



COLORADO DEPARTMENT OF TRANSPORTATION,
REGION 1

WestConnect Coalition Planning and Environmental Linkages (PEL) Study

FINAL CORRIDOR CONDITIONS REPORT

APRIL 2017



WestConnect Coalition PEL



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AND ASSOCIATES INC.





WestConnect Coalition PEL

WESTCONNECT COALITION PLANNING AND ENVIRONMENTAL LINKAGES (PEL) STUDY

Corridor Conditions Report

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COLORADO
Department of Transportation

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LIST OF ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
BLOS	Bicycle Level of Service
BNRR	Burlington Northern Railroad
CDOT	Colorado Department of Transportation
Coalition	WestConnect Corridor Coalition
CO	Colorado State Highway
CR	County Road
C-470	Colorado Highway 470
DEA	David Evans and Associates, Inc.
DRCOG	Denver Regional Council of Governments
EB	Eastbound
EIS	Environmental Impact Statement
E-X	Expressway access category
FHU	Felsburg Holt & Ullevig
FHWA	Federal Highway Administration
ft	feet
F-W	Freeway facilities access category
INJ	Injury
Jeffco	Jefferson County
JPPHA	Jefferson Parkway Public Highway Authority
LOS	Level of Service
LOSS	Level of Service of Safety
LRT	Light rail transit
MOU	Memorandum of Understanding
MP	Milepost
MPH	Miles per hour
NB	Northbound
NEPA	National Environmental Policy Act
O-D	Origin-destination
ODME	Origin destination matrix estimation
OTIS	Online Transportation Information Systems
PDO	Property Damage Only
PEL	Planning and Environmental Linkages Study
R-A	Regional highway access category
ROW	Right-of-way
RTD	Regional Transportation District
SB	Southbound
TWG	Technical Working Group
UNCC	Utility Notification Center of Colorado
UPRR	Union Pacific Railroad
US	United States
US 6	United States Highway 6
USDOT	United States Department of Transportation
vpd	Vehicles per day
vphpl	Vehicles per hour per lane
WB	Westbound



INTRODUCTION

Project Background

In response to increasing traffic operations, safety and mobility challenges and concerns along the C-470/United States Highway (US) 6/Colorado State Highway 93 (CO 93) corridor, local agency stakeholders came together to create the WestConnect Corridor Coalition (Coalition). Coalition members understand the importance of the highway facility, the potential opportunities and impacts related to other area projects. The Coalition worked with the Colorado Department of Transportation (CDOT) to initiate this Planning and Environmental Linkages (PEL) study. As a group, the Coalition serves as the primary stakeholder providing input, comment, and direction for the PEL study.

The PEL study will provide the framework and process for CDOT to work with the Coalition agencies to build a tailored program of discrete projects that can then move into environmental documentation, design, and construction. The study is an opportunity to leverage the benefits of the PEL process by clearly documenting strategic project decisions regarding short- and long-term improvements to this highly important corridor in the western Denver Metropolitan area.

The C-470, US 6, and CO 93 highways along the western edge of the Denver metropolitan area create an important regional highway corridor, the WestConnect corridor, providing transportation connectivity between southern Jefferson County and Boulder County. The WestConnect corridor provides regional mobility for the growing suburban communities and serves as an important connection for recreational travel and a commuter route for area residents and business centers.

The study area for the WestConnect Coalition PEL Study is defined as C-470 from Kipling to I-70/US 6 in south Jefferson County, US 6 from C-470 to CO 58/CO 93 in Golden, and CO 93 from Golden to Marshall Road (CO 170) in Boulder County. The 32-mile WestConnect corridor varies greatly in functional classification, surrounding character, and use, which creates differing issues in the various segments of this regional travel corridor.

This Corridor Conditions Report documents the current and anticipated future transportation conditions along the study corridor, developed from readily available data and windshield surveys. The information presented in this report will be used in the development and analysis of improvement alternatives, which will be documented in a subsequent report.

Project Goals

The purpose of recommendations from this study is to improve safety for all users, reduce recurring congestion, and improve existing and future operational performance while reflecting the local community context along the WestConnect corridor from C-470 at Kipling Parkway, along US 6 through Golden, to CO 93 at CO 170. The objective in pursuing this study is to work with the WestConnect Coalition to explore a range of short- and long-term improvements to identify projects for reducing congestion, improving operational performance, and addressing future transportation needs along the corridor. The study will assist CDOT, public agencies, and resource agencies in identifying issues of importance to each respective agency.



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Project Location

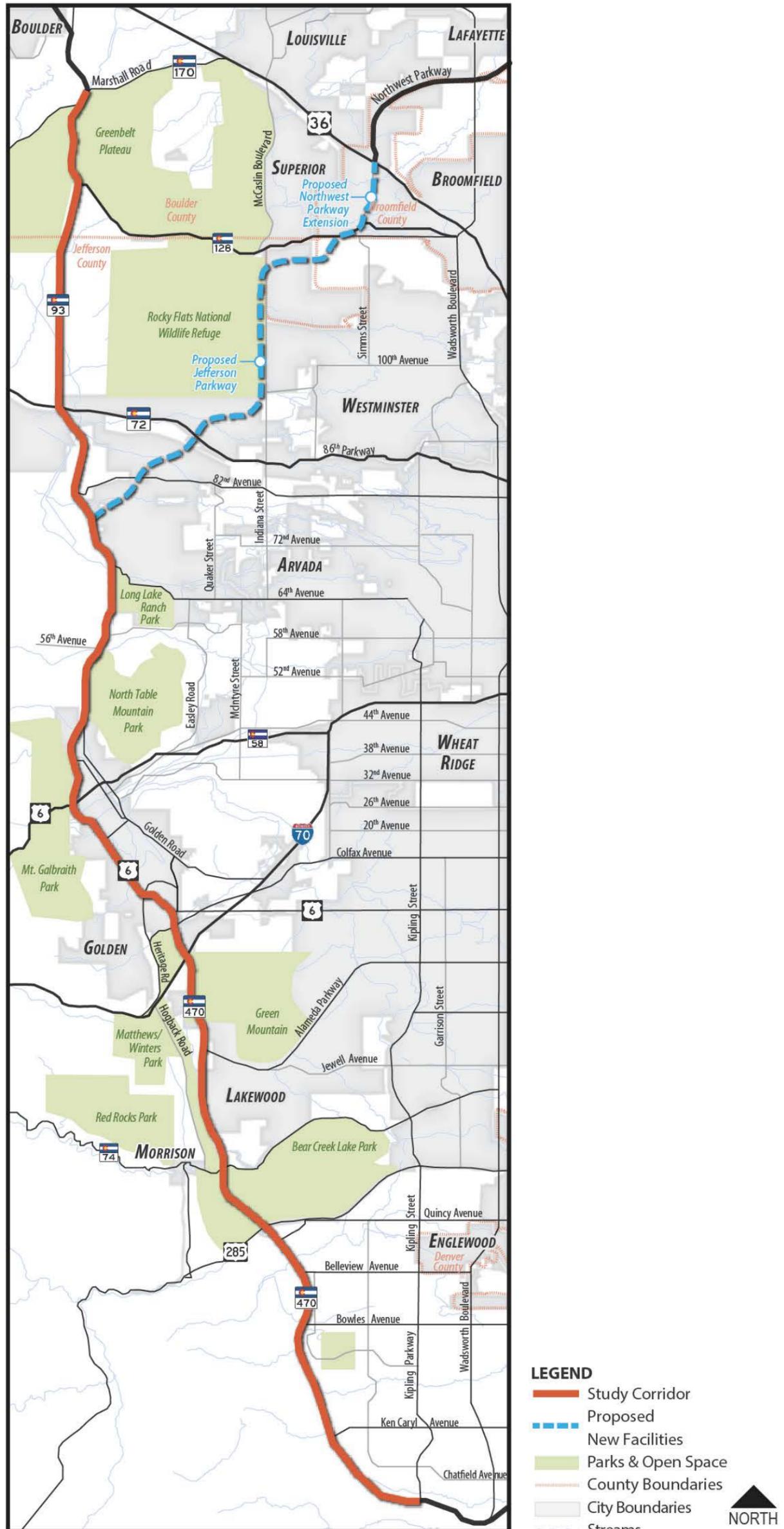
This study is located along the highway corridors of C-470 from South Kipling Parkway to I-70/US 6 in south Jefferson County, US 6 from C-470 to CO 58/CO 93 in Golden, and CO 93 from Golden to Marshall Road/CO 170 in Boulder County, illustrated in **Figure 1**.

Regional Planning Context

The WestConnect corridor highways and the surrounding area have been a focus of past studies with transportation improvement recommendations. Relevant past planning studies were reviewed in relation to the transportation system within or in proximity to the study corridor. The reviewed planning studies, in order of published date, are:

- Northwest Quadrant Feasibility Study (2001), Jefferson County
- Golden Bicycle Master Plan (2003), City of Golden
- The Golden Plan (2003 and update 2013), City of Golden
- Northwest Corridor Transportation and Environmental Planning Study (2008), CDOT
- Broomfield Transportation Plan (2005), City of Broomfield
- Golden Transportation Plan (2011), City of Golden
- Westminster Bicycle Plan (2011), City of Westminster
- Boulder County Transportation Master Plan (2012), Boulder County
- Jefferson County Bicycle and Pedestrian Plan (2012), Jefferson County
- Jefferson County Comprehensive Plan (2013), Jefferson County
- Memorandum of Understanding (MOU) Agreement with CDOT on the US 6 and CO 93 Corridor (2013)
- Superior Transportation Plan (2013 Update), City of Superior
- Arvada Comprehensive Plan (2014), City of Arvada
- Boulder Transportation Master Plan (2014), City of Boulder
- Jefferson County Transportation Plan (2014 Addendum), Jefferson County
- Blunn/Pioneer Master Plan (2015), City of Arvada
- C-470 Revised Environmental Assessment (2015), CDOT
- Lakewood Moves (2015), City of Lakewood
- Morrison Comprehensive Plan (2008, 2015 amendments), Town of Morrison
- Westminster Comprehensive Plan (2015), City of Westminster
- Imagine Arvada: Parks, Trails, and Open Space Master Plan (2016), City of Arvada
- Jeffco Regional Bikeways Wayfinding Guide (2016), Jefferson County

Figure 1: WestConnect Study Area





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Northwest Quadrant Feasibility Study (2001)

Jefferson County led this study to develop a set of transportation improvements that met the following goals: increase mobility, improve safety and provide a higher level of service for transportation facilities over the next 20 years. A number of elements are included in the recommendation for improved transportation in the study area:

- Complete committed projects.
- Employ travel demand management and transportation system management.
- Improved bus service (suburb to suburb, frequencies, travel to cultural facilities) and construction of Gold Line and West Corridor.
- Study light rail transit (LRT) north-south alignment (north to Interlocken and east/west alignment north of 64th Avenue).
- Make improvements on arterials (4 lanes on CO 93 and Indiana Street, link number of lanes phased to demand, link phasing of grade separated interchanges to demand and engineer with minimal impacts).
- Don't preclude option to secure right-of-way (ROW) for future transportation options.
- No support for a freeway.

Golden Bicycle Master Plan (2003)

The *City of Golden Bicycle Master Plan* outlines a citywide bicycle system of on- and off-street routes. While a number of trail improvements have been implemented since this plan, a number of projects identified still remain. The plan recommends the following improvements:

- Complete the following trails: north along CO 93 to 58th Avenue, on the west side of US 6 from 19th Street north to Clear Creek Trail and on the south side of Clear Creek, west to US 6.
- Provide a connection to the existing underpass at Chimney Gulch.
- Construct the following trails: along the west side of US 6 connecting Lookout Mountain Road south to the underpass at US 6, on the east side of Heritage Road between the overpass and Colfax Avenue and on the north side of Colfax Avenue from Moss Street west to US 6 interchange, following on north side of US 6 to Johnson Road.
- Construct grade separated crossings at the following locations: Heritage Road and Colfax Avenue and Heritage Road and US 6.

The Golden Plan (2003 and update 2013)

The recommendations for the US 6 and CO 93 corridors are a result of addressing regional traffic needs as identified in the *Northwest Quadrant Feasibility Study*, meeting the concerns of the community and keeping costs to approximately \$35 million or less. A number of transportation goals were identified through this project (that mirrored those of the *Northwest Quadrant Feasibility Study*): widen to four lanes, improve safety, accommodate traffic volumes anticipated in 2020, easily accommodate future increased traffic volumes beyond 2020 and accommodate multiple modes. The community identified broader goals to achieve through this plan including: minimize noise, enhance neighborhood connectivity and protect the natural and historic beauty of the mountain backdrop. The following items were recommended within the study area:



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- Grade separated interchanges at 19th Street and CO 93/CO 58.
- Wildlife undercrossings near 19th Street, Chimney Gulch and Tributary No. 1.
- Traffic signals with possibility for grade separation at CO 93 and Washington, CO 93 and Golden Gate Canyon Road, and CO 93 and Old CO 93.
- Realign US 6 for 45 miles per hour speed near Jefferson County Parkway/Heritage Street.
- Trail undercrossing near West Fork Kenny Run.
- Pedestrian bridge over CO 93 between Iowa Street and Washington Street and reconstructed pedestrian bridge across CO 93 south of Iowa Street.
- Proposed trails throughout the area, including: along Tucker Gulch (under CO 93), connections to the new pedestrian bridge between Iowa Street and Washington Street, along US 6 between 19th Street and near Clear Creek.

Northwest Corridor Transportation and Environmental Planning Study (2008)

This transportation environmental study was initiated to investigate proposed transportation improvements in the northwest quadrant of the Denver metropolitan area that would provide an improved connection between the Northwest Parkway and the freeway systems in southern Jefferson County (CO 58, I-70 or C-470). A number of alternatives were considered as part of the project. The study identified some recommendations relevant to this study:

- A tollway from CO 93 to the Northwest Parkway. Those traveling further south to access the freeways in southern Jefferson County would then utilize CO 93.
- Trail parallel to the tollway within the new right of way.
- Trail connections allowing movement from CO 93 to the tollway.
- Bicycle lanes added to urban section.

Broomfield Transportation Plan (2005)

The Broomfield Transportation Plan supports the transportation element of the comprehensive plan. The main goal of the plan is to summarize technical information to be used in making transportation policies. A number of roadway improvements have been identified within the study area:

- New roadways connecting 96th Street to Industrial Lane, 112th Avenue to Wadsworth Parkway and US 287 to Wadsworth Parkway.
- Widen from 2 to 4 lanes on Industrial Lane, 112th Avenue and Wadsworth Boulevard.
- Widen from 4 to 6 lanes on Wadsworth Parkway.
- Interchange at US 36 and Wadsworth.
- A number of transit improvements, including: feeder transit service to take riders to and from rail stations, call and ride service and future rail station at Flatirons.
- Trail connections extending the Broomfield Trail via Walnut Creek Trail and Great Western Trail.



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Golden Transportation Plan (2011)

The City of Golden developed an integrated transportation plan to accommodate all transportation modes and ensure that the modes work together for the citizens of Golden. The plan specifically recognizes the importance of integrating light rail transit with the bicycle and pedestrian infrastructure. Although a number of facilities are assumed to remain the same for the near future, the plan recognizes the importance of ensuring some roads be monitored for modifications to improve the transportation system (US 6, CO 93 and CO 58). The following improvements were identified within the study area:

- Priority complete street corridors on a number of roads near the study area, including: Heritage Road, Colfax Avenue, Ulysses, South Golden Road and North Washington.
- A number of pedestrian and bicycle connections to be discussed more in the *Golden Bicycle Master Plan*.

Westminster Bicycle Plan (2011)

This is Westminster's first comprehensive planning effort, intended to guide improvements until 2030. The plan encompasses six main components: 1) Background and existing conditions, 2) Public involvement program, 3) On-street bikeway network plan, 4) Bikeway network wayfinding and signing plan, 5) Bicycle parking plan and 6) Education, encouragement, enforcement and evaluation plan. Among a number of smaller roadway improvements, the plan identifies proposed bicycle facilities on Alkire Street, Simms Street, 100th Avenue/Church Ranch Boulevard/104th Avenue, and Wadsworth Parkway.

Boulder County Transportation Master Plan (2012)

The *Boulder County Transportation Master Plan* lays out five key strategies to accomplish the transportation vision and goals identified in the Comprehensive Plan: 1) Develop a multimodal transportation system, 2) Create the complete trip, 3) Invest in key transportation corridors, 4) Increase accessibility and 5) Enhance mountain area connections. The portion of CO 93 within Boulder County is addressed and included in this plan:

- The Foothills Parkway (CO 93) corridor is one of three primary north-south corridors within the County. As such, fostering improved trail connections and adding bikeable shoulders, bicycle/pedestrian grade separations, and multi-use paths are listed as implementation actions to improve mobility.
- The pavement along CO 93 between CO 170/Marshall Road and CO 58 is noted as poor and there are planned shoulder improvements.

Jefferson County Bicycle and Pedestrian Plan (2012)

Jefferson County developed the bicycle and pedestrian plan in 2012 to address the necessary improvements for bicyclists and pedestrians as they become increasingly popular transportation modes. The relevant projects from the Jefferson County Bicycle Plan (2012) and Pedestrian Plan (2012) include:

- Paved shoulders along CO 93 between Jefferson Parkway and Boulder County, Golden Gate Canyon Road and on CO 93 between Alameda Parkway and CO 74.



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- Bike lanes on Bowles Avenue between Grant Ranch Boulevard and C-470 and on Kipling Parkway between C-470 and Ralston Road.
- Proposed facility (specific type not identified) along Ken Caryl Avenue between C-470 and Kipling Parkway, along Simms Street between Quincy Avenue and Chatfield Avenue; along Chatfield Avenue between Simms Street and Pierce Street.
- A sidewalk on Morrison Road between McIntyre Street and the C-470 Trail.
- A shared use path on CO 93 between Jefferson Parkway and Golden Gate Canyon, Alameda Parkway between Jewell Ave and the C-470 Trail, C-470 Trail and Ellsworth Avenue, the Dutch Creek Trail between Simms Street and the C-470 Trail, Wadsworth Boulevard between the C-470 Trail and Peakview Drive.

Jefferson County Comprehensive Plan (2013)

Within the transportation section of this plan, Jefferson County recognizes the importance of a variety of transportation options while seeing cars as the “preferred” mode of transportation. A number of efforts are acknowledged to increase the efficiency for vehicles, including: carpool opportunities, signal timing and strategic land use choices. As part of this comprehensive plan, a map was created to show road classifications, with the following identified:

- Freeway: C-470, US 285, I-70, CO 58, CO 93 and Jefferson Parkway.
- Principal arterial: Ken Caryl Avenue west of Simms Street and Bowles Avenue.
- Minor arterial: Ute Avenue, South Valley Road, Bellevue Avenue, Quincy Avenue, Morrison Road, Alameda Parkway, US 40, Johnson Road, US 6 west of CO 93, 58th Avenue, 64th Avenue, and CO 72.
- Major collector: 19th Street, Golden Gate Canyon Road, and 82nd Avenue.

MOU Agreement with CDOT on the US 6 and CO 93 Corridor (2013)

CDOT and Golden created an MOU for successful cooperation of current and future highway construction in Golden. Important elements relevant to this study:

- Speed limits remain at 45 miles per hour (MPH) except for a segment between Heritage Road and 19th Street, where it is 55 MPH. Changing the speed limit would be allowed under the following circumstances: road geometry changes, both parties agree, and safety reasons.
- No more than two through lanes in each direction in Golden unless average daily trips exceed 70,000 vehicles per day (vpd) or an average of 1,700 vehicles per hour per lane (vphpl) during peak periods.
- CO 93 north of Washington Avenue to be relocated west of current alignment.
- Interchanges at the intersections of US 6 and 19th Street, CO 93 and Washington Street, and current CO 93 and realigned CO 93.
- Interchanges at the intersections of CO 93 at US 6 and CO 58 that will adhere to parameters identified in the *Golden Plan*.
- All overpass and intersection improvements will accommodate a total of six lanes and to accommodate additional transit infrastructure.



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- Overpasses across CO 93 at Iowa Street and Golden Gate Canyon Road.
- US 6 and CO 93 lowered to accommodate overpasses and interchanges.
- Any significant deviations from the *Golden Plan* need to achieve the same noise performance.
- Mitigate neighborhood and community division.
- Raised and landscaped medians.
- Look for opportunities to accommodate and/or improve neighborhood pedestrian and bicycle connections.
- Golden will donate needed right-of-way.
- Golden will maintain the medians, top surface of overpasses and interchanges developed, landscaped areas, pedestrian/bicycle surfaces and removal of graffiti.

Superior Transportation Plan (2013 Update)

This plan provides a long range evaluation of future mobility solutions and identifies solutions for solving transportation issues. Only one future improvement was identified in the plan as it relates to this study, which is a roundabout or other intersection improvements at CO 128 and McCaslin Boulevard.

Arvada Comprehensive Plan (2014)

The plan addresses three components of the community: 1) growth and economic development, 2) multimodal transportation and 3) vibrant community and neighborhoods. The plan identifies a number of future roadway improvements in the form of new connections, additional lanes and traffic operations or other multimodal improvements. A number of improvements fall within the study area:

- Jefferson Parkway connection from CO 93 to Northwest Parkway.
- Additional lanes on CO 72 between 96th Avenue and 64th Avenue, 64th^h Avenue between CO 72 and Quaker Street, 72nd Avenue between CO 72 and Kipling Parkway.
- Traffic operations or other multimodal improvements on CO 93 at the intersection to the future Jefferson Parkway.

Boulder Transportation Master Plan (2014)

The City of Boulder's *Transportation Master Plan* represents more than twenty years of consistent policy of transportation supporting broader community goals identified in the *Boulder Valley Comprehensive Plan*. This document is meant as an accessible and usable summary of the City's policies and strategies in transportation. A number of concepts relate to this study:

- Major transportation funding improvements will build complete streets (including all modes—pedestrian, bicycle, transit, and automobile) by prioritized corridor segment. The city will make strategic improvements consistent with the priorities of the investment programs.
- A complete and safe bicycle system will connect destinations within the community and the regional system. This system will be enhanced to encourage use by all types of riders for a variety of trip purposes.



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Jefferson County Countywide Transportation Plan (2014 Addendum)

Jefferson County's *Countywide Transportation Plan* was developed as a coordinated approach to address transportation within the County. The plan encompasses all of Jefferson County, including the incorporated municipalities, but is not intended to replace plans adopted by each jurisdiction. The 2014 Addendum replaces the previous Addendum and supplements the 1998 *Countywide Transportation Plan*, including recommendations to complete major gaps in the regional system, signage, and designs. A number of projects have been identified within the study area:

- Fiscally constrained projects
 - Jefferson Parkway with the creation of four interchanges
 - Highway improvements on I-70 west of C-470
 - Bicycle and/or pedestrian and roadway capacity on Quincy Avenue between C-470 and Kipling Parkway
- Needs based projects
 - Roadway capacity projects on the following roads: CO 93/C-470 from the Boulder County boundary to Kipling Parkway, Kipling Parkway between 58th Avenue to Bowles Avenue, US 285 east of C-470, 80th Avenue east of CO 93 to Kipling Street and other smaller segments on roadways east of the corridor
 - Gold Line Light Rail extension from Ward Road to Golden
 - Gold Line park and ride at 44th Avenue and McIntyre Street
 - Golden Gold Line Station

Blunn/Pioneer Master Plan (2015)

This master plan was developed to identify the future vision for 1,600 acres of land just east of CO 93 within the City of Arvada. The Blunn/Pioneer area is roughly bounded by 64th Avenue to the south, Virgil Way to the east and Leyden Road to the north. There is approximately 600 acres of available land for new uses and this plan makes development recommendations. Available land is planned for an easement of the Jefferson Parkway as well as a number of other recreational uses:

- Leyden-Brookes stone circles, outdoor public shooting range, police training facility, solar array, compost transfer site, prairie dog preserve, bike park, Arvada modelers airfield, Westwoods golf course expansion, trail and trail parking and reservoir.
- A proposed signalized intersection located near where the current access point for the Pioneer Sand Company is located now.

C-470 Revised Environmental Assessment (2015)

In 2015, CDOT approved a revised environmental assessment for a proposed action to add tolled express lanes on C-470 between Kipling Parkway and I-25. The proposed action (currently under construction) adds a tolled express lane in each direction within these boundaries, in addition to the existing lanes already in place, and addresses structural deficiencies through pavement reconstruction.



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Lakewood Moves (2015)

The transportation chapter within the comprehensive plan *Lakewood 2025: Moving Forward Together* recognizes the importance of a multimodal transportation system to accommodate different users. Lakewood also recognizes the importance of regional transportation planning and coordinating with surrounding jurisdictions and agencies. Potential improvements identified within the project area:

- Unspecified facility on Alameda Parkway west of C-470 as well as north and south of Alameda Parkway.
- New proposed arterial, major collector and minor collector roadways just east of C-470, north of Morrison Road and south of Alameda Parkway.

Morrison Comprehensive Plan (2008, 2015 amendments)

The first goal of the transportation chapter within the *Town of Morrison's Comprehensive Plan* is to provide and maintain a roadway network that meets circulation and access needs in a safe, economical, and efficient manner. Actions from the plan that relate to the project area include the following:

- Coordinate additions and improvements to the transportation system with the City of Lakewood, Jefferson County and CDOT.
- Develop a continuous system of bicycle/pedestrian routes including connections to schools, natural attractions, businesses, and recreation areas.
- Investigate ways to improve safety of pedestrians and bicyclists crossing C-470, CO 8 and CR 93.
- Designate bicycle lanes with signage and pavement markings where roadway widths permit.
- Provide separate bicycle/pedestrian pathway in the design of future development.
- Establish Old Town Morrison as a bicycle/pedestrian hub to enhance the viability of Old Town.

Westminster Comprehensive Plan (2015)

In the transportation and circulation chapter within the comprehensive plan originally adopted in 2013 and amended in 2015, the roadway network is identified as the core of the city's circulation network. Regional access is provided through a number of roadways, including: I-25, US 36, Wadsworth Parkway, 120th Avenue, Sheridan Boulevard, and Federal Boulevard. As part of this plan, the comprehensive roadway plan examines level of service throughout the city to identify existing and future deficiencies.

Imagine Arvada: Parks, Trails, and Open Space Master Plan (2016)

The City of Arvada developed this plan to manage improvements and the future parks, trails and open spaces. The 2015 *Imagine Arvada: Parks, Trails, and Open Space Master Plan* outlines a vision of a connected park, open space, and trail system throughout the city. This plan developed a new vision called Green Spines, which will connect neighborhoods to a network of the parks system. The following elements have been identified in the plan:

- Trail priority areas for the following: Colorado Front Range Trail, Coal Creek Canyon Trail and Trail along the future Jefferson Parkway.
- Intersect Barbara Gulch Trail and Moon Gulch Trail with future Jefferson Parkway.



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- Connect Ralston Creek Trail to and Jefferson Parkway Trails to Fairmount Trail; Jefferson Parkway underpass needed.
- Extend Van Bibber Creek Trail to Colorado Front Range Trail and to Jefferson Parkway Trails; Jefferson Parkway underpass needed.
- Underpasses at the following locations: at the intersection of Jefferson parkway and Van Bibber Creek Trail crossing with CO 93, the intersection of Jefferson Parkway and CO 93, under CO 93 at 82nd Avenue and CO 93 and CO 72.

Jeffco Regional Bikeways Wayfinding Guide (2016)

Jefferson County completed a wayfinding study to identify recommendations moving forward for bike facilities within Jefferson County. The goal for wayfinding in the area is to improve rider experience and make facilities easier to navigate. The guide is broken in to two different pieces: setting the foundation for developing a wayfinding guide and wayfinding toolkits for implementation on bikeways. The guide outlines the following key principles for implementing a consistent wayfinding system, including: connect places, promote active travel, maintain motion, be predictable and keep information simple. Decision signs, confirmation signs and turn signs are the main sign types utilized to communicate information to users. The C-470 Trail is identified as a Priority 2 regional wayfinding route (out of three levels) within this plan. The following recommendations were identified:

- Consistency and priority in identifying bikeways and destinations
- Placement and programming to be intuitive, consistent and enhance navigability
- Consistent branding of the Jeffco Regional Bikeways graphic
- Communicate “Jefferson County Regional Bikeways” and comply with MUTCD

ROADWAY CONDITIONS

WestConnect Corridor Roadway Characteristics

This section presents the existing roadway characteristics for highways C-470, US 6, and CO 93 within the study area.

Typical Cross Sections

Representative typical cross sections of each of the WestConnect corridor highways are illustrated in **Figure 2**. C-470 has a consistent typical section from Milepost (MP) 15, near the Wadsworth Boulevard interchange, to MP 4, near the Morrison Road interchange. The highway segment consists of four, 12-foot lanes (two lanes in each direction) separated by a depressed median. The outside shoulder typically varies from 10 to 12 feet along the highway and varies from 6 to 8 feet along the auxiliary ramp lanes, although there are segments that are narrower and wider than these widths. The inside shoulder varies from 4 to 8 feet. The median width typically varies from 28 to 32 feet. The overall depressed median is typically 42 feet with 6-foot inside shoulders and a 30-foot wide median. A median cable rail was installed along the C-470 depressed median, mostly on the west side of the median although from the Kipling Parkway interchange to about ½ mile south it is along the east side of the median. There are also intermittent segments of CDOT Type 3 W-Beam guardrail installed along the depressed median.

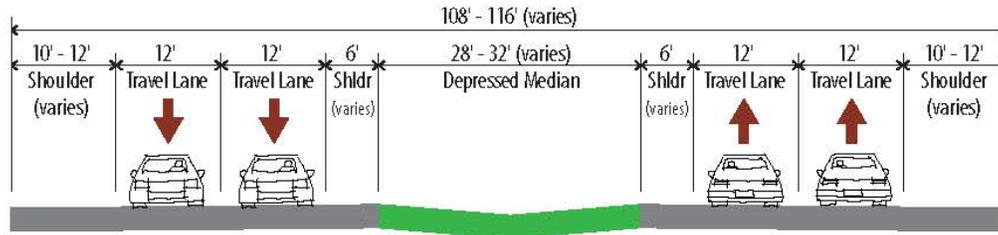
C-470 from north of Morrison Road to I-70 transitions to three 12-foot lanes in each direction separated by a median barrier. The outside shoulder typically varies from 8 to 10 feet along the mainline and varies from 5 to 10 feet along the auxiliary ramp lanes, although there are some segments that are narrower and wider than these widths. The inside shoulder varies from 8 to 12 feet. C-470 from I-70 to US 6 is a transitional area with a typical median width of 10 feet.

US 6 has a consistent typical section from C-470/Johnson Road to 19th Street. The four-lane highway segment has 12-foot lanes separated by a depressed median. The outside shoulder typically varies from 10 to 12 feet along the highway and varies approaching intersections. The inside shoulder is generally 2 feet northbound and varies from 2 to 12 feet southbound. The median typically varies from 18 to 28 feet, although there are segments that are narrower and wider than these widths.

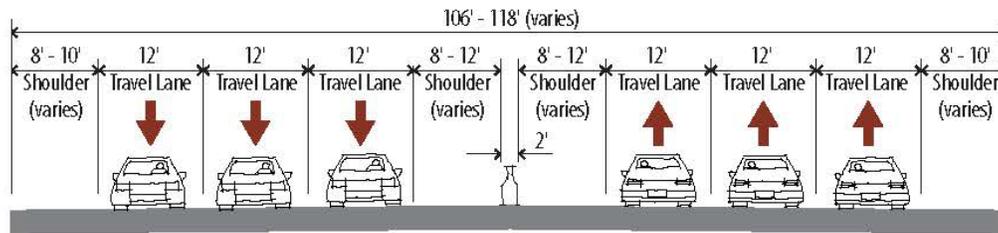
US 6 also has a consistent typical section from 19th Street to US 6/CO 58. The four-lane highway segment has 12-foot lanes separated by a painted median. The outside shoulder northbound typically varies from 6 to 12 feet and southbound from 8 to 12 feet along the highway, and varies narrower at intersections/major accesses. The painted median is typically 4 feet wide and gets wider at intersections.

CORRIDOR CONDITIONS REPORT

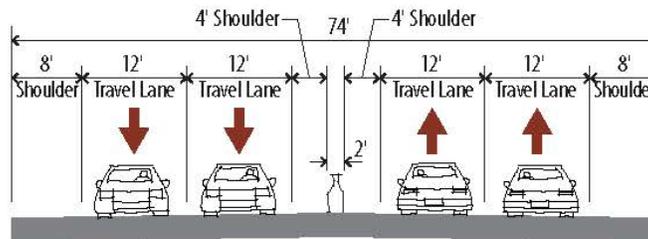
Figure 2: Typical Cross Sections



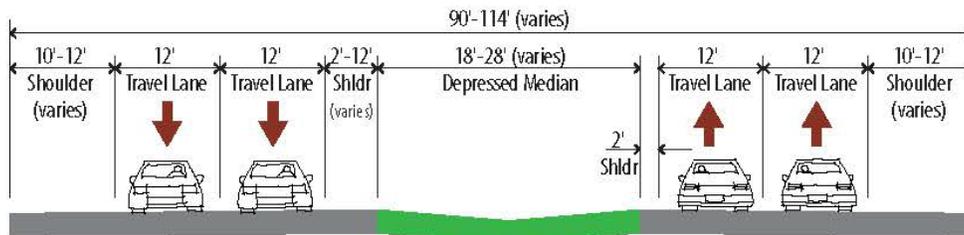
C-470: Wadsworth Avenue Interchange to Morrison Road Interchange



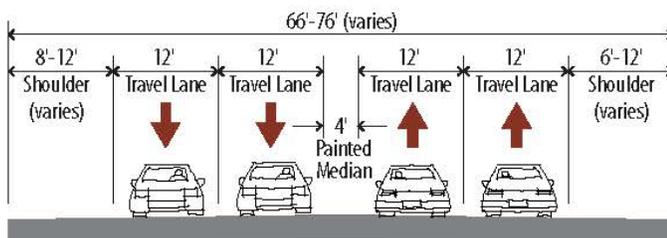
C-470: Morrison Road Interchange to I-70 Interchange



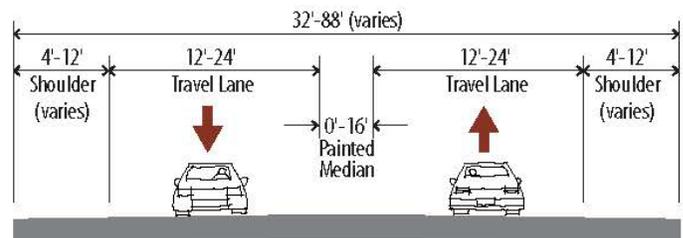
C-470: I-70 Interchange to US 6



US 6: Johnson Road to 19th Street



US 6: 19th Street to US 6/CO 58 Intersection



CO 93: US 6/CO 58 Intersection to Marshall Road (CO 170)



CORRIDOR CONDITIONS REPORT

The typical section for CO 93 varies considerably. From MP 0, near the CO 58 intersection, to MP 0.6, near the Iowa Drive intersection, the undivided highway consists of two 12-foot lanes northbound and one 12-foot lane southbound. The outside shoulder northbound typically varies from 2 to 12 feet and the outside shoulder southbound is typically 10 feet. There are some segments that the shoulder is narrower and wider than these widths. The outside northbound lane merges just before Iowa Drive. There is a median and turn lanes at both CO 58 and Iowa Drive.

From Iowa Drive to Washington Avenue, the divided CO 93 highway segment consists of a 12-foot lane northbound, a 12-foot lane southbound, and about a 12-foot striped median. The outside shoulder northbound is typically 16 feet and the outside shoulder southbound is typically 14 feet. There are some segments that the shoulder is narrower and wider than these widths. There are turn lanes at both Iowa Drive and Washington Avenue.

From Washington Avenue to Golden Gate Canyon Road, the undivided CO 93 highway segment consists of a 12-foot lane northbound and a 12-foot lane southbound. The outside shoulder northbound is typically 10 feet and the outside shoulder southbound is typically 10 feet with a few sections between 2 to 6 feet. There are turn lanes at both Washington Avenue and Golden Gate Canyon Road.

CO 93 from Golden Gate Canyon Road to Pine Ridge Road consists of a 12-foot lane northbound and a 12-foot lane southbound. The outside shoulders range from 6 to 10 feet wide. There are some segments where the shoulder is narrower and wider than these widths. There are turn lanes at both Golden Gate Canyon Road and Pine Ridge Road.

CO 93 from Pine Ridge Road to north of Hogback Drive consists of a 12-foot lane northbound, a 12-foot lane southbound, and a 12- to 18-foot painted median. The outside shoulders are typically 6 feet wide. There are some segments where the shoulder is narrower and wider than these widths. There are turn lanes at Pine Ridge Road and Hogback Drive.

CO 93 from Hogback Drive to 56th Avenue, the undivided highway segment consists of a 12-foot lane northbound and a 12-foot lane southbound. The outside shoulder northbound is typically 14 feet and the outside shoulder southbound typically ranges from 14 to 26 feet, with 6-foot shoulders near Hogback Drive. There are some segments that the shoulder is narrower and wider than these widths. There are turn lanes at both Hogback Drive and 56th Avenue.

CO 93 from 56th Avenue to 58th Avenue consists of a 12-foot lane northbound, a 12-foot lane southbound, and a 6- to 16-foot painted median. The outside shoulders range from 4 to 12 feet wide. There are some segments where the shoulder is narrower and wider than these widths. There are turn lanes at 56th Avenue and 58th Avenue.

From 58th Avenue to ¼ mile north of 64th Parkway, the divided CO 93 segment consists of two, 12-foot lanes northbound, a 12-foot lane southbound, and about a 16-foot painted median. The outside shoulders range from 4 to 6 feet northbound and 4 to 10 feet southbound. There are turn lanes at 58th Avenue, 64th Parkway and at other major intersections/accesses.

From ¼ mile north of 64th Parkway to ¼ mile south of Indian Head Road, the undivided CO 93 segment consists of two, 12-foot lanes northbound and a 12-foot lane southbound. The outside shoulders range



CORRIDOR CONDITIONS REPORT

from 6 to 12 feet northbound and 6 to 14 feet southbound. There are turn lanes at some other major intersections/accesses.

From ¼ mile south of Indian Head Road to 82nd Avenue, the divided CO 93 segment consists of a 12-foot lane northbound, two 12-foot lanes southbound, and a 14-foot painted median. The outside shoulders range from 8 to 10 feet wide. There are turn lanes at 82nd Avenue and Indian Head Road.

From 82nd Avenue to CO 72 (Coal Canyon Road), the undivided CO 93 segment consists of two, 12-foot lanes northbound and a 12-foot lane southbound. The outside shoulders range from 8 to 12 feet wide. There are turn lanes at 82nd Avenue, CO 72, and at other major intersections/accesses.

CO 93 from CO 72 to CO 128 consists of a 12-foot lane northbound and a 12-foot lane southbound. The outside shoulder northbound is typically 14 feet and the outside shoulder southbound typically ranges from 14 to 26 feet. There are some segments that the shoulder is narrower and wider than these widths. There are turn lanes at Coal Creek Canyon Road, CO 128, and at other major intersections/accesses.

CO 93 from CO 128 to Marshall Road/CO 170, the undivided CO 93 segment consists of a 12-foot lane northbound and two 12-foot lanes southbound. The outside shoulder, northbound and southbound, typically varies from 6 to 8 feet. There are some segments that the shoulder is narrower and wider than these widths. There are turn lanes at CO 128 and Marshall Road.

Right-of-Way

Along C-470, the right-of-way varies considerably. **Table 1** summarizes the approximate right-of-way along C-470 and at interchanges.

Table 1: C-470 Right-of-Way Width

SEGMENT	APPROXIMATE RIGHT-OF-WAY WIDTH (FEET)
Wadsworth Boulevard to Kipling Parkway	300 to 500
Kipling Parkway Interchange	300 to 730
Kipling Parkway to Ken Caryl Avenue	300 to 330
Ken Caryl Avenue Interchange	365 to 777
Ken Caryl Avenue to Bowles Avenue	215 to 400
Bowles Avenue Interchange	337 to 1000
Bowles Avenue to Quincy Avenue	350 to 540
Quincy Avenue Interchange	540 to 1300
US 285 Interchange	300 to 2600
US 285 to Morrison Road	270 to 500 (includes Soda Lakes Road)
Morrison Road Interchange	320 to 1100
Morrison Road to Alameda Parkway	320 to 530 (includes Rooney Road)
Alameda Parkway Interchange	380 to 1100
Alameda Parkway to I-70	300 to 750 (includes trails)
I-70 Interchange	700 to 2400
I-70 to US 6	200

Source: Jefferson County Assessor maps



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Along US 6, the right-of-way varies considerably. Table 2 summarizes the approximate right-of-way along the highway and at major intersections.

Table 2: US 6 Right-of-Way Width

SEGMENT	APPROXIMATE RIGHT-OF-WAY WIDTH (FEET)
C-470/Johnson Road to 19th Street	220 to 285
19th Street Intersection	400 to 480
19th Street to US 6/CO 58	175 to 250
US 6/CO 58 Intersection	350 to 460

Source: Jefferson County Assessor maps

Along CO 93, the right-of-way varies considerably. Table 3 summarizes the approximate right-of-way along the roadway and at major intersections.

Table 3: CO 93 Right-of-Way Width

SEGMENT	APPROXIMATE RIGHT-OF-WAY WIDTH (FEET)
Hogback Road to 56th Avenue	150 to 216
56th Avenue to 64th Parkway	124 to 420
64th Parkway to 80th Avenue	124 to 510
80th to UPRR	262 to 432
UPRR to CO 72 (Coal Creek Canyon Road)	115 to 350
CO 72 (Coal Creek Canyon Road) Intersection	160 to 524
CO 72 (Coal Creek Canyon Road) to Boulder County Line	130 to 200
Boulder County Line to CO 128	100 to 200
CO 128 to Marshall Road/CO 170	100 to 200

Source: Jefferson County Assessor maps

Access Categories

CDOT assigns access categories to state highways that define specific roadway characteristics for a roadway segment. The categories are associated with certain requirements for access spacing and auxiliary lanes as documented in the CDOT State Highway Access Code.

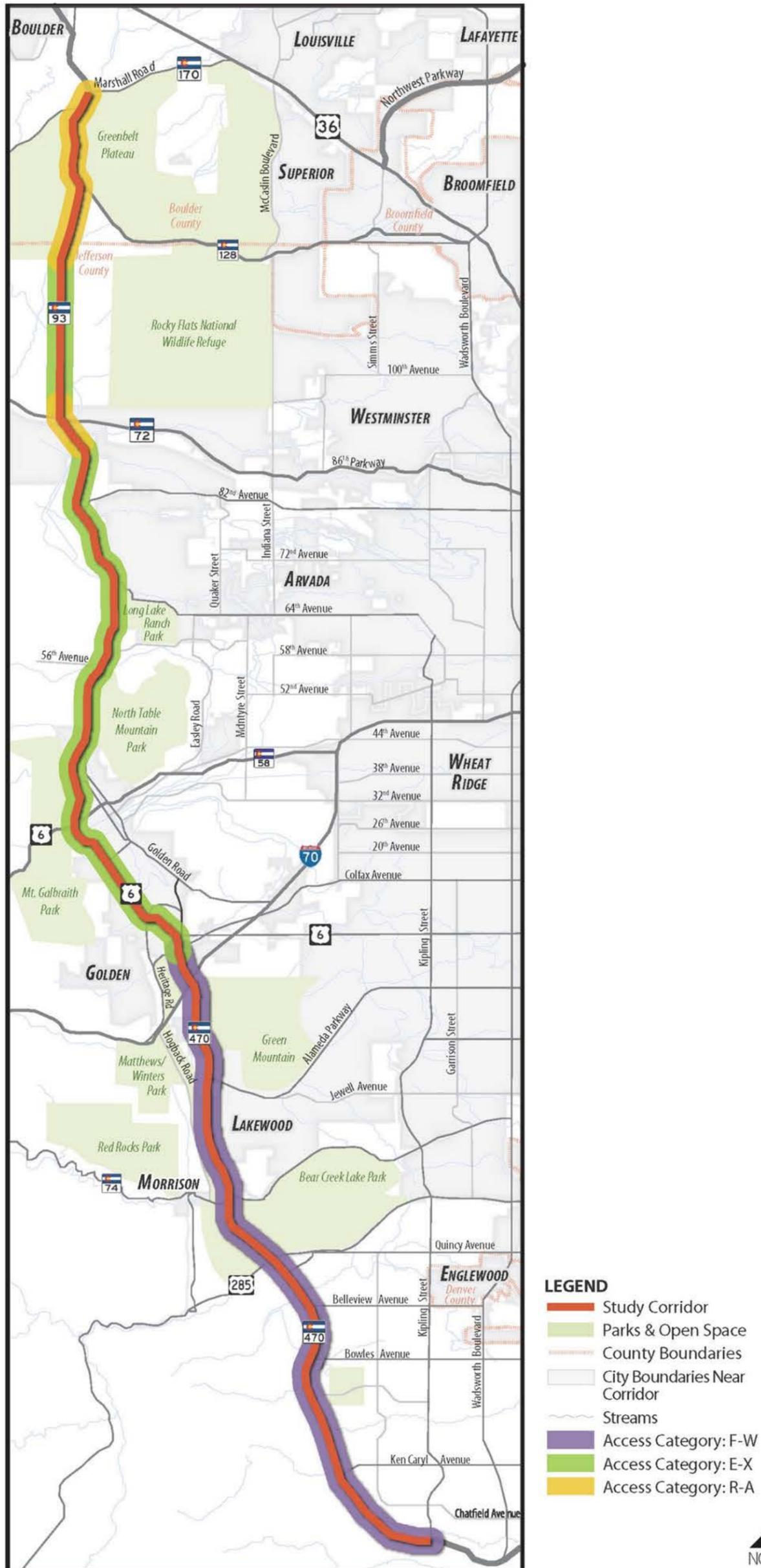
The current access categories for the WestConnect corridor highways are illustrated in Figure 3. C-470 is classified as Interstate System, Freeway Facilities (F-W) for the full extent of C-470 within the study area. US 6 is classified as Expressway, Major Bypass (E-X) along the stretch of US 6 within the study area. The classifications for CO 93 vary along the study segment. CO 93 is classified as E-X from MP 0 to MP 7. The classification changes to Regional Highway (R-A) from MP 7 to about MP 8, then returns to E-X from about MP 8 to about MP 11. From about MP 11 to Marshall Road (CO 170), CO 93 is classified as R-A.



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Figure 3: Current Access Categories





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The access categories along the WestConnect corridor are defined below.

- **F-W:** This category is appropriate for use on highways that have the capacity for high speed and relatively high traffic volumes over medium and long distances in an efficient and safe manner. They provide for interstate, interregional, intra-regional, intercity and, in larger urban areas, intracity travel. Interstate freeways are typical of this category.
- **E-X:** This category is appropriate for use on highways that have the capacity for high speed and relatively high traffic volumes in an efficient and safe manner. They provide for interstate, interregional, intra-regional, and intercity travel needs and to a lesser degree, some intracity travel needs. Direct access service to abutting land is subordinate to providing service to through traffic movements.
- **R-A:** This category is appropriate for use on highways that have the capacity for medium to high speeds and relatively medium to high traffic volumes over medium and long distances in an efficient and safe manner. They provide for interregional, intra-regional, and intercity travel needs. Direct access service to abutting land is subordinate to providing service to through traffic movements. This category is normally assigned to National Highway System routes, significant regional routes in rural areas, and other routes of regional or state significance.

There are no access control plans or access management plans on CDOT's master list for the WestConnect corridor highways.

Parallel Roadway Characteristics

There is no roadway parallel to the WestConnect corridor highways for the entire length of the study area. However, there are several roadways that parallel the corridor for short segments that provide alternative travel options for short trips that may otherwise utilize the corridor highways.

Simms Street and Kipling Parkway/Kipling Street

Simms Street (County Road [CR] 67), a four-lane arterial roadway, begins at Ken Caryl Avenue and extends approximately 4.5 miles to an interchange at US 285. This facility is located about 1.5 miles east of C-470. About 12,000 to 15,000 vpd use this route, with some using this route to avoid congestion along C-470. No future planning efforts or improvements have been identified for this roadway.

Kipling Parkway, a four-lane arterial roadway with auxiliary lanes, begins at C-470 and extends approximately nine miles north to Jewell Avenue, where it becomes Kipling Street and continues north of I-70, ending north of 58th Avenue. This facility is located about 2.5 miles east of C-470. The widening of Kipling Street to six lanes between Colfax Avenue and I-70 is in the *Denver Regional Council of Government (DRCOG) Fiscally Constrained Regional Transportation Plan*, but the rest of the arterial will remain four lanes. About 23,000 to 37,000 vpd use this route south of US 6, with some users avoiding out-of-direction travel to/from southwestern metropolitan neighborhoods and congestion along C-470.

Johnson Road/South Golden Road/ Ford Street/Pine Ridge Road Corridors

Johnson Road, a four-lane arterial roadway carrying about 10,500 vpd, begins at US 6 at the C-470 intersection and extends approximately 1.5 miles to South Golden Road. South Golden Road, a four-lane arterial roadway, carrying about 12,500 vpd begins at Johnson Road and extends about 0.5 mile to

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Ford Street. Ford Street, a two-lane collector roadway carrying about 1,500 vpd with bike lanes and parking, begins at South Golden Road and extends three miles to Pine Ridge Road. Pine Ridge Road, a two-lane residential roadway carrying about 600 vpd, begins at Ford Street and extends about 200 feet to CO 93. Overall, these four linked roads are approximately five miles long. This combined facility is about three miles east of US 6/CO 93 and parallels approximately five miles of US 6/CO 93. Some users of this route are possibly avoiding congestion along US 6 and CO 93.

McIntyre Street/64th Avenue/Indiana Street Corridors

McIntyre Street, a four-lane arterial roadway, begins at CO 58 and extends approximately 1200 feet to 44th Avenue. It then transitions to a two-lane collector from 44th Avenue to 58th Avenue, approximately two miles. McIntyre Street then transitions again to a four-lane arterial roadway from 58th Avenue to 64th Avenue, approximately one mile. The widening from two lanes to four lanes along the segment from 58th Avenue to 60th Avenue is still under development. 64th Avenue, a four-lane arterial roadway, begins at McIntyre Street and extends approximately 1300 feet to Indiana Street. Indiana Street (CR 5), a two-lane collector roadway, begins at 64th Avenue and extends approximately seven miles to 120th Avenue (CR 128). Overall, the three linked roads are about a 10-mile segment.

This facility is about 3.5 miles east of CO 93 and parallels approximately 12.5 miles of CO 93. About 11,000 to 26,000 vpd use this route, with some users avoiding congestion along US 6 and CO 93.

Railroad and Light Rail Proximity

Figure 4 illustrates the location of the railroad and light rail crossings in close proximity to the WestConnect corridor highways. The Burlington Northern Railroad (BNRR) now ends just east of US 6 near Golden. The BNRR travels from the east to Golden, following along W 44th Avenue to a terminus point near 9th Street. The line to the north has been removed and no longer crosses CO 93, south of 56th Avenue.

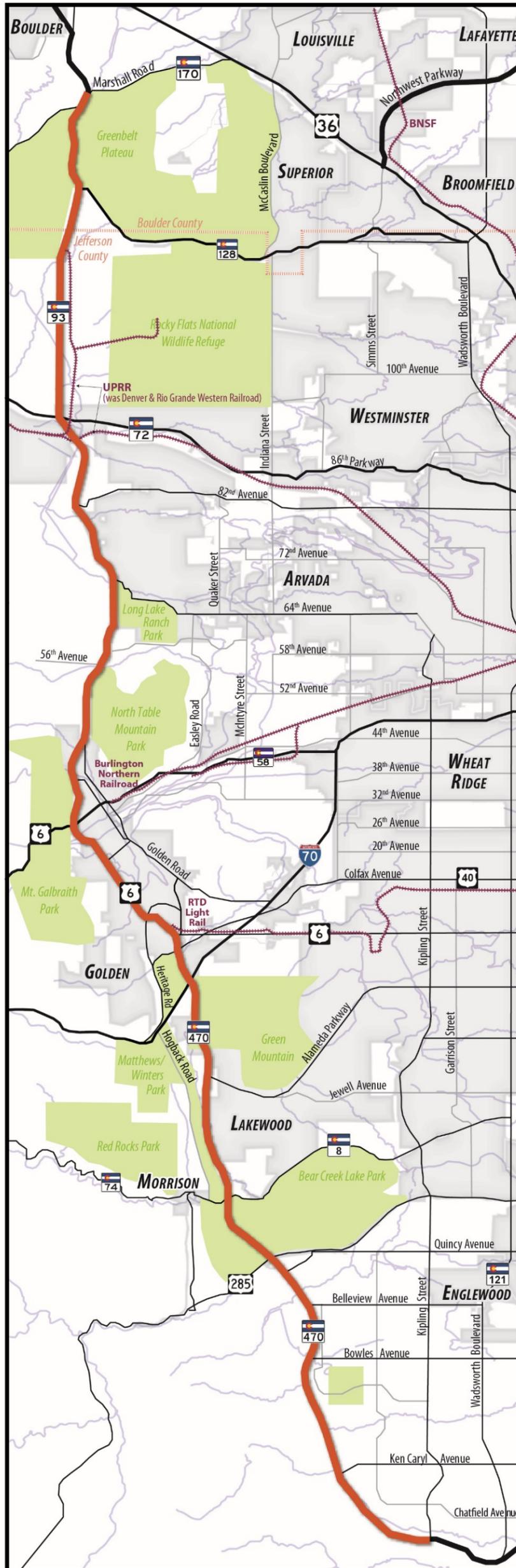
The Denver and Rio Grande Western Railroad (now owned by Union Pacific Railroad (UPRR)) crosses CO 93 south of CO 72 and is parallel to CO 93 north of CO 72. The UPRR travels from the east to the Rocky Flats area near CO 72. There is an at-grade crossing of the UPRR about 1,500 feet south of CO 72, about MP 7.3 on CO 93. There is also a grade-separated crossing under CO 93 approximately 2,800 feet south of CO 72, at about MP 7. The structure number for the CO 93 bridge crossing over the railroad is E-16-NF (DRGW RR (253-297G)). The railroad line heads north on the east side of CO 93 for about 3 miles and is located 1,200 feet to 1,700 feet east of CO 93.

Along US 6, there is a W Line RTD light rail crossing at Johnson Road, north of US 6. This is a single track line with signals.



Grade-separated crossing under CO 93

Figure 4: Railroad Proximity



- LEGEND**
-  Study Corridor
 -  Parks & Open Space
 -  County Boundaries
 -  City Boundaries Near Corridor
 -  Streams
 -  Railroads





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CORRIDOR CONDITIONS REPORT

WestConnect Corridor Roadway Features

Several roadway features were documented along the C-470, US 6, and CO 93 highways to document the types and extent of these features. These include guardrail, fences and walls, lighting, and traffic and railroad signals. A field visit was conducted on June 21, 2016 to document the location and type of features. Google Earth was also used to supplement data collected during the field visit.

Guardrail

Guardrail, cable rail, and concrete barrier locations were identified along each of the study corridors. These were identified along the outside shoulders and within the median. These features are placed to protect against obstructions, steep slopes, and errant cross-over traffic. The location, type and approximate length of guardrail is noted in **Table 4**.

Table 4: Guardrail Locations

HIGHWAY	SEGMENT	GUARDRAIL TYPE	APPROXIMATE LENGTH
C-470	Wadsworth to US 285	Concrete Barrier	Located along all interchanges
		W Beam Guardrail	Intermittent on road segment and located along all interchanges
		Cable Rail	34,000 feet (in center median)
	US 285 to Alameda Pkwy	Concrete Barrier	10,800 feet (in center median) and located along all interchanges
		W Beam Guardrail	Intermittent on road segment and located along all interchanges
		Cable Rail	5,500 feet (in center median)
Alameda Pkwy to US 6	Concrete Barrier	9,500 feet (in center median) and located along all interchanges	
	W Beam Guardrail	Intermittent on road segment and located along all interchanges	
US 6	C-470 to CO 58	W Beam Guardrail	3,000 feet (west side) 6,400 feet (east side) At C-470 and US 6 transition
		Concrete Barrier	At C-470 and US 6 transition
CO 93	CO 58 to CO 72	W Beam Guardrail	2,000 feet (west side) 800 feet (east side)
	CO 72 to CO 128	W Beam Guardrail	3,200 feet (west side) 4,900 feet (east side)
	CO 128 to CO 170	W Beam Guardrail	3,330 feet (west side) 1,700 feet (east side)

Source: Field visit by FHU, June 2016

CORRIDOR CONDITIONS REPORT

Fence and Walls

Along each corridor are a variety of fence and wall types. These were identified along the outside shoulders, along ROW and within the median. These features are placed to identify right-of-way, separate trails from roadway, mitigate noise, retain earth adjacent to the roadway, and mitigate blowing snow. The location, type and approximate length of and walls are noted in **Table 5**.

Table 5: Fence/Wall Locations

HIGHWAY	SEGMENT	FENCE/WALL TYPE	APPROXIMATE LENGTH
C-470	S Wadsworth Blvd to US 285	C-470 Bikeway wire fence	35,000 feet (east side)
		Barbed wire fence	Intermittent (west side)
	US 285 to W Alameda Pkwy	C-470 Bikeway wire Fence	9,000 feet (east side) 1,900 feet (west side)
		Barbed wire fence	Intermittent (west side)
	W Alameda Pkwy to US 6	C-470 Bikeway wire fence	8,500 feet (east side)
		Barbed wire fence	Intermittent (west side)
US 6	C-470 to CO 58	Concrete sound wall	1000 feet at US-6 and C-470 transition
		Kinney Run Trail wire fence	7,500 feet (east side)
		Barbed wire fence	Intermittent
		Concrete Retaining Wall with vertical fence	700 feet (east side)
CO 93	CO 58 to CO 72	Concrete sound wall	380 feet (east side near Pine Ridge Rd)
		Snow fence	2,000 feet (west side near CO 72)
		Bikeway three rail fence	(east side)
		Path wire fence	Near Iowa Dr (east side)
	CO 72 to CO 128	Barbed wire fence	Intermittent most of length north of Washington St (west side and east side)
		Barbed wire fence	Intermittent
		Snow fence	11,500 feet (west side)
		CO 128 to CO 170	Barbed wire fence

Source: Field visit by FHU, June 2016

Lighting

Different levels of lighting are provided throughout the study area. These were identified along the roadway and at intersections and interchanges. The locations of illuminated areas are noted in **Table 6**.



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Table 6: Lighting Locations

HIGHWAY	SEGMENT	DESCRIPTION
C-470	Wadsworth Blvd to US 285	Intermittent illumination along road segment (interchanges are all illuminated)
	US 285 to Alameda Pkwy	Road segment illuminated (including interchanges)
	Alameda Pkwy to US 6	Road segment illuminated (including interchanges)
US 6	C-470 to CO 58	No illumination, except at intersections
	19th St and US 6 Intersection	Intersection illuminated (under construction)
	Jefferson County Pkwy and US 6 Intersection	Intersection illuminated
	Johnson Rd and US 6 Intersection	Intersection illuminated
CO 93	CO 58 to Marshall Rd (CO 170)	No illumination, except at intersections
	CO 170 and CO 93 Intersection	Intersection illuminated
	CO 128 and CO 93 Intersection	Intersection illuminated
	64th Ave and CO 93 Intersection	Intersection illuminated
	58th Ave and CO 93 Intersection	Intersection illuminated
	Pine Ridge Road and CO 93 Intersection	Intersection illuminated
	Golden Gate Canyon Rd and CO 93 Intersection	Intersection illuminated
	Washington Ave and CO 93 Intersection	Intersection illuminated
	Iowa Dr and CO 93 Intersection	Intersection illuminated
	CO 58 and CO 93 Intersection	Intersection illuminated

Source: Field visit by FHU, June 2016

Traffic Signals

Along the C-470 corridor, traffic signals are located at interchange ramp terminal intersections, although not all ramp intersections are controlled by signals.

The US 6 corridor has a variety of signal types for intersection traffic and a signalized light rail crossing at Johnson Road. The at-grade signalized intersection at 19th Street is currently under construction to be replaced with a grade separated interchange.

The CO 93 corridor includes a mix of mast arm and span wire traffic signals. There is also a railroad span wire signalized crossing just south of CO 72 on CO 93. The locations and types of signals along the WestConnect corridor highways are noted in **Table 7**.

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Table 7: Traffic Signal Locations

HIGHWAY	SEGMENT	DESCRIPTION
C-470	C-470 and Wadsworth Blvd Interchange	Mast arm signal poles with separate pedestrian signal poles
	C-470 and Kipling Pkwy Interchange	Mast arm signal poles with separate pedestrian signal poles
	C-470 and Ken Caryl Ave Interchange	Mast arm signal poles
	C-470 and Bowles Ave Interchange	Mast arm signal poles
	C-470 and Quincy Ave Interchange	Stop signs
	C-470 and US 285 Interchange	Clover leaf interchange with no signal
	C-470 and Morrison Rd Interchange	Single point urban interchange with signal poles and signals mounted on the side of bridge
	C-470 and Alameda Pkwy Interchange	Mast arm signal poles
	C-470 and I-70 Interchange	No signal
US 6	Johnson Rd and US 6 Interchange	Mast arm signal poles and LRT signals
	Jefferson County Pkwy and US 6 Intersection	Mast arm signal poles
	Intersection 19th St and US 6 Intersection	Signal poles with span wires (under construction)
CO 93	CO 58 and CO 93 Intersection	Mast arm signal poles
	Iowa Dr and CO 93 Intersection	Mast arm signal poles (recently constructed)
	Washington Ave and CO 93 Intersection	Signal poles with span wires
	Golden Gate Canyon Rd and CO 93 Intersection	Signal poles with span wires
	58th Ave and CO 93 Intersection	Signal poles with span wires
	64th Pkwy and CO 93 Intersection	Signal poles with span wires
	Railroad just south of CO 72	Railroad signal poles with span wire
	CO 72 and CO 93 Intersection	Mast arm signal poles
	Westgate and CO 93 Intersection	Signal poles with span wires
	CO 128 and CO 93 Intersection	Mast arm signal poles
	CO 170 and CO 93 Intersection	Mast arm signal poles

Source: Field visit by FHU, June 2016

Roadway Deficiencies

Design deficiencies were identified along the C-470, US 6 and CO 93 corridors based on comparing the existing conditions to the proposed design criteria utilized for this study. It is important to note that design standards are often updated and the identified locations may have met standards in place during the design and construction of the facilities. Available as-built plans were reviewed for key design elements to determine potential deficiencies. However, plans were not available for all segments. Deficiencies that were considered included insufficient horizontal and vertical alignments, grades

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related to sight distances; narrow shoulder widths; acceleration, deceleration, and redirect taper lengths; and potential clear zone issues. **Table 8** lists the location and potential deficiency along each corridor. Roadway design criteria is provided in **Appendix A**.

Table 8: Potential Roadway Deficiencies

HIGHWAY	SEGMENT	DESCRIPTION
C-470	North of US 285 to Morrison ramps, North of Morrison Rd (SB side), South of I-70 intersection at Rooney Crossing	Outside shoulders are less than 8 ft or inside shoulders less than 10 ft, for 6-lane section.
	US 285 Interchange ramps	Cloverleaf and button-hook Loop ramp curve radii (posted 15 MPH to 25 MPH) and weaving sections
	I-70 Interchange ramps	Cloverleaf Loop ramp curve radii (posted 30 MPH) and weaving sections
US 6	Most of study corridor	Inside shoulders less than 2 ft, outside shoulders less than 10 ft and less than 2 ft at intersections.
	North of 19th St intersection	Vertical grade greater than 6%
CO 93	Between CO 58 and Iowa Dr; Golden Gate Canyon Rd and Hogback Dr; 56th Ave and Indian Head Rd; and CO 128 and Marshall Rd.	Outside shoulders are less than 8 ft
	Leaving CO 58 (MP 0)	NB acceleration length insufficient based on posted 40 MPH speed limit.
	North of CO 58	Horizontal curves do not meet design speed of 50 MPH (MDS of 40 MPH)
	North of CO 58	Vertical grade greater than 5%
	Approaching/leaving Washington Ave	NB acceleration length and SB and NB deceleration length insufficient, based on posted 45 MPH speed limit.
	Approaching/leaving Golden Gate Canyon Rd	SB and NB deceleration length, and median redirect (north and south of access) insufficient based on posted 45 MPH speed limit.
	North of 58th St	Vertical grade a bit greater than 5%
	Approaching/leaving landfill access (about MP 6.75)	NB acceleration length, SB and NB deceleration length, and median redirect (north and south of access) insufficient based on posted 55 MPH speed limit.
	Approaching/leaving 82nd Ave (about MP 5.88)	SB deceleration length, and median redirect (north of roadway) insufficient based on posted 55 MPH speed limit.
	Between MP 6.23 and MP 7.06	Vertical grade at 6%
	Near Boulder County line	Vertical grade greater than 5%
	North of CO 128	Vertical grade slightly over 5%
	Between MP 12 and MP 13.5	Vertical grade greater than 5% and mostly at 7%
Many sections of the highway, mostly on the west side.	There are large trees potentially within clear zone.	

Source: Field visit by FHU, June 2016



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Existing Structures

A listing of major and minor structures and substantial wall structures was compiled from the CDOT database. The major structures are associated with interchanges and crossings of larger creeks while minor structures cross smaller creeks and unnamed drainageways. The full listing of major structures can be found in **Appendix A**.

Along the C-470 portion of the study corridor, there are 30 major and 27 minor structures and 26 major wall structures. Only one of the structures along C-470 has a noted deficiency. The westbound C-470 structure over I-70 has a sufficiency rating of 55.6 and is deemed functionally obsolete. Its minimum vertical clearance (and of the eastbound structure over I-70) is only 15.6 feet and the westbound bridge has experienced impact from a passing truck.

There are only five major and five minor structures along the US 6 portion of the study corridor and two major wall structures. The major structures over a draw at MP 273.4 was built in 1951, has a sufficiency rating of 67 and is considered structurally deficient. The major structure over Clear Creek is much newer, built in 1999, but has a sufficiency rating of only 63 and is considered functionally obsolete.

Along CO 93 from CO 58 to CO 170, there are eight major and 22 minor structures and only one major wall structure. The major structure over Aggregate Road has a vertical clearance of only 13.8 feet and is considered functionally obsolete.

Major Utilities

Major utilities are defined as electric transmission lines and substations, high pressure gas lines and regulator stations, oil and gas facilities, raw water lines, water transmission lines and storage facilities, public water wells, water and wastewater treatment plants and pump stations, sanitary sewers at least 18 inches in diameter, storm sewers at least 36 inches in diameter, brick and clay sanitary sewers, force mains, critical telecom facilities, and communication trunk lines.

To identify owners of major utilities in the project area, the Utility Notification Center of Colorado (UNCC) database was searched. Utility owners were contacted to confirm the presence or absence of facilities in the study corridor, to obtain key maps and to find out if any new or upgrades to major utilities were planned. To the extent possible based on surface features, information from utility owners was confirmed and supplemented by a field visit on July 6, 2016.

Table 9 lists the utility owners with facilities along the study corridor. Both public and private entities own facilities in the study corridor. Owners of utilities located in public right-of-way that need to be relocated for public projects are relocated at the cost of the utility owner, except if they are owned by a governmental entity or are in a pre-existing easement. Utilities that are in private property and/or are in an easement are usually relocated at project cost.



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Table 9: Utility Owners with Facilities in the WestConnect Corridor

UTILITY OWNER	C-470	US 6	CO 93
AT&T	■		
Colorado Department of Transportation (ITS)	■	■	■
CenturyLink	■	x	■
City of Arvada			■
City of Golden	□	□	■
City of Lakewood	x		
City of Louisville			■
College Park Water and Sanitation District	x		
Colorado School of Mines		x	
Comcast	x	x	x
CrownCastle		■	
Denver Water Department	■		■
Genesee Water and Sanitation District	■		
Green Mountain Water and Sanitation District	x		
Intermountain Rural Electric Association	■		
Jefferson County Emergency Communications Authority		■	
Jefferson County School District	x	x	x
Ken Caryl Ranch Water and Sanitation District	x		
Lakehurst Water and Sanitation District	□		
Lockheed Martin	■		
MCI/Verizon	■		■
Meadowbrook Fairview Metro District	□		
Meadowbrook Water District	□		
Mount Carbon Metro District	x		
North Table Mountain Water and Sanitation District			■
Plains Metro District	□		
Pleasant View Sanitation District		x	
Roxborough Water and Sanitation District	■		
Southwest Metro Water and Sanitation District	□		
Sprint	■		
Sun Edison			■
T-Mobile	■		
Town of Morrison	x		
United Power			■
West Meadows Metro District	x		
Willowbrook Water and Sanitation District	□		
Xcel Energy	■	■	■
Zayo	x	x	■

Source: UNCC June 2016

x Information from the utility owner is pending

■ Major utilities have been confirmed by utility owner and/or field survey

□ Utilities are present, but are not consider major utilities

Several types of major utilities were documented along the study corridor. These include: electric transmission lines and substations, high pressure gas lines, raw water lines, water transmission lines and storage facilities, public water wells, a water treatment plant and pump station, a sanitary force main,



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critical telecom facilities, and communication trunk lines. The location and type of major utilities are noted in **Table 10**.

Denver Water’s North System Renewal Project will replace the existing Moffat Treatment Plant in Lakewood with a new plant, the Northwater Treatment Plant, near Ralston Reservoir west of CO 93. In addition, two existing conduits that cross CO 93 north of 64th Parkway will be replaced with a new 84-inch conduit. Construction is expected to begin in 2018.

Table 10: Location of Major Utilities

HIGHWAY	OWNER	TYPE	MILEPOST START	MILEPOST END	LOCATION
C-470	CDOT	ITS Fiber backbone	14.1	6.1	Buried facility east of C-470 in CDOT ROW between Quincy and Wadsworth
	Lockheed Martin	Critical telecom	14.1		Buried facility crossing under C-470 east of Wadsworth
	Denver Water	Raw water	13.9		Crossing under C470 in Wadsworth
	Roxborough WSD	Sanitary force main	13.9	14.1	Along outside of southeast side of Wadsworth interchange
	Denver Water	Water transmission	13.6		Crossing under C-470 in Carr St
	Denver Water	Water transmission	13.0		Crossing under C-470 between Kipling and Wadsworth
	Xcel Energy	Gas Transmission	13.0		Crossing under C-470 between Kipling and Wadsworth
	AT&T	Communication trunk line	12.5		Buried facility crossing under C-470 in Kipling
	Denver Water	Water transmission	12.5		Crossing under C-470 in Kipling
	Lockheed Martin	Critical telecom	12.5		Buried facility crossing under C-470 in Kipling
	CenturyLink, Verizon, T-Mobile, Sprint	Critical telecom	11.7		In small buildings south of C-470 4000 feet west of Kipling
	Xcel Energy	Electric Transmission	9.5		Crossing over C-470 north of Ken Caryl
	Denver Water	Water transmission	8.2		Crossing under C-470 1500 feet south of Bowles and along SW side of interchange
	Denver Water	Water transmission	6.8		Crossing under C-470 in Belleview
	Intermountain Rural Electric Association	Electric Substation	6.2		4675 Eldridge St SE of Quincy onramp to NB C-470
	Xcel Energy	Electric Transmission	6.2		Crossing over C-470 at Quincy overpass
	CDOT	ITS Fiber backbone	6.1	0.0	Buried facility west of C-470 in CDOT ROW between I-70 and Quincy
	Xcel Energy	Electric Transmission	5.8		Crossing over C-470 at US 285
	Genessee WSD	Public water well	4.6		Southeast of the Morrison Rd interchange
	Genessee WSD	Public water well	2.9		Northeast of the Morrison Rd interchange (location uncertain)
Xcel Energy	Electric Transmission	1.8		Crossing over C-470 north of Alameda Pkwy	
Xcel Energy	Electric Transmission	0.4		Crossing over US 6 north of I-70	
Xcel Energy	Gas Transmission	0.2	0.6	Crossing and parallel to east side of C470 south of I-70	



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HIGHWAY	OWNER	TYPE	MILEPOST START	MILEPOST END	LOCATION
US 6	CDOT	ITS Fiber backbone	271.5	274.6	Buried facility west of US 6 in CDOT ROW from CO 58 to east of Johnson Rd
	Jefferson County Emergency Communication Authority	Critical telecom	271.5	274.6	Buried facility along US 6 from CO 58 to east of Johnson Rd
	Crown Castle	Critical telecom	271.5		Crossing under US 6 at CO 58
	Xcel Energy	Electric Transmission	273.7		Crossing over C-470 along alignment of 10th Ave in Golden
CO 93	CDOT	ITS Fiber backbone	0.0	13.6	Buried facility west of CO 93 in CDOT ROW from US 6 to Marshall Rd East of CO 93 under CO 72.
	City of Golden	Water Transmission	0.8	1.7	Crossing under and parallel to CO 93 between Washington and water tanks west of CO 93 near MP 1.7. Crosses near MP 1.2.
	City of Golden	2 water tanks	1.7		Two water tanks west of CO 93
	North Table Mountain WSD	Water Treatment Plant	4.2		Northeast corner of CO 93/64th Parkway
	North Table Mountain WSD	Raw water (2 pipelines)	4.3		Crossing under CO 93 north of 64th Parkway
	Sun Edison	Solar Array	4.3		East of CO 93 north of 68th Ave.
	Denver Water	Raw water (2 pipelines)	4.4		Crossing under CO 93 north of 68th Ave.
	City of Arvada	Raw water (2 pipelines)	4.6		Crossing under CO 93 south of Ralston Creek
	MCI/Verizon	Communication trunk line	7.5		Crossing under CO 93 at CO 72
	City of Arvada	Pump station	7.5		Northeast corner of CO 93/CO 72.
	Xcel Energy	Gas Transmission	7.5	10.5	Crossing under and parallel to CO 93 between CO 72 and 3 miles north of CO 72
	CenturyLink	Communication Trunk Line	7.5	13.6	Buried facility along CO 93 between CO 72 and Marshall Rd.
	United Power	Electric Substation	8.2		Southeast corner of CO 93/Westgate Rd.
	Xcel Energy	Electric Transmission	9.5		Crossing over CO 93 north of Westgate Rd.
	Xcel Energy	Electric Transmission	11.1		Crossing over CO 93 about 3000 feet south of CO 128
	Zayo	Communication Trunk Line	11.8		Crossing under CO 93 at CO 128
	Xcel Energy	Gas Transmission	13.4		Crossing under CO 93 about 1300 feet south of Marshall Rd.
City of Louisville	Raw water	13.6		Crossing under CO 93 at Marshall Rd.	

Sources: Field visit, key maps and information from utility owners.



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CDOT is currently installing a fiber optic backbone along the CO 93 corridor between Golden and Boulder. A limited number of video cameras are planned for installation in late spring/early summer of 2017, utilizing the new fiber backbone.

A new water line is also being planned to serve the NREL facility north of Rocky Flats as shown in the proposed waterline figure in **Appendix A**.

Geotechnical Conditions

Based on review of existing geologic maps, the following potential geologic hazards have been identified that could impact design of roadways and structures associated with the project.

Swelling Soil and Rock

Moderate to very high swell potential should be anticipated along the majority of the study corridor except across the Rocky Flats pediment, across the pediment surface just east of Ralston Reservoir, and in the vicinity of Clear Creek canyon. Swell mitigation measures will likely be required.

Steeply Dipping Bedrock

Steeply dipping bedrock should be anticipated along much of the study corridor. Nearly the entire alignment is located in what Jefferson County has identified as a Designated Dipping Bedrock Area, for which special regulations regarding the design and construction of habitable structures have been established (Jefferson County Planning and Zoning, 2009). However, these regulations do not apply to the construction of transportation features such as roads, bridges, and culverts. Instead, these features will need to follow standard CDOT and County transportation design specifications.

Erosion

Moderate to severe erosion potential should be anticipated along most of the study corridor except across the Rocky Flats pediment and other generally low-gradient surfaces underlain by alluvial deposits. Erosion potential should be mitigated by providing proper drainage and grading. Appropriate temporary and permanent erosion control features, which could include turf reinforcement mats, riprap and drop structures, should also be included.

Slope Stability

Based on review of published geologic maps, there is a low probability of landslide activity affecting the study corridor. A field reconnaissance will be necessary to better characterize potential landslide hazards along the project corridor.

Mine Subsidence

Maps produced by the Colorado Geological Survey (2012), indicate undermined areas may impact the northern end of the study corridor, near CO 170/Marshall Road, the intersection of CO 93 and the proposed Jefferson Parkway, the greater Golden area, and near the I-70 interchange. Mine subsidence is an active and ongoing problem in the Golden area. Where mine subsidence hazards exist, the likelihood of sinkholes and settlement occurring can be reduced by directing surface drainage away from the mine features. A more proactive approach to mitigate the hazard could consist of conducting low-



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mobility grouting beneath key project element(s), which may include bridges and retaining structures. Low-mobility grouting consists of injecting a low-slump sand-cement grout into the ground under pressure. In locations where relatively large mine voids are present, the features could be filled with a foam-sand slurry. During final design, geotechnical explorations should be completed to characterize abandoned mine workings, particularly at structure locations.

Seismicity

Because Quaternary movement is unproven on faults in close proximity to the study corridor, and because the peak horizontal ground acceleration for this area of Colorado is low, seismic hazard potential for the project corridor is deemed to be low.

Hydrology and Groundwater

Several drainages that cross the study corridor experience occasional flooding as indicated by the United States Department of Agriculture Natural Resources Conservation Service (2016), for drainages listed below:

- Turkey Creek
- Unnamed drainage near Fossil Trace golf course
- Clear Creek
- Tucker Gulch
- Cressmans Gulch
- Ralston Creek
- Coal Creek

Groundwater could be encountered in excavations. In some areas, groundwater may be encountered at relatively shallow depths. Shallow groundwater is not anticipated to affect a significant portion of the study corridor. Temporary dewatering may be required at relatively deep excavations. Groundwater is likely to be encountered in drilled shaft excavations. At stream crossings, the design of structures should account for flooding and associated scour. During design, streambed materials and the depth to bedrock at stream crossings should be characterized to support scour evaluations.

Mineral Resources

Mineral resources in the study area that may support construction of the project could include crushed aggregate and sand and gravel. It may be feasible to establish borrow pits near the highway to provide a source of aggregates, which can reduce costs associated with importing and hauling materials. If borrow pits will be developed for a project, potential pit locations should be evaluated and characterized to confirm the suitability of the material source.

VEHICULAR TRAFFIC OPERATIONS

This section describes the existing and future intersection and roadway traffic operations to identify locations with operational problems and recurring congestion issues. Intersection and corridor operational analyses were completed for the WestConnect corridor utilizing methods outlined in the 2010 Highway Capacity Manual (HCM 2010). Traffic operations along the US 6 and CO 93 highway corridors were analyzed using Synchro/SimTraffic and Highway Capacity Software traffic analysis software. Traffic operations along the C-470 freeway corridor were analyzed using the Transmodeler microsimulation software package for its abilities to model freeway operations and potential benefits of freeway improvements, including managed lane facilities. The models were calibrated to existing field data, including traffic counts and travel time runs. The existing intersection and corridor lane configurations and balanced peak hour traffic volumes for the existing (2016) condition were used to analyze the Levels of Service (LOS) at each key study intersection and corridor segment for the weekday AM and PM peak hours.

For intersections, LOS is directly related to control delay and is a measure of traffic flow and level of congestion at an intersection measured on a scale of A to F. LOS A describes conditions with essentially uninterrupted flow and minimal delay. LOS F describes a breakdown of traffic flow where there exists excessive congestion delay. Signalized intersection capacity analysis results in an overall LOS representative of all movements through the intersection. Unsignalized intersection capacity analysis produces LOS results for each vehicle movement that yields the right-of-way to conflicting traffic. **Table 11** summarizes the signalized and unsignalized LOS thresholds used in this analysis.

Table 11: Intersection Level of Service (LOS) Thresholds

LOS	INTERSECTION LOS CRITERIA	
	SIGNALIZED DELAY RANGE (SEC)	TWO-WAY STOP CONTROL DELAY RANGE (SEC)
A	0 – 10	0 – 10
B	10 – 20	10 - 15
C	20 – 35	15 – 25
D	35 – 55	25 – 35
E	55 – 80	35 – 50
F	80 and above	50 and above

Source: Highway Capacity Manual (2010)

The LOS of a highway facility can be measured based on the average travel speed of vehicles along a specified corridor segment. In urban areas, travel speed is calculated based on the traffic volumes, influence of intersection control and density, and congestion along a corridor, measured on a scale of A to F. The CO 93 study corridor is considered urban in the analysis due to its higher volumes and the spacing of the signalized intersections and their impact on roadway operations. LOS A describes primarily free-flow operations with travel speeds exceeding 85% of the base free-flow speed. LOS F is characterized by heavy congestion, high delay, and extensive queuing with travel speeds at 30% or less

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of the base free-flow speed. **Table 12** summarizes the LOS thresholds for vehicles on an urban arterial segment.

Table 12: Arterial Highway Level of Service (LOS) Thresholds

LOS	TRAVEL SPEED AS A PERCENTAGE OF BASE FREE-FLOW SPEED (%)
A	> 85%
B	67 – 85%
C	50 – 67%
D	40 – 50%
E	30 – 40%
F	<= 30%

Source: *Highway Capacity Manual (2010)*

For freeway segments, LOS is related to three performance measures: density in terms of passenger cars per mile per lane, speed in terms of mean passenger-car speed, and volume-to-capacity (v/c) ratio. Each of these measures is an indication of how well traffic flow is being accommodated by the freeway. The three measures are interrelated and the measure used to estimate LOS is density. When LOS is greater than or equal to LOS C, it is general good or free-flow conditions, while LOS D indicates increasing congestion. When LOS drops to LOS E or F, it indicates a serious breakdown in operations.

Existing Traffic Conditions

Weekday traffic count data were collected along the WestConnect corridor in May 2016. Current and historical traffic count data were also compiled as available from CDOT. The weekday daily and peak hour traffic volumes compiled for the corridor are shown in **Figures 5 through 7**. The traffic count data are included in **Appendix B**.

Existing Traffic Volumes

Daily traffic volumes provide a perspective on how traffic levels compare for a road facility type. The daily traffic counts used for the study are the average for two days of weekday data collection. Traffic volumes along C-470 vary from 54,000 north of Kipling Parkway to 90,000 north of Alameda Parkway. The highest volumes on an arterial cross street are 27,400 vehicles per day (vpd) on Ken Caryl Avenue east of the C-470 interchange. US 285 carries 25,000 vpd east of C-470 and 35,000 west of the C-470 interchange. Vehicle classification count data were also compiled at select locations in order to measure truck traffic. Approximately two percent of vehicles traveling on C-470 are heavy trucks.

Traffic volumes along US 6 through Golden are approximately 39,200 vpd south of 19th Street. Traffic volumes along CO 93 in Golden are 24,400 vpd north of CO 58 and 25,900 vpd north of Pine Ridge Road. Up to eight percent of vehicles along CO 93 north of CO 58 are trucks.

Along CO 93 north of 64th Parkway, traffic volumes vary from 23,500 vpd south of CO 72 to 20,100 vpd south of CO 170. Heavy trucks accounted for about eight percent of daily traffic on CO 93 south of CO 72 while almost six percent of traffic south of CO 128 were trucks.



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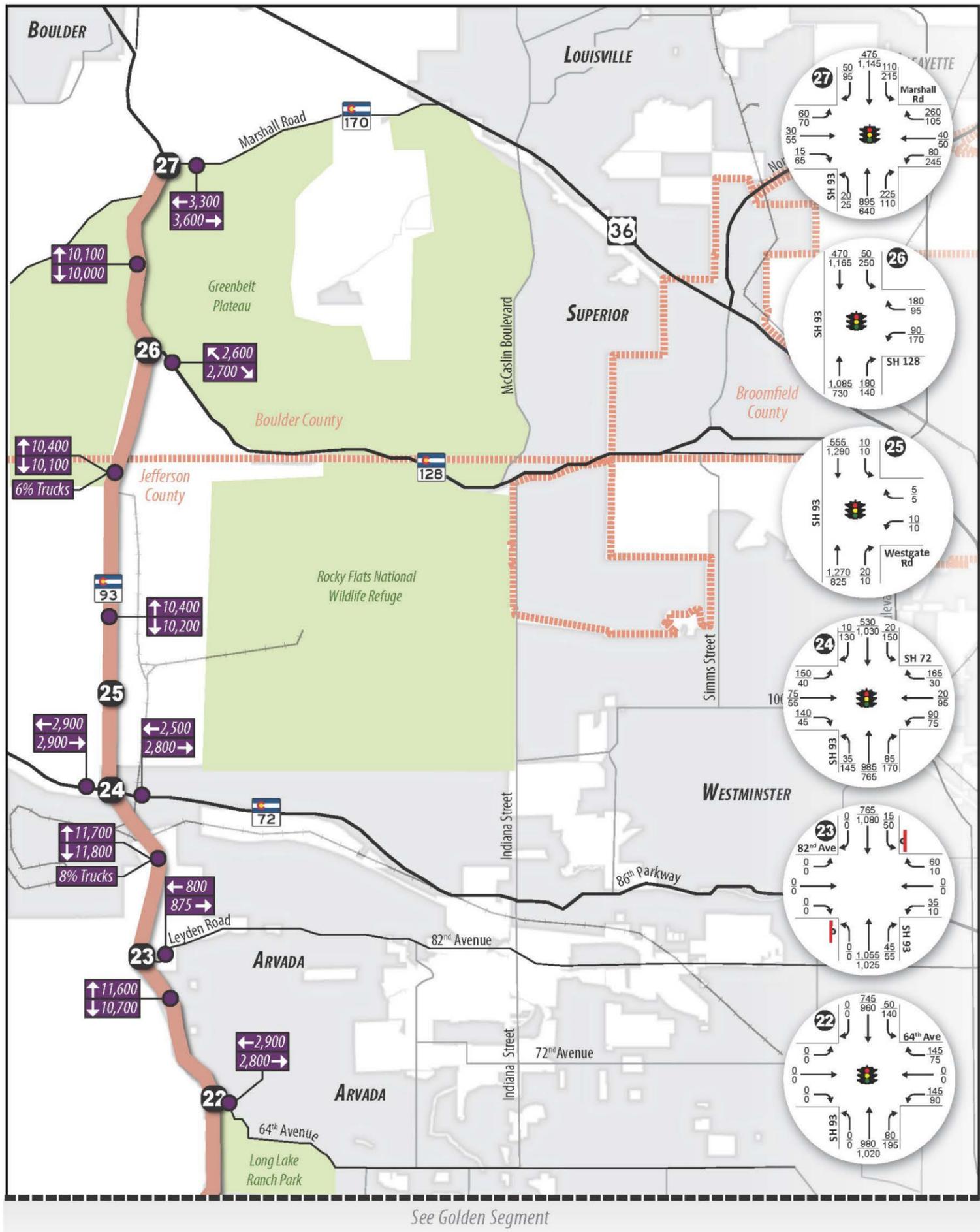


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Figure 7: Existing Weekday Traffic Volumes – CO 93 Segment



See Golden Segment

LEGEND

- Study Corridor
- Planned New Facilities
- Parks & Open Space
- County Boundary
- City Boundaries
- Signalized Intersection
- Stop Sign
- AM/PM Peak Hour Traffic Volumes
- Existing Daily Traffic Volumes (Vehicles per day)

Source: Counts collected May 2016 (All Traffic Data); Count data CDOT, City of Golden.





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Weekend Traffic Volumes

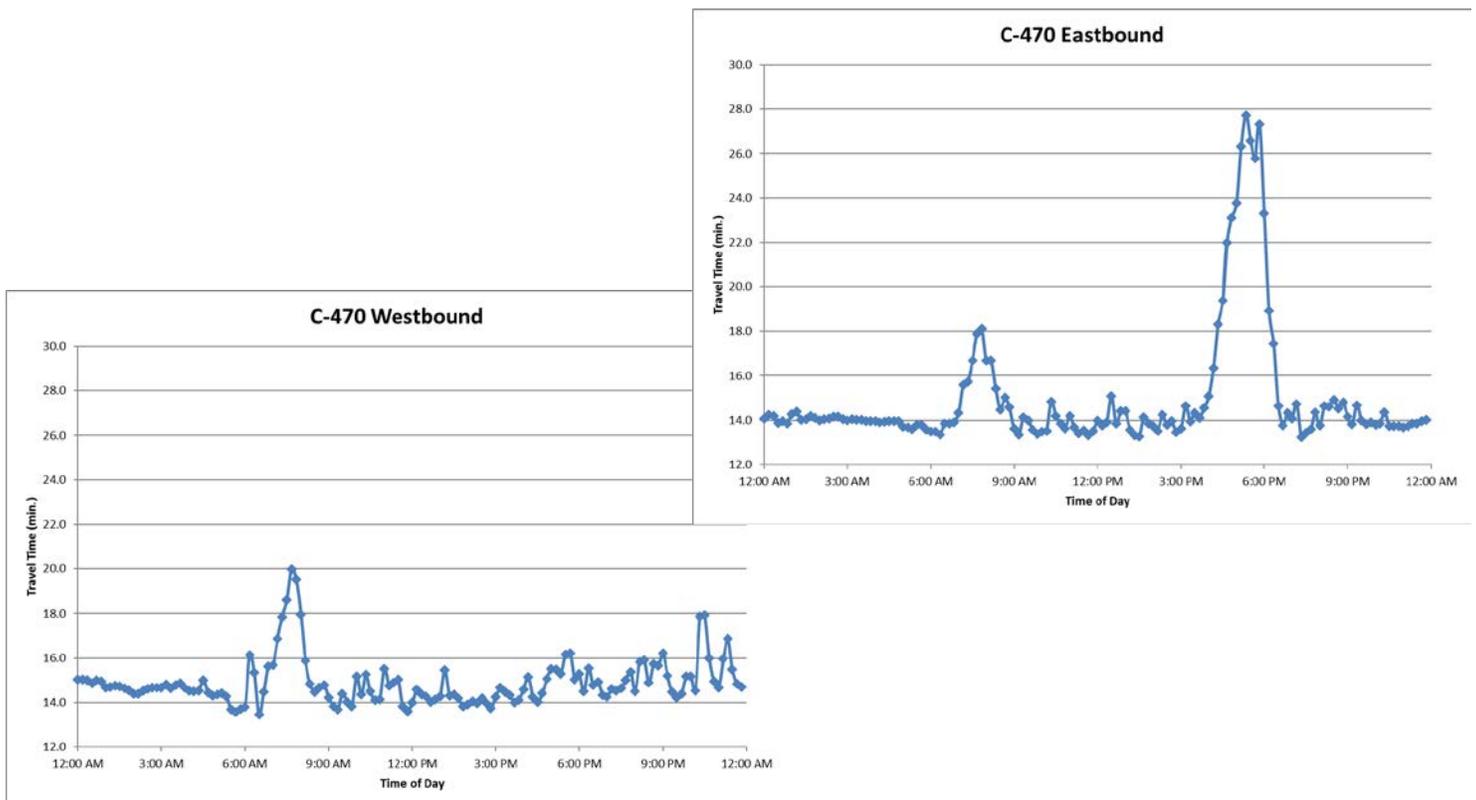
Traffic volumes over weekends were reviewed to evaluate if weekends experienced higher traffic volumes than weekday peak hours. Data from automatic traffic counters from the last year were compiled to compare winter and summer peak months and May, when traffic counts were collected for the study. The daily traffic and hourly distribution for weekends and weekdays were compared at locations along C-470 and CO 93. The volumes and graphs illustrating the comparison are included in **Appendix B**.

The volume comparison shows that traffic volumes do not differ more than ten percent across months, weekdays versus Fridays, and direction of travel (northbound versus southbound). May is one of the highest months of the year for traffic volumes along the corridor, while February generally experiences lower daily traffic volumes. However, the peak hour traffic volumes are relatively similar across all months. Therefore, the May traffic counts and the weekday peak hours are representative of the peak period for corridor travel.

Travel Times

Travel time was compiled using INRIX data to determine the travel duration along the WestConnect corridor in each direction for the AM and PM peak periods during the same days the traffic volume data were collected. The travel time for the C-470 study corridor is summarized in **Figure 13**.

Figure 13: C-470 Travel Times

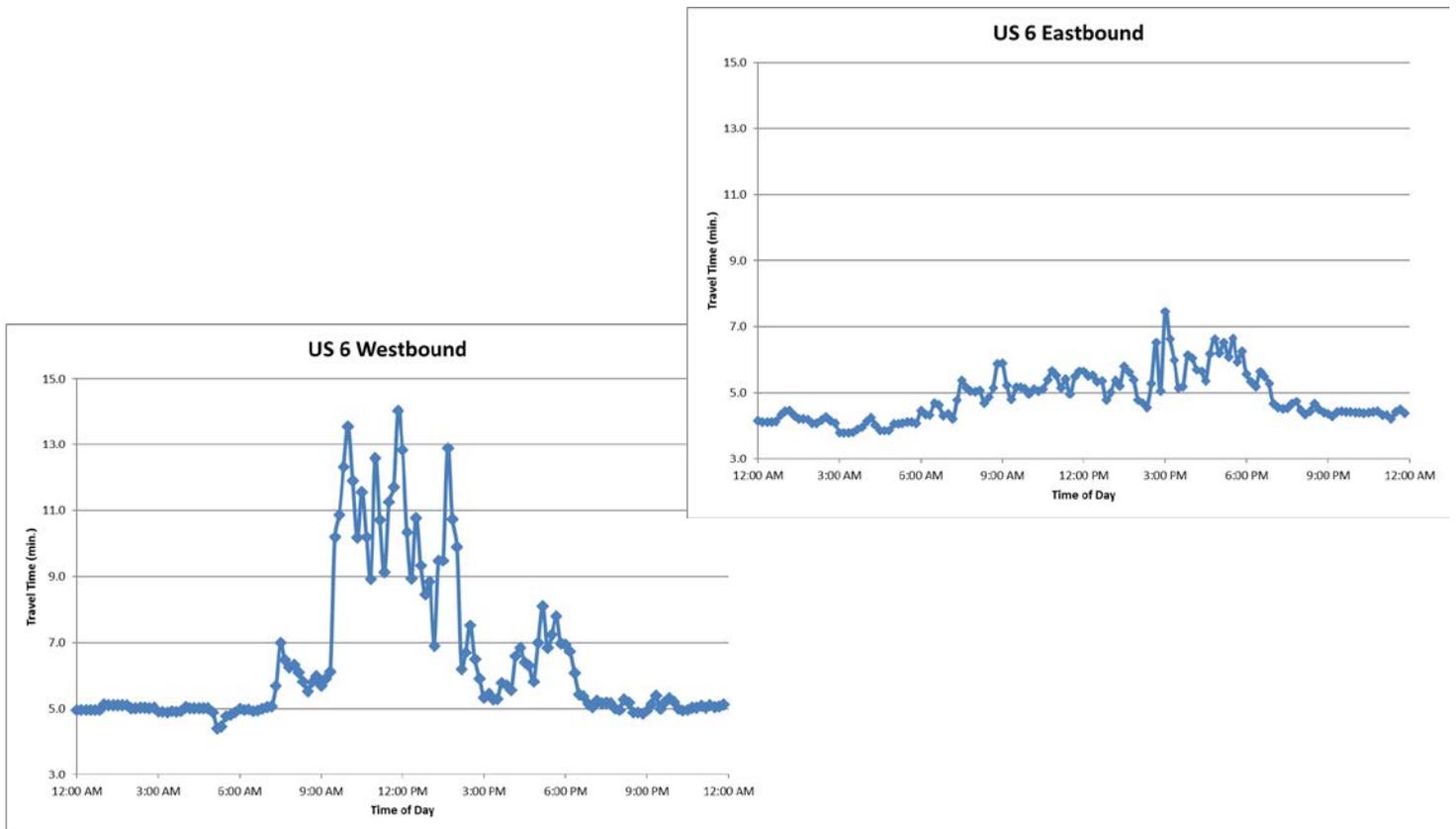


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Westbound C-470 experiences a notable increase in travel time during the morning commuter peak period, between 6:00 AM and 9:00 AM. Eastbound C-470 also experiences an increase in travel time during the same morning peak period, but experiences a substantial increase in travel time during the evening peak period, with almost double the travel time around 5:00 PM.

The travel time for the US 6 study corridor is summarized in **Figure 14**. Eastbound US 6 through Golden experiences a relatively small increase in travel time throughout the day. Westbound US 6 experiences a larger increase in travel time throughout the day, particularly between the school hours of 9:00 AM to 3:00 PM. Increases in travel time during typical commute hours are less pronounced along US 6.

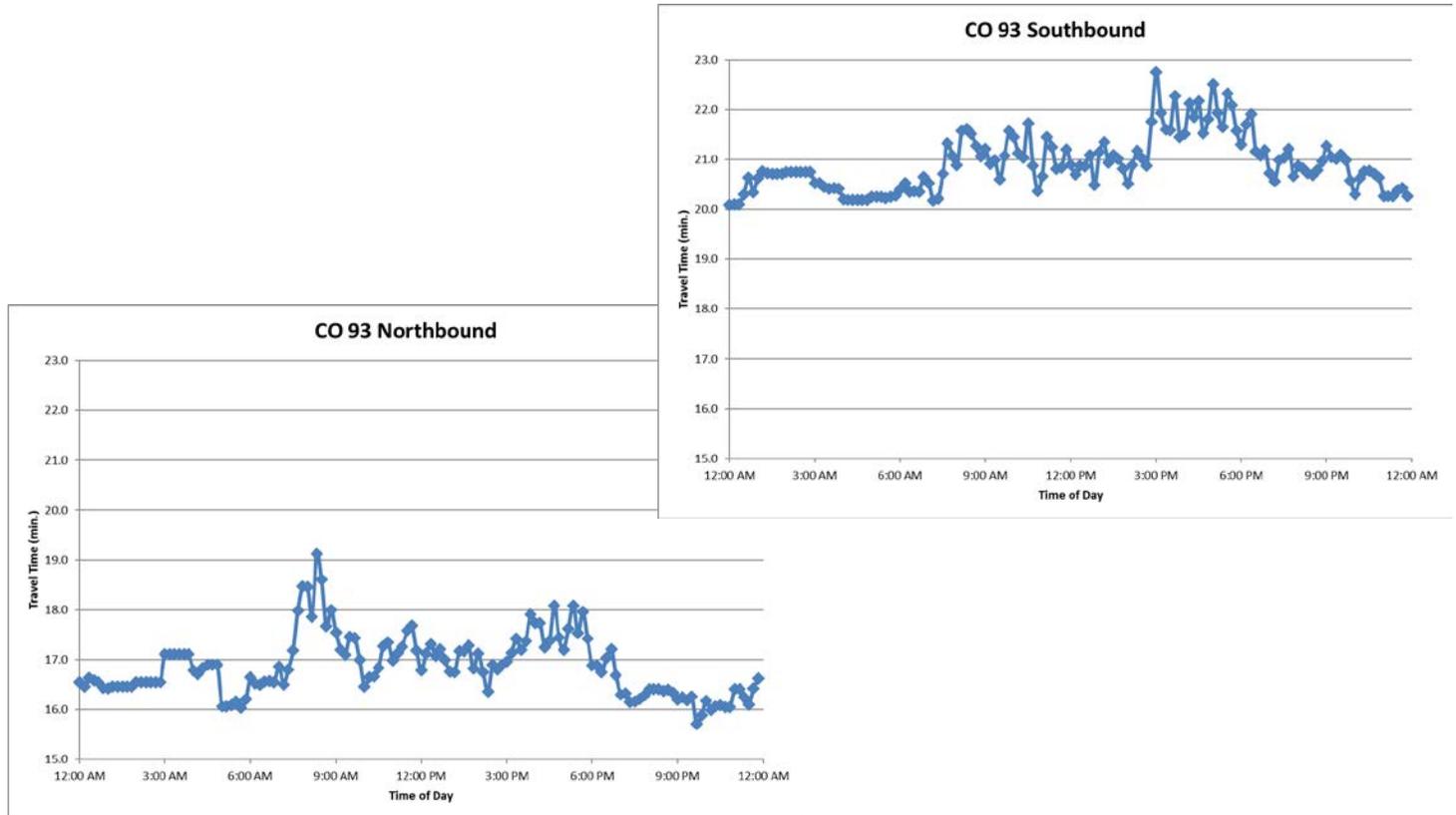
Figure 14: US 6 Travel Time



The overall travel time for southbound CO 93 approaching CO 58 is three to four minutes longer than the travel time for northbound CO 93, which may be due to higher congestion approaching the CO 58 intersection and other intersections along the corridor in the southbound direction. Northbound CO 93 experiences a notable increase in travel time during the morning commuter peak period while southbound CO 93 experiences an increase in travel time during the evening peak period. The travel time for the CO 93 study corridor is summarized in **Figure 15**.

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Figure 15: CO 93 Travel Time



Existing Traffic Operations

Existing peak hour traffic operations for intersections along the WestConnect corridor are summarized in **Table 16**. In urban areas, LOS E and F are typically considered unacceptable traffic operations. The unacceptable delay and levels of service are shown in red. Operational analyses for US 6 through Golden, between the C-470/Johnson Road and the CO 93/CO 58 intersections, were gathered from traffic analyses recently completed as part of *The Golden Plan* and subsequent projects.

As shown, the majority of the intersections operate acceptably during the peak hours with LOS D or better. Signals along the corridor are timed to let the larger volume on the arterials to pass, keeping the overall delay at the intersection relatively low. A new grade-separated interchange at the US 6 and 19th Street intersection is currently under construction and the City of Golden is currently seeking funding for an interchange at US 6 and Heritage Road. The CO 93 and Washington Avenue signalized intersection operates at LOS F during both the morning and evening peak hours. The other intersections operating at LOS F along the corridor are unsignalized and the delay is experienced by side street traffic waiting to turn onto CO 93.

Several intersections along the corridor operate at LOS D during at least one peak hour. The Bowles Avenue intersection with the Eastbound C-470 ramp operates at LOS D in the evening peak hour due to a substantial volume turning left from the C-470 off ramp. The C-470/Johnson Road intersection on



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US 6 operates at LOS D in the morning peak hour due to the heavy eastbound US 6 volume and volume heading north on Johnson Road. The CO 93 and Iowa Drive intersection operates at LOS D in the morning peak hour, as does the CO 93 and CO 170/Marshall Road intersection.

Table 16: Existing Intersection Performance

CORRIDOR SEGMENT	INTERSECTION	AM PEAK HOUR		PM PEAK HOUR	
		DELAY (SEC)	LOS	DELAY (SEC)	LOS
C-470	Kipling Pkwy / WB Ramps	17	B	14	B
	Kipling Pkwy / EB Ramp	17	B	28	C
	Ken Caryl Ave / WB Ramps	16	B	22	C
	Ken Caryl Ave / EB Ramps	25	C	26	C
	Bowles Ave / WB Ramps	14	B	9	A
	Bowles Ave / EB Ramps	32	C	42	D
	Quincy Ave / WB Ramps	3	A	4	A
	Quincy Ave / EB Ramps	9	A	8	A
	Morrison Rd / Ramps	23	C	23	C
	Alameda Pkwy / WB Ramps	5	A	4	A
	Alameda Pkwy / EB Ramp	17	B	18	B
US 6 / C-470 / Johnson Rd	37	D	28	C	
Golden	Heritage Rd ⁽¹⁾	63	E	56	E
	19th St ⁽¹⁾	29	C	62	E
	US 6 / CO 93 / CO 58	28	C	31	C
	Iowa Dr	49	D	24	C
	Washington Ave	80	F	175	F
	Golden Gate Canyon Rd	11	B	10	B
	Pine Ridge Rd ⁽²⁾	27	D	> 300	F
	56th Ave ⁽²⁾	89	F	130	F
	58th Ave	16	B	10	A
64th Pkwy	15	B	9	A	
CO 93	82nd Ave ⁽²⁾	162	F	132	F
	CO 72 / Coal Creek Canyon Rd	25	C	20	C
	Westgate Rd	12	B	8	A
	CO 128	14	B	19	B
	CO 170 / Marshall Rd	38	D	33	C

⁽¹⁾ Level of Service from City of Golden System Level Feasibility Study as part of The Golden Plan

⁽²⁾ Unsignalized intersection – worst approach delay reported



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Existing peak hour freeway (for C-470) and arterial highway (for CO 93) levels of service along the WestConnect corridor are summarized in **Table 17**. The unacceptable delay and levels of service are shown in red.

Table 17: Existing Corridor Segment Performance

CORRIDOR SEGMENT	SEGMENT	AM PEAK HOUR		PM PEAK HOUR	
		NB / WB	SB / EB	NB / WB	SB / EB
C-470	Kipling Pkwy to Ken Caryl Ave	B	C	C	C
	Ken Caryl Ave to Bowles Ave	C	D	D	D
	Bowles Ave to US 285	D	D	D	D
	US 285 between ramps	F	D	D	D
	US 285 to Morrison Rd	E	C	C	F
	Morrison Rd to Alameda Pkwy	D	C	C	F
	Alameda Pkwy to I-70	E	C	B	E
I-70 to US 6/Johnson Rd	D	B	B	C	
Golden	US 6/Johnson Rd to 19th St ⁽¹⁾	E	C	E	D
	19th St to US 6 / CO 93 / CO 58 ⁽¹⁾	B	C	B	C
	US 6 / CO 93 / CO 58 to Iowa Dr	D	C	C	C
	Iowa Dr to Washington Ave	E	D	E	C
	Washington Ave to Golden Gate Canyon Rd	C	C	C	C
	Golden Gate Canyon Rd to 58th Ave	C	D	C	C
CO 93	58th Ave to 64th Pkwy	C	D	C	D
	64th Pkwy to 84th Ave	A	A	A	B
	84th Ave to CO 72 / Coal Creek Canyon Rd	B	A	B	B
	CO 72 / Coal Creek Canyon Rd to Westgate Rd	B	B	B	B
	Westgate Rd to CO 128	C	B	B	B
CO 128 to CO 170 / Marshall Rd	B	B	C	C	

⁽¹⁾ Level of Service from traffic analysis completed for City of Golden System Level Feasibility Study as part of The Golden Plan

Along C-470, the peak travel direction is westbound during the morning peak period. There are major reductions in operations around the US 285 interchange, with reductions in speed both before and after this area, resulting in poor LOS due to lane drops and geometry between US 285 and Morrison Road. There are also issues at the off ramp to eastbound I-70, resulting in LOS E and spillback along the C-470 mainline. There are very few issues in the morning peak in the eastbound direction along C-470, with no segment operating worse than LOS D. During the evening peak period, the peak travel direction is in the eastbound direction. There is a significant bottleneck for eastbound C-470 at a lane drop at the Morrison Road interchange, which spills back to the Alameda Parkway interchange with speed reductions back to I-70.

CO 93 north of Golden generally operates acceptably at LOS D or better. However, the segment between Iowa Drive and Washington Avenue operates poorly at LOS E during both the morning and



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evening peak periods, likely due to the lane merge that occurs just south of Iowa Drive. Most of southbound CO 93 leading into Golden from 64th Parkway operates at LOS D during the morning peak hour. The southbound CO 93 segment between 58th Avenue and 64th Parkway, which is a single lane, operates at LOS D during both the morning and evening peak periods.

Future Traffic Conditions

The horizon year for this study is 2040, consistent with the horizon year for the current DRCOG regional travel demand model.

Travel Demand Model

The DRCOG next generation activity-based model, referred to as the Focus model, reflects recent improvements in travel modeling to more realistically simulate how people travel. Activity-based models such as Focus are designed to model traveler behavior rather than travel patterns. The DRCOG Focus model was used to develop traffic forecasts for this study. The demographic and traffic forecasting information contained in this model summary reflect the DRCOG model version available in October 2016. A newer DRCOG model version, Focus 2, was released in December 2016, subsequent to the forecasting and analysis presented in this report. Based on a comparison of the two models, described later in this section of the report, it is believed that the Focus model initially developed for the study provides a sound forecasting basis for continued use in the PEL study.

Demographic Forecasts

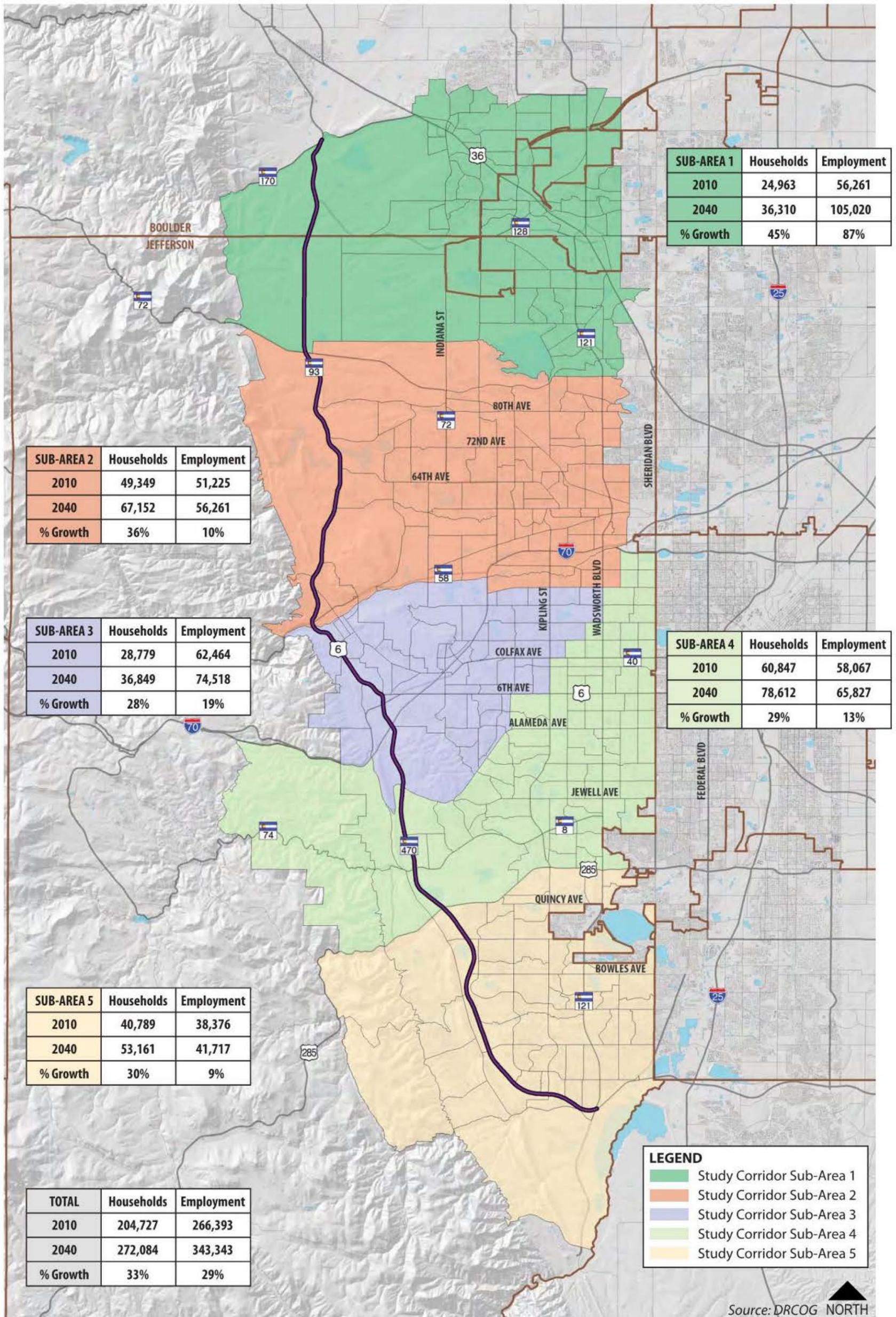
DRCOG has developed regional demographic data for 2010 and 2040 forecasts that are used as inputs to the regional travel model. These forecasts are developed by transportation analysis zone (TAZ). The broad WestConnect study area was divided into five subareas, which are groupings of TAZs for different parts of the corridor. The subareas generally include the following WestConnect corridor jurisdictions:

- Subarea 1 – Boulder County, Broomfield, Louisville, Superior, Westminster and unincorporated Jefferson County
- Subarea 2 – Arvada, Wheat Ridge and unincorporated Jefferson County
- Subarea 3 – Golden and Wheat Ridge
- Subarea 4 – Lakewood and unincorporated Jefferson County
- Subarea 5 – Unincorporated Jefferson County

Figure 8 shows the DRCOG existing and forecasted population and employment data by TAZ along with growth between 2010 and 2040. The map provides 2010 and 2040 household and employment data for the five subareas and for the study area as a whole.

Total study area households are forecast to increase by 33% between 2010 and 2040 to approximately 272,000. Household growth is projected in each subarea, with subarea growth ranging from 12% in Subarea 5 to 45% in Subarea 1. Total study area employment is forecast to increase by 29% between 2010 and 2040 to 343,000. Subarea 1 has the highest projected employment increase of 87%, representing more than 60% of the total forecasted study area employment growth.

Figure 8: Study Area Land Use



Source: DRCOG NORTH

C-470 WestConnects PEL (Kipling to I-70) 16-019 09/26/16



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Base Year

The Focus model was calibrated to replicate observed travel patterns in the corridor. While regional models like Focus are designed specifically to simulate regional travel patterns, they are less accurate within smaller geographic areas. Another reason for the calibration was to refine the origination-destination (O-D) flows to a level suitable for use as input into the models that were developed for the traffic operations analysis. Rarely are trip tables from a regional model faithful to observed traffic condition without further refinement.

DRCOG’s base year Focus model (2010) was used as the basis for the study base year (2016). Base year trip tables were developed using a procedure that adjusts the subarea trip tables incrementally from the regional model to better match observed traffic counts. This procedure is known as origin destination matrix estimation (ODME) and is a mathematical process that is performed within the existing travel demand model.

Since the ODME relies on traffic counts, it is important that the observed counts are balanced (or internally consistent) within the area of study. Downstream traffic volumes on a freeway, for example, should equal the upstream traffic volumes on the mainline plus or minus any traffic entering or exiting via corridor ramps. In locations where traffic counts for the study were absent, counts were estimated by accounting for ramp and mainline volumes from adjacent or upstream facilities.

Year 2040

Year 2040 vehicle trip tables were developed by adding the raw growth in travel demand to the adjusted base year vehicle trip tables. Results of the ODME process served as the adjusted base year vehicle trip tables. The adjusted forecast year vehicle trip tables were computed by applying the equation shown below to each zone pair. This equation replaces negative demand in any individual zone pair with zero, but such cases were monitored and found to be rare.

$$\begin{aligned}
2040 \text{ Adjusted Vehicle Trips} &= \text{Max}[2010 \text{ Adjusted Vehicle Trips} \\
&+ (2040 \text{ Raw Vehicle Trips} - 2010 \text{ Raw Vehicle Trips}), 0]
\end{aligned}$$

Networks Assumptions

The DRCOG 2010 roadway network within the study area was reviewed to ensure the base year included roadway projects that were not in the network in 2010 but are in operation today. Minor refinements were also made to centroid connectors. A link was added to represent 56th Avenue and Pine Ridge Road west of CO 93 and centroid connectors were adjusted accordingly. More network detail was added and centroid connectors were adjusted in Golden, north of CO 58, including removing centroid connectors originally attached to a limited access portion of CO 93. A section of Alameda Parkway was removed west of Rooney Road as this facility has been permanently closed to traffic.

The 2040 roadway network assumed all projects from DRCOG’s fiscally-constrained Regional Transportation Plan - Cycle 2. Major roadway enhancements, such as adding capacity, were fairly limited for the study corridors. However, the background network did include the implementation of Jefferson Parkway, which is planned to connect to CO 93 between 82nd Avenue and 64th Parkway. The 2040 No Action traffic forecasts were conducted with and without Jefferson Parkway.

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Year 2040 No Action Forecasts

Compared to 2015 and 2016 traffic counts, C-470 traffic volumes are forecasted to increase by up to 72 percent by 2040. On C-470 west of Kipling Parkway, the model suggests an increase of 39,400 vehicles (a 64 percent growth) to 93,400 by 2040 during an average weekday. South of Alameda Parkway, traffic volumes on C-470 are projected to increase by 53,300 vehicles to 136,300 vpd.

For the most part, traffic on CO 93 is forecasted to increase at slower rate than C-470. For example, south of CO 170/Marshall Road, the model forecasts suggest traffic volumes may increase by 7,400 vehicles to 27,500 in 2040 during an average weekday. North of 56th Avenue, traffic volumes are forecasted to increase by 32 percent to 33,600 vpd. The one location projected to have a very large increase is the segment just south of the connection with the planned Jefferson Parkway. Current traffic counts are 22,300 at this location while the 2040 forecasts suggest traffic may increase by 19,000 vehicles to 41,300 vpd by 2040. This large increase is attributed to the travel demand between Jefferson Parkway and the corridor south of the parkway, combined with travel demand between 64th Parkway and the corridor to the north. By 2040, Jefferson Parkway is forecasted to carry 12,200 vehicles on the segment immediately east of CO 93.

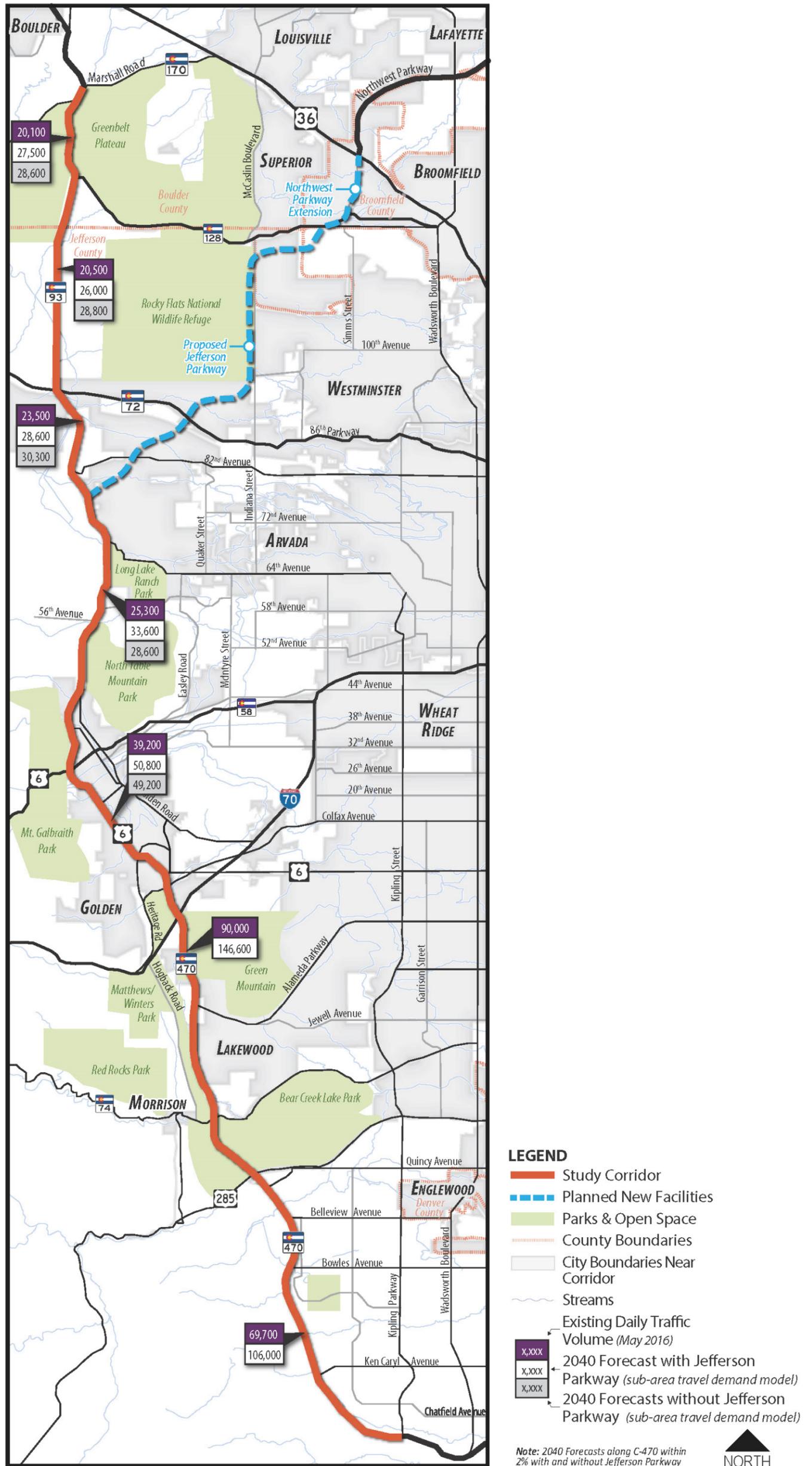
The travel demand for the 2040 No Action scenario was also forecasted without Jefferson Parkway. This sensitivity run was performed in order to assess the impact of this major roadway project on travel demand along the CO 93 corridor. The traffic forecasts indicate the greatest impact on CO 93 would occur on the segment just south of the Jefferson Parkway connection. **Table 18** below shows a comparison between the 2040 traffic forecasts. For example, north of Jefferson Parkway, travel demand on CO 93 is approximately the same (29,000 vehicles versus 30,800). However, south of Jefferson Parkway, the traffic forecasts show a difference of 10,500 vehicles between the two network scenarios. 64th Parkway also shows a difference of 2,400 vehicles. However, farther away from the Jefferson Parkway connection, there is very little difference in traffic volumes with and without Jefferson Parkway. On US 6 at 19th Street, the volumes are approximately the same.

Table 18: Comparison of 2040 Traffic Forecasts with and without Jefferson Parkway

Road and Segment	2040 No Action with Jefferson Parkway	2040 No-Action without Jefferson Parkway	Absolute Difference	Percent Difference
CO 93 north of Jefferson Parkway	29,000	30,800	-1,800	6.2%
CO 93 south of Jefferson Parkway	41,300	30,800	10,500	-25.4%
64th Parkway east of CO 93	13,800	11,400	2,400	-17.3%
CO 93 south of 64th Parkway	33,600	28,600	5,000	-14.9%
US 6 south of 19th Street	50,800	49,200	1,600	-3.1%

The 2040 weekday daily traffic volume forecasts for the corridor with and without Jefferson Parkway are shown in **Figure 9**.

Figure 9: 2040 No Action Weekday Traffic Volumes





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Focus 2 Model Comparison

The newly released Focus 2 model was obtained from DRCOG and compared with Focus model results to determine whether the Focus model forecasts continue to be a reasonable for using with the study. First, study area land use forecasts were compared. **Table 19** shows that Focus 2 forecasts for the study area as a whole are six percent higher for households and one percent lower for employment compared with the Focus model.

Table 19: Focus and Focus 2 Model – 2040 Land Use Forecast Comparison

DATASET	FOCUS MODEL	FOCUS 2 MODEL	PERCENT DIFFERENCE
Households	272,084	289,193	+6%
Employment	343,343	341,464	-1%

A simplified post-model adjustment process was performed using the Focus 2 model and resulting 2040 traffic volume forecasts on study corridor segments were compared with the adjusted forecasts developed study using the Focus model. **Table 20** shows that forecasts derived from the Focus 2 model are all lower and within nine percent of the Focus model forecasts.

Table 20: Focus and Focus 2 Model – 2040 Traffic Volume Forecast Comparison

LOCATION	ADJUSTED FOCUS MODEL	FOCUS 2 MODEL	PERCENT DIFFERENCE
SH 93 south of Marshall Road	27,500	27,100	-1%
SH 93 south of SH 128	26,000	23,700	-9%
SH 93 south of SH 72	28,600	26,100	-9%
SH 93 south of 68th Avenue	33,600	32,800	-2%
US 6 north of 19 th Street	50,800	46,900	-8%
C-470 north of Alameda Parkway	147,000	143,400	-2%
C-470 north of US 285	152,900	144,200	-6%
C-470 north of Ken Caryl Avenue	106,100	104,600	-1%
C-470 south of Ken Caryl Avenue	93,400	91,100	-2%

Since both the overall corridor land use and, most importantly, the corridor traffic forecasts from the Focus 2 model are within nine percent of the Focus model, it is believed that forecasting results from the Focus Model, as previously described in this report, are considered reasonable for the base No Action forecasting and analysis moving forward.

2040 Traffic Operations

2040 peak hour traffic operations for intersections along the WestConnect corridor are summarized in **Table 21**. The unacceptable delay and levels of service are shown in red.



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Table 21: 2040 No Action Intersection Performance

CORRIDOR SEGMENT	INTERSECTION	WITH JEFFERSON PARKWAY				WITHOUT JEFFERSON PARKWAY			
		AM PEAK HOUR		PM PEAK HOUR		AM PEAK HOUR		PM PEAK HOUR	
		DELAY (SEC)	LOS	DELAY (SEC)	LOS	DELAY (SEC)	LOS	DELAY (SEC)	LOS
C-470	Kipling Pkwy / WB Ramps	26	C	17	B	26	C	17	B
	Kipling Pkwy / EB Ramp	21	B	31	C	21	B	31	C
	Ken Caryl Ave / WB Ramps	26	C	24	C	26	C	24	C
	Ken Caryl Ave / EB Ramps	57	E	26	C	57	E	26	C
	Bowles Ave / WB Ramps	114	F	4	A	114	F	4	A
	Bowles Ave / EB Ramps	35	D	39	D	35	D	39	D
	Quincy Ave / WB Ramps	53	D	5	A	53	D	5	A
	Quincy Ave / EB Ramps	220	F	8	A	220	F	8	A
	Morrison Rd / Ramps	24	C	39	D	24	C	39	D
	Alameda Pkwy / WB Ramps	5	A	4	A	5	A	4	A
	Alameda Pkwy / EB Ramp	34	C	20	B	34	C	20	B
	US 6 / C-470 / Johnson Rd	27	C	174	F	27	C	174	F
Golden	Heritage Rd ⁽¹⁾	123	F	105	F	123	F	105	F
	US 6 / CO 93 / CO 58	172	F	177	F	160	F	143	F
	Iowa Dr	127	F	30	C	109	F	32	C
	Washington Ave	138	F	> 300	F	100	F	219	F
	Golden Gate Canyon Rd	34	C	45	D	25	C	16	B
	Pine Ridge Rd ⁽²⁾	> 300	F	218	F	> 300	F	> 300	F
	56th Ave ⁽²⁾	> 300	F	> 300	F	> 300	F	> 300	F
	58th Ave	39	D	33	C	22	C	13	B
CO 93	64th Pkwy	> 300	F	> 300	F	74	E	80	F
	82nd Ave ⁽²⁾	> 300	F	> 300	F	> 300	F	> 300	F
	CO 72 / Coal Creek Canyon Rd	38	D	61	E	64	E	52	D
	Westgate Rd	29	C	46	D	73	E	60	E
	CO 128	21	C	38	D	42	D	52	D
	CO 170 / Marshall Rd	199	F	112	F	239	F	92	D

⁽¹⁾ Level of Service from City of Golden System Level Feasibility Study as part of The Golden Plan

⁽²⁾ Unsignalized intersection – worst approach delay reported

Note: Level of Service along C-470 the same with and without Jefferson Parkway

The results of the intersection analyses show the impact of the mainline congestion throughout the WestConnect corridor. The traffic volumes and operations along the C-470 segment are essentially the same with and without Jefferson Parkway. In the morning peak period, several of the interchanges along C-470 are seriously impacted by the congestion of the mainline freeway. At Ken Caryl Avenue, the



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eastbound C-470 ramps intersection is impacted by queuing from the westbound C-470 on ramp. At Bowles Avenue, the volume of westbound traffic turning right to the westbound C-470 on ramp significantly increases in 2040, while at the same time being hindered by congestion on the mainline freeway. There are also issues at the Quincy Avenue interchange where both intersections are affected by the growing congestion on the local street that affects both directions on C-470 during the morning peak hour. An intersection with a significant impact is the US 6/C-470/Johnson Road intersection, which experiences significant queue delay attempting to access C-470. The westbound approach delay approaches 50 minutes, indicating that the operations have completely broken down.

Almost all intersections along the US 6 and CO 93 segments through Golden operate unacceptably, at LOS E or F, during one or both of the peak hours. The construction of Jefferson Parkway, without additional capacity along CO 93 to the south of the connection, adds substantial delay to intersections already expected to operate at LOS F. North of the Jefferson Parkway connection, the delay at the unsignalized intersection at 82nd Avenue is expected to grow exponentially. Several intersections north of Jefferson Parkway are expected to operate with less delay with the construction of Jefferson Parkway, since it would provide an alternative corridor, particularly during peak commuter periods.

Existing peak hour freeway (for C-470) and arterial highway (for CO 93) levels of service along the WestConnect corridor are summarized in **Table 22**. The unacceptable delay and levels of service are shown in red.

Traffic operations along the WestConnect corridor continue to degrade by 2040. Along westbound C-470 at the US 285 interchange, there is significant congestion with queues extending to the southern end of the study area. North of Morrison Road, the LOS is improved, but only because the bottleneck severely restricts the freeway throughput in the westbound direction. However, the off ramp to eastbound I-70 remains an issue with a heavy traffic movement. In the eastbound direction, congestion at the Quincy Avenue interchange creates a bottleneck that affects freeway operations. During the evening peak period, a bottleneck forms in the westbound direction at Morrison Road, spilling back to the southern end of the study area. The bottleneck at Morrison Road in the eastbound direction restricts freeway throughput to a point that the LOS south of this location is not degraded.

By 2040, segments of CO 93 between Golden and Boulder degrade to LOS F with peak hour congestion and reduced speeds. The sections with one lane north of Golden operate poorly, with or without Jefferson Parkway. Adding Jefferson Parkway to the roadway network impacts southbound CO 93 during the evening peak hour, both north and south of the connection.



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Table 22: 2040 No Action Corridor Segment Performance

CORRIDOR SEGMENT	SEGMENT	WITH JEFFERSON PARKWAY				WITHOUT JEFFERSON PARKWAY			
		AM PEAK HOUR		PM PEAK HOUR		AM PEAK HOUR		PM PEAK HOUR	
		NB / WB	SB / EB	NB / WB	SB / EB	NB / WB	SB / EB	NB / WB	SB / EB
C-470	Kipling Pkwy to Ken Caryl Ave	F	E	F	D	F	E	F	D
	Ken Caryl Ave to Bowles Ave	F	D	F	D	F	D	F	D
	Bowles Ave to US 285	F	E	F	D	F	E	F	D
	US 285 between ramps	F	F	F	D	F	F	F	D
	US 285 to Morrison Rd	F	E	F	E	F	E	F	E
	Morrison Rd to Alameda Pkwy	D	F	D	F	D	F	D	F
	Alameda Pkwy to I-70	F	D	E	F	F	D	E	F
	I-70 to US 6/Johnson Rd	B	C	B	F	B	C	B	F
Golden	US 6/Johnson Rd to 19th St ⁽¹⁾	E	C	D	E	E	C	D	E
	19th St to US 6 / CO 93 / CO 58 ⁽¹⁾	D	D	C	C	D	D	C	C
	US 6 / CO 93 / CO 58 to Iowa Dr	F	D	C	C	E	C	D	C
	Iowa Dr to Washington Ave	F	E	D	C	F	F	E	C
	Washington Ave to Golden Gate Canyon Rd	C	D	C	C	C	F	C	D
	Golden Gate Canyon Rd to 58th Ave	C	C	C	C	C	D	C	D
	58th Ave to 64th Pkwy	D	F	D	F	D	B	D	D
CO 93	64th Pkwy to 84th Ave	A	B	A	E	B	B	A	B
	84th Ave to CO 72 / Coal Creek Canyon Rd	B	B	B	E	C	B	B	C
	CO 72 / Coal Creek Canyon Rd to Westgate Rd	B	B	B	E	C	B	B	C
	Westgate Rd to CO 128	B	B	B	B	C	B	B	C
	CO 128 to CO 170 / Marshall Rd	C	B	C	D	C	B	C	E

⁽¹⁾ Level of Service from traffic analysis completed for City of Golden System Level Feasibility Study as part of The Golden Plan

Note: Level of Service along C-470 the same with and without Jefferson Parkway



CRASH HISTORY

The crash history for the five-year period from January 1, 2010 through December 31, 2014 was examined for the highways in the WestConnect corridor to locate crash clusters and identify collision causes. A detailed safety assessment report is included in **Appendix C**. In general, segments along C-470 were found to be performing well in terms of crash frequency and severity compared to other similar facilities, while segments along US 6 and CO 93 were found to be performing worse than comparable facilities and exhibit a higher potential for crash reduction. The crash evaluation is summarized in **Figure 10**.

WestConnect Corridor Crashes

The WestConnect corridor was divided into seven segments for analysis.

C-470 from Kipling Parkway to Morrison Road

This 8.2-mile long segment of C-470 experienced a total of 477 crashes within the study period. There were 19 injury collisions and one fatal collision; 117 injured and one person killed overall. Rear end, fixed object, wild animal and wind related crashes were significant, along with overturning and rain/wet road crashes. Approximately 12 percent of all mainline crashes occurred during adverse weather conditions, with about 18 percent occurring during adverse road conditions (wet, icy, snowy, etc.). About four percent of all mainline crashes occurred during windy conditions.

With respect to the human factors contributing to crashes, about 15 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in five percent of crashes. This particular segment was found to be performing well in terms of both the frequency and severity of crashes reported compared to other similar freeway segments and has a low potential for crash reduction.

C-470 from Morrison Road to I-70

Within the study period, this 4.25-mile long segment of C-470 experienced a total of 448 crashes. Of these, there were 93 injury collisions and one fatal collision; 121 injured and two people killed overall. Significant crash types include rear end, wild animal, fixed object, wind and snowy/icy road. Approximately 12 percent of all mainline crashes occurred during adverse weather conditions, with nearly 30 percent occurring as a result of adverse road conditions (wet, icy, snowy, muddy, etc.). About one percent of all mainline crashes occurred during windy conditions.

With respect to the human factors contributing to the crashes, 16 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in approximately 4 percent of crashes. This segment operates better than other similar freeway facilities in terms of the frequency and severity of crashes reported and has a low to moderate potential for crash reduction.

C-470 from I-70 to US 6

This 1.2-mile long segment of C-470 between I-70 and US 6 had a total of 32 reported crashes, four of which involved an injury, within the study period. Fixed object, concrete barrier and snowy/icy road crashes were overrepresented. Approximately 50 percent of all mainline crashes occurred during



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adverse weather conditions, with nearly 67 percent occurring as a result of adverse road conditions (wet, icy, or snowy,). No mainline crashes occurred during windy conditions.

With respect to the human factors contributing to the crashes, 19 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were not suspected in any of the crashes. In terms of the total number of crashes reported, this segment has slightly higher than expected crash rates and has moderate to high potential for crash reduction.

US 6 from C-470/Johnson Road to CO 58/CO 93

Within the study period, this approximately 3-mile long segment of US 6 had a total of 194 crashes. There were 39 injury collisions and two fatal collisions; 59 injured and two people killed overall. Wild animal, guard rail, and wet road crashes were the significant crash types. Approximately 12 percent of all mainline crashes occurred during adverse weather conditions, with nearly 20 percent occurring as a result of adverse road conditions. Less than one percent of all mainline crashes occurred during windy conditions.

With respect to the human factors contributing to the crashes, 13 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in approximately six percent of crashes. The segment is performing less than expected compared to similar facilities and exhibits a high potential for crash reduction based on the frequency of crashes.

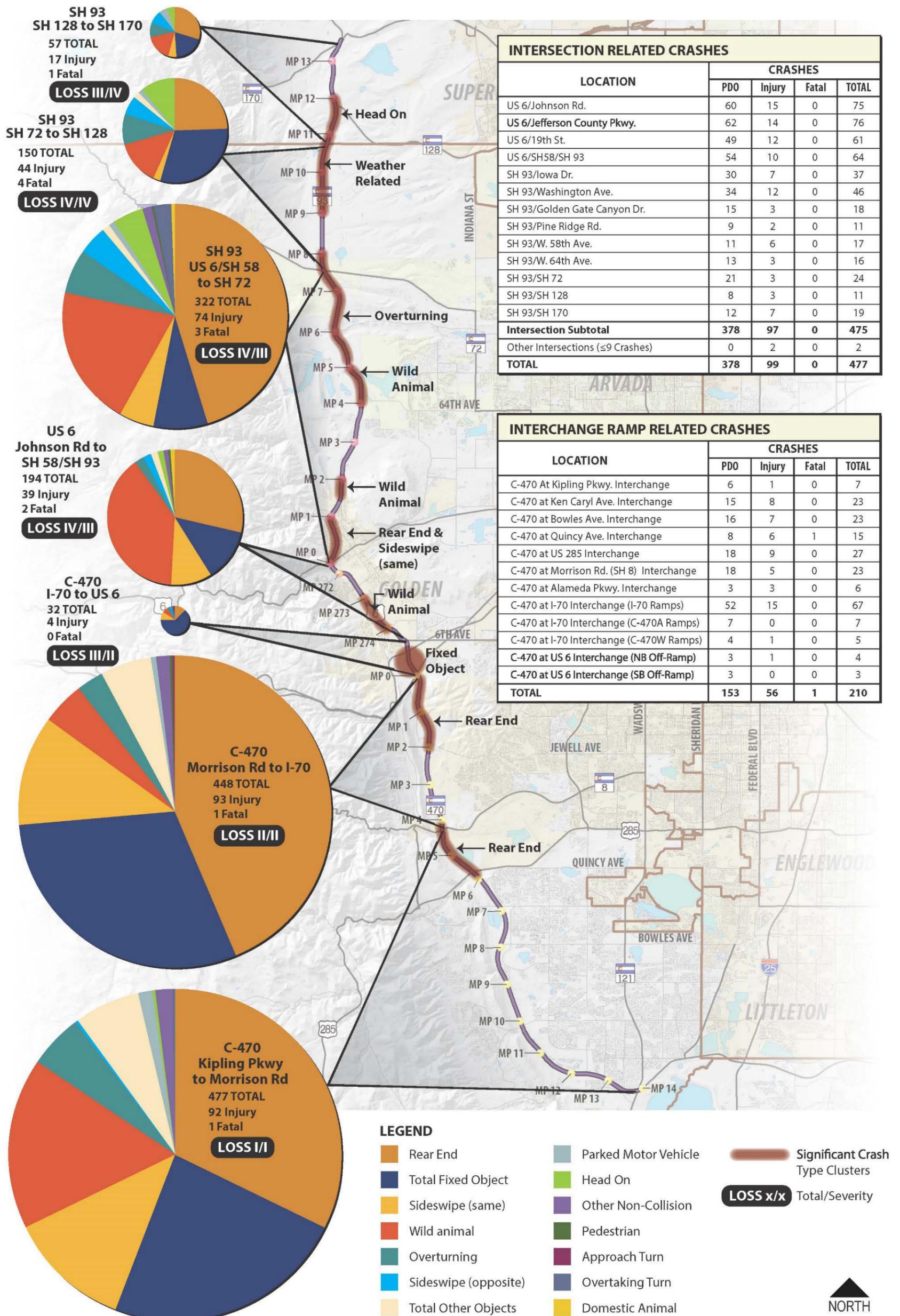
CO 93 from US 6/CO 58 to CO 72

This 7.6-mile long segment of CO 93 experienced a total of 322 crashes within the study period. Of these, there were 74 injury collisions and three fatal collisions; 110 injured and three people killed overall. The segment had a number of crash types that were overrepresented and occurred at a higher than expected rate, including: rear end, overturning, wild animal, sideswipe (same direction), head on, wind, and snow/sleet/hail. Approximately 15 percent of all mainline crashes occurred during adverse weather and road conditions, with approximately 3.5 percent occurring during windy conditions.

With respect to the human factors contributing to the crashes, 15 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in approximately three percent of crashes. From a total crash frequency standpoint, this segment has a high potential for crash reduction and is performing less than expected when compared to roadways with similar characteristics.

A total of 15 intersections within this segment along CO 93 were also evaluated. Rear end crashes were found to be occurring at a higher than expected frequency at the intersections of CO 93 with US 6/CO 58, Iowa Drive, Washington Avenue and CO 72. Approach turn crashes were overrepresented at the intersection with 58th Avenue and mainly occur during the afternoon peak period between 4:00 and 6:00 PM.

Figure 10: Corridor Crash Evaluation





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CO 93 from CO 72 to CO 128

Within the study period, this 4.2-mile long segment of CO 93 had a total of 150 reported crashes, of which 44 involved an injury (78 injured) and four involved a fatality (5 people killed). Consistent with the southern CO 93 segment evaluated, rear end, overturning, head on, wild animal, wind and snow/sleet/hail crashes were significant crash types. This segment also had fence and fixed object crashes occurring at a higher than expected rate. Approximately 30 percent of all mainline crashes occurred during snow/sleet/hail weather conditions, roughly 40 percent in adverse road conditions (wet, icy or snowy pavement) and almost 10 percent occurred during windy conditions. With respect to the human factors contributing to the crashes, approximately 20 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in approximately five percent of crashes. From both a crash frequency and severity standpoint, this segment is operating worse than other similar roadways and exhibits a high potential for crash reduction.

The intersection with CO 128 was included within this segment. Rear end crashes were found to be significant, with the highest occurrence during the morning peak period (7:00-9:00 AM).

CO 93 from CO 128 to CO 170

This 1.9-mile segment along CO 93 had a total of 57 reported crashes during the five-year analysis period. Of these, there were 17 injury collisions and one fatal collision; 24 injured and one person killed overall. The significant crash types were consistent with other segments along CO 93 that were evaluated and include: rear end, wild animal, fixed object, wind, and snow/sleet/hail crashes. Approximately 25 percent of all mainline crashes occurred adverse weather conditions (rain, snow or fog), roughly 12 percent in windy conditions, and approximately 35 percent in adverse road conditions (wet, icy or snowy pavement). With respect to the human factors contributing to the crashes, approximately 18 percent cited driver distraction/preoccupation as a reason for the crash. Alcohol or drugs were suspected in approximately 11 percent of crashes. This segment exhibits a high potential for crash reduction from a severity standpoint.

The intersection with CO 170 was included within this segment. Rear end crashes were found to be significant, but were found to occur sporadically throughout the day from 7:00 AM to 7:00 PM.

Crash Types

Table 23 summarizes the severity of crashes for each of the segments analyzed. The Level of Service of Safety (LOSS) for each of the segments is also tabulated. The LOSS ratings reflect how a roadway segment is performing in regard to its expected crash frequency and severity at a specific level of average daily traffic (ADT). The four LOSS ratings are defined below and describe the magnitude of the safety problem present from both a crash frequency and severity standpoint, as well as the potential for crash reduction.

- LOSS I – Indicates a low potential for crash reduction.
- LOSS II – Indicates a low to moderate potential for crash reduction.
- LOSS III – Indicates a moderate to high potential for crash reduction.
- LOSS IV – Indicates a high potential for crash reductions.



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Table 23: Non-Intersection Related Crash Severity and Level of Service of Safety

LOCATION	CRASHES				LOSS TOTAL	LOSS INJURY+ FATAL
	PDO	INJURY	FATAL	TOTAL		
C-470 – Kipling Pkwy to Morrison Rd	384	92	1	477	I	I
C-470 – Morrison Rd to I-70	354	93	1	448	II	II
C-470 – I-70 to US 6	28	4	0	32	III	II
US 6 – C-470/Johnson Rd to CO 58/CO 93	153	39	2	194	IV	III
CO 93 – US 6/CO 58 to CO 72	245	74	3	322	IV	III
CO 93 – CO 72 to CO 128	102	44	4	150	IV	IV
CO 93 – CO 128 to CO 170	39	17	1	57	III	IV
Non-Intersection Crash Total	1,305	363	12	1,680		

Table 24 summarizes the location and severity of crashes for the intersection related crashes along the WestConnect corridor. Only intersections with 10 or more total crashes are listed in the table.

Table 24: WestConnect Corridor Intersection Related Crashes

INTERSECTION	CRASHES			
	PDO	INJURY	FATAL	TOTAL
US 6/C-470/Johnson Rd	60	15	0	75
US 6/Jefferson County Pkwy	62	14	0	76
US 6/19th St	49	12	0	61
US 6/CO 58/CO 93	54	10	0	64
CO 93/Iowa Dr	30	7	0	37
CO 93/Washington Ave	34	12	0	46
CO 93/Golden Gate Canyon Dr	15	3	0	18
CO 93/Pine Ridge Rd	9	2	0	11
CO 93/58th Ave	11	6	0	17
CO 93/64th Pkwy	13	3	0	16
CO 93/CO 72	21	3	0	24
CO 93/CO 128	8	3	0	11
CO 93/CO 170	12	7	0	19
Other intersections (≤ 9 crashes each)	0	2	0	2
Intersection Related Crash Total	378	99	0	477

Crashes that occurred at ramp terminal intersections at interchanges along C-470 are summarized in **Table 25**.



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Table 25: C-470 Interchange Ramp Terminal Intersection Related Crashes

LOCATION	CRASHES			
	PDO	INJURY	FATAL	TOTAL
Kipling Pkwy Eastbound C-470 Ramp	6	2	0	8
Kipling Pkwy Westbound C-470 Ramp	6	4	0	10
Ken Caryl Ave Eastbound C-470 Ramp	12	2	0	14
Ken Caryl Ave Westbound C-470 Ramp	16	7	0	23
Bowles Ave Eastbound C-470 Ramp	6	4	0	10
Bowles Ave Westbound C-470 Ramp	4	2	0	6
Quincy Ave Eastbound C-470 Ramp	8	1	0	9
Quincy Ave Westbound C-470 Ramp	6	4	0	10
Alameda Pkwy Eastbound C-470 Ramp	4	2	0	6
Alameda Pkwy Westbound C-470 Ramp	4	1	0	5
Total Ramp Terminal Crashes	72	29	0	101

Table 26 summarizes the number of crashes that occurred along interchange on- and off-ramps along C-470. Prevalent crash types on the interchange ramps include rear end and sideswipe same direction crashes, which are not uncommon when trying to complete merge/diverge maneuvers in congested conditions or when queuing back from a ramp terminal traffic signal extends far onto the off ramp.

Table 26: C-470 Interchange Ramp Crashes

LOCATION	CRASHES			
	PDO	INJURY	FATAL	TOTAL
C-470 at Kipling Pkwy Interchange	6	1	0	7
C-470 at Ken Caryl Ave Interchange	15	8	0	23
C-470 at Bowles Ave Interchange	16	7	0	23
C-470 at Quincy Ave Interchange	8	6	1	15
C-470 at US 285 Interchange	18	9	0	27
C-470 at Morrison Rd Interchange	18	5	0	23
C-470 at Alameda Pkwy Interchange	3	3	0	6
C-470 at I-70 Interchange (I-70 Ramps)	52	15	0	67
C-470 at I-70 Interchange (C-470 Ramps)	7	0	0	7
C-470 at I-70 Interchange (C-470 Ramps)	4	1	0	5
C-470 at US 6 Interchange (NB Off-Ramp)	3	1	0	4
C-470 at US 6 Interchange (SB On-Ramp)	3	0	0	3
Interchange Ramp Related Crash Total	153	56	1	210



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The fatal crash that occurred at the C-470/Quincy Avenue interchange involved an intoxicated motorcyclist traveling on the eastbound off-ramp. The motorcyclist ran off the road to the left, hit a fixed object, and suffered an incapacitating injury when thrown from the motorcycle.

Bicycle/Pedestrian Crashes

An evaluation related specifically to bicycle and pedestrian crashes was also conducted. Within the study area, including the ramps and intersections at interchanges along C-470 in addition to the specific segments noted previously, there were a total of nine crashes involving cyclists and four crashes involving pedestrians.

Along C-470, a total of three bicycle crashes occurred—two at the Bowles Avenue interchange and one at the Ken Caryl Avenue interchange. One pedestrian crash occurred at the Morrison Road interchange. Along US 6, four bicycle crashes occurred at the intersection with 19th Street and a fatal crash involving an intoxicated pedestrian occurred near the Jefferson County Justice Center. A project to reconfigure the 19th Street intersection to a grade-separated interchange with pedestrian and bicyclist facility improvements is currently under construction. Two crashes involving bicyclists and one crash involving a pedestrian occurred along CO 93. The crashes involving bicyclists occurred at Washington Avenue and at CO 170, while the pedestrian crash was reported south of Coal Creek Canyon Road.

Wild Animal Crashes

A total of 275 crashes with wild animals were reported along the seven segments analyzed. Crashes involving wild animals were found to occur at a higher than expected rate on five of the seven segments analyzed. The two segments where crashes involving wild animals represented the highest overall percentage of total reported crashes include US 6 between C-470/Johnson Road and CO 58/CO 93 (nearly 40 percent) and CO 93 from US 6/CO 58 to CO 72 (20 percent).



CORRIDOR MULTIMODAL MOBILITY

The existing conditions for transit, pedestrian and bicycle facilities and movements in the WestConnect corridor were evaluated. The corridor provides a variety of regional transit services, as well as a number of trails and multiuse paths. The multimodal options include regional transit services, recreational trails, and on-street facilities (shoulders) and off-street facilities (multiuse path) for bicyclists. CO 93 provides shoulders for bicyclists and a number of trailheads for trails adjacent to the corridor.



A variety of users at the Pine Ridge Road crossing.

Transit Services

Figure 11 illustrates the existing transit service within the WestConnect corridor study area. The transit services included in this evaluation run on the corridor for any part of the route. The stops and park and rides were selected based on being within a half mile of the corridor, as well as providing service to the routes that travel on the corridor.

Four bus routes, one LRT line, and two call and ride service areas provide transit service to the study area. The buses provide regional service between Boulder and Golden (Route GS), as well as to Denver from Pine Junction (Routes CS/CV/CX) and Denver from the Ken Caryl area (Routes 116L and 116X). The W Line provides light rail service between Golden and downtown Denver. The two call and rides provide first and final mile connections to locations within a specified boundary within the call and ride service areas. The Golden Call and Ride provides service to almost all of downtown Golden, with a popular connection between the Jefferson County Government Center – Golden Station with the rest of the community. The South JeffCo Call and Ride provides service east and north of C-470 to the Southwest Plaza Park and Ride as well as to the Littleton Downtown LRT Station and Littleton Mineral LRT Station.

LRT

The W Line provides service every day of the week between downtown Denver to the most western station at the Golden Station. Trains provide service in both directions approximately every 15 minutes during weekdays and provide the best transit service to the area. The frequent 15-minute headways occur over a large span of service hours—from about 3:30 AM until 2:00 AM everyday on a weekday (Monday-Thursday) schedule. **Table 27** shows the weekday LRT headways.



CORRIDOR CONDITIONS REPORT

Table 27: Weekday W Line LRT Headways

DIRECTION	WEEKDAY SERVICE HOURS*	END LOCATION	FREQUENCY	SCHEDULE
WB	3:30 AM – 1:30 AM	Denver	15 minutes until approximately 11:00 PM at night, then 30-60 minutes	Regular service throughout the entire day
EB	4:00 AM – 2:00 AM	Golden	15 minutes until approximately 11:30 PM at night, then 30-60 minutes	

Source: RTD, Schedule effective April 24, 2016 - August 13, 2016
 *Leave times of the first stop rounded to the nearest half hour.



The highest ridership at the Golden Station occurs Monday-Thursday, likely serving a mix of commuters and other travelers. Overall, riders take about 2,000 one-way trips that either begin and/or end at the Golden Station every Monday-Thursday. Fridays experience slightly fewer riders, with a total of about 1,800 one way trips. Saturday alightings are higher than boardings. However, on Sunday, there are about 500 boardings and alightings to make a total of just over 1,000 one-way trips on LRT within the study area.

On a daily basis, the LRT operates at about eight percent capacity. Throughout the 80 trips in both directions, there are approximately 12,000 seats available but only about 950 are filled. The W Line operates more service that terminates at the Federal Center during the peak morning and evening periods. **Table 28** shows the service and ridership details associated with the W Line.

Table 28: W Line - Monday through Friday Service and Ridership

ROUTE	STOP NAME	EASTBOUND				WESTBOUND			
		TRIPS	LOAD	TOTAL SEATS	% FILLED	TRIPS	LOAD	TOTAL SEATS	% FILLED
W line	Golden Station	80	923	12,201	8%	80	985	12,197	8%

Source: RTD Daily Ridership, January 2016 Bus

Figure 11: Existing Transit Service

Bus Route GS

Peak period weekday service between Golden and Boulder (Downtown Boulder Transit Center). There are 6 runs in each direction in the morning. In the evening, there are 4 runs to Boulder and 6 runs to Golden.

LRT Route W Line

All day regular service (Monday-Sunday) from the Jefferson County Government Station (Golden Station) location with service to Union Station in downtown Denver. Monday-Thursday service operates every 15 minutes during peak periods.

Bus Route 116L

Similar to the 116X, but provides more local service. Directional peak period weekday service between Ken Caryl and Denver (Civic Center Station). There are 4 runs in the morning to Denver and 4 runs in the evening to Ken Caryl.

Bus Route CV/CS

Directional peak period weekday service between Pine Junction and Conifer to Denver. There are 9 runs in the morning from Pine Junction to Denver (Civic Center Station) and 6 runs in the evening from Denver to Pine Junction.

Bus Route 116X

Directional peak period weekday service between Ken Caryl and Denver (Civic Center Station). There are 4 runs in the morning to Denver and 4 runs in the evening to Ken Caryl.



LEGEND

- Study Corridor
- Parks & Open Space
- County Boundaries
- City Boundaries
- Highway
- Major Road
- Minor Road
- Park and Ride
- Bus Stop
- Bus Route: 116L
- Bus Route: 116X
- Bus Route: CV/CS
- Bus Route: GS
- Bus Route: FLEX Routes
- Bus Route: Fixed Routes
- Light Rail: W Line
- Call and Ride Service Areas
- Northbound: xx
Southbound: xx

Source: RTD weekday ridership, January 2016





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CORRIDOR CONDITIONS REPORT

All four bus routes along the WestConnect corridor only provide service during the peak periods on the weekdays. The four routes provide service at some point along the study corridor. The weekday bus headways are summarized in **Table 29**.

- **Route 116L** (South Simms Limited) recently provided morning service from the Ken Caryl Park and Ride to the Federal Center. Service was provided northbound in the morning and southbound in the evening. This route was recently discontinued (January 2017).
- **Route 116X** (South Simms Express) provides morning service along C-470 and US 6 from Ken Caryl to Civic Center in Denver and the reverse service in the evening
- **Routes CS/CV/CX** (Pine Junction/Conifer/Denver) provide service along US 285, C-470 and US 6 from Pine Junction to Civic Center in Denver. The majority of morning trips provide eastbound service from Pine Junction to Denver with the reverse in the evening. The CS provides the most extensive service, serving all park and rides along US 285 in addition to Federal Center. The CV provides a semi-express service by skipping the Federal Center. The CS is the express service that provides direct service from Aspen Park park and ride to Civic Center Station. All three variations of this route travel along C-470.
- **Route GS** (Golden/Boulder) provides service along CO 93 between Boulder and Golden in both directions during peak periods. The south terminus is the Federal Center and the north terminus is the Downtown Boulder Station in downtown Boulder. All routes serve the Federal Center and stops in Golden and Boulder while a small number of trips do not serve within the Federal Center campus or along Colfax Avenue.

Table 29: Weekday Bus Headways

ROUTE	SERVICE HOURS*	TERMINI	FREQUENCY	TRIPS PER DAY
116L**	NB: 5:00 AM – 9:00 AM SB: 3:00 PM – 8:00 PM	Denver	Approximately every 90 minutes	NB: 3 morning peak SB: 4 evening peak
116X	NB: 5:30 AM – 7:00 AM SB: 3:30 PM – 6:00 PM	Denver	NB: 30 minutes in morning peak SB: 40-70 minutes in evening peak	NB: 4 morning peak SB: 4 evening peak
CV/CS/CX	WB: 5:30 AM – 7:00 AM WB: 3:30 PM – 6:00 PM EB: 5:00 AM – 7:00 AM EB: 4:30 PM – 6:00 PM	Conifer, Denver	WB: 15-45 minutes in evening peak EB: 10-30 minutes in morning peak	WB: 4 morning peak and 8 evening peak EB: 7 morning peak and 2 evening peak
GS	NB: 5:30 AM – 8:30 AM NB: 4:00 PM – 6:30 PM SB: 5:00 AM – 8:30 AM SB: 2:00 PM – 6:30 PM	Boulder, Golden	30-60 minutes for all directions during all peak periods	NB: 5 morning and evening peak SB: 6 morning and evening peak

Source: RTD, Schedule effective April 24, 2016 - August 13, 2016

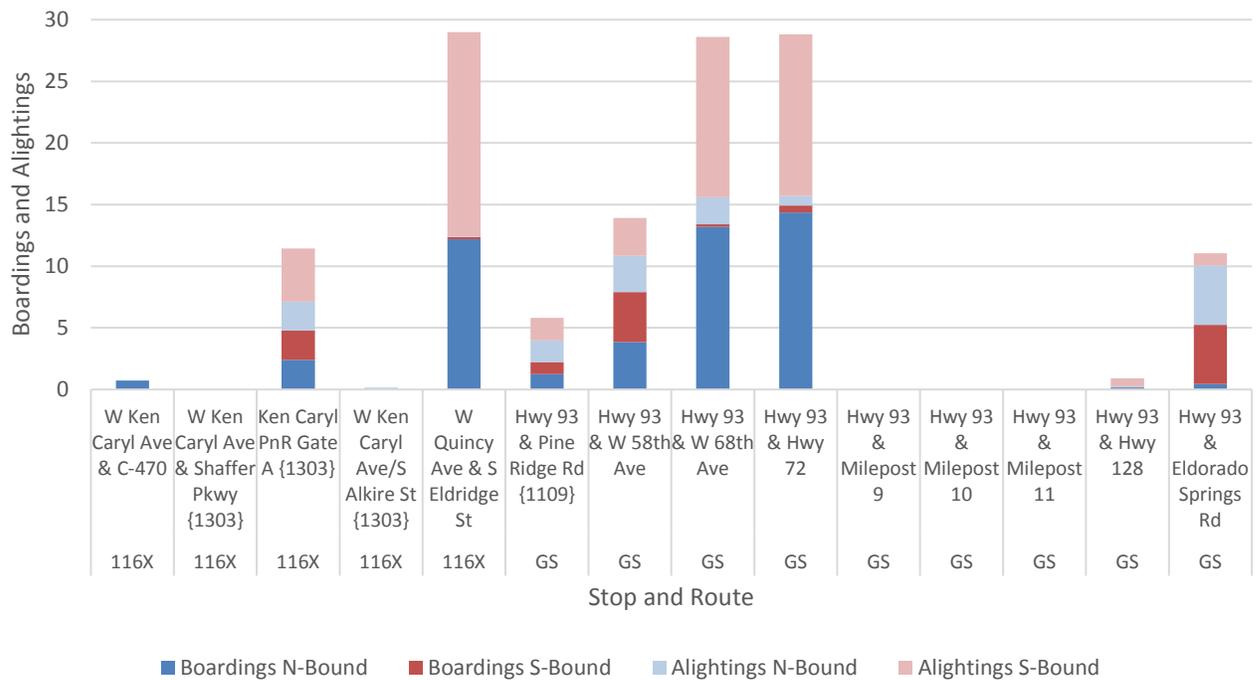
*Leave times of the first stop rounded to the nearest half hour.

**The 116L service will be discontinued in January 2017.

CORRIDOR CONDITIONS REPORT

Boardings and alightings at stops within the study area are a relatively small proportion of travel movements throughout the area. There are roughly three stops that experience relatively more boarding and alighting than others: Quincy Avenue and Eldridge Street (116X), CO 93 and 68th Avenue (GS) and CO 93 and CO 72. The remaining stops experience under 15 boardings and alightings over the course of the day. A total of four stops do not receive any boarding or alighting activity: Ken Caryl Avenue and Shaffer Parkway, CO 93 at MP 9, CO 93 at MP 10 and CO 93 at MP 11. **Figure 12** shows the boardings and alightings at stops within the study area. **Table 30** shows the total weekday boardings for routes within the corridor.

Figure 12: Daily Boardings and Alightings at Stop within the Study Area



Source: RTD Daily Ridership, January 2016

Table 30: Weekday Boardings for Routes within the Corridor

ROUTE	EASTBOUND	WESTBOUND	NORTHBOUND	SOUTHBOUND
116L	-	-	12	16
116X	-	-	65	76
CV	214	237	-	-
GS	-	-	215	239

Source: RTD Daily Ridership, January 2016



CORRIDOR CONDITIONS REPORT

In addition to the boardings and alightings of stops within the study area, the sum load data (total number of people on the bus) was obtained for buses running along the corridor. This gives a better indication of people traveling through the area via bus. Based on the sum load and sum seats available, the GS buses operate with about a third of the seats full. The 116X buses have a lower percentage of full seats, with under five percent of seats filled. However, at the Quincy Avenue and Eldridge Street stop east of C-470, the bus is closer to a third full in both the northbound and southbound directions. **Table 31** shows the sum load for all the bus stops of the routes operating within the study area.

Table 31: Sum Load for Stops of Routes on the Corridor

ROUTE	STOP	NORTHBOUND			SOUTHBOUND		
		SUM LOAD	TOTAL SEATS AVAILABLE	% FULL TOTAL	SUM LOAD	TOTAL SEATS AVAILABLE	% FULL TOTAL
116X	Ken Caryl Ave & C-470	N/A			1	169	0%
116X	Ken Caryl Ave & Shaffer Pkwy {1303}	7	169	4%	N/A		
116X	Ken Caryl PnR Gate A {1303}	7	169	4%	6	186	3%
116X	Ken Caryl Ave/Alkire St {1303}	0	169	0%	8	186	4%
116X	Quincy Ave & Eldridge St	61	169	36%	52	186	28%
GS	CO 93 & Pine Ridge Rd {1109}	152	570	27%	164	684	24%
GS	CO 93 & 58th Ave	153	570	27%	164	684	24%
GS	CO 93 & 68th Ave	164	570	29%	164	684	24%
GS	CO 93 & CO 72	177	570	31%	177	684	26%
GS	CO 93 & Milepost 9	177	570	31%	189	684	28%
GS	CO 93 & Milepost 10	176	570	31%	189	684	28%
GS	CO 93 & Milepost 11	177	570	31%	189	684	28%
GS	CO 93 & CO 128	178	570	31%	189	684	28%
GS	CO 93 & Eldorado Springs Rd	173	570	30%	190	684	28%

Source: RTD Daily Ridership, January 2016

In addition to the bus routes described above, there are a number of routes in the surrounding area that provide service. They are not directly on the corridor, but these routes are noted as important connections as they relate to mobility surrounding the corridor. These routes will be especially important when developing alternatives to improve transit service. **Table 32** lists the surrounding routes with details about the service.



CORRIDOR CONDITIONS REPORT

Table 32: Surrounding Bus Routes

ROUTE	ROUTE NAME	DESCRIPTION
16	West Colfax	Service between downtown Golden and Civic Center Station along South Golden Rd and Colfax Ave (includes stops at the Federal Center, Oak Station, Lakewood-Wadsworth Station, Decatur-Federal Station and the Colfax at Auraria Station).
16L	West Colfax Limited	Service with limited stops between Simms and Civic Center providing service between downtown Golden and Civic Center along South Golden Rd and Colfax Ave (includes stop at the Colfax at Auraria Station). Provides more direct service than the 16.
52	52nd Avenue/South Bannock	Service between CO 93 and Alameda Station (a major LRT transit point serving the C, D, E, F and H lines as well as bus lines 3,4, and 33) as well as providing service to the Olde Town Arvada Park and Ride and Civic Center.
59	West Bowles	Service between Bowles Ave and Coal Mine just east of C-470 to Littleton Downtown Station (includes service to the Southwest Plaza at Wadsworth and Bowles).
77	Ken Caryl Avenue	Service between Ken Caryl Park and Ride and Littleton Mineral Station (which serves the C & D LRT lines as well as bus routes 85, 401, 402L and 403) along Ken Caryl Ave to Mineral.
85	Chatfield Avenue	Service between Ken Caryl Park and Ride and Littleton Mineral Station (which serves the C & D LRT lines as well as bus routes 85, 401, 402L and 403) along Chatfield Ave to Platte Canyon to Mineral.
100L	South Kipling Limited	Service between Ken Caryl Park and Ride and Civic Center (includes service to the Federal Center and then express service from the Federal Center to Civic Center).
CV	Pine Junction/Conifer/Denver	Service between Pine Junction and Conifer to Civic Center. Provides express service from Twin Forks Park and Ride to Civic Center.
ES	Evergreen/Aspen Park/Denver	Service between Aspen Park and Evergreen to Civic Center along CO 73, I-70 to US 6.
100	Kipling Parkway	Service between Southwest Plaza (at Wadsworth and Bowles) and US 36/Sheridan Station along Kipling Pkwy. This service no longer operates as of December 2016.
116L	Ken Caryl Limited	Service between Ken Caryl Park and Ride to Federal Center. This service is discontinued as of January 2017.

Source: RTD

The data in **Table 33** shows total trips, sum load, total available seats and total filled seats for both directions of travel.

CORRIDOR CONDITIONS REPORT

Table 33: Trips and Load Information for Surrounding Routes

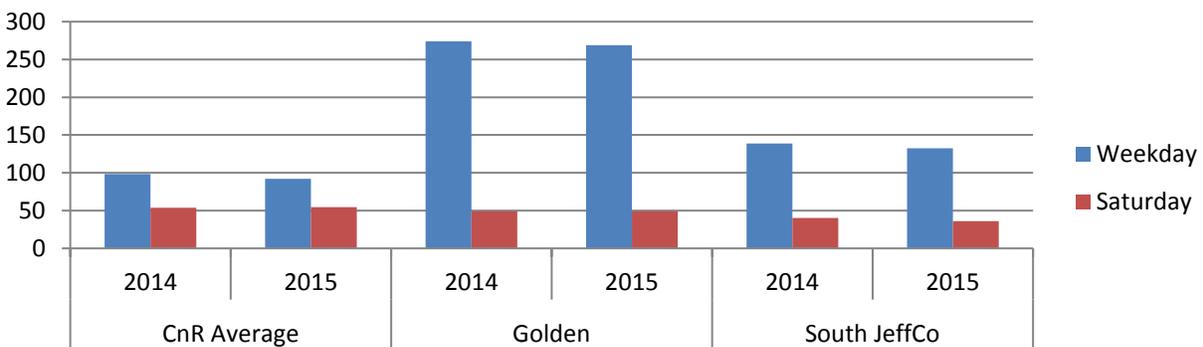
ROUTE	STOP NAME	EASTBOUND/NORTHBOUND				WESTBOUND/SOUTHBOUND			
		TRIPS	SUM LOAD	SUM SEATS	% FILLED	TRIPS	SUM LOAD	SUM SEATS	% FILLED
16	10th St/Washington Ave	9	22	345	6%	10	17	382	4%
16L	10th St/Washington Ave	33	98	1,266	8%	34	95	1,304	7%
52	68th Ave/CO 93	10	12	369	3%	9	10	333	3%
59	Coal Mine and Arbor Pl	26	45	971	5%	25	35	933	4%
77	Ken Caryl Park and Ride	22	17	576	3%	21	25	549	5%
85	Ken Caryl Park and Ride	12	11	315	3%	12	11	315	3%
100L	Ken Caryl Park and Ride	4	5	220	2%	4	5	205	2%
116X	Ken Caryl Park and Ride	4	7	169	4%	4	6	186	3%
CV	Twin Forks Park and Ride	9	83	513	16%	6	55	342	16%
ES	CO 40/CO 26	8	74	456	16%	7	75	398	19%
100	Southwest Plaza	30	87	1,112	8%	29	82	1,085	8%
116L	10th St/Washington Ave	3	2	112	2%	4	3	152	2%

Source: RTD Daily Ridership, January 2016

Call-and-Ride Service

The Golden Call and Ride provides service to almost all of downtown Golden, with a popular connection between the Golden Station and the rest of the community. The South JeffCo Call and Ride provides service east and north of C-470 to the Southwest Plaza Park and Ride as well as to the Littleton Downtown LRT Station and Littleton Mineral LRT Station. Both call and rides operate more on weekdays than on Saturdays. Neither provide service on Sundays. Based on 2014 and 2015 averages, both call and rides experience more riders than the average RTD call and ride service per weekday (approximately 275 for Golden and 130 for South JeffCo). On Saturdays, the call and rides were closer to the average of about 50 people per day. **Figure 13** shows the averages for daily boardings.

Figure 13: Call and Ride Boardings



Source: RTD Call and Ride data, 2014 and 2015

CORRIDOR CONDITIONS REPORT

Golden Call and Ride

In addition to providing a traditional call and ride service where riders make either recurring or one-time reservations, the Golden Call and Ride also has two Flex routes where the service follows a general route but allows deviations from the route to get people to their destinations (shown in **Figure 14**). These two routes depart from the Golden Station and run on an established schedule, leaving the LRT station every 30 minutes. The Golden Flex Route serves the School of Mines, Downtown and the VA Clinic from 6 AM-6 PM. The Human Services Flex Route serves the Jefferson County Human Services building from 8 AM-6 PM. Other destinations within the service area depart every 30 minutes between 8:30 AM-6:30 PM. On Saturdays, service is slightly less frequent, departing from the station every hour from about 8:45 AM-5:45 PM. These three options provide a number of different ways people can get to and from LRT from the Golden area.

Figure 14: Golden Call and Ride



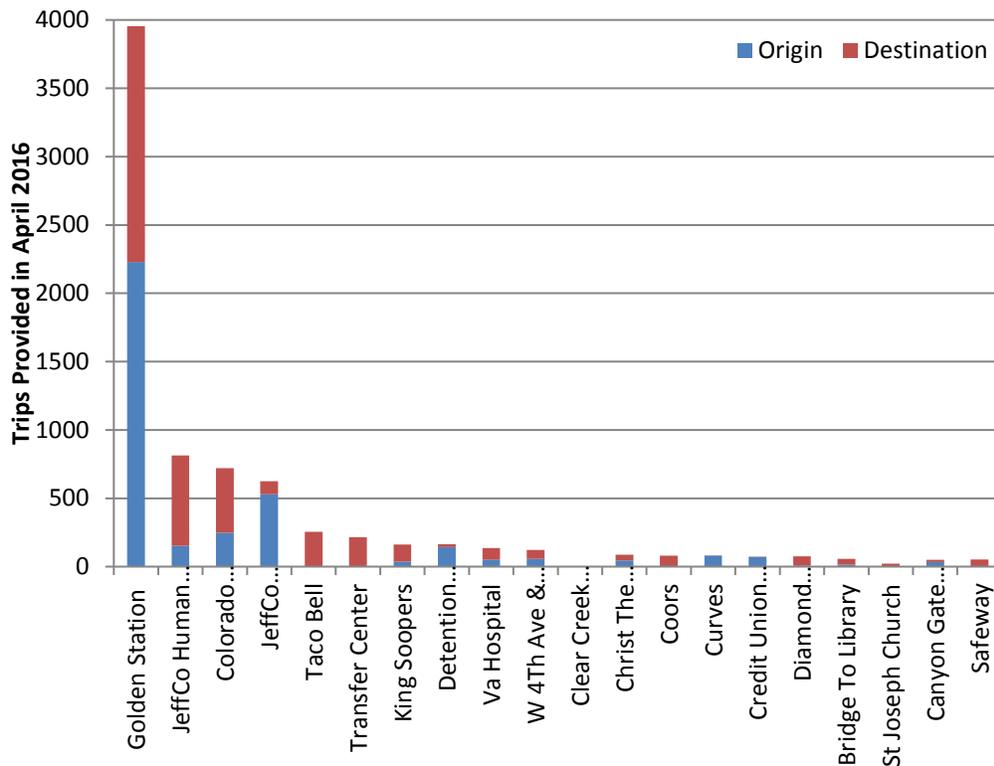
A flex route is an established routing with published times and serves numerous stops along a route. No phone call is needed when using any of these published times and locations, customers only need board the bus and tell the driver their destination. If a customer is at a pickup location within a block or two from the route and between published stops, and they have a special need, they can call the driver and request a deviation from the flex route. If the driver has the time and the computer allows it, it can be done.

- RTD Definition of Flex Route

CORRIDOR CONDITIONS REPORT

The most popular origin and destination for the Golden Call and Ride is the Golden Station, with over 4,000 people leaving and/or arriving at this station over the course of the month of April 2016. Other common origins and destinations include: JeffCo Human Services, Colorado School of Mines, JeffCo Workforce, Taco Bell, Transfer Center, King Soopers, Detention Facility (Jail) and VA Hospital as depicted in **Figure 15**. In addition to common locations arising from the call and ride data, a number of common trips emerged, based mostly to and from Golden Station.

Figure 15: Golden Call and Ride Top Locations



Source: RTD Call and Ride data, April 2016

South JeffCo Call and Ride

The South JeffCo Call and Ride provides service between Ken Caryl Park and Ride to the Littleton Downtown Station/Littleton Mineral Station with the Southwest Plaza Park and Ride and C-470 as the north and south boundaries (shown in **Figure 16**). Overall, the number of rides taken on the South JeffCo Call and Ride (1,400) is much lower than the Golden Call and Ride (4,000).

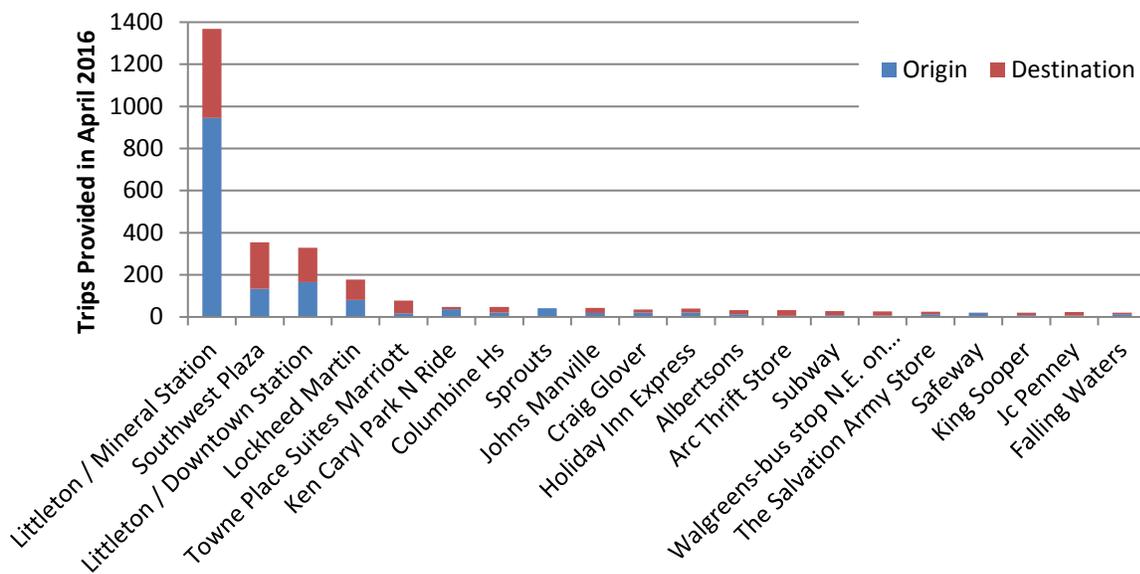
CORRIDOR CONDITIONS REPORT

Figure 16: South JeffCo Call and Ride



The Littleton/Mineral Station is the most popular location for people using the call and ride. A number of locations fall within the study area, but at relatively low quantities: Towne Place Suites Marriott (77), Ken Caryl Park and Ride (48), Holiday Inn Express (40), Albertsons (33) and Safeway (21). The top locations for this call and ride is shown in **Figure 17**.

Figure 17: South JeffCo Call and Ride Top Locations



Source: RTD Call and Ride data, April 2016

CORRIDOR CONDITIONS REPORT

Park and Rides

Three park and rides provide parking within the study area: Golden Station, Ken Caryl & C-470 and CO 72 & CO 93. The Golden Station Park and Ride serves as the western end for the W Line while the Ken Caryl & C-470 Park and Ride serves a number of bus routes (77, 85, 100L, 116L and 116X). The CO 72 & CO 93 park and ride serves the GS. Both the Golden Station and Ken Caryl & C-470 park and rides experience lower utilization than the average for their respective mode of park and rides (either LRT or bus). The CO 72 & CO 93 park and ride experiences a very high average utilization at 93 percent.

Table 34 and **Figure 18** show the parking utilization for the park and rides as well as the average for the W Line, LRT, and bus park and rides.

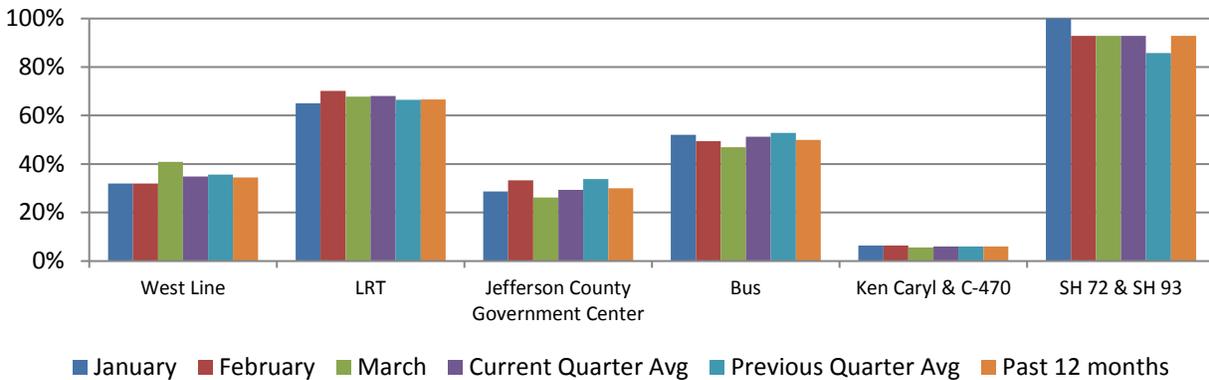
Table 34: Park and Ride Spaces and Utilization

LOCATION	SPACES	PAST 12 MONTHS UTILIZATION
W Line	4,774	35%
Golden Station	705	30%
LRT – all park and rides	15,841	67%
Ken Caryl & C-470	268	6%
CO 72 & CO 93	14	93%
Bus – all park and rides	14,435	50%

Source: RTD Parking Utilization Memo, April 2016

LRT park and rides usually experience higher parking utilization (67 percent over the past 12 months) than bus park and rides (50 percent over the past 12 months). However, the CO 72 & CO 93 park and ride very high utilization at 93 percent. The Golden Station Park and Ride experienced a 30 percent utilization over the past 12 months, staying relatively consistent over time and only slightly lower than the average for the W Line (35 percent for the past 12 months). The Ken Caryl & C-470 Park and Ride consistently averages 6 percent utilization.

Figure 18: Park and Ride Utilization



Source: RTD Parking Utilization Memo, April 2016

CORRIDOR CONDITIONS REPORT

Pedestrian and Bicycle Conditions

The C-470 Trail and other segments of the WestConnect corridor play an important role in the Denver regional trail network as well as the State's overall trail system. Throughout the corridor, over 20 miles of paved trail for bicyclists, pedestrians, and joggers connect several significant parks as well as commercial and residential areas. The corridor also connects to other important regional trails, such as the Clear Creek and Bear Creek Trails, and to the local and arterial street network at numerous locations. Much of the C-470 Trail coincides with the alignment for the Colorado Front Range Trail, which would extend from the New Mexico to Wyoming state lines upon completion.

Due to the built environment characteristics in the majority of the corridor, (except the Golden area) the distance between destinations is often far, therefore most of the discussion of this section centers around conditions for bicycle travel. The findings are based on a combination of discussions with stakeholders, field observation, GIS data collection, Google Maps, Google Earth, and other publicly available sources.

In June 2016, members of the project team convened a group of corridor stakeholders, including those from the cities of Lakewood and Golden, Jefferson County, CDOT, and Bike Jeffco. An overview of the project was provided and stakeholders provided input on projects that relate to the corridor, provided feedback about the existing trail and jurisdictional boundaries, and identified opportunities for improvement and connection along the corridor. This input informed the development of this report.

C-470 Segment

In this portion of the study area, pedestrian and bicycle accommodation is provided largely by the C-470 Trail, which is owned and maintained by CDOT. Short sections of roadway fill gaps in the C-470 Trail. The pedestrian and bicycle facilities are illustrated in **Figure 19**.

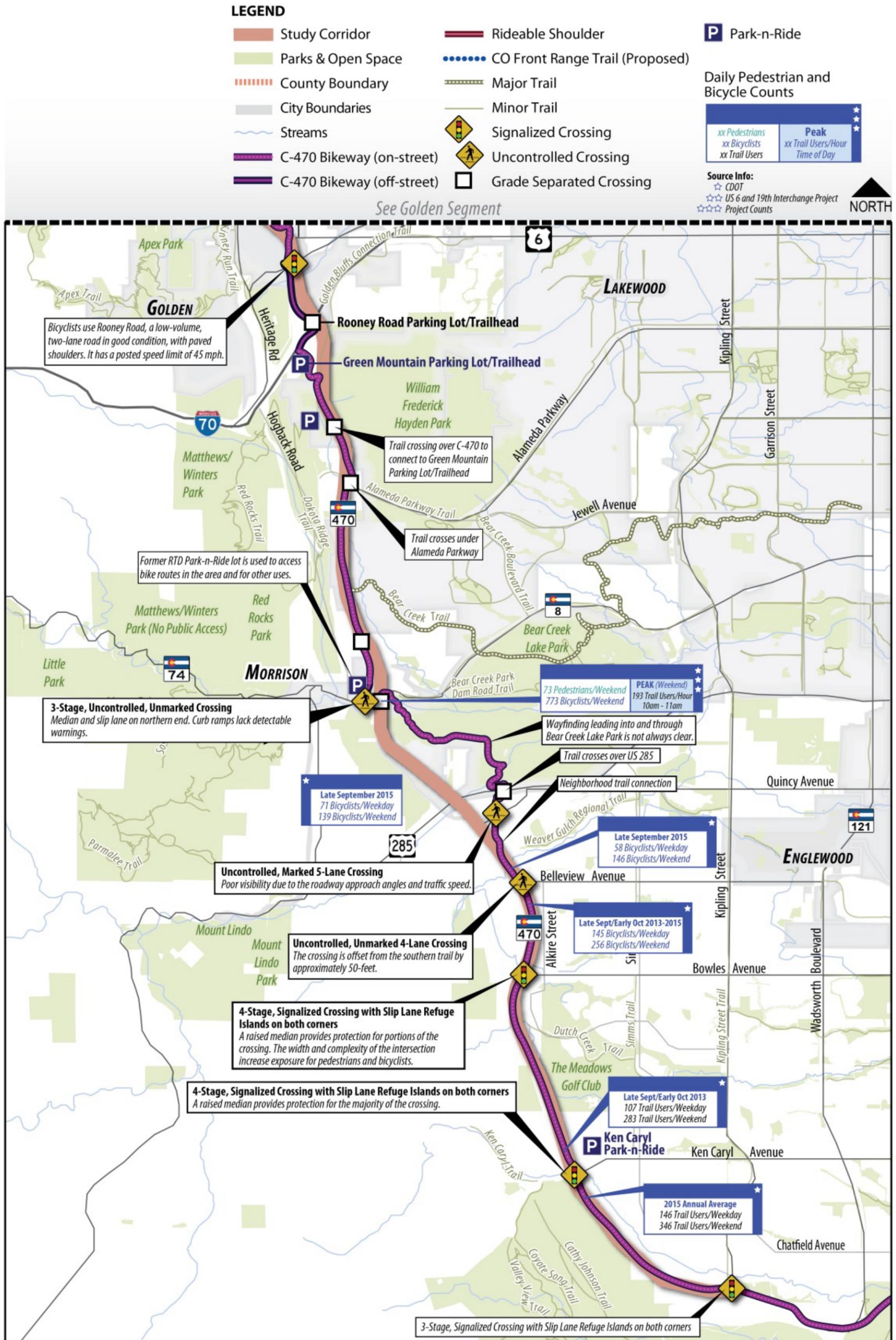
In the southernmost portion of this segment, the trail closely parallels the east side of the C-470 roadway alignment, but it begins to diverge from C-470 about 0.85 miles south of the US 285

interchange. Here, the trail travels eastward and parallels Eldridge Street, crosses Quincy Avenue, and drops down to the US 285 bridge overpass via a series of switchbacks. Through portions of Bear Creek Lake Park, which is operated by the City of Lakewood, the C-470 Trail is located up to 0.5 miles northwest of C-470.



Two bicyclists pass on the C-470 Trail south of Green Mountain.

Figure 19: Pedestrian and Bicycle Facilities – C-470 Segment





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CORRIDOR CONDITIONS REPORT

As the trail leaves Bear Creek Lake Park and approaches Morrison Road, it crosses under C-470 towards Rooney Road. At Rooney Road, trail users cross Morrison Road at-grade to proceed north. For a short length, trail users travel along Rooney Road before reconnecting with the trail to continue north along the west side of C-470. Once the trail is re-established, it follows the C-470 corridor closely until it terminates south of I-70, crossing under C-470 twice in this stretch.



The C-470 underpass at Rooney Road lacks a comfortable and continuous trail connection.

For southbound bicyclists, the trail abruptly ends 0.6 miles north of the Morrison Road parking lot. There is poor visibility at this location and while traffic volumes are low, the angle of the trail encourages

people to walk or ride against traffic to access the trail on the southern side of Morrison Road. The trail ends at the shoulder edge on the northeast side of the underpass and resumes on the southwest corner. There is no formal trail transition at this location and the asphalt edges on both sides of the roadway include a considerable lip from consecutive overlays.



The abrupt trail to street connection at Rooney Road.

Between the C-470/I-70 interchange and Colfax Avenue, dedicated pedestrian and bicycle facilities are not provided, as the C-470 Trail terminates south of I-70. As such, bicyclists typically use Rooney Road in this section. There is currently little pedestrian activity in this area, but a separated trail might result in greater activity from pedestrians and joggers. Between Colfax Avenue and US 6, a City of Golden trail is provided on the west side of C-470.



Bicyclists riding south of Colfax in the paved shoulder along Rooney Road.

*CORRIDOR CONDITIONS REPORT****Context and Use***

The C-470 Trail connects or is in close proximity to several parks, particularly in the northern portion between US-285 and I-70. Nearby parks include: Bear Creek Lake Park, Mount Glennon Park, Red Rocks Park, North Dinosaur Park, Mathews/Winters Park, and Green Mountain Park. Additionally, it intersects the Bear Creek Trail, which provides connectivity to the east into Denver via the Platte River Trail. Hogback Road along the Dinosaur Ridge is another attraction for recreational bicyclists who access Hogback Road via the on-street network at Alameda Parkway and the existing trail network within this segment.

Given the number of parks without other land uses within this portion of the corridor, recreational bicycling is the primary use of the C-470 Trail. Among the broad category of recreational bicyclists, those covering long distances are the most common user group, given the limited access points along the trail. Obtaining a high speed of travel is a key objective for many of these bicyclists. Some use of the trail by mountain bikers is also likely, as it can serve as a connection to unpaved trails in the various parks along the corridor. While there may be some use by bicycle commuters, it is unlikely that they comprise a large portion of trail users.

Due to the topography in this segment of the corridor, portions of the C-470 Trail involve significant grades, which make the trail challenging for certain user groups, such as young children, joggers, novice bicyclists, and others with mobility impairments. Additionally, with a limited variety of destinations along the C-470 Trail, its appeal to a broad user group is minimal.

The north end of the C-470 segment represents a transition from the various parks and open spaces adjacent to C-470 to the commercial and residential areas near the intersection of US-6 and Colfax

Avenue. The land adjacent to Rooney Road south of Colfax Avenue is mostly undeveloped; however, between Colfax Avenue and US 6, there are large housing developments and other residential pockets west of C-470 and the multiuse trail. Immediately east of C-470, there are office, warehouse, and big-box retail uses. Although the corridor passes through these residential and commercial areas, the primary use of the facilities in the C-470 extension corridor is for recreational, long-distance bicycling.



A bicyclist uses the trail within Bear Creek Lake Park.



A bicyclist makes the street to trail connection at Eldridge Street.

CORRIDOR CONDITIONS REPORT

Operational Conditions

The C-470 Trail is constructed of concrete and is typically 10 feet wide throughout this segment. In general, the trail is in good condition, though there are some locations near trailheads or intersections, such as south of the Morrison Road trailhead and throughout Bear Creek Lake State Park, where wider conditions could more comfortably accommodate a greater mix of users. According to the *CDOT Roadway Design Guide, Chapter 14 Bicycle and Pedestrian Facilities*, 10 feet is the minimum acceptable width for shared use paths with two directions of travel. Wider sections of trail are provided in areas with sharp curves.

Rooney Road is a low-volume, two-lane road that roughly parallels C-470 in the northern portion of this segment. The road pavement is in good condition, has paved shoulders between four and nine feet wide, and is signed to alert motorists to the presence of bicyclists. However, with a posted speed limit of 45 MPH, it is not a comfortable facility that could attract a more diverse composition of riders. The trail north of Colfax Avenue is in good condition and of adequate width for current usage.



A bicyclist rides in the shoulder along Rooney Rd.

Available pedestrian and bicycle counts were compiled for various points along the C-470 Trail. **Table 35** shows weekday and weekend volumes from these counts.

Table 35: C-470 Trail User Counts

LOCATION	COUNT PERIOD	MODES COUNTED	VOLUME	
			WEEKDAY	WEEKEND
South of Ken Caryl Ave.	2015 (Continuous)	Bicycle and Pedestrian	146/day	346/day
North of Ken Caryl Ave.	September / October 2013	Bicycle	107/day	283/day
North of Bowles Ave.	September / October 2013-2015	Bicycle	145/day	256/day
North of Belleview Ave.	September 2015	Bicycle	58/day	146/day
Eldridge St.	September 2015	Bicycle	71/day	139/day
South of Morrison Rd.	July 2016	Bicycle and Pedestrian	No data	846 (8a-8p)

Source: CDOT

Grade-separated crossings are provided at US 285, various locations along C-470, and Alameda Parkway. In general, these crossings work well for trail users.

The C-470 Trail crosses several major roadways at-grade. In general, these crossings are not ideal for trail users as they impose a substantial delay and are less safe than grade-separated crossings. The trail crossings at Kipling Parkway, Ken Caryl Avenue, and Bowles Avenue are signalized with the interchange ramp intersections. The trail crossing at Kipling Parkway is divided into three stages with slip lane refuge islands and push buttons on each corner. The Ken Caryl Avenue crossing is divided into four stages. It

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has slip lanes on both corners and a raised median that provides protection for the majority of the crossing. The Bowles Avenue crossing has similar features as the Ken Caryl Avenue crossing, but due to the overall width and complexity of the intersection, exposure for bicyclists and pedestrians is higher at this intersection. Additionally, some of the crossings are skewed and the refuge areas provide limited protection. The curb ramps lack detectable warnings and do not meet current American with Disabilities Act (ADA) requirements.

The trail crossing at Belleview Avenue is an uncontrolled, unmarked four lane crossing. It is offset from the southern trail approach by approximately 50 feet. A painted median area offers some protection for trail users who need to wait in the middle before crossing the second half of the street. The Tufts Avenue crossing is a stop-controlled, unmarked two-lane crossing. Given the low traffic volume and relatively short crossing, this arrangement may be adequate; however, the placement of the crossing before the stop sign provides a mixed message to drivers about where to stop, and can lead to queued vehicles blocking the crossing. There is a general lack of crossing signage and markings at this crossing.

The Quincy Avenue crossing is an uncontrolled, marked five-lane crosswalk. This crossing configuration (marked, uncontrolled crossing on multilane road without additional safety features) is known to be unsafe for pedestrians and bicyclists and is generally discouraged. There is a very narrow median to the west of the crossing that may provide limited protection for trail users, but overall the crossing suffers from poor visibility due to roadway curvature on all approaches, coupled with high traffic speeds.



A marked, but uncontrolled trail crossing at Quincy Avenue.

There are several minor uncontrolled, marked crossings within Bear Creek Lake Park. Given the low traffic volume and good visibility, these crossings appear to be adequate.

The trail crossing at the Morrison Road/Rooney Road intersection is perhaps the most problematic crossing within the C-470 Trail section. It is a three-stage unmarked, uncontrolled crossing with a median and slip lane provided on the northern end. The existing turn radius for motorists from Rooney Road going east onto Morrison Road is very wide, thereby shortening the median island and reducing comfort for trail users. The existing median provides minimal protection and is also not consistent with current ADA requirements



A bicyclist seeks refuge at the median along Morrison Road.

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for detectable warnings at curb ramps. The north end of the crossing terminates in a narrow sidewalk that does not provide an adequate transition for bicyclists to use Rooney Road to continue north.

As Rooney Road approaches Colfax Avenue from the south, bicyclists are expected to cross at the Colfax Avenue/Rooney Road traffic signal. From there, a wide sidewalk along the north side of Colfax Avenue connects to the trail approximately 150 feet to the east. A recent project added curb ramps to the northeast corner of the intersection; however, ramps are lacking on the southeast corner. The other north/south crossing has the same issue; a curb ramp is installed on the northwest corner of the intersection, but there is not a ramp on the southwest corner, despite push buttons being installed at that corner. Overall, the expected manner for bicyclists to cross the intersection is unclear, and ADA access is not provided. Signage directing bicyclists to use the pedestrian crosswalks is not installed and, based on field observation at this location, it is evident that bicyclists vary in terms of how they cross the intersection. Some northbound bicyclists avoid the intersection entirely, choosing instead to cross midblock to the east of the intersection. Southbound bicyclists cross on the east or west leg.

In addition to challenges for bicyclists, the Colfax Avenue/Rooney Road intersection does not serve pedestrians well. The main pedestrian movement is along the north crossing (parallel to Colfax), as residents from adjacent neighborhoods access nearby retail establishments or the trail to the east. This crossing is unnecessarily wide and encourages high speed turns from Colfax Avenue onto West Street. Additionally, curb ramps are lacking on the southeast and southwest corners of the intersection.

At the north end of the C-470 Extension, the multiuse trail approaches the southwest corner of US 6 and Johnson Road. The pedestrian push button, at the base of the signal mast arm, is located approximately 12 feet east of the trail. A sidewalk connects the two, but bicyclists must dismount or go out of their way to use it. The trail itself lacks physical gradation or other contextual changes to slow users before the crossing. There is no vertical separation (e.g. a curb) separating waiting trail users from vehicular traffic. The crossing of US 6 is a five-lane, 125 feet wide at-grade crossing which leaves trail users highly exposed.



A bicyclist waits to cross US 6 at Johnson Road.

At the northwest corner of US 6 and Johnson Road, there is a curb cut and a pedestrian push button. The sidewalk is 12 feet and adjacent to the road. Here, the W Line crosses at-grade and there are no crossing arms at the trail crossing for pedestrians and bicyclists. Due to the poor sight distances and limited space for trail users, this is a stressful and potentially dangerous trail crossing location. The sidewalk on the northern side of the rail crossing is 10 feet with a 7-foot landscape buffer. The sidewalk along the northern segment of US 6 stops just east of the intersection. Two heavily-worn paths have developed between the 6th Avenue Trail and both approaches to LRT and 6th Avenue Trail. This shows that pedestrians are seeking shorter, more direct ways of accessing the transit and trail facilities without needing to walk the entire length of the switchback.

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Crash History

Four vehicular crashes involving a bicycle or pedestrian occurred in the C-470 portion of the study area. Three involved a bicyclist, while a pedestrian was struck in the other crash:

- Pedestrian crash north of Morrison Road interchange: A pedestrian attempting to cross mainline C-470 at around 11:20 PM walked into the path of a southbound vehicle.
- Bicycle crash at Bowles Avenue interchange: A bicyclist crossing Bowles Avenue traveling southbound in a crosswalk (at the east side of the interchange) was struck by a vehicle traveling westbound.
- Bicycle crash at Bowles Avenue interchange: A bicyclist was crossing northbound in front of a motorcyclist making a right turn from westbound Bowles Avenue onto the C-470 westbound ramp. The motorcyclist unsuccessfully swerved to avoid the bicyclist. The crash appears to have occurred at the raised island where the trail crosses the right turn lane.
- Bicycle crash at Ken Caryl Avenue interchange: A bicyclist crossing westbound at the crosswalk/trail crossing at the southeast corner of the interchange was struck by a vehicle traveling northbound through the intersection after exiting westbound C-470.

Parking Areas and Trailheads

Few trailheads exist to provide direct access to the C-470 Trail, leading most bicyclists to access the trail from other streets or trails. A formalized trailhead is provided at Green Mountain Park, off of Rooney Road north of Alameda Parkway. There is one bike rack near the restrooms, though it is partially hidden by vegetation.



A diverse group of trail users at the trailhead of Green Mountain Park.

An informal parking lot along the east side of Rooney Road, just north of Morrison Road also provides parking access to the corridor. A heavily worn foot path at this location indicates the need for a better connection to the trail on the south side of Morrison Road. This parking lot used to serve a bus route before the W Line opened and now a number of users use this parking lot to carpool and bicycle along the corridor.

At the northwest corner of the intersection of US 6 and Johnson Road, the RTD Golden Station Park and Ride is used by passengers riding the W Line or buses. This park and ride has 705 vehicle parking spaces, 12 bike lockers, and 6 bike racks, and is connected to the 6th Avenue Trail.

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Wayfinding

Wayfinding signage on the C-470 Trail was recently upgraded based on recommendations from Bike

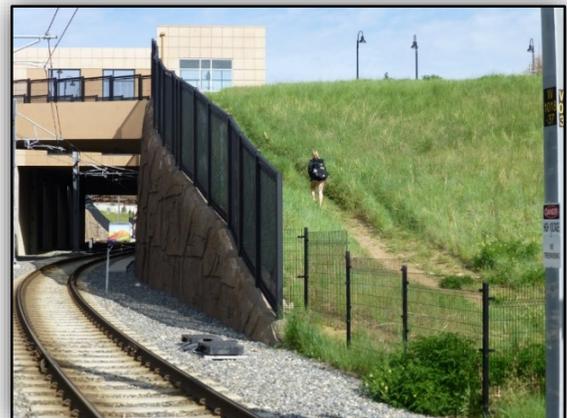
Jeffco. Nonetheless, wayfinding remains challenging in certain portions of the trail, most notably at the entrance and within Bear Creek Lake Park, where the route is not clearly marked. Wayfinding is also inadequate where the trail terminates at Morrison Road and follows Rooney Road before starting again north of Morrison Road.



Signage along the C-470 Trail south of Alameda Parkway.

In general, wayfinding in the northern portion of the C-470 segment is problematic at the transitions between trails and on-street bicycle facilities. Bike route signs are provided in the section of Rooney Road south of Colfax Avenue and there are City of Golden signs placed at the entrances to the trail between Colfax Avenue and US 6, which helps orient bicyclists and pedestrians in this area. However, wayfinding through the Rooney Road/Colfax Avenue intersection is somewhat ambiguous.

Near the US 6 intersection, signage to help users navigate the area leading up to the RTD facilities is lacking. For example, on the northbound approach to the RTD park and ride, the area lacks signage alerting users to presence of the Golden Station and the park and ride.



A pedestrian uses the social path along the W Line.

Golden Segment

The 6th Avenue Trail extends approximately 4.7 miles between the US 6 and Johnson Road intersection and the North Table Mountain parking lot. At the intersection of US 6 and Johnson Road, pedestrians and bicyclists can use the sidewalk to the Jefferson County Government Center and Golden Station park and ride. The pedestrian and bicycle facilities for the Golden segment are illustrated in **Figure 20**.

In the southernmost portion of this segment, the trail closely parallels the east side of the US 6 roadway alignment. The trail is 10 feet wide and in good condition. It is owned and maintained by the City of Golden. Several paths connect directly to Justice Center Park, the Jefferson County Building Department, and the County Human Services Department. The trail crosses Jefferson County Parkway at-grade and continues to parallel US 6 up to Chimney Gulch where it extends eastward by the Colorado School of Mines baseball fields and connects with the Clear Creek Trail.

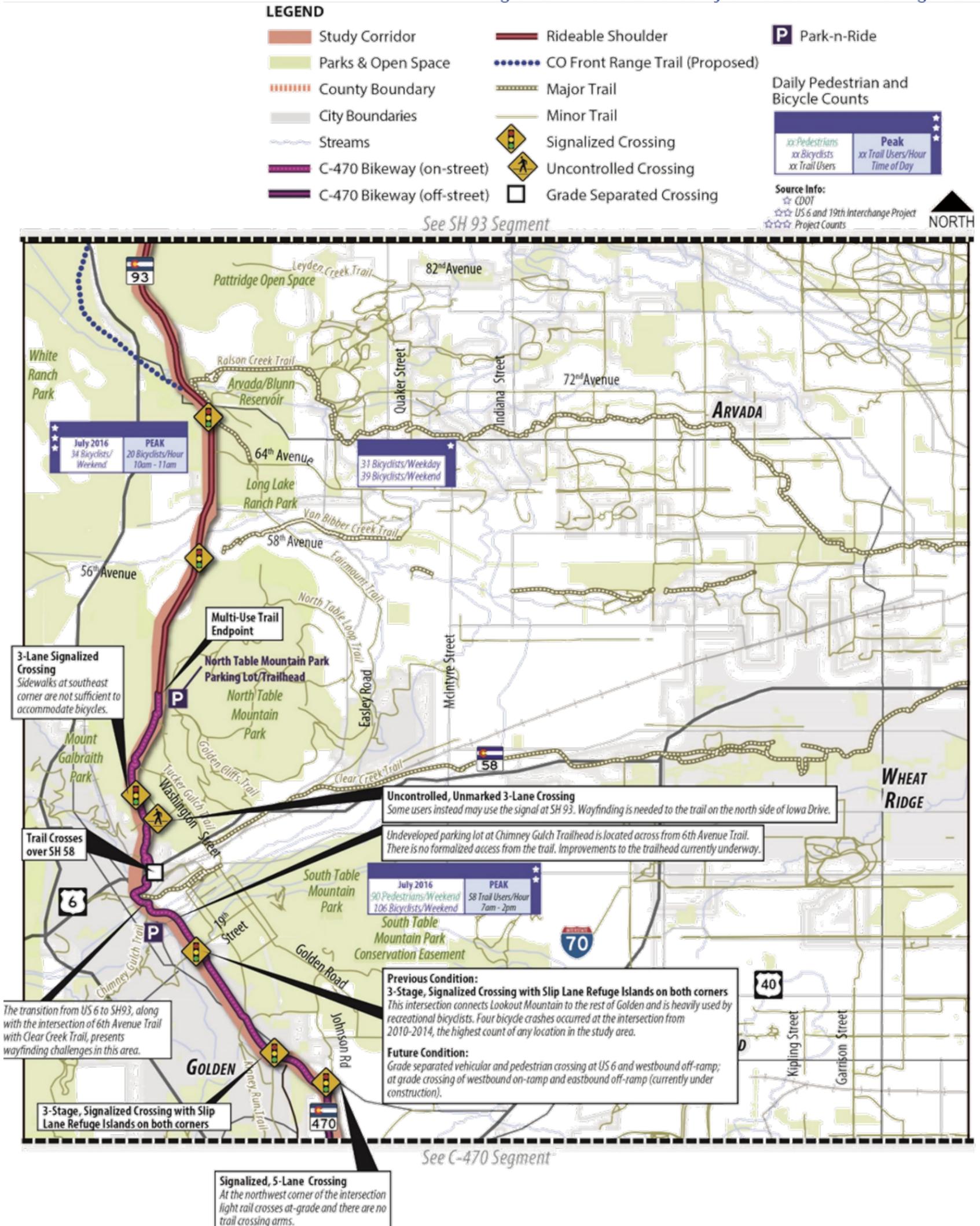


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Figure 20: Pedestrian and Bicycle Facilities - Golden Segment





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The 6th Avenue Trail crosses the Clear Creek Canyon via a bicycle and pedestrian bridge. It crosses the Clear Creek Trail once again, then crosses a community garden plot before coming to an at-grade crossing at 8th Street. Here, the trail continues along a newly-constructed sidepath and trail connection to a grade-separated crossing of CO-58 and a short set of switchbacks into New Loveland Mine Park. There is no wayfinding or other route identification signage throughout the corridor to guide users through this segment.

Beyond New Loveland Park, the trail crosses the local street of High Point Drive/Rubey Drive then continues to parallel Rubey Drive for one third of a mile to Iowa Drive. Between Iowa Drive and the North Table Mountain parking lot, the trail parallels CO 93 closely and every street crossing is at-grade.

Context and Use

Due to the land uses, large employment centers, transit connections, recreational opportunities, parks, universities, and residential densities throughout Golden, the 6th Avenue Trail transitions from a corridor used primarily for long-distance recreational bicycling to one used by pedestrians, city commuters, families, joggers, and other users.



The 6th Avenue Trail near the Jefferson County Government Center is enjoyed by a variety of users.

Operational Conditions

The 6th Avenue Trail is constructed of concrete and is typically ten or more feet wide throughout this segment. In general, the trail is in good condition. However, the portion of trail that abuts the sound wall along CO 93 across from Spyderco Way (between Mesa Drive and Pine Ridge Road) feels uncomfortable due to the proximity to traffic, and is narrow and dark.

A bicycle and pedestrian count was conducted at the intersection of US 6 and 19th Street on a Saturday in July 2014. From 7:00 AM to 2:00 PM, 406 bicyclists and pedestrians were observed, making this one of the busiest intersections in the WestConnect corridor for bicyclists and pedestrians. Counts were conducted on CO 93 north of CO 58 on May 18-19, 2016. On those weekdays, an average of 115 bicyclists was observed in the northbound direction with 111 bicyclists traveling southbound.

Between the 8th West housing development and New Loveland Mine Park, the trail crosses over CO 58 via a bicycle and pedestrian bridge. There is a steep staircase that leads directly between the bridge and the park, serving as a cut-through for pedestrians who may not want to use the full switchbacks. The landing at the foot of the stairs is small and could create conflicts between pedestrians and bicyclists. The switchbacks between the bridge and New Loveland Mine Park feature very sharp angles on the turns, which make it difficult to navigate by bicycle.

The trail crossing at Jefferson County Parkway is a divided crossing at a traffic signal. Pedestrians and bicyclists cross a channelized right turn lane, then use the pedestrian push button to cross five lanes of

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vehicular traffic along Jefferson County Parkway, before crossing another uncontrolled channelized right turn lane. The slip lane refuge islands have narrow curbed channels that are difficult to navigate while riding a bicycle. Furthermore, the curb constraints make it challenging to reach the pedestrian push button and may pose a challenge when multiple users are crossing at the same time.

This trail crossing is very similar to the Jefferson County Parkway as it functions as a three-way staged crossing involving two slip lanes and a signalized movement across 19th Street. This intersection connects Lookout Mountain to the rest of Golden. Construction has begun for a grade-separated interchange with two roundabouts, a pedestrian plaza, and a separated bike trail over US 6 by 2017.

The 8th Street crossing is an uncontrolled two-lane crossing of a low-volume street. This narrow crossing (approximately 20 feet) has a marked crosswalk and pedestrian warning signage along both approaches. There is a short sidepath along the southern side of 8th Street. This crossing was updated in 2014 to include new curb ramps, concrete, and improved geometry.

The Rubey Drive trail crossing is an uncontrolled, unmarked crossing of a low-volume residential street. There are curb ramps on both approaches.

There are two trail crossing options at the CO 93 and Iowa Drive intersection. Trail users can use the pedestrian push button to cross at the marked, signalized crossing, or they can use the 10-foot wide sidewalk that connects to the trail approximately 150 feet east of the intersection. This sidewalk along Iowa Drive is comfortable, but lacks a formalized connection with the 6th Avenue Trail. The crossing of Iowa Drive and Rubey Drive is difficult due to approach angles that compromise visibility of pedestrians and bicyclists, particularly for westbound traffic. Furthermore, there is no signage to indicate the trail crossing. People riding bicycles have little refuge or maneuvering space to change direction from eastbound Iowa Drive (via the wide sidewalk) to southbound Rubey Drive.

The CO 93 and Washington Avenue crossing is a signalized three-lane crossing with a marked crosswalk and curb ramps. The southbound curb ramp, pedestrian refuge area, and sidewalk connection to the trail are only five feet wide, which is too narrow to accommodate bicyclist movements. Additionally, the angle where the sidewalk meets the trail is too sharp for bicyclists to easily maneuver.



A narrow sidewalk connects the Washington Avenue crossing to the 6th Avenue Trail.

The CO 93 and Golden Gate Canyon Road intersection has an unmarked trail crossing. While the trail crossing bends, the crosswalk does not align with the trail crossing and the pedestrian activation button is hidden by a barrier and shrubs.

The crossing at CO 93 and Pine Ridge Road is an unmarked crossing of Pine Ridge Road, a local two-way street. Traffic traveling westbound along Pine Ridge Road has a stop sign, though the placement of the stop bar relative to the alignment of the trail may lead to confusion as to the appropriate location for vehicles to stop when trail users are attempting to cross.

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Crash History

There were seven motor vehicle crashes involving a bicycle or pedestrian in this portion of the WestConnect corridor from 2010 through 2014. Five involved a bicyclist, while a pedestrian was involved in the other two crashes:

- Bicycle crash at Washington Avenue: A southbound bicyclist turned in front of a northbound vehicle.
- Pedestrian crash south of Coal Creek Canyon Road: An eastbound pedestrian crossed illegally in front of a southbound motorcycle.
- Four bicycle crashes at US 6 and 19th Street: Each of these crashes involved vehicles turning left in front of bicycles traveling straight through the intersection on 19th Street.
- Pedestrian crash on US 6: An impaired pedestrian illegally crossed US 6 southbound near the Jefferson County Government Center in front of an eastbound vehicle. The pedestrian died as a result of this crash.

Parking Areas and Trailheads

While on-street parking exists within a few blocks of the 6th Avenue Trail, few trailheads exist to provide direct access to the trail, leading most bicyclists to access the trail from other streets or trails. A formalized trailhead is provided at North Table Mountain; however, there is no bike parking available at this trailhead. The Chimney Gulch trailhead, an undeveloped dirt trailhead, is located across from the trail and the Colorado School of Mines baseball diamonds. There is no formalized access from the trail so users must either walk under US 6 through a box culvert, walk along the shoulder of US 6, or illegally cross US 6 at-grade.



The North Table Mountain trailhead parking lot.

Wayfinding

Due to the urban context and circuitous route of the 6th Avenue Trail, wayfinding is needed. Where the trail pulls away from the US 6 corridor (e.g., near the Colorado School of Mines campus, where it crosses the Clear Creek Trail, and where it passes through New Loveland Mine Park), the route is not clear to users. Additionally, wayfinding to trailheads that are immediately adjacent to the trail, such as Chimney Gulch and North Table Mountain Park, would improve the trail user experience.

CO 93 Segment

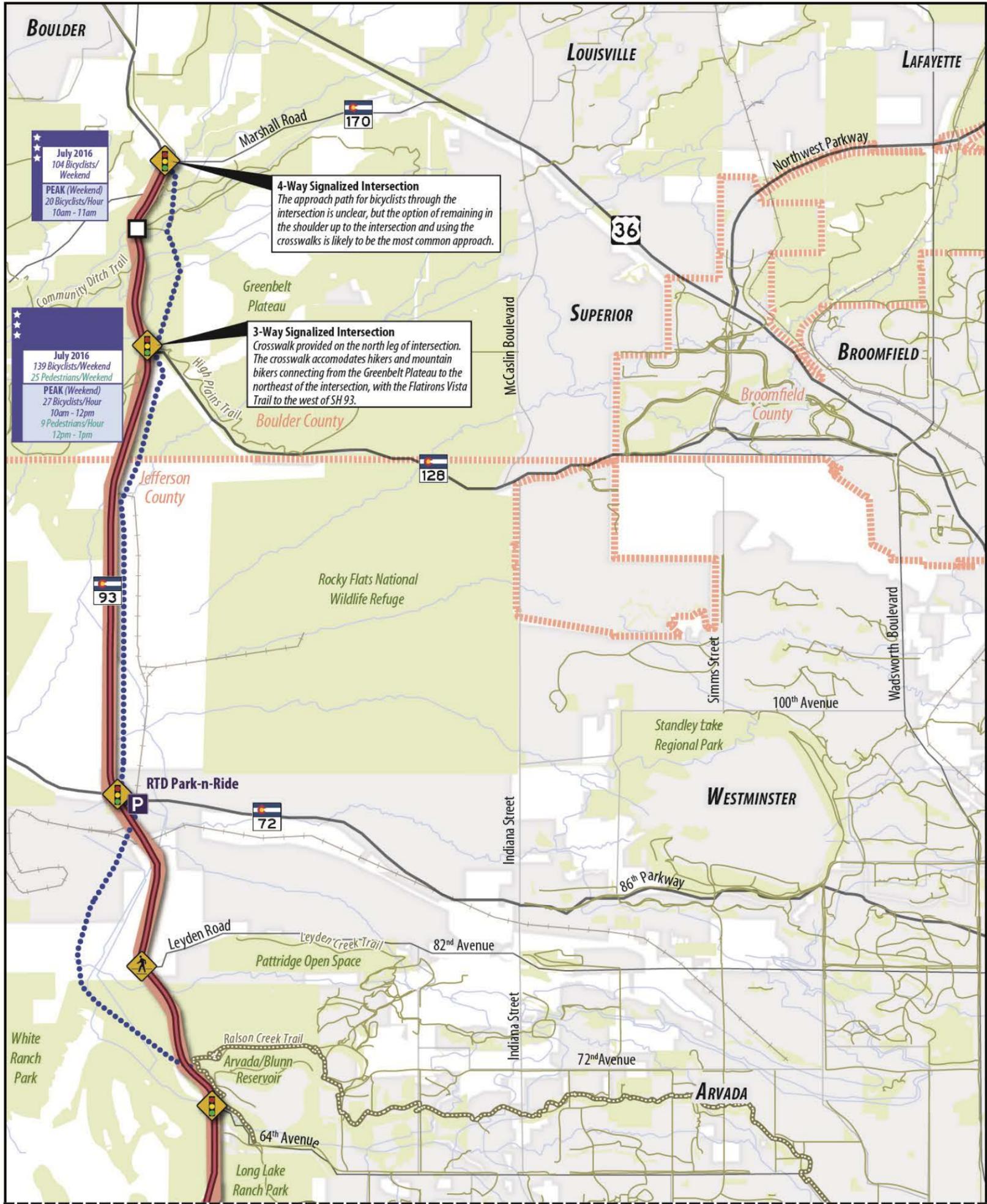
The northernmost portion of the WestConnect corridor extends roughly 11 miles along CO 93 from 56th Avenue, north of Golden, to CO 170 in Boulder County. Dedicated bicycling and walking facilities are generally not provided in this segment; however, adjacent development has resulted in the creation of



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sidewalks or paths along portions of the corridor. Paved shoulders provide a basic accommodation for bicyclists along CO 93. The pedestrian and bicycle facilities for this segment are illustrated in **Figure 21**.

Figure 21: Pedestrian and Bicycle Facilities – CO 93 Segment



See Golden Segment

LEGEND

- Study Corridor
- Parks & Open Space
- County Boundary
- City Boundaries
- Streams
- C-470 Bikeway (on-street)
- C-470 Bikeway (off-street)
- Rideable Shoulder
- CO Front Range Trail (Proposed)
- Major Trail
- Minor Trail
- Signalized Crossing
- Uncontrolled Crossing
- Grade Separated Crossing
- P Park-n-Ride

Daily Pedestrian and Bicycle Counts

xx Pedestrians xx Bicyclists xx Trail Users	Peak xx Trail Users/Hour Time of Day
☆☆☆☆	☆☆☆☆
☆☆☆☆	☆☆☆☆
☆☆☆☆	☆☆☆☆
☆☆☆☆	☆☆☆☆

Source Info:
☆☆ CDOT
☆☆☆ US 6 and 19th Interchange Project
☆☆☆☆ Project Counts





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Context and Use

With the exception of the area between 56th Avenue and 64th Parkway, this section of the study area passes through mostly undeveloped land or low-density land uses. While there are few commercial destinations for pedestrians and bicyclists in the corridor, there are several nearby parks, including North Table Mountain Park, Long Lake Ranch Park, White Ranch Open Space Park, and the Greenbelt Plateau. Access to hiking and mountain biking trails is the primary attraction for bicyclists and pedestrians, though most hikers arrive by car. Additionally, for long-distance bicyclists, the corridor connects the cities of Boulder and Golden.

Operational Conditions

Paved shoulders are provided along CO 93 throughout the length of this section. These shoulders vary in width from around three to six feet or more in some areas. According to the *Colorado Bicycling and Scenic Byways Map*, the shoulders are greater than four feet (CDOT's recommended minimum shoulder width for accommodating bicycles) north of CO 72, but are less than four feet south of the CO 72 intersection. For reference, Boulder County's *Multimodal Transportation Standards* call for six-foot shoulders on principal arterials while Jefferson County's *Transportation Design & Construction Manual* recognizes four feet as a minimum bicycle facility designation.



A bicyclist uses the paved shoulders of CO 93 traveling southbound.

As the shoulder width varies throughout the CO 93 segment, it follows that the comfort level for bicycling also varies. **Table 36** indicates the range of Bicycle Levels of Service (BLOS) in the corridor, based on variations in traffic volume, heavy vehicle percentage, and shoulder width. The ranges shown are based on traffic counts conducted in May 2016, as well as the review of shoulder widths. Other BLOS parameters are based on those used in Chapter 14 of the *CDOT Roadway Design Guide* and the posted speed of 55 MPH. The significance of the paved shoulder width is apparent. For any combination of traffic volume and heavy vehicles, increasing the width of the shoulder by two feet generally improves BLOS by one level (e.g., from BLOS B to C or C to D).



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Table 36: Bicycle Level of Service Ranges on the CO 93 Corridor

DAILY TRAFFIC (VEHICLES PER DAY)	HEAVY VEHICLE PERCENTAGE	PAVED SHOULDER WIDTH (FEET)			
		2	4	6	8
20,000	4%	E	D	C	B
20,000	6%	E	E	D	C
20,000	8%	F	E	D	C
25,000	4%	E	D	C	B
25,000	6%	F	E	D	C
25,000	8%	F	E	D	C

While the pavement condition appears to be good, the adjacent roadside is rocky and does not provide a safe area for bicyclists to exit the shoulder, if needed. Additionally, rumble strips approximately six inches wide have been installed in some sections, reducing the available width of shoulders for bicyclists. Several bicycle counts were conducted along CO 93 in May and July 2016. The observed volumes are shown in **Table 37**.

Table 37: CO 93 Bicycle and Pedestrian Counts

LOCATION	COUNT PERIOD	MODES COUNTED	VOLUME	
			WEEKDAY	WEEKEND
South of 56th Ave., Northbound	May 18-19, 2016	Bicycle	90/day	
South of 56th Ave., Northbound	May 18-19, 2016	Bicycle	72/day	
North of 82nd Ave., Northbound	May 18-19, 2016	Bicycle	109/day	
North of 82 Ave., Southbound	May 18-19, 2016	Bicycle	81/day	
South of CO 128, Northbound	May 18-19, 2016	Bicycle	75/day	
South of CO 128, Southbound	May 18-19, 2016	Bicycle	83/day	
CO 93 & 64th Pkwy	July 16, 2016	Bicycle and Pedestrian		34/day (8a-8p)
CO 93 & CO 128	July 16, 2016	Bicycle and Pedestrian		268/day (8a-8p)

A bicycle and pedestrian underpass is provided just north of the Boulder County line to connect the Greenbelt Plateau Trail with the Flatirons Vista Open Space.

The intersection of CO 93 and 58th Avenue is a three-legged signalized intersection, with marked crosswalks on the east and north legs of the intersection. A ramp is provided at the southeast corner for northbound bicyclists to cross in the crosswalk. At the northeast corner, a recently-constructed refuge island is provided to facilitate crossings in both directions. Southbound bicyclists using the multiuse trail on the east side of CO 93 and to the north of 58th Avenue cross the north leg of the intersection to continue south along CO 93 using the paved shoulder. Pedestrian push buttons are provided at each corner.



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The CO 93 and 64th Parkway intersection is a three-legged signalized intersection. Crosswalks are provided along the north and east legs of the intersection to facilitate north-south bicycle travel as well as connections between CO 93 and 64th Parkway, which has bike lanes in both directions. A crosswalk is not needed on the west side of the intersection, as 64th Parkway terminates at CO 93 and bicyclists may continue south along the shoulder of CO 93.

The intersection at CO 72/Coal Creek Canyon Road is a signalized intersection designed to accommodate high speeds through the intersection. For bicyclists, there is not currently a clear path through the intersection; however, it is likely that most north-south bicyclists merge across the right-turn lanes to continue in the through travel lane. Bus stops are located on the northwest and southeast corners of the intersection and an unpaved parking facility exists adjacent to the southeast corner of the intersection. Crosswalks are provided to connect transit users from the parking lot to the bus stops.

The intersection of CO 93 and CO 128 is a three-legged signalized intersection with a crosswalk provided on the north leg of the intersection. The crosswalk accommodates hikers and mountain bikers connecting from the Greenbelt Plateau (northeast of the intersection), with the Flatirons Vista Trail west of CO 93. Refuge areas or other accommodations for northbound bicyclists are lacking; however, southbound bicyclists may use the paved shoulder which extends across the west side of the intersection.

The CO 93 and Marshall Road (CO 170) intersection is a signalized intersection with crosswalks on all four approaches. The appropriate path for bicyclists through the intersection is unclear. However, the option of remaining in the shoulder and using the crosswalks is likely to be the most common approach. Pedestrian push buttons are provided on all corners to facilitate this movement.

Crash History

There was one reported bicycle crash within this segment of the corridor from 2010 through 2014. The crash occurred at the CO 93 and Marshall Road (CO 170) intersection, involving an eastbound motorist turning right and crashing into a bicyclist.

Wayfinding

Minimal, if any, bicycle or pedestrian wayfinding exists along this segment of the corridor.

Multimodal Mobility Challenges and Opportunities

Pedestrians and bicyclists within the WestConnect corridor are accommodated primarily through off-street trails. In some sections, gaps in the trail network lead users to use on-street facilities. Throughout the corridor, the primary bicycling and walking activity is recreational in nature. In particular, long-distance bicyclists, joggers, and families are the most frequent users of the trail sections. In and around Golden, bicycling and walking for utilitarian purposes is more common, but recreational trips remains the dominant use in these areas. The sections without trail are mostly used by long-distance bicyclists.

Trail widths typically meet standards, but could be wider in some areas where usage is higher. Paved shoulders in the northern section of the corridor accommodate bicyclists, but these segments do not



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provide a physical separation between bicyclists and the adjacent high-speed, high-volume traffic. Without greater separation from traffic, these paved shoulders are unlikely to be comfortable for only the most experienced bicyclists.

At-grade street crossings present a significant challenge throughout the corridor. While crosswalks are typically provided at major street crossings, the crossing width coupled with the high speed of traffic raises safety concerns for pedestrians and bicyclists. There is potential for conflicts between motorists and trail or sidewalk users. Many of the crossings do not offer adequate refuge areas and compliance with ADA requirements vary.

There are a limited number of parking areas and trailheads providing direct access to the WestConnect corridor for bicycling and walking. These generally exist where the trail interfaces with a park. More commonly, access is provided by intersecting streets.

Opportunities for improved wayfinding exist throughout the corridor. A recent effort has improved wayfinding on the C-470 Trail, but additional enhancements are needed. This is especially important in areas with connections to other trails, where trails interface with streets, and where complex intersection crossings are required.

Transit Service

The most used bus service in the area allows people to travel between Golden and Boulder at peak weekday commute times. While this is likely when most people are traveling between these two communities, addressing limited service during the day would allow people to feel more comfortable with flexible schedules. More frequent service during peak periods could attract new users since it would allow timing flexibility for riders.

The existing call and ride in Golden does not provide service on Sundays; potential service expansion would provide greater mobility options.

Limited regional transit service is provided to access major destinations (including Boulder and Denver) for people living along this corridor. Although regional service does exist, it may be hard to compete with driving since the regional service stops at multiple points. In addition to increasing transit service, a robust vanpool and carpool network would help enhance corridor mobility. This is especially appropriate in the southern part of the study area where the call and ride carries fewer people.

To allow more people to bike to transit, secure and protected bicycle parking at the park and rides will allow people to store their bikes without fear of inclement weather or vandalism and theft.



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APPENDIX A: DESIGN CRITERIA, MAJOR STRUCTURE SUMMARY, AND PROPOSED WATERLINE



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APPENDIX B: TRAFFIC COUNTS



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APPENDIX C: SAFETY ASSESSMENT REPORT