized intersection *(Figure 4-16).*

*Stage 1: Retained.*

*Stage 2: Retained. Potential to increase person carrying capacity and improve transit travel times. Localized right-of-way impacts.*

**Figure 4-16.  Queue Jump Concept**

**Source:** NACTO Transit Street Design Guide, 2016

**Bus Rapid Transit in Exclusive Lanes (New Right-of-Way)**

Provide exclusive transit lanes for the entire corridor or certain segments. This improvement would require an extensive investment in right of way to widen the corridor and provide new lanes for exclusive transit use.

*Stage 1: Eliminated. Substantial right-of-way requirements and low ease of implementation.*
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Bus Rapid Transit in Exclusive Lanes (Existing Right-of-Way)

This improvement would repurpose the existing cross section to dedicate existing travel lane(s) to transit or right turning vehicles only.

Stage 1: Retained.
Stage 2: Retained.

Mobility Hubs

Mobility hubs are generally located near transit stations and are surrounded by significant levels of transit service and high residential and employment development potential; places of connectivity where different modes come together seamlessly with a high concentration of working/living/shopping/ playing. Mobility hubs can incorporate several amenities/strategies, including real-time transit information, bike share/bike stations, bus bulb-outs, ticketing, parking, enhanced pedestrian crossings, enhanced pedestrian and bicycle facilities, etc. Figure 4-17 illustrates a potential mobility hub.

Mobility hubs could include connections to transit, transportation networking companies, such as Uber and Lyft, bike and car share, bike parking, car and van pooling, and pedestrian and bicycle travelways.

Stage 1: Retained as complementary.

Figure 4-17. Example Mobility Hub

Source: NoHo – RNLDesign, Rocky Mountain West

Bus Stop Improvements

Add accessible infrastructure compliant with ADA, including pads (clear, level landing areas) and ramps where required, and/or repair sidewalk connections to stops where current access is limited.

Bus stops can be used to attract riders, improve operational efficiency, build the brand identity of a system, and foster local economic development. Some important stop elements to improve comfort and utility include shelters, information and wayfinding, seating, bike parking, real-time arrivals and departures information, etc.

Stage 1: Retained as complementary.

Land Use/Urban Design Alternatives

To ensure a balance of infrastructure investments for all transportation modes, focus on creating nodes every couple of miles along the corridor. These nodes would implement urban design redevelopment strategies and could coincide with the Mobility Hub locations. The City could promote investment through the development of complementary zoning recommendations where needed.

Stage 1: Retained as complementary.

Stage 3 Packaging of Improvements

Due to the complexity and length of the corridor, it was anticipated that no single improvement would fully meet the needs of the entire corridor. Therefore, improvements retained after Stage 2 were evaluated on their ability to be combined into alternative packages to meet the corridor’s needs. Stage 3 focused on answering questions about the improvements retained in Stage 2, with the intent of identifying alternative packages and the Recommended Alternative.

This section describes the questions asked to better understand, refine, and develop alternative packages to meet the corridor needs. Questions included:

1) If a managed lane were implemented, what would be the preferred managed-lane strategy to support enhanced bus service/Bus Rapid Transit (BRT) on the corridor?
2) Can queue jumps provide travel time savings competitive with managed lanes?

3) What are the best bicycle and pedestrian treatments for Leetsdale Drive?

**If a managed lane were implemented, what would be the preferred managed-lane strategy to support enhanced bus service/BRT on the corridor?**

Managed lanes can take many forms based on what vehicles can use the lane, times of day the lanes are managed, and if they are located on the outside lanes or in the median. This section describes the key managed lane features evaluated, including:

- Exclusive transit lanes
- Semi-exclusive managed transit lanes
- Exclusive reversible managed transit lane
- Reversible vehicle lane with semi-exclusive managed transit lane

Each of these lane types could accommodate enhanced bus or BRT service. The City may opt to start with a lower capital investment with enhanced bus service and implement BRT features such as branded vehicles, higher frequency service, real-time passenger information, off-board fare collection and low-floor buses over time.

**Can the corridor accommodate exclusive managed transit lanes and if so, where?**

This managed lane improvement would repurpose the outside lane in both directions as bus only lanes. The lane conversion was evaluated by calculating daily vehicle volumes per lane. Conversion was not considered viable for segments where existing vehicles per lane per hour consistently exceeded 1,000 vehicles per lane.

- On segments of the corridor with a cross section of more than four lanes (1st Avenue and Speer Boulevard), converting a general purpose lane to an exclusive managed transit lane resulted in queuing and delays at locations with high right-turn vehicle volumes.

- Based on projected daily vehicle per lane volume analyses, Alameda Avenue, between Colorado Boulevard and Leetsdale Drive, was the only segment of the corridor found to have the potential to repurpose a general purpose lane as an exclusive bus lane.

- On segments of the corridor with a four-lane cross section (Leetsdale Drive), converting a general purpose lane to an exclusive bus lane resulted in excessive queues and delays.

**Can the corridor accommodate semi-exclusive bus lanes and if so, where?**

This option would repurpose the outside lane in both directions for use by transit vehicles and select other vehicles. Management scenarios such as electric vehicles or HOVs could be considered. An HOV-managed lane scenario could provide approximately 3 to 5 minutes of peak hour transit travel time savings.

A semi-exclusive lane to be used by buses and right-turning vehicles only (similar to Broadway and Lincoln) could provide 7 to 10 minutes of peak hour transit travel time savings when traveling the length of the study area. The corridor segments were evaluated assuming “buses and right turns only” managed lanes.
Speer Boulevard and 1st Avenue have the potential to repurpose general purpose lanes as semi-exclusive bus lanes.

On Alameda Avenue between Cherry Creek Drive North and Colorado Boulevard, the average daily vehicle per lane volumes indicated repurposing could result in excessive queues and delays.

Alameda Avenue, between Colorado Boulevard and Leetsdale Drive, could be repurposed as a semi-exclusive bus lane.

On Leetsdale Drive/Parker Road, repurposing outside travel lanes could result in excessive queues and delays.

Can the corridor accommodate a reversible bus lane and if so, where?

Peak hour lane capacity analysis and existing transit ridership patterns were also used to identify locations where a reversible managed transit lane would function best with the lane operating toward Downtown Denver during the AM peak periods and outbound toward Cherry Creek, Glendale, and Parker in the PM peak periods. Travel in the off-peak direction would occur in the existing general purpose lanes.

- Speer Boulevard west of Downing is separated by Cherry Creek flowing through the below grade parkway; a reversible managed transit lane is not viable on this segment.
- The median on 1st Avenue between Downing Street and University Boulevard has historic status; a reversible managed transit lane is not viable on this segment.
- An idea was raised by the public to repurpose the median on 1st Avenue between University Boulevard and Steele Street to accommodate a new bicycle/pedestrian facility. A reversible managed transit lane could be considered.
- Alameda Avenue between Bayaud Avenue and Leetsdale Drive could be considered for a reversible managed transit lane.
- Leetsdale Drive currently experiences some of the higher travel time delays. The TWLTL that runs the length of the Leetsdale Drive portion of the corridor could be converted to a reversible managed transit lane.

Can the corridor accommodate a reversible managed vehicular lane with a semi-exclusive bus lane and if so, where?

In 1996 the City and County of Denver conducted the Leetsdale Drive: Reversible Lane Design Study to evaluate the potential for a reversible lane to alleviate congestion on Leetsdale Drive. The study recommended implementing a reversible general purpose lane on Leetsdale Drive extending from Cherry Street to Mississippi Drive.

To address transit needs identified during the Go Speer Leetsdale study, a reversible managed vehicle lane has been evaluated only in conjunction with the outermost managed as a semi-exclusive bus lane for buses and right-turning vehicles only during peak periods.

The 1996 recommendation included eliminating left-turn movements at signalized locations. Unlike the reversible managed transit lane improvement, the reversible managed vehicular lane cannot accommodate left turns at signalized intersections because the left-turn movement would conflict with the reversible through movement when the reversible lane is traveling in the same direction as the left turn.

Speer Boulevard and 1st Avenue cannot accommodate a reversible vehicular lane for the same reasons documented in the reversible managed transit lane discussion.

Leetsdale Drive cannot accommodate a reversible vehicular lane due to the inability to adequately accommodate the existing left-turn volumes at signalized intersections and the potential for driver confusion.

With the reversible managed transit lane and shared use path, can Leetsdale Drive still accommodate other complementary intersection improvements to improve safety for all modes?

As previously discussed, the reversible managed transit lane can serve a dual purpose as the raised median. Implementation of an access control plan along Leetsdale Drive can supplement the safety benefits related to the reversible managed transit lane.

The reversible managed transit lane concept would require the reconstruction of most signalized intersections on Leetsdale Drive. Each
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Intersection redesign should include the appropriate curb ramp, crosswalk, and turning radii design improvements.

The shared use path and sidewalk improvements could also impact the existing transit stops. Many existing stops on Leetsdale Drive lack designated passenger waiting areas. The redesign of the sidewalk facilities should consider the inclusion of bus stop amenities such as lighting, waiting areas, benches, real-time passenger information, wayfinding, and shelters where space allows.

The conceptual design for the reversible managed transit lane includes extending the median bus stops to offer a median refuge island for pedestrians and bicyclists, see Figure 4-18.

**Preferred Managed Lane Scenario Conclusion**

**Speer Boulevard – Broadway to Downing Street**: Repurpose outside travel lanes for semi-exclusive managed transit lanes.

**1st Avenue – Downing to Bayaud Avenue**: Repurpose outside travel lanes for semi-exclusive managed transit lanes.

**Alameda Avenue – Bayaud Avenue to Colorado Boulevard**: Add a reversible managed transit lane.

**Alameda Avenue – Colorado Boulevard to Leetsdale Drive**: A reversible managed transit lane or a semi-exclusive bus lane could be accommodated; adding a reversible managed transit lane was retained to achieve consistency with the sections east and west along the corridor that are only able to accommodate a reversible managed transit lane.

**Leetsdale Drive – Alameda Avenue to Mississippi Avenue**: add a reversible managed transit lane.

*Can bus queue jumps provide travel time savings competitive with the managed lanes?*

2040 travel time estimates were made for a scenario assuming queue jumps at six major intersections along the corridor and for semi-exclusive bus lanes. Estimates were made using Denver’s Synchro model, RTD’s TriTapt data, and existing travel time runs. Queue jumps were paired with transit signal priority to provide the most potential benefit. Travel time savings were estimated to be on the order of 10 to 20 seconds per intersection. Table 4-5 compares the travel time savings to queues jumps to the managed lanes. As shown, the managed lanes provide a more substantial travel time savings.

<table>
<thead>
<tr>
<th>2040 Travel Time Comparison</th>
<th>Westbound AM</th>
<th>Eastbound PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queue Jump</td>
<td>35–40 minutes</td>
<td>45–50 minutes</td>
</tr>
<tr>
<td>Managed Lanes</td>
<td>25–30 minutes</td>
<td>30–35 minutes</td>
</tr>
</tbody>
</table>

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Can bus queue jumps provide travel time savings comparable to managed lanes – Conclusion

Managed lanes, even semi-exclusive managed lanes, provide substantially more transit travel time savings than queue jumps, which are the most competitive with private auto travel time.

What bicycle and pedestrian facility for Leetsdale Drive?

Two bicycle facilities were evaluated for Leetsdale Drive: (1) a two-way protected bike lane with a separate pedestrian sidewalk, and (2) a shared use path.

Two-way protected bike lanes are physically separated bike lanes that allow bicycle movement in both directions on one side of the street. A separated bike lane is physically separated from motor vehicle traffic and adjacent sidewalk (see Figure 4-19). This two-way protected bike lane would be placed in between the street buffer and sidewalk, providing a protected and dedicated space for both modes.

Existing sidewalks are sometimes narrow or lack a street buffer. Adding a street buffer and consistently providing an 8-foot sidewalk would meet the City’s design standards while also increasing pedestrian comfort.

This solution with the separate pedestrian sidewalk would require approximately 37-feet of right-of-way outside the curb line. Preliminary evaluation of the additional right-of-way requirements indicated that several properties would be impacted and substantial right-of-way acquisition would be necessary.

Shared use paths are designed for combined bicycle and pedestrian use. These facilities should generally be a minimum of 10-feet-wide on average. Due to the shared space, travel speeds, and transit access movements, the shared use path should be coupled with signal timing and intersection improvements such as raised crossings, curb extensions, conflict markings, dedicated crossing phases, and warning signage.

A shared use path level of service analysis was completed to gauge corridor operations at various design widths and potential user volumes. This analysis, coupled with the 2012 AASHTO Guide for the Development of Bicycle Facilities, indicated that an 11-foot shared use path is appropriate to meet the future bicycle and pedestrian needs along Leetsdale Drive.

This width would allow bicyclists with the ability to pass another going the same direction at the same time a path user is approaching from the opposite direction, while still accommodating pedestrians and other wheeled users such as strollers and wheelchairs.

Figure 4-19. Two-Way Protected Bike Lane with a Separate Pedestrian Sidewalk

Source: Toole Design Group, 2017
The shared use path with improved 8-foot detached sidewalks has been estimated to require approximately 30 feet of space outside the curb line. This alternative would result in less right-of-way acquisition than the two-way protected bike lane while still providing a high-quality connection.

*Can the Leetsdale Drive right-of-way accommodate the reversible managed transit lane and the shared use path?*

The preliminary conceptual design of the reversible managed transit lane indicates that additional right-of-way requirements are generally confined to the intersections. Widening at the intersections is required at most signalized intersections to accommodate left-turn lanes.

Widening between intersections would be required to accommodate the shared use path and improved sidewalks. While the dimensions for the shared use path described previously are the ideal dimensions, additional conceptual design will be required to identify the best way to accommodate and balance the desired elements of the roadway. For example, in exceptionally constrained portions of the corridor, the width of the travel lanes, street buffer, or shared use path may be reduced.

*Ease of Use Bicycle and Pedestrian Facility for Leetsdale Drive*

Conclusion

While a two-way protected bike lane with improved sidewalks would provide the highest level of mobility for active modes along the corridor, the additional right-of-way impact and proximity to the existing Cherry Creek Trail indicated that a shared use path would be the best compromise of cost, impact, and mobility along the corridor.
CHAPTER 4: ALTERNATIVES DEVELOPMENT AND EVALUATION

Recommended Alternative Evaluation

Throughout the alternative packaging and evaluation process, specific metrics were reviewed and supporting information was researched to refine the Recommended Alternative. These are discussed in this section.

What are the existing and projected 2040 peak hour corridor long (Broadway - Mississippi) auto travel times?

Table 4-6. Corridor-long Auto Travel Times

<table>
<thead>
<tr>
<th>Existing</th>
<th>2040 Without Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM(WB): 25 minutes</td>
<td>AM(WB): 25-30 minutes</td>
</tr>
<tr>
<td>PM(EB): 30 minutes</td>
<td>PM(EB): 35-40 minutes</td>
</tr>
</tbody>
</table>

How will repurposing the Two-way Left Turn Lane on Leetsdale Drive as a reversible managed transit lane impact private auto travel times?

Peak hour travel time simulations were used to evaluate changes in vehicular travel times. These simulations estimate the following general purpose lane travel time impacts associated with the “Buses and Right Turn Only” managed transit lane solution on Speer Boulevard and 1st Avenue:

Table 4-8. Auto Travel Time with Managed Transit Lane Broadway - Colorado Boulevard

<table>
<thead>
<tr>
<th>AM Eastbound</th>
<th>1 minutes longer</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM Westbound</td>
<td>3-4 minutes longer</td>
</tr>
<tr>
<td>PM Eastbound</td>
<td>5-7 minutes longer</td>
</tr>
<tr>
<td>PM Westbound</td>
<td>2-3 minutes longer</td>
</tr>
</tbody>
</table>

What are the estimated corridor long travel time impacts of the managed transit lane and reversible managed transit lane on auto travel times?

Table 4-9. Corridor-long Auto Travel Times

<table>
<thead>
<tr>
<th>AM Eastbound</th>
<th>2-4 minutes longer</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM Westbound</td>
<td>4-6 minutes longer</td>
</tr>
<tr>
<td>PM Eastbound</td>
<td>4-5 minutes longer</td>
</tr>
<tr>
<td>PM Westbound</td>
<td>1-2 minutes longer</td>
</tr>
</tbody>
</table>
What are the estimated impacts to ridership associated with the managed transit lane and the reversible managed transit lane improvements?

To evaluate the impacts of the managed transit lane and reversible managed transit lane improvements on ridership, RTD used the latest version of the Compass model (Compass 5.0) and the most recent socioeconomic datasets and network assumptions from DRCOG to conduct travel demand model runs for both the existing (2015) and future (2040) horizons.

Model runs for each horizon were conducted with and without the proposed improvements to evaluate the impacts of the Recommended Alternative.

To capture the anticipated benefits to travel time and reliability associated with the exclusive and semi-exclusive nature of the reversible managed transit lane and managed transit lane, respectively, RTD added a separate mode in the model called Denver Urban BRT. This new mode incorporated a 15 percent benefit to the in-vehicle travel time weight in the model. This is similar too, but not as high as, the benefit (30 percent) applied to light rail and commuter rail modes.

The resulting model runs indicated that the recommended improvements could result in an increase in daily ridership of up to 40 percent.

The low end of the range represents the ridership increase without any of the applied benefit factor to consider travel time and reliability, whereas the high end of the range represents ridership with the changes. Note that the high-end ridership change in the model included a significant ridership shift from other routes to the project routes.

Could additional ridership gains occur with increased bus service frequency?

RTD also conducted 2040 model runs with doubled Route 83L service frequencies as a sensitivity test (e.g., 7.5-minute peak-period headways instead of 15 minutes), and the model showed a substantial increase (nearly doubling) in ridership.

An analysis of modeled revenue hours for the No-Build and Build scenarios was conducted to evaluate the potential operating savings for RTD. The analysis indicated 7 percent savings in the total weekday revenue hours for entire lengths of the routes (83L and 83D). These results illustrate that while the project would contribute to the savings of operating costs for RTD, the travel time savings would not be significant enough to allow additional service to be put into the corridor without additional operations funding.

Are there other opportunities to reduce the vehicular travel time and capacity impacts?

The impacts of the transit components of the Recommended Alternative were based on 2040 traffic volume forecasts. It may be reasonable to assume that the anticipated competitive travel times corresponding to the improved transit service could promote mode shift and decrease vehicle volumes on the corridor. However, no vehicular volume adjustments were made to the Recommended Alternative model to account for mode shift.

Other opportunities to increase capacity and travel time savings could arise from advancements in transportation technologies. Technological innovations in the ways vehicles operate, the transportation network is built, and interactions between the two offer many new possibilities.
Recommended Alternative: Capital Cost

Very preliminary capital cost estimates were developed for primary improvements included in the Recommended Alternative. Additional design will be needed to better understand the cost of several items such as right-of-way, utilities, and stormwater management, which are not included in detail in the estimates below. Initial estimates assumed the following:

Table 4-10. Capital Cost Estimates

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Cost per Mile</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reversible Managed Transit Lane</td>
<td>$10 M</td>
<td>$45.0 M</td>
</tr>
<tr>
<td>Managed Transit Lanes</td>
<td>$0.5 M</td>
<td>$1.2 M</td>
</tr>
<tr>
<td>Mobility Hubs</td>
<td>$1.0 M</td>
<td>$4.0 M</td>
</tr>
<tr>
<td>New Ped and Bike Connections</td>
<td></td>
<td>$2.0 M</td>
</tr>
<tr>
<td>Shared Used Path (Leetsdale)</td>
<td>$1.0 M</td>
<td>$4.5 M</td>
</tr>
<tr>
<td>Other Improvements</td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$56.7 M</strong></td>
<td></td>
</tr>
</tbody>
</table>

These 2017 costs include bus platforms, canopies, communications, signalizations, traffic signal upgrades, design, and a 35 percent contingency.

Recommended Alternative: Operating Cost

Current annual operating cost for the Speer/Leetsdale bus service (Route 83) is $3.6 million. This equates to $79 per vehicle hour and $6 per vehicle mile. The current route uses eight peak period buses (four during off peaks). Using the same cost per operating hour, in 2040, operating cost would be reduced to $2.6 million. Both are in 2017 dollars. The cost is lower as result of the improved travel times and a correlating smaller fleet requirement. Based on the travel time saving, it is estimated that the peak

OPPORTUNITIES FOR NEW TECHNOLOGIES

Technological transportation innovations have the potential to dramatically influence transportation in Denver. Innovation may come in the form of connected vehicles and/or increasingly autonomous vehicles.

The recommendations resulting from this study are intended to integrate and complement future technologies. Economic and technical innovations have the potential to complement the proposed investment in alternative modes and lead to a shift away from personally owned transportation modes to mobility alternatives that are consumed as a service (e.g., transit, car share, and rideshare). Complementary transit alternatives such as microtransit, mobility hubs, and virtual mobility hubs aid in this pursuit and reduce the vehicular demand on the roadway.

For example, the managed lane concept could be modified to accommodate and provide a semi-exclusive lane for autonomous vehicles. The reversible managed transit lane could provide an opportunity to test in-road electric vehicle charging for electric transit vehicles.

Source: University of California – Berkeley, Sutardja Center for Entrepreneurship & Technology

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Source: University of California – Berkeley, Sutardja Center for Entrepreneurship & Technology
fleets could be reduced to six buses (three off peak) in order to maintain the existing level of service.

**Recommended Alternative: Benefit Cost Analysis**

A preliminary benefit cost analysis was completed to determine if the Recommended Alternative could meet the current FTA Small Starts funding criteria. Cost-effectiveness refers to annualized capital and operating cost per rider. The following assumptions were made:

- Annual operating cost of $2.566 million using the cost per hour of $80
- Annualized ridership calculated by multiplying daily ridership by 300 (a standard way of calculating annual riders for FTA purposes; this incorporates assumptions for lower ridership on weekends)
- Capital cost of $47 million ($45 million for reversible managed transit lanes and $1.2 million for managed transit lanes)
- Annualized capital cost multiplied the $47 million by 8 percent, a standard annualization estimate that averages all FTA cost categories
- Low ridership of 6,900 in 2040
- High ridership of 8,900 in 2040

Using these assumptions, the cost-effectiveness ranges from $3.98 for the 2015 Build/Low ridership scenario (which would be a “medium” rating for FTA Small Starts) to $1.85 for the 2040 Improved Headways/High Ridership scenario (which would be a “medium-high” rating for FTA Small Starts). A cost benefit of less than $1.00 is required to achieve a “high” FTA rating. This would require reducing the cost or attracting a higher volume of ridership.

Based on this cursory analysis, the Speer/Leetsdale project could potentially be in the range for FTA Small Starts funding eligibility. However, more detailed design and operating information will be needed if and when the City and County of Denver advances this project to future phases.