CITY OF BOULDER
TRANSPORTATION ADVISORY BOARD
AGENDA ITEM

MEETING DATE: August 8, 2016

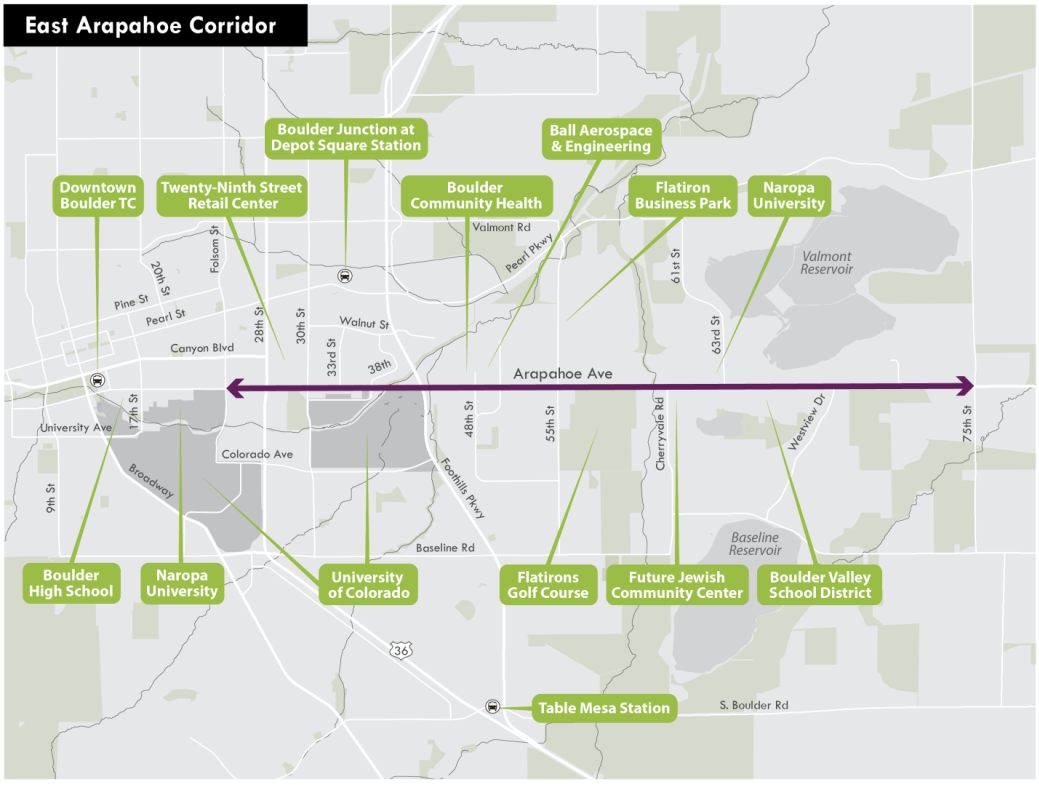
AGENDA TITLE: Staff briefing and TAB input on the East Arapahoe Transportation Plan Update

PRESENTERS: Michael Gardner-Sweeney, Director of Public Works for Transportation
Kathleen Bracke, GO Boulder Manager
Jean Sanson, Senior Transportation Planner, GO Boulder

EXECUTIVE SUMMARY

The purpose of this agenda item is to provide a briefing to the Transportation Advisory Board (TAB) on the East Arapahoe Transportation Plan planning process. Figure 1 illustrates the East Arapahoe Transportation Plan study area between the Downtown Boulder Transit Center and 75th Street.

Figure 1: East Arapahoe Transportation Plan Study Area



The project team is currently in the process of working with the newly established Community Working Group to narrow a long list of potential design and management elements being considered to achieve the goals of the plan. Design elements are physical improvements along the corridor (such as enhanced landscaping and roadway configurations) and management elements refer to strategies that influence people's time, route, or mode of travel (such as transit service, shared use mobility, and parking management). The project team will be carrying forward for further consideration those elements that are aligned with the project purpose and goals and meet basic feasibility, cost, or safety criteria.

The next steps in the planning process will be to engage the broader community and local and regional agency partners in a discussion of the initial screening results. Based on additional input and feedback, the project team will develop and refine a set of alternatives – or packages of design and management elements – for more detailed evaluation, comparison and refinement.

TAB ACTION REQUESTED

Key Questions for the TAB:

1. Does TAB have any questions or suggestions for enhancing and/or clarifying the Plan Purpose, Goals and Objectives?
2. Does TAB have any questions or suggestions for enhancing and/or clarifying the evaluation process and communicating the results?
3. Does TAB have questions or suggestions for the upcoming community engagement process and would TAB like to host a public meeting for this plan?

SUMMARY OF COMMUNITY WORKING GROUP MEETINGS & PLANNING PROCESS

Since the last update to TAB on the East Arapahoe Transportation Plan on March 14, 2016, staff has convened a Community Working Group (CWG) of twenty-two members who have participated in three meetings to date. The working group, which represents different interests and perspectives, is providing input and feedback to the project team during the East Arapahoe planning process.

- The first CWG meeting, held on May 5, 2016 was an opportunity to introduce the project, the role of the working group and for the working group members to engage in small group discussions about the purpose and goals of the plan.

- At the second CWG meeting, held on June 15, 2016, city staff presented and obtained input on the Plan Purpose, Goals and Objectives, which has been revised based on input from the first working group meeting. The project team also provided the working group with information about current conditions in the corridor. See **Attachment A: Existing Conditions** for detailed information on current conditions in the corridor. Much of the meeting discussion centered on best practices for multimodal corridor planning and

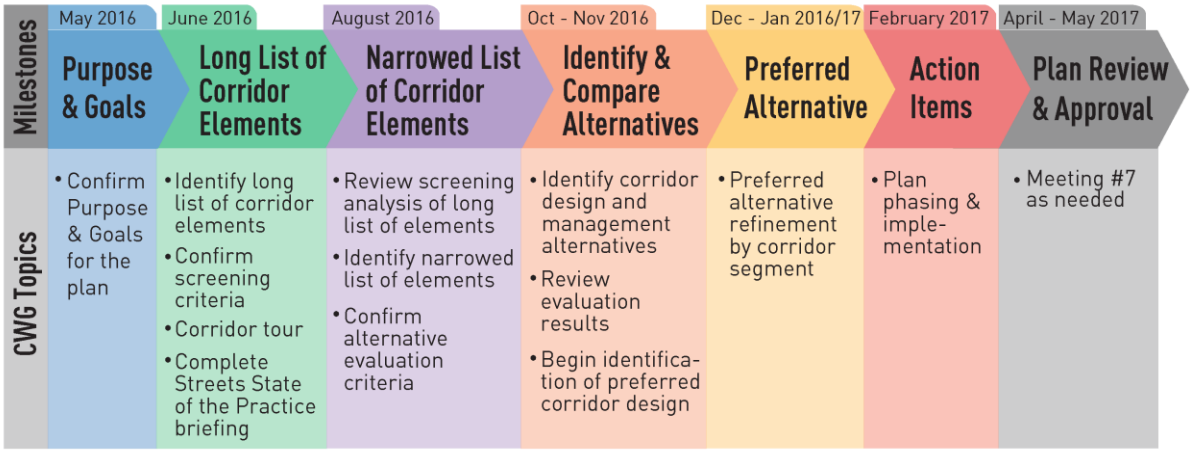
obtaining input from the working group on the wide range of transportation design and management elements to be considered for the East Arapahoe corridor.

A corridor tour was held in conjunction with second meeting. Members of the working group walked many portions of the corridor, pointing out and discussing potential issues and opportunities related to current conditions such as vehicle speeds, noise, pedestrian crossings, bicycle travel, landscaping and urban design, sidewalks and multiuse paths and transit stops and service.

- The third CWG meeting, held on August 3, 2016, provided an opportunity for the working group to review and provide feedback on an initial screening of design and management elements.

Figure 2 illustrates the planning process and schedule, as well as Community Working Group meeting topics.

Figure 2: East Arapahoe Transportation Plan Schedule & Process Diagram



PLAN PURPOSE, GOALS AND OBJECTIVES

City staff has collaborated with the Community Working Group, TAB, City Council and other stakeholders to establish a Plan Purpose, Goals and Objectives. The Purpose, Goals and Objectives reflect public input received in prior phases of the planning process and expand on and refine the guiding principles which had previously been developed as part of Envision East Arapahoe. The Goals and Objectives will serve as the framework to guide the development of the East Arapahoe Transportation Plan, including the development and analysis of alternative solutions to multimodal transportation needs along the corridor, though recognizing the unique needs of each segment.

Plan Purpose

The Plan Purpose has been crafted as a narrative that describes why the city is undertaking this planning process and what the long term plan aims to accomplish:

> Today, the East Arapahoe Corridor is one of the city's busiest regional travel corridors. As we plan for the future, exponential growth in surrounding

communities will likely place additional demands on the corridor's existing transportation system. From people commuting into Boulder for work or school, traveling to Boulder for healthcare services, or simply accessing recreational and shopping amenities – forecasted regional transportation demands on the East Arapahoe Corridor will change how the corridor functions today.

Coupled with increased regional transportation demand, are the changing local travel needs for people working, living and accessing services within the East Arapahoe corridor itself. East Arapahoe is no longer seen as a "pass through" corridor for in-commuters; and has, in fact, become one of Boulder's largest employment centers. People are looking for safe and convenient ways to travel between destinations along Arapahoe and other areas of the city. From students traveling between university campuses, to employees wanting to grab lunch – the need for people to move safely and conveniently via walking, biking, transit, ride sharing, driving plus moving goods and services changes how we think about travel and transportation options in this transitioning area of the city.

Recognizing these changing regional and local conditions, the East Arapahoe Transportation Plan is a long-range plan that considers a number of potential transportation improvements within the East Arapahoe corridor, including safety for people using all modes, walking and biking enhancements, improved regional and local transit, efficient vehicular travel, as well as urban design features that work hand in hand with mobility improvements to truly transform the corridor. As East Arapahoe becomes more of a destination, people using all modes are looking for a more comfortable experience – with features that are scaled for people and create a place that is attractive to both travel through and spend time in.

Importantly, transportation improvements will support the goals and objectives of the Boulder Valley Comprehensive Plan, the Transportation Master Plan (TMP), Access Management and Parking Strategy (AMPS), and the city's Climate Commitment and Sustainability Framework.

Plan Goals and Objectives

Each of the goals and objectives listed below support the Boulder Valley Comprehensive Plan, the Boulder TMP and the city's Sustainability Framework. They are categorized by the Boulder 2014 TMP Focus Areas – including Complete Streets, Regional Travel, Transportation Demand Management (TDM), Funding and Integration with Sustainability Initiatives and are aligned with the TMP objectives. While organized by Focus Area, each goal and associated objective is interrelated and mutually supporting to achieve the desired outcome.

Goal 1. Complete Streets: Provide Complete Streets in the East Arapahoe corridor that offer people a variety of safe and reliable travel choices.

- Objective 1.a. Provide safe travel for people of all ages and stages of life using all modes along the East Arapahoe corridor.
- Objective 1.b. Improve the ease of access, comfort and experiences for people walking in the East Arapahoe corridor.
- Objective 1.c. Broaden the appeal of bicycling along the East Arapahoe corridor to people of all ages and bicycling abilities.

- Objective 1.d. Make riding transit a convenient and practical travel option in the East Arapahoe corridor.
- Objective 1.e. Move drivers efficiently through the East Arapahoe corridor.

Goal 2. Regional Travel: Increase the number of person trips the East Arapahoe corridor can carry to accommodate growing local and regional transportation needs.

- Objective 2.a. Improve local travel options within the East Arapahoe corridor for residents, employees, and visitors.
- Objective 2.b. Improve regional travel options between Boulder and communities to the east for work and other regional trips, including access to health care facilities.

Goal 3. Transportation Demand Management (TDM): Promote a more efficient use of the transportation system and offer people travel options within the East Arapahoe corridor.

- Goal 3.a. Improve "first-and-last-mile" connections to help people conveniently and safely walk, bike, or make shorter car trips to and from transit.
- Goal 3.b. Promote the use of multiple transportation options and TDM programs in East Boulder by residents and workers (examples include EcoPass programs, shared use mobility and parking management).

Goal 4. Funding: Deliver cost-effective transportation solutions for the East Arapahoe corridor that can be phased over time.

- Objective 4.a. Coordinate with public and private entities, including adjacent land owners and local and regional agency partners, to implement cost-effective transportation improvements (including capital, operating and maintenance investments).

Goal 5. Sustainability Initiatives: Develop transportation improvements in the East Arapahoe corridor that support and integrate with the Boulder Valley Comprehensive Plan and Boulder's Sustainability Framework *(desired outcomes include a community that is Safe, Healthy & Socially Thriving, Livable, Accessible & Connected, Environmentally Sustainable, and Economically Vital Community and provides Good Governance)*.

- Goal 5.a. Reduce greenhouse gas (GhG) emissions and air pollution from vehicle travel within the East Arapahoe corridor.
- Goal 5.b. Improve travel options that promote public health for residents and workers along the East Arapahoe corridor.
- Goal 5.c. Provide access to affordable transit and other travel options to low- and moderate-income residents and workers along the East Arapahoe corridor.
- Goal 5.d. Preserve and enhance economic vitality in the East Arapahoe corridor, working with Boulder businesses.

See **Attachment B: Purpose, Goals & Objectives** for a more detailed description each plan goal and associated objectives, including the rationale each objective will address in order to attain the goals.

INITIAL SCREENING OF CORRIDOR DESIGN & MANAGEMENT ELEMENTS

In the current phase of the planning process, the project team is screening a long list of potential corridor design and management elements that can help achieve the stated purpose and goals of the East Arapahoe Transportation Plan. The design and management elements were identified based on national and international best practices, local and regional plans related to the East Arapahoe corridor, previous technical work in this corridor, TAB and City Council input, public and stakeholder outreach completed prior to the formation of the Community Working Group, and input received at the second working group meeting in June 2016.

In coordination with the Community Working Group members at the third meeting in August 2016, the project team conducted an initial "screening" of the long list of potential corridor design and management elements. The purpose of the screening is to eliminate elements that are not aligned with the project purpose and goals or do not meet basic feasibility, cost, or safety criteria. This is the first step in a multi-stage process to develop and refine a set of alternatives, or packages of design and management elements, that can help to achieve the stated purpose and goals for the corridor.

Figure 3 summarizes the results of the initial screening. The shading of the element indicates the recommendation as follows:

Recommend **moving forward** for consideration
Recommend using in **limited circumstances**
Recommend **removing from consideration**

See **Attachment C: Initial Screening of Corridor Design and Management Elements** for a more detailed description of the screening and recommendations.

Figure 3 Summary of Screening Results

Bike/Pedestrian/Streetscape	
S1	Additional crossings
S2	Intersection enhancements
S3	Multi-use path (off-street bike facility; shared space)
S4	Enhanced multi-use path (e.g., delineation between bikes and pedestrians)
S5	Shared travel lanes with pavement markings (sharrows)
S6	Bike lanes
S7	Buffered bicycle lanes
S8	Protected bicycle lanes
S9	Shared bus & bike lane (11-12' lane that allows bus and bikes)
S10	Amenity zone features (lighting, planters, bus shelters, benches, public art, etc.)
S11	Landscaping
S12	Public art
S13	Gateway features

Transit and Transportation Demand Management (TDM)	
T1	Side running bus in mixed traffic
T2	Enhanced Bus (similar to BRT but without dedicated lanes)
T3	Bus Rapid Transit (side-running in Business Access and Transit Lane)
T4	Bus Rapid Transit (center running in dedicated lanes)
T5	Streetcar
T6	Light rail transit
T7	Commuter rail
T8	Peak-only exclusive transit lanes
T9	Better information and timed transfers
T10	Real-time, app-based information
T11	Expanded EcoPass
T12	Reversible transit lane
T13	Improved transit amenities
T14	Park and rides (assumed to be edge or satellite parking)
T15	Parking management
T16	First/last-mile connections
T17	Shared use mobility

Vehicular	
V1	Three general purpose travel lanes per direction (maintain existing number of lanes)
V2	Two general purpose travel lanes per direction with one lane repurposed for enhanced transit (and/or pedestrian, bicycle and/or streetscape enhancements)
V3	Three general purpose travel lanes with an additional transit lane per direction
V4	Adding general purpose lanes (east end of corridor)
V5	Reversible traffic lane (zipper lane)
V6	Wider general purpose travel lanes
V7	Narrower general-purpose travel lanes (subject to working with CDOT)
V8	High-occupancy vehicle (HOV) lanes
V9	Managed lanes (Express lanes)
V10	Signal timing adjustments
V11	Reduce posted speed limit (assumes reduction of 45 mph segments to 35 mph)
V12	Access management (assumes closing some driveways and converting parking lots to shared use/access)
V13	Roundabout
V14	Grade separated interchange (Foothills & Arapahoe)
V15	Speed humps
V16	Tunnel

NEXT STEPS

- Conduct community outreach events between August and October 2016 to obtain input and feedback on the results of the initial screening.
- Collaborate with the Community Working Group in October and November 2016 to identify alternatives (packages of design and management elements) for detailed evaluation and comparison in Winter 2016/17. Continue coordination with Boulder County SH 7 Study.
- Continue on-going coordination with multi-departmental staff team, including collaboration with the Boulder Valley Comprehensive Plan update process, as well as with Boulder County, Colorado Department of Transportation, Regional Transportation District, and other agency partners.
- City Council Study Session as part of the Renewed Vision for Transit (October 25, 2016).

TAB ACTION REQUESTED

1. Does TAB have any questions or suggestions for enhancing and/or clarifying the Plan Purpose, Goals and Objectives?
2. Does TAB have any questions or suggestions for enhancing and/or clarifying the evaluation process and communicating the results?
3. Does TAB have questions or suggestions for the upcoming community engagement process and would TAB like to host a public meeting for this plan?

For more information, please see the East Arapahoe plan website:

www.EastArapahoeTransportationPlan.net

Attachments:

A. East Arapahoe Transportation Plan: Plan Purpose, Goals and Objectives July 2016 – DRAFT
B. East Arapahoe Transportation Plan: Existing Conditions, July 2016 – DRAFT
C. East Arapahoe Transportation Plan: Initial Screening of Corridor Design and Management Elements, July 2016 – DRAFT

East Arapahoe Transportation Plan

CITY OF BOULDER

EAST ARAPAHOE TRANSPORTATION PLAN
Existing Conditions

July 2016 – DRAFT

NELSON NYGAARD

FOX TUTTLE HERNANDEZ TRANSPORTATION GROUP

FEHR & PEERS

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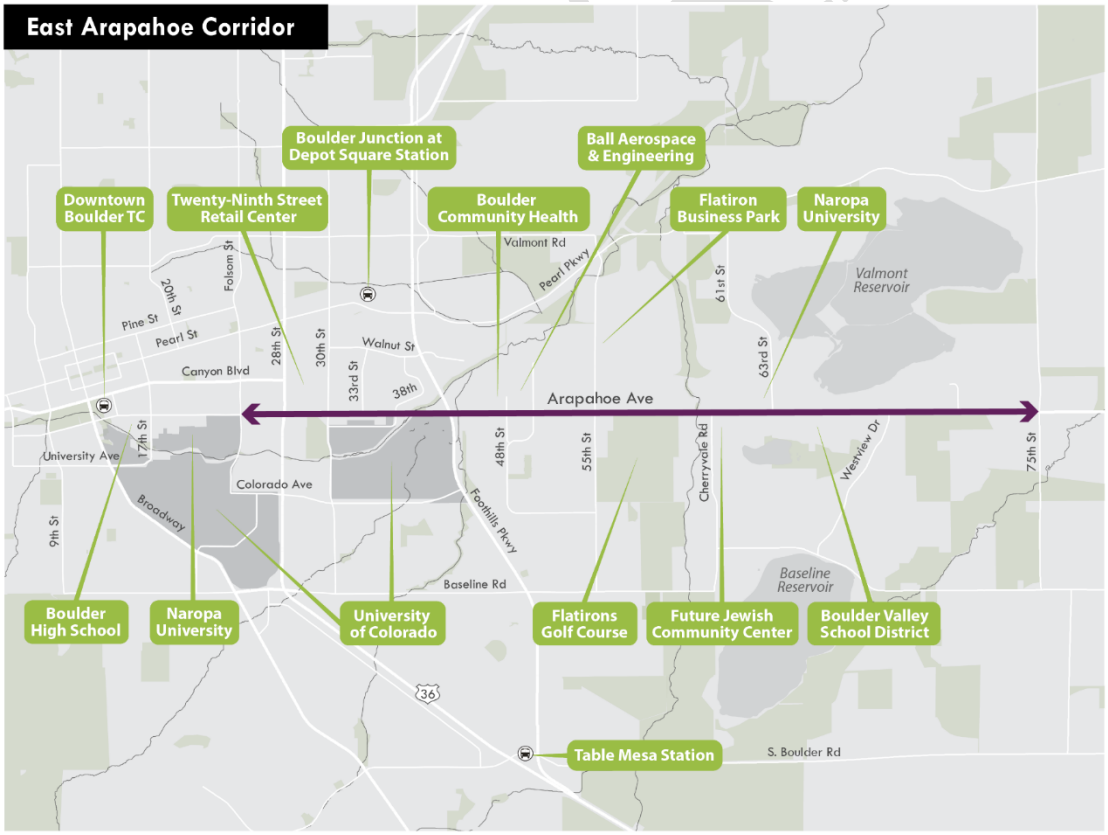
1 INTRODUCTION

PLAN & CORRIDOR OVERVIEW

The East Arapahoe Transportation Plan is a long-range plan that will consider a number of potential transportation improvements within the East Arapahoe corridor, including walking, biking, public transportation, and vehicle travel. The study area for the plan, illustrated in Figure 1-1, is primarily focused on a 4.5 mile segment of Arapahoe Avenue between Folsom Street and 75th Street.

Arapahoe Avenue is one of the city's major access corridors serving both regional commuters living or working outside Boulder and local trips by people who live and/or work along the corridor. The corridor also serves growing residential areas and major employment centers and institutions including the University of Colorado (CU) East Campus, Boulder Community Health, Ball Aerospace, Flatiron Business Park, Naropa University, and Boulder Valley School District offices. Major north-south streets that intersect with the study area include 28th Street, 30th Street, Foothills Parkway, 55th Street, Cherryvale Road, and 63rd Street.

Figure 1-1 East Arapahoe Corridor Overview



RELATED PLAN AND STUDIES

The City of Boulder and other jurisdictions and agencies have developed a series of planning documents related to the East Arapahoe Corridor. These plans include:

- **City of Boulder Transportation Master Plan (TMP).** The Transit State of the System Report, completed as part of the transit planning element of Boulder's Transit Master Plan (TMP) update in 2014, identified significant opportunities to improve access and connections to transit, serve East Boulder and other transition areas such as the East Arapahoe corridor as they redevelop, and serve the growing areas of Boulder Junction and CU East Campus. The TMP identified the East Arapahoe corridor as one of the City of Boulder's priority corridors for Bus Rapid Transit (see Figure 1-2).
- **Northwest Area Mobility Study (NAMS).** The Northwest Area Mobility Study, completed in 2014, created a prioritized list of mobility improvements for the Regional Transportation District's Northwest area. The project identified Arapahoe/SH 7 between Boulder and Brighton as a candidate arterial BRT route. The identified corridor included a 17.9 mile corridor with 46% of the route running in dedicated lanes and a 34-minute projected travel time from Boulder to Lafayette. A key characteristic of the study was a connection to I-25, and implementation of the SH 7 Planning and Environmental Linkage study. The City of Boulder and other Boulder County communities have agreed on the results of the RTD Northwest Area Mobility Study and are supporting efforts to fund the next steps of work toward implementing arterial BRT. The corridors connecting to Boulder are the Diagonal (SH 119), Arapahoe Avenue (SH 7) and South Boulder Road. The graphic in Figure 1-2 illustrates these corridors.
- **Boulder Access Management and Parking Strategy (AMPS)**. The City of Boulder is in the process of developing an Access Management and Parking Strategy to guide creation of efficient transportation networks within the city. AMPS includes edge parking along rapid transit corridors focused on commuters and transit-oriented corridors, including the East Arapahoe corridor, designed to emphasize transit oriented development (TOD) at a corridor scale. With increased development within the East Arapahoe corridor, the plan calls for a Transportation Demand Management (TDM) Access District approach combined with capital investments in multi-modal facilities and service that could significantly improve long term sustainability and reduce the impacts of new developments.
- **City of Boulder Sustainability Framework**. The framework uses seven broad categories to define community outcomes necessary to achieve Boulder's vision of a great community. It states that when the city implements the strategies outlined in the framework, then Boulder will have a Safe, Healthy & Socially Thriving, Livable, Accessible & Connected, Environmentally Sustainable, and Economically Vital Community and provide Good Governance.

Figure 1-2 City of Boulder TMP and RTD NAMS Priority BRT Corridors Serving Boulder

Source: Boulder Transportation Master Plan

- **Boulder Valley Comprehensive Plan**. The Boulder Valley Comprehensive Plan is a joint plan between the City of Boulder and Boulder County to inform and guide their shared responsibility for planning and development in the Boulder Valley. The policies and core values in the plan include using sustainability as a unifying framework to meet environmental, economic and social goals; supporting evolution to a more sustainable urban form; environmental stewardship and climate action; an all-mode transportation system to make getting around without a car easy and accessible to everyone; and physical health and well-being.
- **Boulder County Transportation Master Plan**. In 2011, the County spent nearly $1 million to improve transit service and access to transit. In 2012, the County updated its Transportation Master Plan with a focus on improving regional multimodal connections. Strategies specific to improving transit include: Increase bike capacity at transit stops; Increase the bicycle capacity on transit vehicles; Improve intersections; Collaborate with communities; Invest in new transit service; Promote regional bus rapid transit; and Enhance bus stop facilities.
- **Colorado Department of Transportation (CDOT) State Highway 7 Planning and Environmental Linkages (PEL) Study**. The Colorado Department of Transportation completed the State Highway 7 Planning and Environmental Linkages Study in 2014. The study identified improvements needed on SH 7 between US 287 and US 85 in Brighton, which is approximately 20 miles from the eastern boundary of the East Arapahoe study area. The study identified a recommended alternative for five segments between US 287 and US 85. Alternatives included changes/expansion of the existing right of way to accommodate future demand, transit lanes/queue jumps, shoulder bicycle lanes, and mixed use pedestrian paths.
- **Boulder County State Highway 7 Bus Rapid Transit Study**. In summer 2016, Boulder County is initiating the SH 7 BRT Transit Study intended to address current and future traffic issues on SH 7 and develop a BRT system before build out of the area is complete. The study will investigate recommendations from the CDOT PEL study, investigate BRT feasibility and develop an operations plan for the corridor, and conduct a connectivity analysis to other RTD services. The East Arapahoe corridor within the City of Boulder is the western segment of this study area.
- **University of Colorado (CU) East Campus Master Plan**. The CU East Campus is bound by 30th Street and Foothills Parkway (east to west) and Arapahoe Avenue and Colorado Avenue (north to south). The East Campus includes 197 acres of developable land, with the potential for over 4 million square feet of new building space. The CU East Campus Connections Project is a partnership between CU and the City of Boulder to identify mutually agreed upon projects to "move the bar forward" on important sustainable transportation connections that will be needed in the east campus area.
- **Envision East Arapahoe.** Envision East Arapahoe originated as a long-term land use scenario planning project intended to create a community-driven land use vision for the corridor. The study analyzed three alternative future land use scenarios: Current Trends, District Focus, and Housing Choices. Following community input, long-term land use planning decisions were placed on hold in 2014 and the project was refocused on planning for multimodal transportation improvements in the corridor.
- **East Arapahoe Transportation Connections Plan.** The 2004 East Arapahoe Transportation Network Plan addresses the multi-modal transportation system needs for moving to and through the Arapahoe Avenue corridor between 35th Street and Boulder's eastern city limits. The plan defines the desired future transportation network in the area for all modes of travel. The plan developed policies for connectivity to the larger Boulder transportation system, coordination with City of Boulder departments, design parameters, and near-term project implementation. This plan was not formally adopted by the City of Boulder.

- **City of Boulder Sustainable Streets and Centers.** The 2014 Sustainable Streets and Centers study analyzed strategies for integrating sustainable transportation and land use tools for developing a more sustainable street network. The study developed seven street typologies and five functional overlays to drive form-based development. The study area included five Arapahoe Avenue focus areas, and identified challenges and opportunities for focus areas to conform to sustainable design. Arapahoe Avenue corridor segments assessed in the study included 28th-29th Streets, 30th to 33rd Streets, Foothills Pkwy to 48th Street, 56th Streets to Old Tale Road, and Cherryvale Road to 63rd Streets. Consistent challenges identified throughout the corridor included difficulty in adapting it since it is a State Highway, adapting dominantly auto-oriented uses, and conflicting community values in regards to the importance of industrial sites and vibrant streets.

DOCUMENT ORGANIZATION

The remainder of this document is organized into the following sections:

- **Chapter 2: Land Use and Demographics.** Describes current land use and demographic characteristics of the corridor along with commute patterns and future projections for population and employment growth.
- **Chapter 3: Existing Modal Conditions.** Describes existing conditions for people driving, walking, biking, and using transit along the corridor, as well as an overall analysis of safety issues. The first section describes conditions for all modes in each segment of the corridor, while the remaining sections provide additional detail on particular modes or topics.

2 LAND USE AND DEMOGRAPHICS

This chapter provides an overview of land use, demographic characteristics, and commuting patterns within the corridor, all of which significantly impact people's transportation needs and choices.

Key Highlights

- The East Arapahoe corridor has a high concentration of regionally-significant employers, including six of the top ten employers in Boulder. Employment in the corridor is generally concentrated north of Arapahoe Avenue.
- Approximately 13% of the city's population lives within a half-mile of the corridor and about 40% of the city's jobs are also within a half-mile of the corridor.[1] The corridor's population is small relative to the number of jobs, meaning that most workers commute into the corridor.
- There is a higher share of minority and low-income residents and a higher share of renter-occupied households than the city overall. Although the residential population is small, it is comprised of demographic groups that typically have a relatively high propensity to travel by transit, walking, and biking.

LAND USE

This section summarizes the existing land uses along the East Arapahoe corridor. The interaction between transportation and land use determines how people access destinations, the length of trip required, and the directness of the route.

Figure 2-1 illustrates corridor land use designations. The northern section of the East Arapahoe corridor contains major retail and light industrial uses. Primary destinations include the Twenty-Ninth Street Retail Center, Boulder Community Health, Ball Aerospace, and Naropa University's Nalanda Campus. The southern section of Arapahoe Avenue features major institutions such as the University of Colorado (CU) East Campus and Boulder Valley School District (BVSD) offices, along with generally low-density residential areas. The corridor's western end is highly developed with mixed-use commercial and residential buildings; the intensity of land use decreases to the east of the corridor.

Chapter 3 provides a more detailed description of specific land uses in each segment of the corridor.

POPULATION AND EMPLOYMENT DENSITY

This section describes the existing and projected population and job densities in the East Arapahoe corridor. Population and employment density is particularly relevant to the transportation network as the location and clustering of people and jobs helps determine how and where people travel.

The East Arapahoe corridor has a high concentration of regionally-significant employers, including six of the top ten employers in Boulder, such as Ball Aerospace and Boulder Community Health.[2]

Figure 2-2 shows the density of existing population and employment within the East Arapahoe corridor. The north side of the corridor is primarily employment-oriented, with the exception of the area between 33rd Street and Foothills Parkway, which is more mixed use. Residential uses are concentrated in the

[1] Population data from American Community Survey (ACS). Employment data from US Census Bureau Longitudinal Household-Employer Dynamics (LEHD).

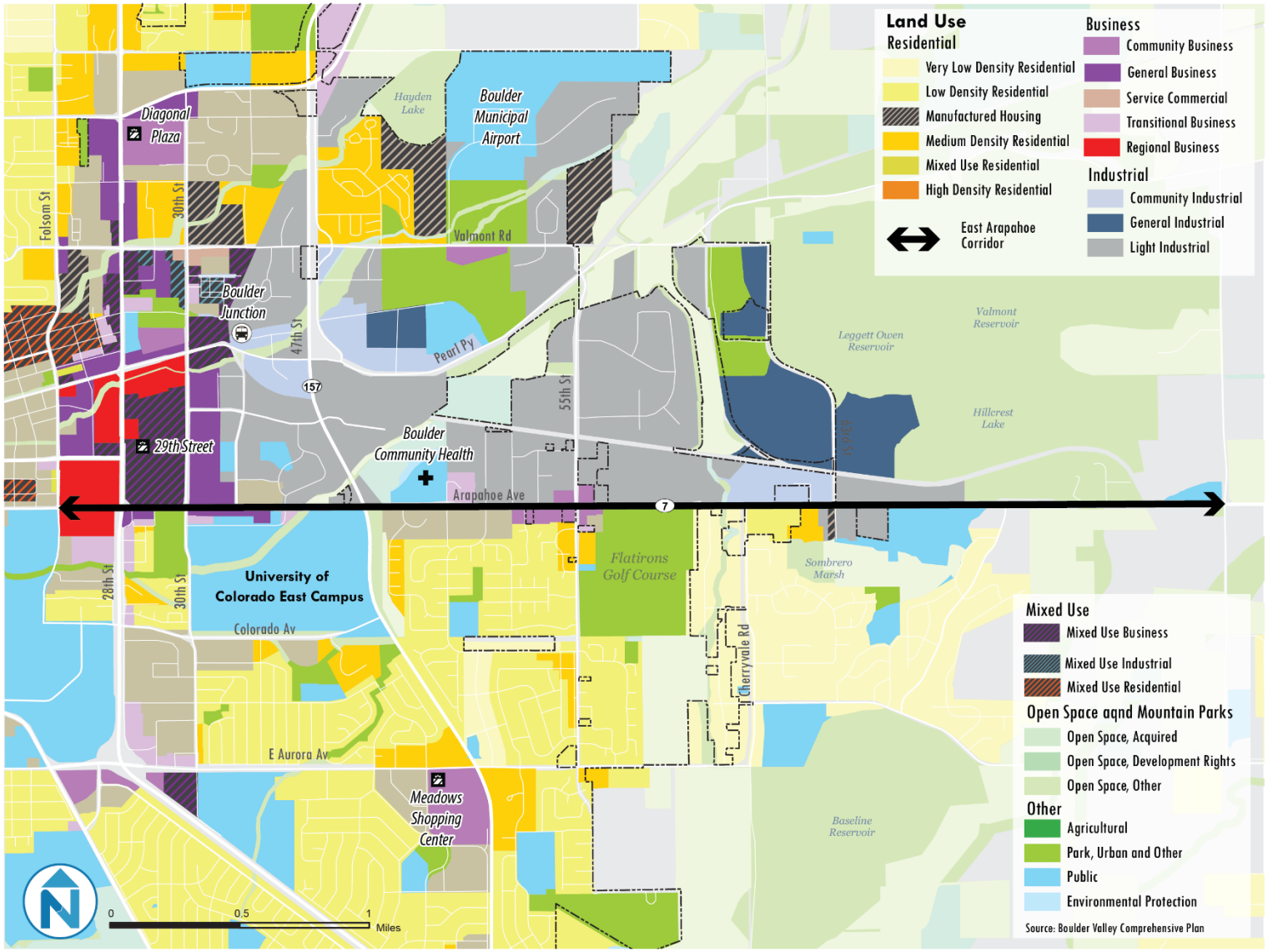
[2] https://www-static.bouldercolorado.gov/docs/2015-community-profile-update-1-201511190845.pdf

south side of the corridor between Foothills Parkway and 55th Street. East of 55th Street land use in the corridor is a mix of commercial and institutional uses and low-density residential areas.

Figure 2-3 illustrates where population and employment densities in the corridor are projected to increase by 2035 based on the Boulder Valley Comprehensive Plan.[3] The most significant changes in employment density in the corridor are projected to occur west of Foothills Parkway and east of 55th Street. Population density in the corridor is projected to intensify on the western end of the corridor, east of Foothills Parkway including the parcels adjacent to the University of Colorado.

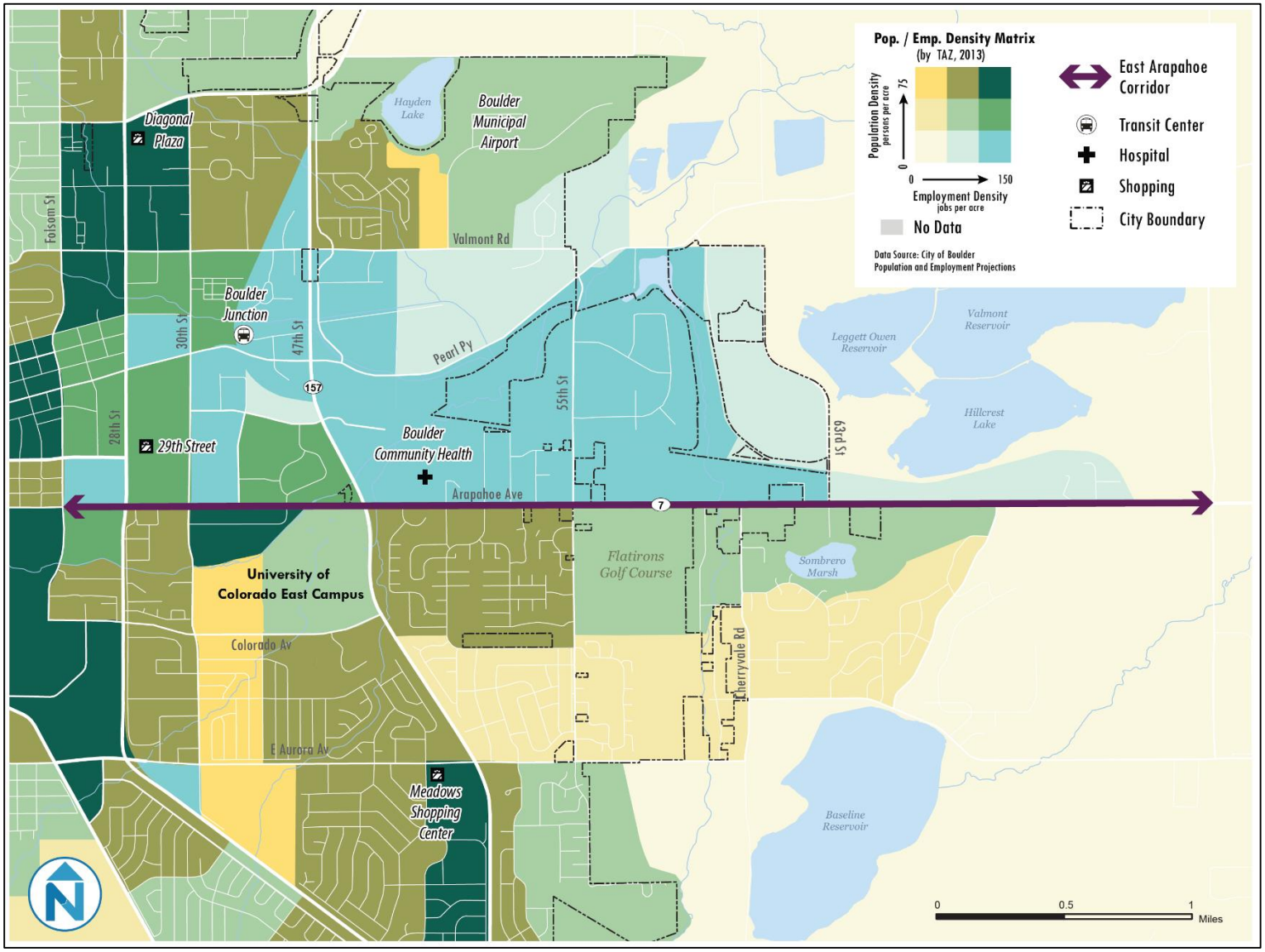
[3] The projected land use information illustrated in Figure 2-3 reflects the current Boulder Valley Comprehensive Plan (BVCP). The City of Boulder and Boulder County are currently updating the BVCP (see https://bouldercolorado.gov/bvcp for more information). This process began in summer of 2015 and is expected to be complete by the end of 2016. Transportation/GO Boulder and Comprehensive Planning staff are continuing to work with the BVCP team to review and coordinate technical data, and this data will be provided as an update at a future working group meeting.

Figure 2-1 Existing Land Use and Key Development Areas



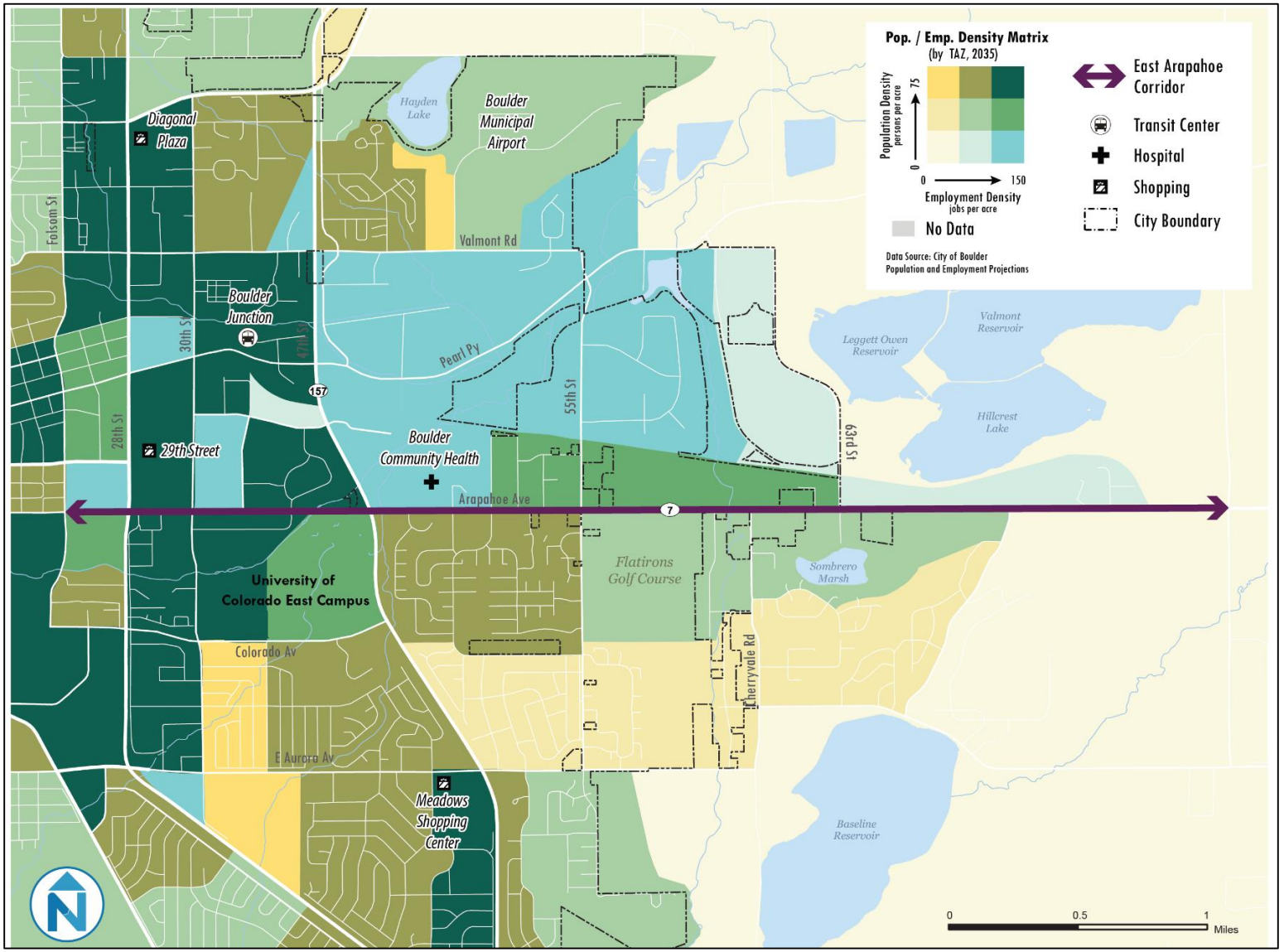
Source: City of Boulder Transportation Master Plan, State of the System Report 2014, Figure 3-9. Data from Boulder Valley Comprehensive Plan.

Figure 2-2 Existing Population and Employment Density, 2013



Source: City of Boulder Transportation Master Plan, State of the System Report 2014, Figure 3-10. Data from City of Boulder Population and Employment Projections.

Figure 2-3 Projected Population and Employment Density, 2035



Source: City of Boulder Transportation Master Plan, State of the System Report 2014, Figure 3-11. Data from City of Boulder Population and Employment Projections.

COMMUTE PATTERNS

This section describes commute patterns within a half-mile and 1.5 mile radius of the study area. The distance people live and/or work from the corridor affects their transportation needs, choices, and potential demand for active transportation modes. For example, a half-mile is typically considered to be walkable and 1.5 miles can easily be accomplished by a short bike ride. People who both live and work along the corridor may be the most likely to take advantage of transit and active transportation options along the corridor.

The analysis of commute patterns is based on data from the U.S. Census Longitudinal Employer Household Dynamics (LEHD) for 2014. Figure 2-4 identifies commute patterns for people who live and/or work within a half-mile or 1.5-mile radius of Arapahoe Avenue between Folsom Street and 75th Street.

- **Half-Mile:** Nearly 4,300 workers live within a half-mile of the corridor, compared to over 35,500 jobs. Only 1,100 people both live and work in the half-mile area; the remaining over 34,400 workers commute to the corridor from a half-mile or more away. Employment within a half-mile comprises nearly 40% of jobs citywide.
- **1.5 Miles:** Nearly 22,000 workers live within a broader 1.5-mile radius of the corridor, while there are 72,600 jobs within the 1.5-mile area. Nearly 10,200 workers both live and work within the 1.5-mile area. The remaining 62,400 workers commute from 1.5-miles or more away.

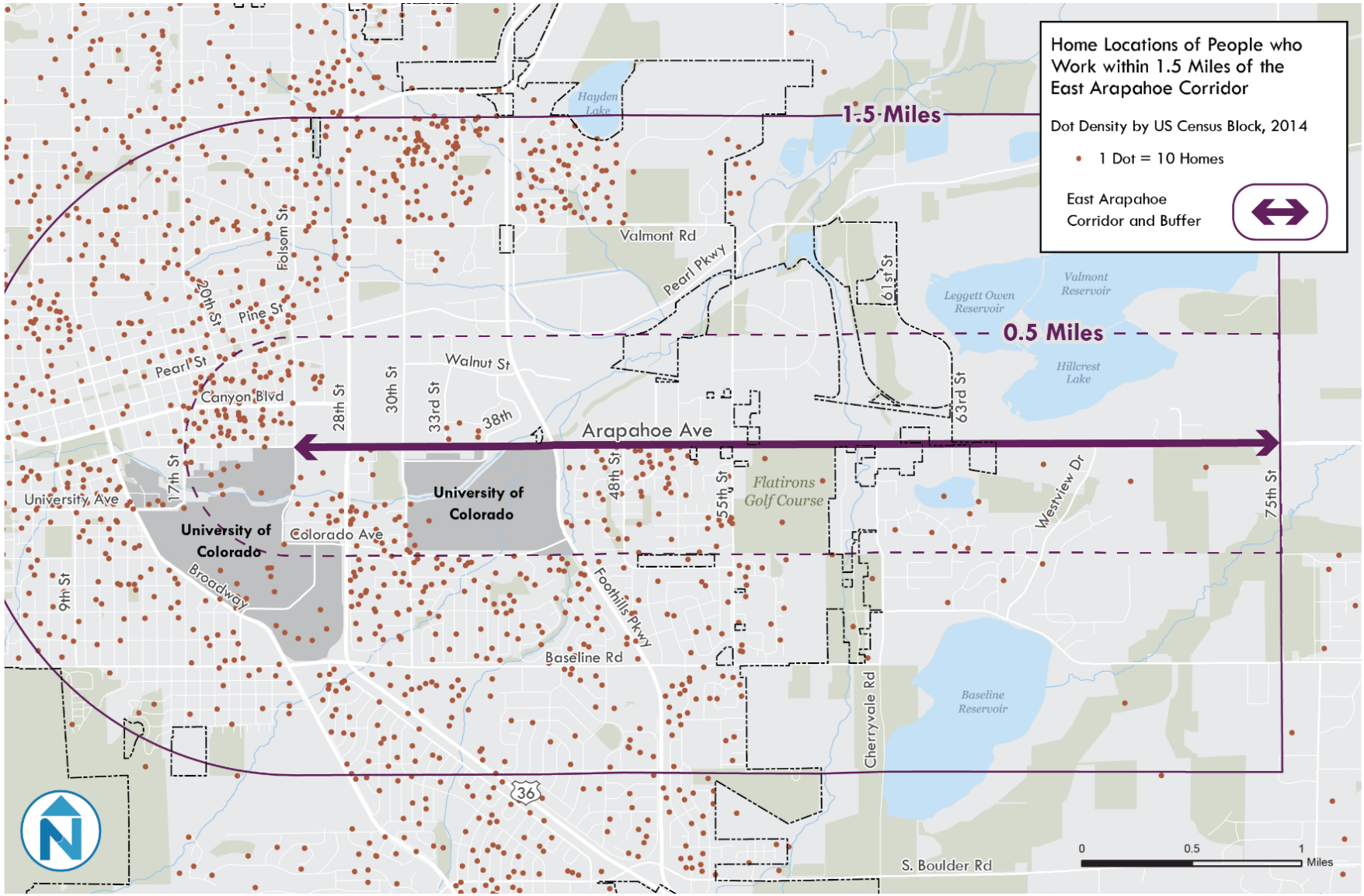
Maps of this data illustrate residential and work location patterns. Figure 2-5 displays the home locations of people that work within 1.5 miles of the corridor, west of 75th Street. Figure 2-6 displays the employment locations of people who reside within 1.5 miles of the corridor, west of 75th Street. These locations include a large concentration of workers in downtown Boulder along Broadway both north and south of downtown.

Figure 2-4 Home and Work Locations within Half-Mile and 1.5 Miles of the Corridor

Employment and Residence Status	Half-Mile	1.5 Miles
Live within 0.5 or 1.5 Miles of Corridor	4,291	21,988
Work within 0.5 or 1.5 Miles of Corridor	35,519	72,656
Live and Work within 0.5 or 1.5 Miles of Corridor	1,115	10,267
Live within 0.5 or 1.5 Miles of Corridor but Work Outside	3,176	11,721
Work within 0.5 or 1.5 Miles of Corridor but Live Outside	34,404	62,389

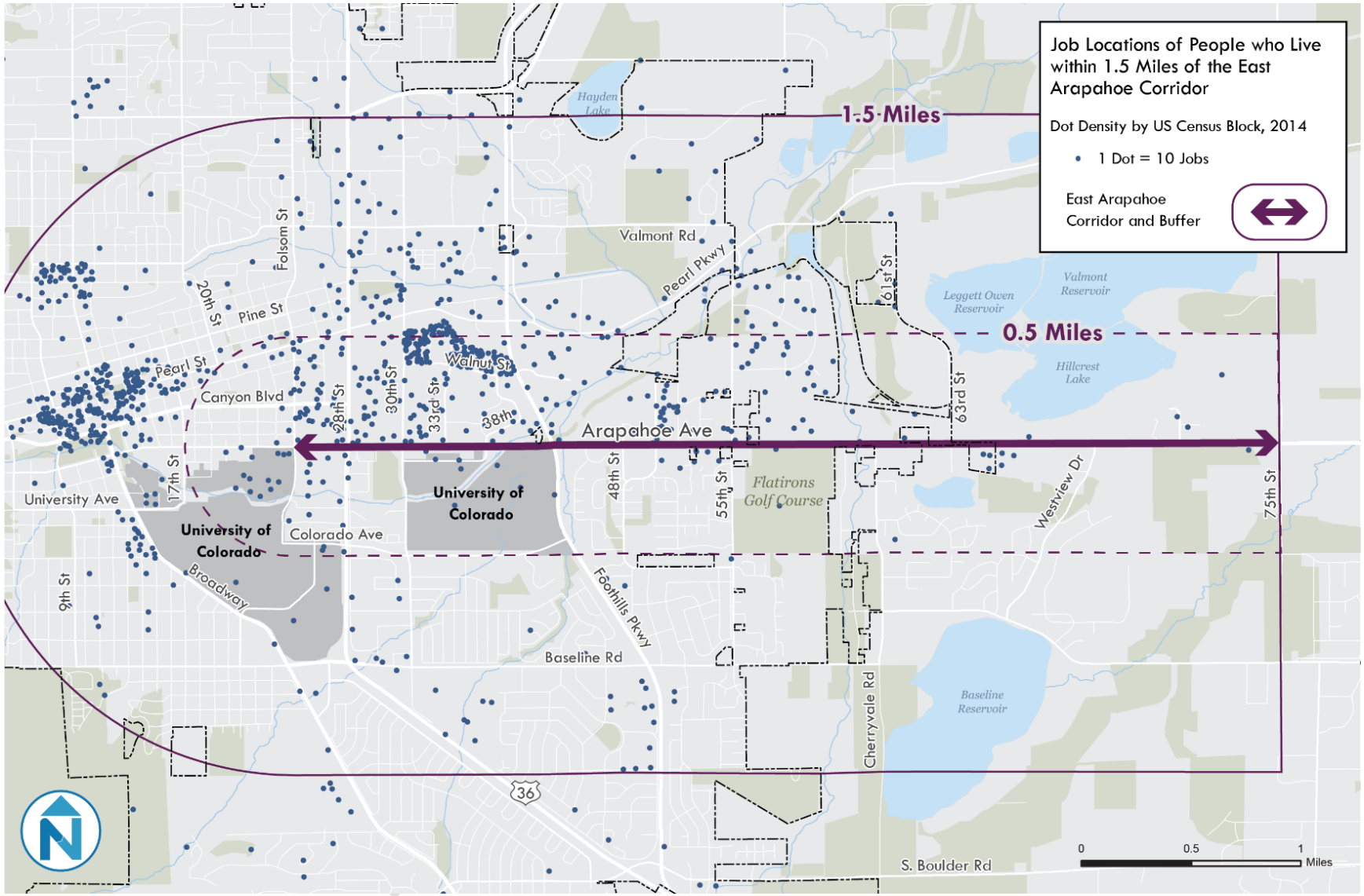
Each dot in Figure 2-5 and Figure 2-6 represents ten workers' home or work locations; the individual dots are randomly distributed within Census blocks.

Figure 2-5 Home Locations Map



Source: US Census Bureau Longitudinal Employer-Household Dynamics, 2015

Figure 2-6 Work Locations Map



Source: US Census Bureau Longitudinal Employer-Household Dynamics, 2015

DEMOGRAPHICS

This section describes demographic characteristics of study area residents, compared to the City of Boulder overall. This analysis can highlight the presence and general location of demographic groups that are more likely to use transit, walk, and bike.

Figure 2-7 summarizes the demographic characteristics for study area residents compared to Boulder overall. Key points include:

- Approximately 13% of the city's population lives within a half-mile of the corridor.
- The median age of corridor residents (37) is higher than the City as a whole (28) and the average household size is greater.
- There is a higher share of minority and low-income residents and a higher share of renter-occupied households; these demographic groups are more likely to travel by riding transit, walking, and biking.

Figure 2-7 Demographic Summary, Half-Mile of East Arapahoe Corridor

	Population	Median Age	Minority Population	Poverty (<150%)*	Households	Rent	Own	Average Household Size
East Arapahoe	13,817	37	17%	35%	6,011	68%	32%	2.35
City of Boulder	102,002	28	12%	31%	44,029	49%	51%	2.18

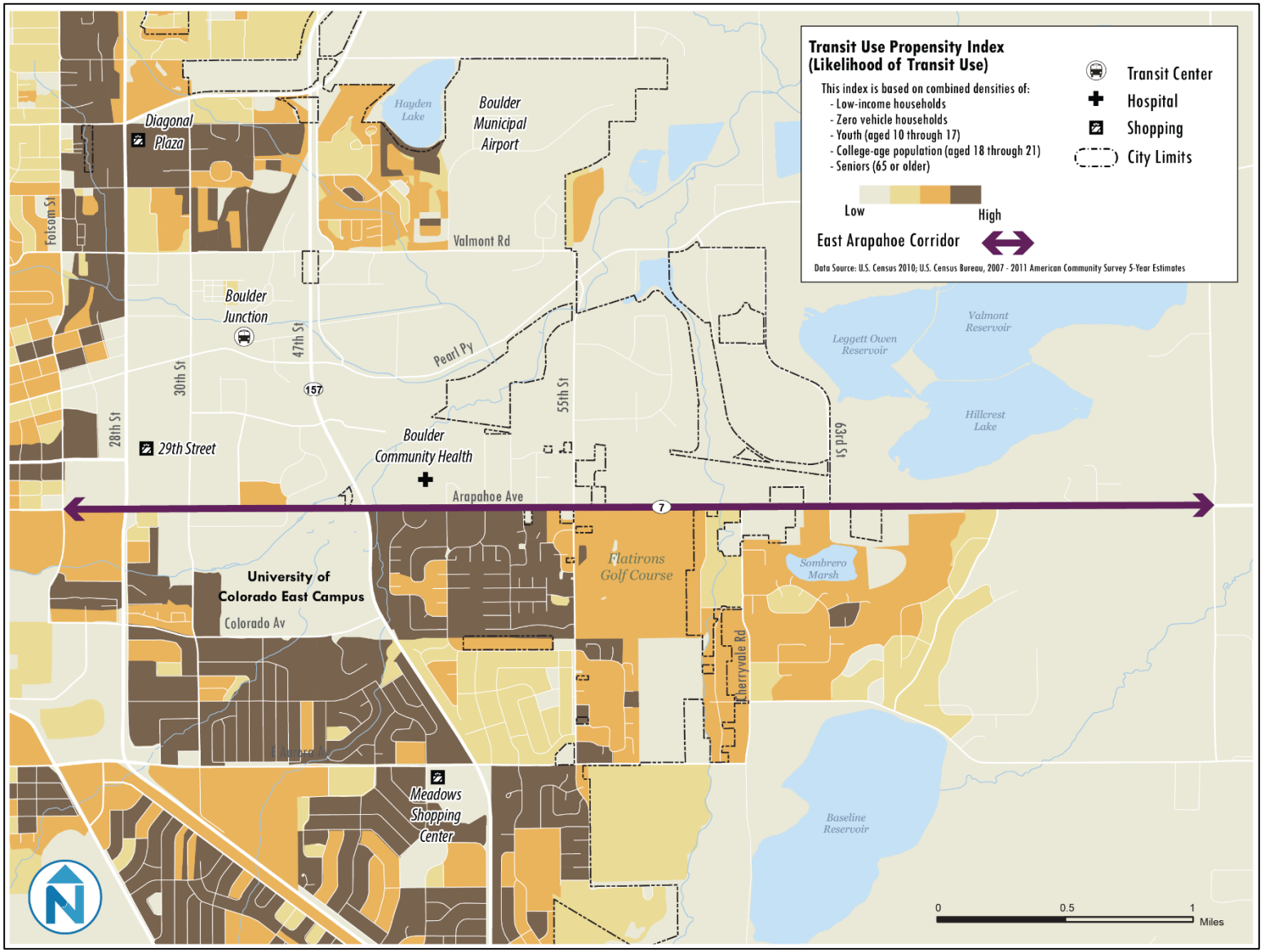
Notes: * Earning at or below 150% of the federal poverty level.

Source: American Community Survey, 2010-2014 5-Year Average

Transit Use Propensity Index

The transit use propensity (TUP) index, illustrated in Figure 2-8, combines the strongest indicators of transit demand. The TUP index is based on population and employment densities, low-income households, persons with disabilities, seniors (age 65+), and rates of access to automobiles. In the East Arapahoe corridor, TUP scores are highest in neighborhoods around the CU East Campus, and between Foothills Parkway and 55th Street south of Arapahoe Avenue. Neighborhoods east of 55th Street and south of Arapahoe Avenue also rate moderately high.

Figure 2-8 Transit Use Propensity Index Map



Source: City of Boulder Transportation Master Plan, State of the System Report 2014, Figure 3-12. Data from Census 2010 and 2007-2011 ACS 5YR Estimates.

3 EXISTING MODAL CONDITIONS

This chapter describes existing conditions for each travel mode that uses Arapahoe Avenue, and is organized into the following sections:

- **Existing Street Cross-Sections**. Describes existing street characteristics of Arapahoe Avenue by segment, including facilities for each mode and key land uses.
- **Vehicles**. Describes traffic volumes, signalized intersections, motor vehicle level of service, travel time, and other information related to motor vehicle travel along the East Arapahoe corridor.
- **Pedestrian and Bicycle**. Provides additional detail on existing and proposed facilities along Arapahoe Avenue (e.g., multi-use paths and bike lanes) and pedestrian and bicycle activity in the corridor.
- **Transit**. Describes existing service, facilities, and transit ridership in the corridor.
- **Safety**. Provides an analysis of safety in the corridor for all modes of travel.

EXISTING STREET DESCRIPTION AND CROSS SECTIONS

Arapahoe Avenue's streetscape varies through the study area, from a five-lane street on the west end, to a seven-lane street in the middle of the study area, and a three-lane street on the eastern end. Figure 3-1 summarizes the typical characteristics of different segments of Arapahoe Avenue for various modes. Lane configurations, such as extra turn lanes approaching intersections, may vary slightly within each segment. A more detailed discussion of each segment is provided below.

Figure 3-11 illustrates pedestrian and bicycle facilities along the corridor.

Figure 3-1 Cross Section Summary Table

Segment	# of General Purpose Lanes	Center Turn Lane	Sidewalk or Multi-Use Path [1]	Bike Lane	Transit Lane
Folsom Street to 28th Street	4	Median Separated	▪ Both sides: multi-use path	No	No
28th Street to 30th Street	6	Median Separated	▪ Both sides: multi-use path	No	No
30th Street to Foothills Pkwy	6	Median Separated	▪ North side: multi-use path ▪ South side: both sidewalk and multi-use path incomplete	No	No
Foothills Pkwy to 55th Street	6	Median Separated	▪ North side: multi-use path ▪ South side: sidewalk complete; multi-use path incomplete	No	No
55th Street to Cherryvale Road	5	Median Separated	▪ North side: both sidewalk and multi-use path incomplete ▪ South side: sidewalk incomplete; no multi-use path	Yes	No
Cherryvale Road to 63rd Street	5	Median Separated	▪ North side: multi-use path ▪ South side: multi-use path	Yes	No
63rd Street to Westview Drive	2	Continuous	▪ North side: multi-use path ▪ South side: multi-use path	Yes	Yes
Westview Drive to 75th Street	2	Continuous	▪ North side: multi-use path ▪ South side: none	Wide shoulders	No

Notes: [1] Figure 3-11 illustrates the presence of pedestrian and bicycle facilities along the corridor.

Figure 3-2 Arapahoe Avenue, with Multi-Use Path

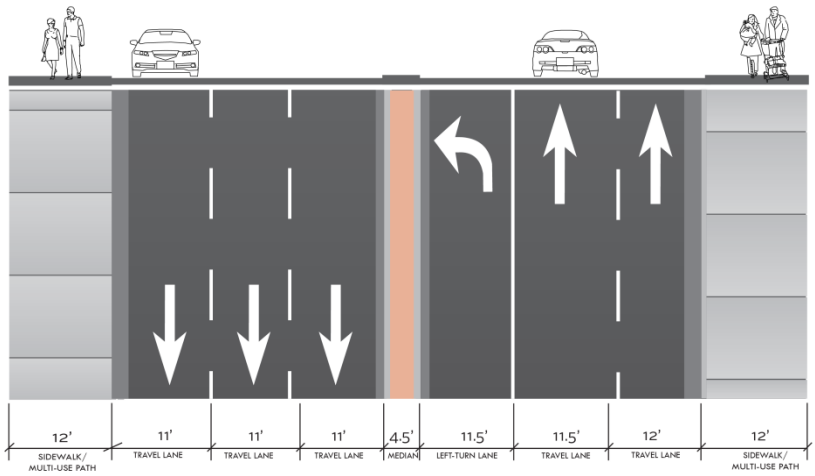
Source: City of Boulder

Folsom Street to 28th Street

The Folsom Street to 28th Street segment has four general-purpose travel lanes plus turn-lanes, with predominantly retail land uses.

Category	North	South
Key Land Uses	▪ Village Shopping Center	▪ Arapahoe Village Shopping Center, including Safeway
General-Purpose Travel Lanes	▪ Two general-purpose travel lanes in each direction with a single median-separated center-turn lane throughout, and right-turn lanes. ▪ The west side of the Arapahoe and 28th Street intersection has double left-turn lanes	
Intersections and Crossings	▪ Signalized intersections are 650 feet apart and have directional curb ramps and continental crosswalk markings on all four legs. There are no marked crosswalks provided between signalized intersections.	
Pedestrian / Off-Street Bicycle Facilities	▪ 12 foot wide multi-use paths on both sides of the roadway, separated from the roadway with vegetation at some points.	
On-Street Bicycle Facilities	▪ None	
Dedicated Bus Lanes / Queue Jumps	▪ None	

Typical Existing Cross-Section: Arapahoe Village Looking West

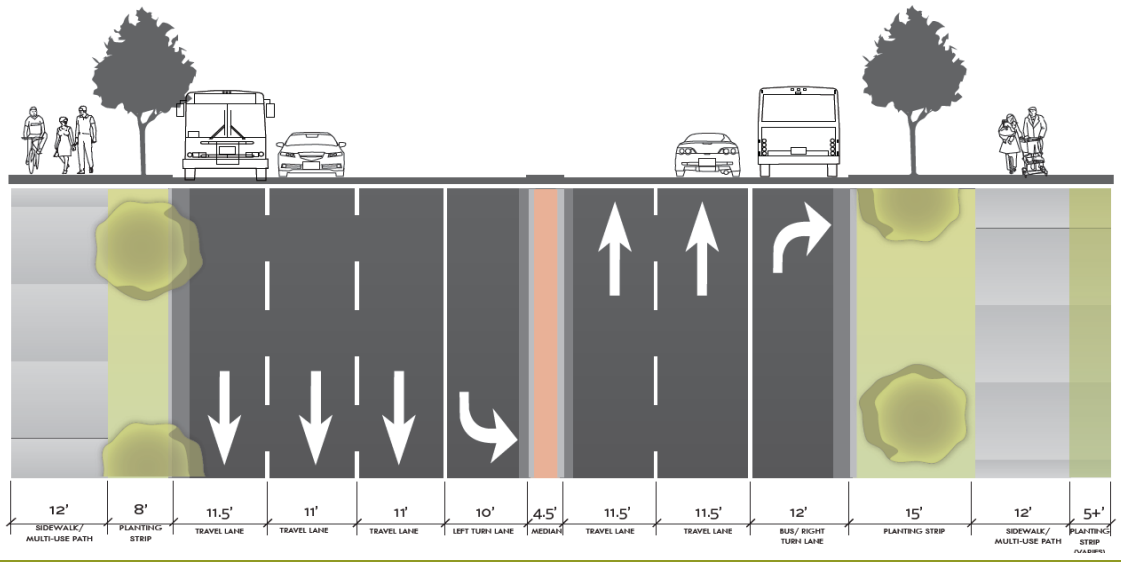


28th Street to 30th Street

This segment includes six general-purpose travel lanes plus turn-lanes, with predominantly retail land uses. The multi-use path is buffered from the roadway by trees and vegetation and signals are relatively close together (650 feet). As a result, this portion of Arapahoe Avenue provides a more comfortable environment for pedestrians than nearby segments.

Category	North	South
Key Land Uses	▪ Twenty-Ninth Street Retail Center, including Home Depot and other big-box retail with parking fronting the street. Parking lot has an internal pedestrian path leading to the front door.	▪ Scott Carpenter Park
General-Purpose Travel Lanes	▪ Three general-purpose lanes in each direction plus left-turn lanes, right-turn lanes, and a 4-5 foot median. ▪ The outside westbound through lane transitions to a westbound right-turn lane west of 29th Street and terminates at 28th Street.	
Intersections and Crossings	▪ Signalized intersections are 650 feet apart and have directional curb ramps and continental crosswalk markings on all four legs. There are no marked crosswalks provided between signalized intersections.	
Pedestrian / Off-Street Bicycle Facilities	▪ 12 foot wide multi use paths on both sides of the roadway, separated from the roadway with vegetation at some points.	
On-Street Bicycle Facilities	▪ None	
Dedicated Bus Lanes / Queue Jumps	▪ Short, westbound bus-only segment just west of 29th Street ▪ Westbound queue jump at 28th Street	

Typical Existing Cross-Section: East of 29th Street Looking West

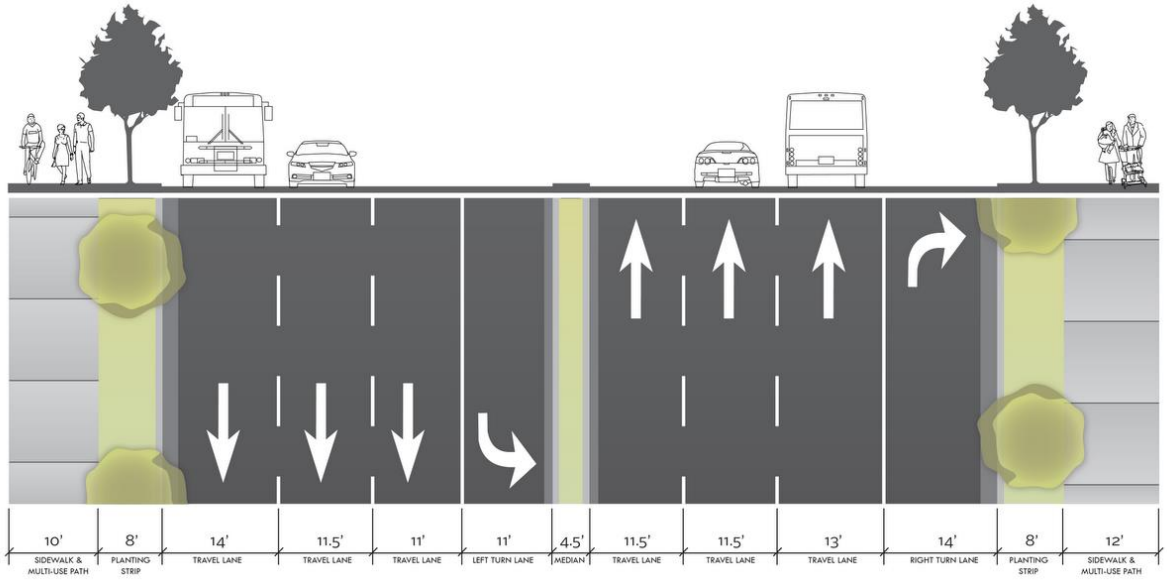


30th Street to Foothills Avenue

This portion of Arapahoe Avenue has six general-purpose lanes plus turn-lanes with a mix of retail, medium-density residential, and employment/institutional land uses.

Category	North	South
Key Land Uses	Mixed retail, employment, and institutional uses: ▪ Big box retail between 30th Street and 33rd Street with parking lots along Arapahoe ▪ Peloton high-density mixed-use residential ▪ CU Center for Innovation	▪ Small-scale retail businesses with individual parking lots and limited connections between each site. ▪ University of Colorado East Campus including buildings on both sides of Marine Street ▪ Wetlands
General-Purpose Travel Lanes	▪ Three travel lanes in both directions, with median-separated left-turn lanes at intersections and mid-block. Channelized right turn lanes are present at all intersections.	
Intersections and Crossings	▪ Signalized intersections are approximately a thousand feet apart and no marked crosswalks are provided between signalized intersections. ▪ Signalized intersections have directional curb ramps and continental crosswalk markings on all four legs, except for 33rd Street which is missing curb ramps. ▪ There is an undercrossing of Arapahoe for the Boulder Creek Path between 38th Street and Foothills Parkway.	
Pedestrian / Off-Street Bicycle Facilities	▪ The multi-use path is continuous on the north-side ▪ Between 30th Street and the Boulder Creek Path the south side pedestrian facility is designated as a sidewalk; the sidewalk is as narrow as five feet, but includes a landscaped buffer. There is a 500 foot section that lacks a pedestrian facility of any type through parking lots east and west of 33rd Street. ▪ On the south side there are no bike facilities between 30th Street and the Boulder Creek Greenway (see above). There is a multi-use path between the Boulder Creek Greenway and Foothills Parkway; west of this junction the path diverges from Arapahoe.	
On-Street Bicycle Facilities	▪ None	
Dedicated Bus Lanes / Queue Jumps	▪ There are queue jumps in both directions at Foothills Parkway.	

Typical Existing Cross-Section: West of 38th Street Looking West

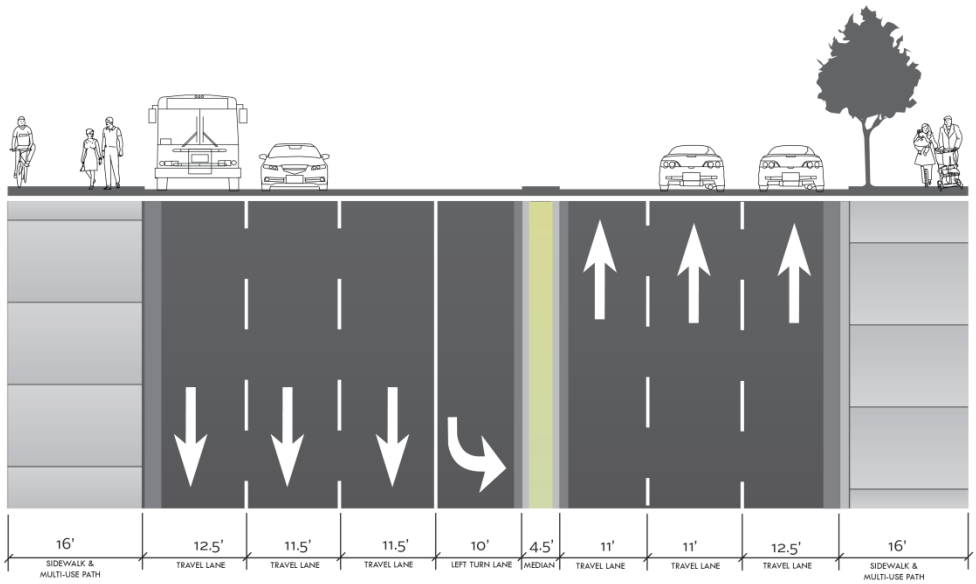


Foothills Parkway to 55th Street

East of Foothills Parkway, Arapahoe Avenue generally has six general-purpose travel lanes with a left-turn lane. Land uses transition to generally lower-density uses.

Category	North	South
Key Land Uses	Mixed institutional, employment, and light industrial. Some buildings, such as on the northwest corner of Arapahoe and 55th, front the street while others have parking frontages. ▪ Boulder Community Health ▪ Ball Aerospace (major employer) ▪ Light industrial and office uses east of Ball Aerospace, including breweries, printing press, Rocky Mountain Theater for Kids. ▪ Office and hotel uses between Foothills Pkwy, Boulder Creek, and the railroad tracks	▪ Primarily low-density, single-family residential ▪ Some medium or high density residential, e.g., between Foothills Parkway and Eisenhower Drive ▪ Several one and two-story office buildings are transitioning to medical offices for the personnel using the hospital facility ▪ Isolated office (east of Foothills) and auto-oriented retail/service (west of 55th)
General-Purpose Travel Lanes	▪ At Foothills Parkway, there are three westbound through travel lanes, a right-turn lane, and three left-turn lanes. Eastbound, there are three travel lanes, a right-turn lane, and two left-turn lanes. In both directions, the right-turn lanes become bus queue jumps through the intersection. On the opposite side of the intersection, the queue jump lane transitions to a merging lane for traffic turning right onto Arapahoe. ▪ East of Foothills, there are generally three lanes per direction with a median. Median-separated left-turn lanes occur at intersections and mid-block.	
Intersections and Crossings	▪ There is an undercrossing of Arapahoe east of Foothills Parkway. ▪ Foothills Parkway and 48th Street are over 1600 feet (over 1/4 mile) apart. ▪ Average intersection spacing between signalized intersections is over 850 feet between 48th Street and 55th Street. These intersections have directional curb ramps and continental crosswalk markings on all four legs. ▪ No marked crosswalks are provided between signalized intersections. Signalized intersections have directional curb ramps and continental crosswalk markings on all four legs, except for missing crosswalks on the south leg of Conestoga Street.	
Pedestrian / Off-Street Bicycle Facilities	▪ The north side has a continuous 12 foot multi-use path. ▪ Pedestrian access on the south side changes between a 12 foot multi-use path and 5 foot sidewalk multiple times; there is no path or bike lane between MacArthur Drive and 48th Street or between Eisenhower Drive and 55th Street. ▪ There is not always a buffer between the sidewalk and the street. Businesses typically do not have pedestrian paths to their front doors.	
On-Street Bicycle Facilities	▪ None	
Dedicated Bus Lanes / Queue Jumps	▪ There are queue jumps in both directions at Foothills Parkway.	

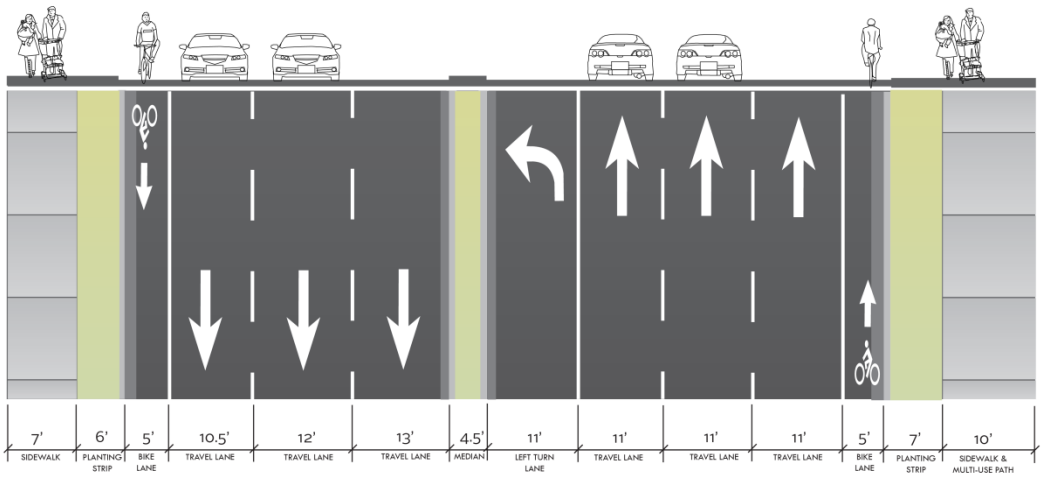
Typical Existing Cross-Section: Range Street Looking West



55th Street to Cherryvale Road

Arapahoe Avenue transitions to two eastbound travel lanes east of 55th Street, and has five to six total general-purpose travel lanes between 55th Street and Cherryvale Road. The north side multi-use path intersects the South Boulder Creek Greenway approximately 400 feet west of Cherryvale, where Arapahoe Avenue crosses over South Boulder Creek. The Flatirons Golf Course is the dominant land use on the south side.

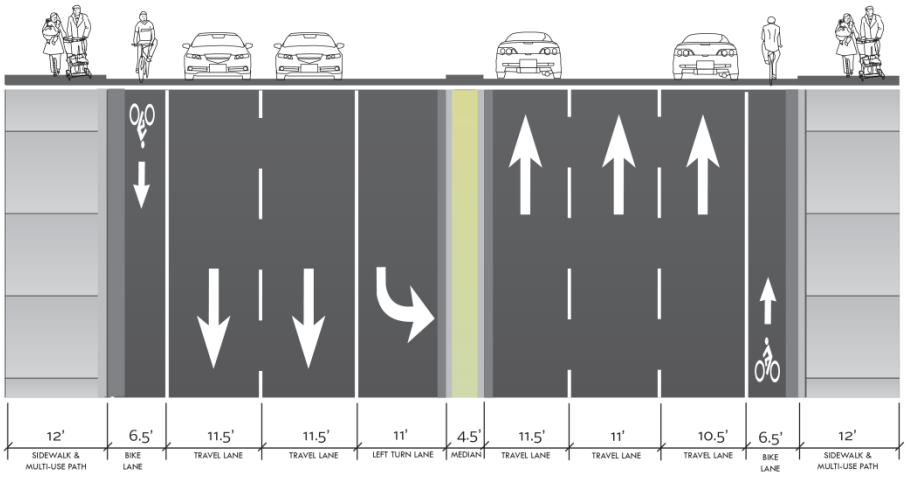
Category	North	South
Key Land Uses	▪ Accessed from 55th Street, Flatiron Business Park is north of the railroad tracks ▪ Office and light industrial uses south of the railroad tracks, accessed from Arapahoe	▪ Retail/services and office uses between 55th and the golf course ▪ Flatirons Municipal Golf Course ▪ Very low density, single-family residential along Old Tale Road
General-Purpose Travel Lanes	▪ Three travel lanes in each direction, transitioning to two eastbound lanes approx. 800 feet east of 55th.	
Intersections and Crossings	▪ No marked crosswalks between the signalized intersections at 55th and Cherryvale, nearly 0.7 miles apart. These intersections have directional curb ramps and continental crosswalk markings on all four legs, except for missing crosswalks on the south and west legs of Cherryvale. ▪ Pedestrian/bicycle undercrossing of Arapahoe that connects the South Boulder Creek Greenway to Old Tale Road (approx. 400 feet west of Cherryvale).	
Pedestrian / Off-Street Bicycle Facilities	▪ On the north side, the multi-use path is continuous except for an approx. 650 foot gap west of the South Boulder Creek Greenway undercrossing that connects the path to Old Tale Road on the south side of Arapahoe. ▪ On the south side, there is no sidewalk or multi-use path next to the Flatirons Golf Course. The multi-use path resumes east of Cherryvale Road. There is a short segment near Old Tale Road where there are no sidewalks or multi-use paths on either side of the street.	
On-Street Bicycle Facilities	▪ There are bike lanes on <u>both</u> sides of Arapahoe east of 55th	
Transit Lanes or Queue Jumps	▪ None	
Typical Existing Cross-Section: 55th Street Looking West		



Cherryvale Road to 63rd Street

Arapahoe Avenue between Cherryvale Road and 63rd Street has a similar roadway configuration to the 55th – Cherryvale segment—five total general-purpose travel lanes with bike lanes in both directions. A new Jewish Community Center is being constructed on the southeast corner of Cherryvale Road and Arapahoe Avenue.

Category	North	South
Key Land Uses	▪ Auto dealerships, light industrial, and service uses ▪ North of railroad tracks along 63rd, Boulder County Resource Center, Western Disposal's main facility, Stazio Softball Fields, Via Mobility ▪ West of 63rd, Naropa University Nalanda Campus	▪ Future Boulder Jewish Commons east of Cherryvale ▪ Open space / wetlands ▪ Auto repair business ▪ Mobile home park
General-Purpose Travel Lanes	▪ Three westbound and two eastbound general-purpose lanes. ▪ Median-separated left-turn lanes at intersections and mid-block.	
Intersections and Crossings	▪ No marked crosswalks between the signalized intersections at Cherryvale and 63rd, which are approximately 1,800 feet (1/3 mile) apart. ▪ These intersections have directional curb ramps and continental crosswalk markings on all four legs, except for missing crosswalks on the south and west legs of Cherryvale.	
Pedestrian / Off-Street Bicycle Facilities	▪ There are multi-use paths on both sides of Arapahoe.	
On-Street Bicycle Facilities	▪ There are 6.5-foot bike lanes in both directions.	
Transit Lanes or Queue Jumps	▪ None	
Typical Existing Cross-Section: West of 62nd Street looking West		

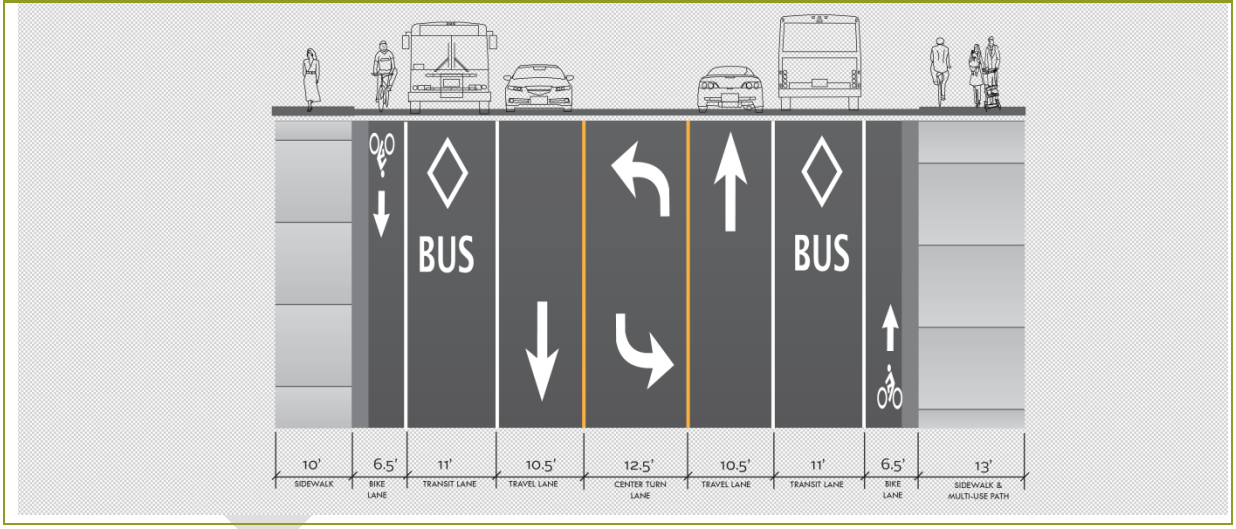


63rd Street to Westview Drive

Between 63rd Street and Westview Drive, Arapahoe Avenue has two general purpose travel lanes with a two-way center-turn lane and a transit lane in each direction. The Boulder Valley School District offices and Arapahoe Ridge High School are major land uses.

Category	North	South
Key Land Uses	▪ Self-storage facilities and retail/service businesses south of the railroad tracks ▪ Xcel Energy Valmont Power Station north of railroad tracks	▪ Self-storage facilities ▪ Eco-Cycle and ReSource ▪ Boulder Valley School District (BVSD) Arapahoe Campus ▪ Arapahoe Ridge Alternative Technical High School
General-Purpose Travel Lanes	▪ One travel lane in each direction with a two-way center turn lane.	
Intersections and Crossings	▪ Directional curb ramps and continental crosswalk markings on all four legs of the signalized intersections at 63rd and 65th. ▪ Approximately 1,600 foot spacing between 63rd and 65th	
Pedestrian / Off-Street Bicycle Facilities	▪ Multi-use path on the north side; the south side sidewalk is narrower and does not continue east of Westview Drive.	
On-Street Bicycle Facilities	▪ On-street bike lanes on both sides.	
Transit Lanes or Queue Jumps	▪ Transit-only lane in both directions between 63rd Street and approximately Arapahoe Ridge High School.	

Typical Existing Cross-Section: West of 65th Looking West



Westview Drive to 75th Street

Between Westview Drive and 75th Street, Arapahoe Avenue has three total lanes and is mostly bordered by open space, with a cluster of light industrial businesses at Valtec Lane.

Category	North	South
Key Land Uses	▪ Open space between Westview Drive and Valtec Lane ▪ Light industrial at Valtec Lane ▪ City on the Hill Church east of 75th	▪ Open space between Westview Dr and Valtec Lane ▪ Convenience store and gas station at 75th
General-Purpose Travel Lanes	▪ One travel lane in each direction and a two-way center turn lane.	
Intersections and Crossings	▪ T-intersection of Westview Drive and Arapahoe only has a curb ramp on the southwest corner; there are no marked crossings or connecting facilities on the south side east of Westview. Westview Drive also lacks sidewalks. ▪ Approx 1.2 mile spacing between 65th Street and 75th Street; there is no marked crossing at the bus stops at Valtec Lane. ▪ There is an above-grade double-track railroad overcrossing of Arapahoe east of Valtec Lane. ▪ Curb ramps and continental crosswalk markings at 75th Street except for a missing curb ramp on the northeast corner.	
Pedestrian / Off-Street Bicycle Facilities	▪ Multi-use path on the north side only, with a landscaped buffer west of Valtec Lane; the south side has no pedestrian facility.	
On-Street Bicycle Facilities	▪ Wide shoulders or striped bike lanes on both sides.	
Transit Lanes or Queue Jumps	▪ None	

VEHICLES

This section describes existing conditions for vehicles using Arapahoe Avenue in the study area. Arapahoe Avenue is an important roadway for local motor vehicle trips within Boulder and is one of the primary commuter corridors between Boulder and Lafayette, Erie, and I-25.

Key Highlights

- Traffic volumes at the west end of the corridor have remained fairly stable over the past 30 years, while volumes on the east end have nearly doubled.
- Travel time between Folsom Street and 65th Street ranges from 5.9 to 9.5 minutes eastbound and from 6.8 to 8.4 minutes westbound during the morning and afternoon peak hours, respectively. An "unimpeded" auto trip (with no traffic signals or other stops) would take 4.75 minutes to travel between Folsom and 65th Streets at the posted speed limits.

Average Daily Traffic

The map provided in Figure 3-5 shows the location of traffic counts along the corridor. Average Daily Traffic (ADT) was recorded at the locations marked in blue on each end of the corridor (west of 23rd Street and east of 75th Street).

In 2015, an average of approximately 19,000 vehicles per day (vpd) were counted at both traffic count locations. In the vicinity of the intersection of Foothills Parkway and Arapahoe Avenue, one of the busiest intersections in the city, Arapahoe Avenue carries approximately 32,000 vehicles per day. This busy intersection was reconstructed in 2006 to address roadway design issues including safety and the addition of a new multi-use path underpass. Traffic volumes at the west end of the corridor have remained fairly stable (typically between 20,000 and 25,000 vpd) since the initial count in 1983, while volumes on the east end have nearly doubled.

Figure 3-3 Average Daily Traffic, Arapahoe Avenue, 2015

	West of Folsom	East of 75th
First year of data	22,500 (1983)	10,500 (1982)
2015 Average Daily Traffic	19,500	19,000

Source: 2015 Boulder Arterial Count Program, and Boulder Valley Count Program.

Figure 3-4 provides current traffic volumes at several locations along Arapahoe Avenue. Additional details on current traffic volumes are provided in Figure 3-10.

Figure 3-4 Average Daily Traffic Volumes, Arapahoe Avenue, 2015

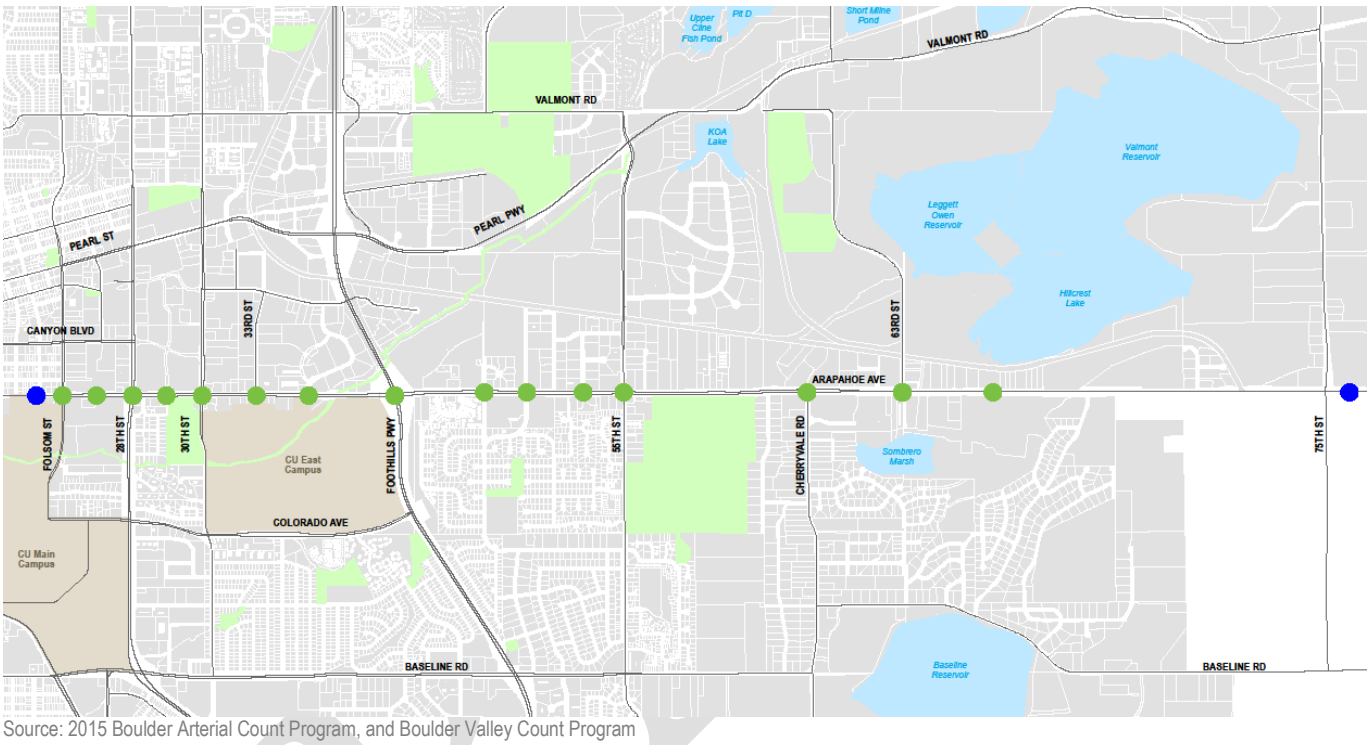
Intersection	Existing 2015
Arapahoe Avenue and W. of 28th Street	27,500
Arapahoe Avenue and E. of 30th Street	28,300
Arapahoe Avenue and E. of Foothills Parkway	31,300
Arapahoe Avenue and E. of 55th Street	26,200

Source: Travel Forecasts based on Regional Travel Demand Model, 2040

Signalized and Non-Signalized Intersections

The corridor includes 16 signalized intersections and nine non-signalized intersections. Figure 3-5 illustrates the signalized intersections and Figure 3-6 provides a table of all intersections with public streets along the Arapahoe Avenue in the study area, listed from west to east.

Figure 3-5 Traffic Count Locations and Signalized Intersections along Arapahoe Avenue



Source: 2015 Boulder Arterial Count Program, and Boulder Valley Count Program

Figure 3-6 Intersection Type

Cross Street	Intersection Type
Folsom Street	Fully Signalized Intersection
26th Street	Fully Signalized Intersection
28th Street	Fully Signalized Intersection
Culver Court	Right Turn In, Right Turn Out
29th Street	Fully Signalized Intersection
30th Street	Fully Signalized Intersection
33rd Street	Fully Signalized Intersection
38th Street	Fully Signalized Intersection
Foothills Parkway	Fully Signalized Intersection
Riverbend Drive	Right Turn In, Right Turn Out
MacArthur Drive	Non Signalized, Turns Allowed Both Ways
48th Street	Fully Signalized Intersection
Eisenhower Drive / Commerce Street	Fully Signalized Intersection

Cross Street	Intersection Type
Range Street	Non Signalized, Turns Allowed Both Ways
Patton Drive	Right Turn In, Right Turn Out
Conestoga Street	Fully Signalized Intersection
55th Street	Fully Signalized Intersection
56th Street	Right Turn In, Right Turn Out
Old Tale Road	Non Signalized, Turns Allowed Both Ways
Cherryvale Road	Fully Signalized Intersection
62nd Street	Non Signalized, Turns Allowed Both Ways
63rd Street	Fully Signalized Intersection
65th Street	Fully Signalized Intersection
Westview Drive	Non Signalized, Turns Allowed Both Ways
Valtec Lane	Non Signalized, Turns Allowed Both Ways
75th Street	Fully Signalized Intersection

Source: City of Boulder

Vehicle Turning Movement Counts

Vehicle turning movement counts are tracked at signalized intersections every three years during the morning, midday, and afternoon peak hours (starting at 7:45 am, noon, and 4:45 pm, respectively). These locations are indicated by green dots in Figure 3-5, and are one-day snapshots of every vehicle counted over each one-hour period. Traffic volumes are typically highest on weekdays during the morning and afternoon peak hours when employees are traveling to and from work. Figure 3-10 shows the morning and afternoon peak hour vehicle counts at four of the busiest intersections in the corridor. Detailed counts at all of the signalized intersections in the corridor are available on the City of Boulder's website.[4]

Intersection Level of Service

Intersection level of service (LOS) is a qualitative measure of the quality of roadway operations at signalized intersections. LOS measures the effect of increased peak hour traffic volumes on vehicle travel time. LOS is calculated as the average time that vehicles are delayed at an intersection, and is reported as A through F letter grades:

- **LOS A** indicates very good operation (free flow) and equates to average delay of 10 seconds or less per vehicle
- **LOS F** indicates poor operation (congested traffic), with an average delay of 80 seconds or more

Figure 3-7 lists the existing LOS at the four busiest and most congested intersections in the corridor in the morning (AM) and afternoon (PM) peak hours. The smaller intersections (with less side street traffic) typically experience LOS in the A through C range.

[4] Boulder Turning Movement Count Program.

Figure 3-7 Intersection Level of Service, Arapahoe Avenue, 2015

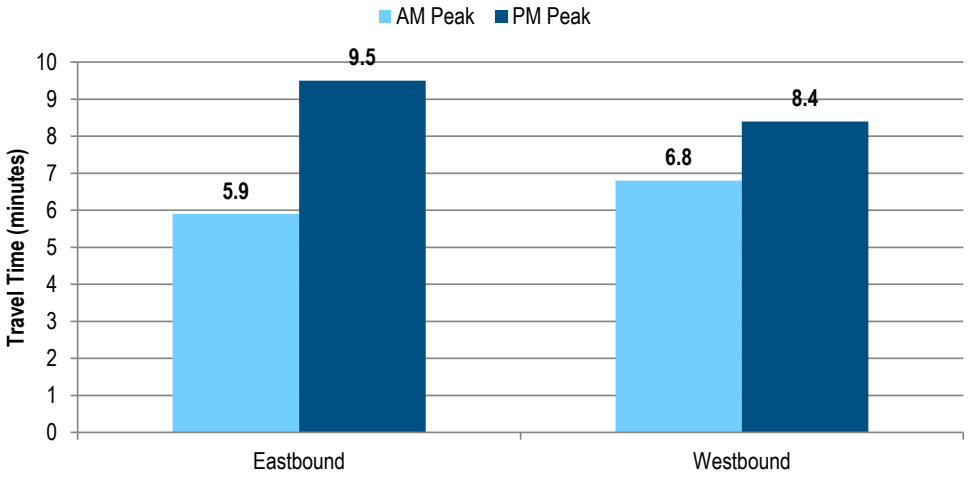
Intersection	Existing AM Peak	Existing PM Peak
Arapahoe Avenue and 28th Street	C	D
Arapahoe Avenue and 30th Street	C	C
Arapahoe Avenue and Foothills Parkway	C	D
Arapahoe Avenue and 55th Street	C	C

Source: Travel Forecasts based on Regional Travel Demand Model, 2040

Travel Time

The City of Boulder monitors vehicle travel times in key arterial corridors, including Arapahoe Avenue. Travel time on the Arapahoe Avenue corridor has held reasonably steady since 1987. Most recently (2014), in the segment between Folsom Street and 65th Street the travel time averaged 6.3 minutes in the morning peak hour and 8.8 minutes in the afternoon peak hour. If there were no impediments or stops on Arapahoe Avenue (e.g., no traffic signals), an "unimpeded auto trip" would take 4.75 minutes to travel between Folsom and 65th Streets at the posted speed limits. The relatively constant travel time indicates that the City of Boulder's transportation management policies and programs have been effective in maintaining efficient vehicle travel, even as the city's population and vehicle traffic has grown. Existing travel times in the corridor between Folsom and 65th Streets vary depending on direction, and are shown in Figure 3-8. Eastbound travel time ranges from 5.9 minutes during the morning peak hour to 9.5 minutes during the afternoon peak hour. Westbound travel time ranges from 6.8 minutes during the morning peak hour to 8.4 minutes during the afternoon peak hour.

Figure 3-8 Existing Vehicle Travel Times (Folsom Street to 65th Street)



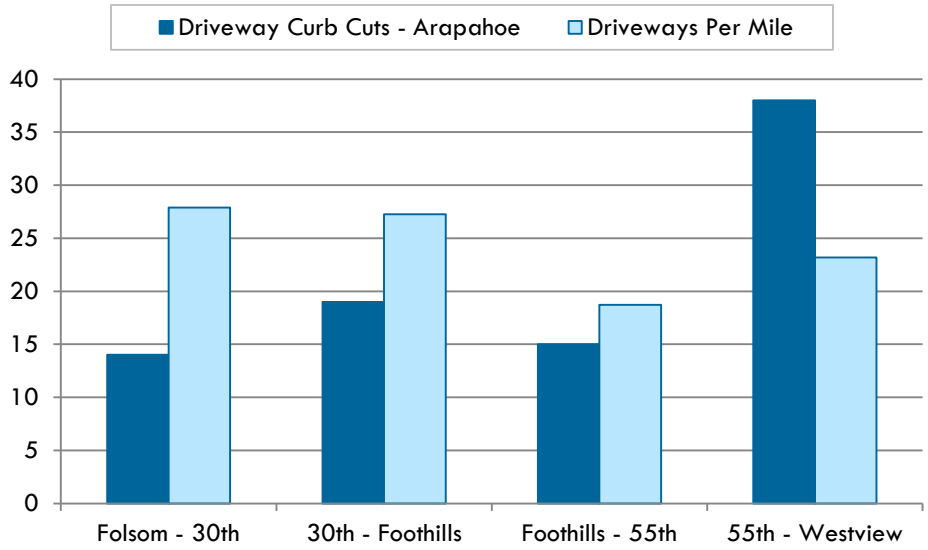
Source: City of Boulder

Driveways and Business Access

Between Folsom Street and Westview Drive on Arapahoe Avenue there are 86 driveway curb cuts. Over 3.6 miles, this averages to approximately 24 driveways per mile along the corridor, not including side streets. Figure 3-9 compares the number of driveways and curb cuts for several segments of the corridor.

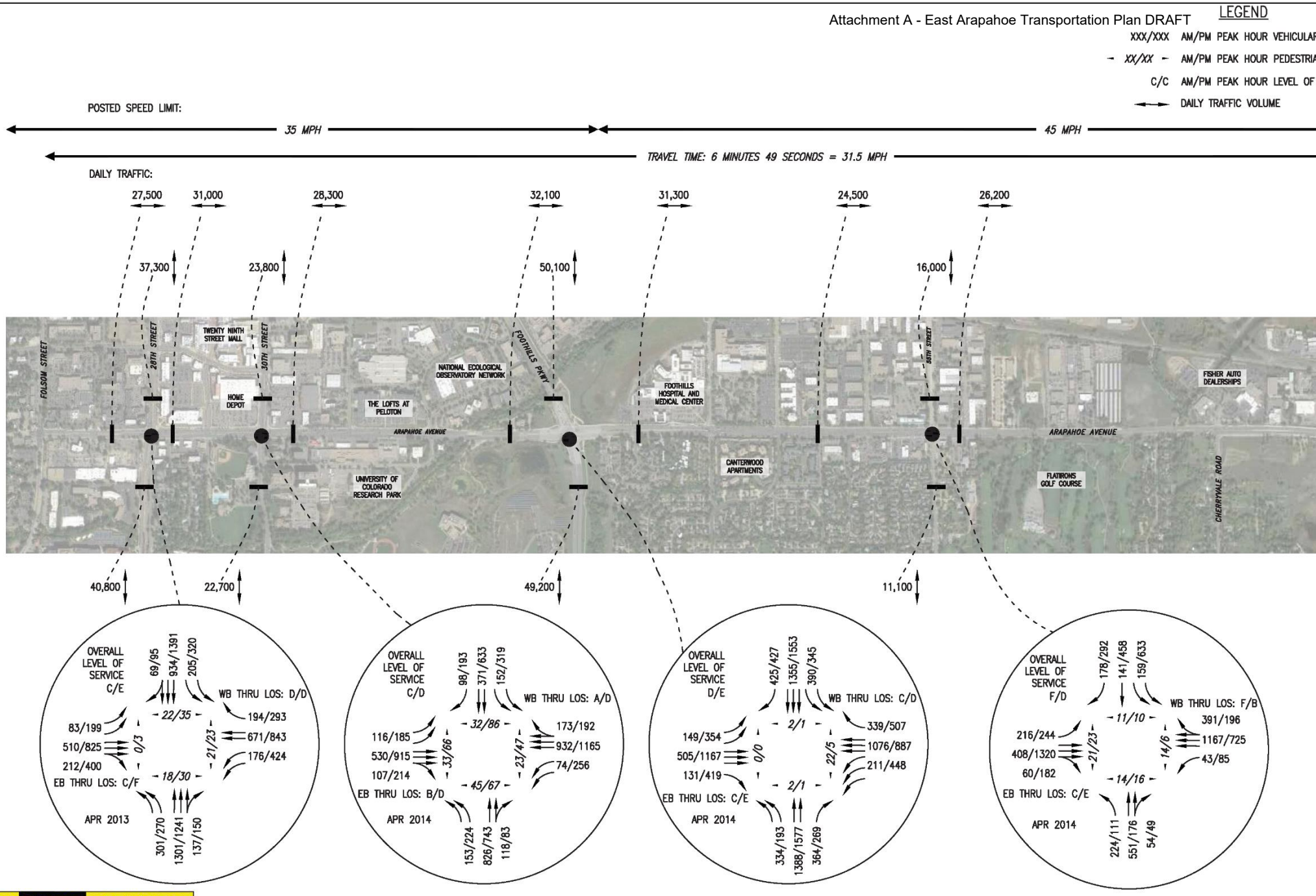
The highest number of curb cuts in the corridor is the segment from 55th Street to Westview Drive, with 38 driveways intersecting Arapahoe Avenue.

Figure 3-9 Driveway and Business Access, Total and Per-Mile



Source: City of Boulder Inventory

Figure 3-16 Existing Traffic Volumes and Level of Service, 2015



FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

EAST ARAPAHOE AVENUE TRANSPORTATION PLAN

2015 EXISTING TRAFFIC VOLUME

PEDESTRIANS AND BICYLISTS

This section describes existing conditions for people walking and traveling by bicycle in the study area. Walking is a part of every trip, including parking and walking to the front door of a business or walking from home to a bus stop and from a bus stop to a final destination. Bicycling can be an efficient and healthy way to complete a variety of short- to medium-length trips. Both walking and biking are common travel modes in the City of Boulder. According to the 2012 Boulder Travel Diary, over 20% of all trips are made by foot and almost 19% of all trips are made by bike.[5]

Pedestrian and bicycle facilities along the East Arapahoe corridor are part of a citywide network of on-street and off-street facilities. Figure 3-11 illustrates the existing network of pedestrian and bicycle facilities in the study area. Figure 3-12 illustrates existing *and proposed* facilities. Pedestrian and bicycle facilities and travel are summarized below.

Key Highlights

- There are key gaps in the sidewalk network along Arapahoe Avenue: north-side at Old Tale Road and south-side at 33rd Street, between 55th Street and Cherryvale Road, and east of Westview Drive.
- There are neither bike lanes nor a multi-use path on the south side of Arapahoe Avenue between 30th Street and the Boulder Creek Greenway, between MacArthur Drive and 48th Street, and between Eisenhower Drive and 55th Street.
- There are on-street bike lanes east of 55th Street, but the multi-use path has a north-side gap at Old Tale Road and south-side gaps between 55th Street and Cherryvale Road, as well as east of Westview Drive.
- There are long distances between opportunities to cross Arapahoe Avenue at crosswalks or undercrossing in some segments, and there are no marked crossings between signalized intersections.

Summary of Pedestrian Facilities and Travel

Pedestrian facilities along the corridor include sidewalks and multi-use paths. Multi-use paths are shared facilities with sufficient width to accommodate people both walking and bicycling. Figure 3-11 illustrates the existing pedestrian facilities along the East Arapahoe corridor (either sidewalk or multi-use path). These paths are part of a city-wide bicycle and pedestrian network.

Sidewalk at 63rd Street.

As described for each segment of the study area in the Existing Modal Facilities section above, there are sections of Arapahoe Avenue that lack continuous pedestrian facilities of any type (sidewalks or multi-use paths). These gaps include:

- On the north side near Old Tale Road, west of the South Boulder Creek Greenway
- On the south side east and west of 33rd Street, between 55th Street and Cherryvale Road, and east of Westview Drive

[5] National Research Center, Modal Shift in the Boulder Valley, 1990-2012

Figure 3-12 illustrates proposed pedestrian facilities that would help fill the above gaps in pedestrian connectivity along the corridor.

Pedestrian Crossing Locations

There are sections of Arapahoe Avenue where there is a significant distance between marked crosswalks, which are only at signalized intersections. Figure 3-11 illustrates marked crosswalk locations at signalized intersections, and pedestrian undercrossings that are provided at key trail intersections including the Boulder Creek Path (east of 38th Street), east of Foothills Parkway, and the South Boulder Creek Greenway (at Old Tale Road).

Pedestrian Activity along Arapahoe

Figure 3-14 (Folsom Street to Foothills Parkway) and Figure 3-15 (48th Street to 65th Street) illustrate pedestrian counts at intersections along the corridor in the morning and afternoon peak hours.[6] These diagrams indicate that:

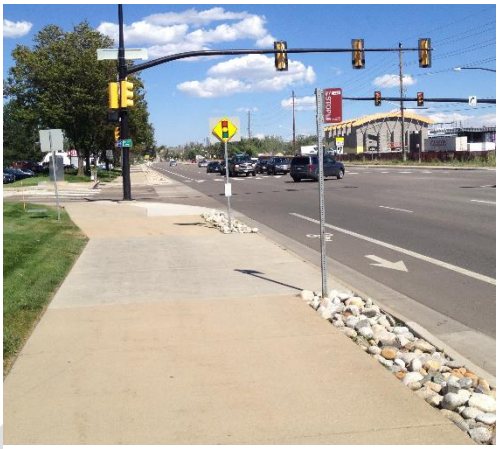
- The highest level of pedestrian activity was observed at the intersection of Folsom Street and Arapahoe Avenue, next to the CU West Campus.
- At 33rd and 38th Streets pedestrian volumes were highest on the north side of the street. This could be due to the gap in sidewalk connectivity on the south side at 33rd Street.
- At Foothills Parkway no pedestrians were counted crossing the intersection's north leg and most pedestrian crossings were on the south leg. This could be attributed to the pedestrian undercrossing of Arapahoe Avenue on the east side of Foothills Parkway. The Boulder Creek Greenway also runs north of Arapahoe Avenue and crosses under Foothills Parkway.
- There were few pedestrians observed crossing Arapahoe Avenue or side streets east of Cherryvale Road.

Summary of Bicycle Facilities and Travel

Bicycle facilities along the corridor include bicycle lanes and multi-use paths that are part of a city-wide bicycle and pedestrian network. These facilities include:

[6] Pedestrian counts were collected by the City of Boulder as a part of peak hour counts at all signalized intersections in the City of Boulder. Data is collected approximately every three years on a rotational basis and includes three peak periods (AM, Noon and PM peaks). The data for this study area was collected between April 2013 and October 2014.

- **On-street bicycle lanes** between 55th Street and 63rd Street and wide shoulders east of 63rd Street. Lanes are approximately 5 to 6.5 feet wide with no buffer separating the facilities from vehicle travel lanes.
- **Off-street, detached multi-use paths** along one or both sides of Arapahoe Avenue that are typically 10 to 12 feet wide, sufficiently wide to accommodate people walking and bicycling. In some cases, there is a buffer between the path and adjacent travel lanes.



North-side (westbound) multi-use path and bike lanes at Cherryvale Road. The south-side lacks a continuous multi-use path between Cherryvale Road and 55th Street and there is a north-side gap west of the South Boulder Creek Greenway.

As shown in Figure 3-11, the multi-use paths are not continuous. Figure 3-12 illustrates proposed new or upgraded multi-use path segments (dashed green lines or dashed black lines, respectively) in the Boulder Transportation Master Plan. The north-side multi-use path is nearly continuous, except the gap west of the South Boulder Creek Greenway (near Old Tale Road). The south-side multi-use path has several gaps, including where a sidewalk is present but is not wide enough to accommodate both people walking and biking. In particular, this includes between 30th Street and the Boulder Creek Path; there is no bike lane in this segment. There is also no south-side path or bike lane between MacArthur Drive and 48th Street or between Eisenhower Drive and 55th Street. There are on-street bike lanes east of 55th Street, but the multi-use path has a north-side gap at Old Tale Road and south-side gaps between 55th Street and Cherryvale Road, as well as east of Westview Drive. These gaps are also described for each segment of the study area in the Existing Modal Facilities section above.

In addition, at intersections bicyclists using the multi-use path experience conflicts with auto traffic; there are no specialized intersection treatments. There are also frequent driveways which present additional conflict points.

Bicyclist Volumes along Arapahoe Avenue

Figure 3-16 and Figure 3-17 illustrate morning and afternoon peak-hour bicycle counts at intersections along the corridor. The volume of bicycle traffic is highest at 30th Street, both along and across Arapahoe Avenue. There is also moderate bicyclist activity at Folsom Street, 38th Street, 48th Street (north-side only), and Cherryvale Road (north-side only).

Bicyclist Volumes Citywide

According to the 2009-2013 3-Year American Community Survey, 10.6 percent of Boulder residents make work trips by bicycle, a rate 19 times the national average.

Connecting Bicycle Facilities and Bicyclist Volumes

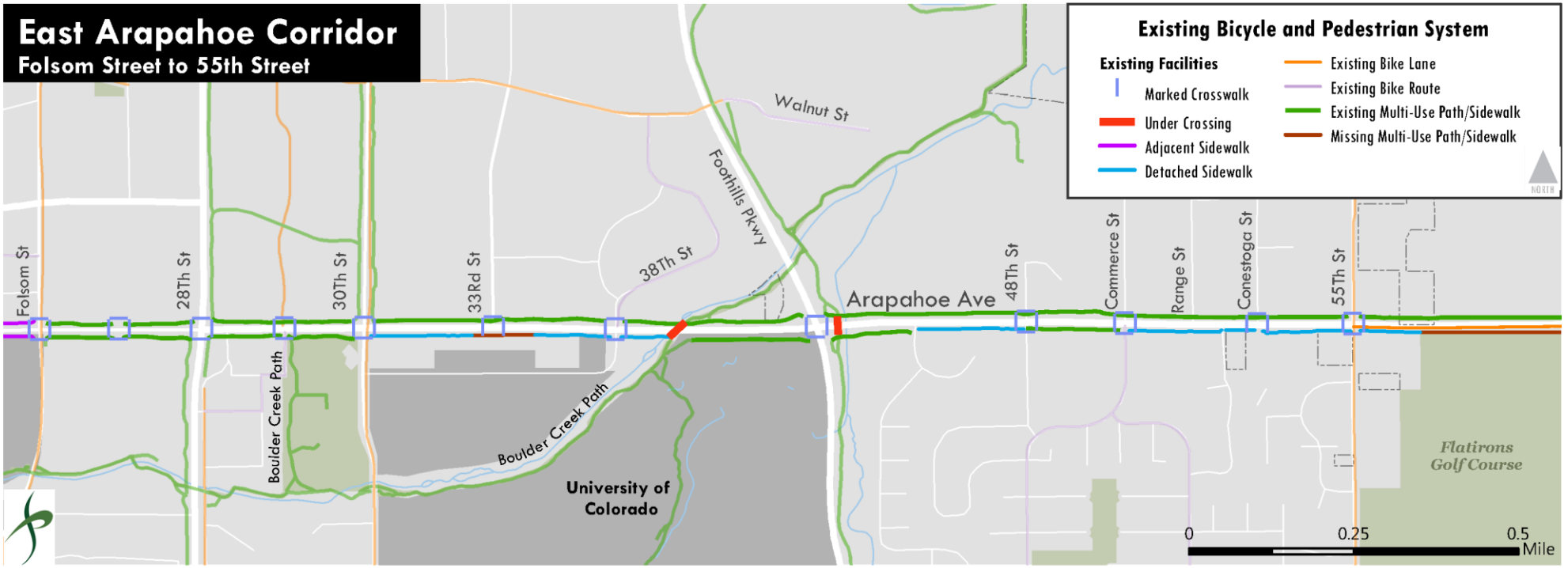
Bicyclists can connect the on- and off-street bicycle facilities along Arapahoe Avenue with the overall bicycle network to complete a variety of trips in Boulder.[7] Key facilities parallel or connecting to the East Arapahoe corridor include:

[7] Bicycle counts were collected by the City of Boulder as a part of peak hour counts at all signalized intersections in the City of Boulder. Data is collected approximately every three years on a rotational basis and includes three peak periods (AM, Noon and PM peaks). The data for this study area was collected between April 2013 and October 2014. The City of Boulder also conducts bicycle counts on various key multi-use paths, including on the Boulder Creek Path in 2013.

- **Boulder Creek Greenway:** Generally east-west off-street facility running roughly parallel to Arapahoe Avenue between Folsom Street and 48th Court. It is joined by the Skunk Creek Path just before it crosses under Arapahoe Avenue east of 38th Street. In 2013, average daily counts of bicyclists conducted by the City of Boulder on the Boulder Creek Path (at the Skunk Creek Path intersection) ranged from 1,200 to 1,400 per day.
- **Folsom Street**: bicycle lanes north and south of Arapahoe Avenue
- **28th Street**: multi-use path
- **29th Street**: bicycle lanes north of Arapahoe Avenue and multi-use path south of Arapahoe Avenue
- **30th Street**: bicycle lanes north and south of Arapahoe Avenue, and multi-use path north of Arapahoe Avenue. There is
- **Foothills Parkway:** multi-use path on east side
- **55th Street**: bicycle lanes
- **South Boulder Creek Greenway:** intersects Arapahoe Avenue from the north at Old Tale Road.
- **63rd Street**: bicycle lanes

Bicycle Sharing

Boulder B-Cycle operates the bicycle sharing system in the City of Boulder. Customers can rent and return a bike at any B-Cycle station. Figure 3-13 illustrates station locations along Arapahoe Avenue and near the corridor, including between Folsom-28th Streets, at 38th Street, and at 48th Street.


East Arapahoe Corridor
Folsom Street to 55th Street
Existing Bicycle and Pedestrian System
Existing Facilities
Marked Crosswalk
Under Crossing
Adjacent Sidewalk
Detached Sidewalk
Existing Bike Lane
Existing Bike Route
Existing Multi-Use Path/Sidewalk
Missing Multi-Use Path/Sidewalk
NORTH
Walnut St
Foothills Pkwy
Folsom St
28Th St
30Th St
33Rd St
38Th St
Arapahoe Ave
48Th St
Commerce St
Range St
Conestoga St
55Th St
Boulder Creek Path
Boulder Creek Path
University of Colorado
Flatirons Golf Course
0
0.25
0.5
Mile


East Arapahoe Corridor
Cherryvale Road to 75th Street
Hillcrest Lake
63Rd St
Arapahoe Ave
Valtec Ln
75Th St
Old Tale Rd
Cherryvale Rd
Westview Dr
Flatirons Golf Course
Sombrero Marsh
0
0.25
0.5
Mile

Figure 3-12 Existing and Proposed Pedestrian and Bicycle Facilities

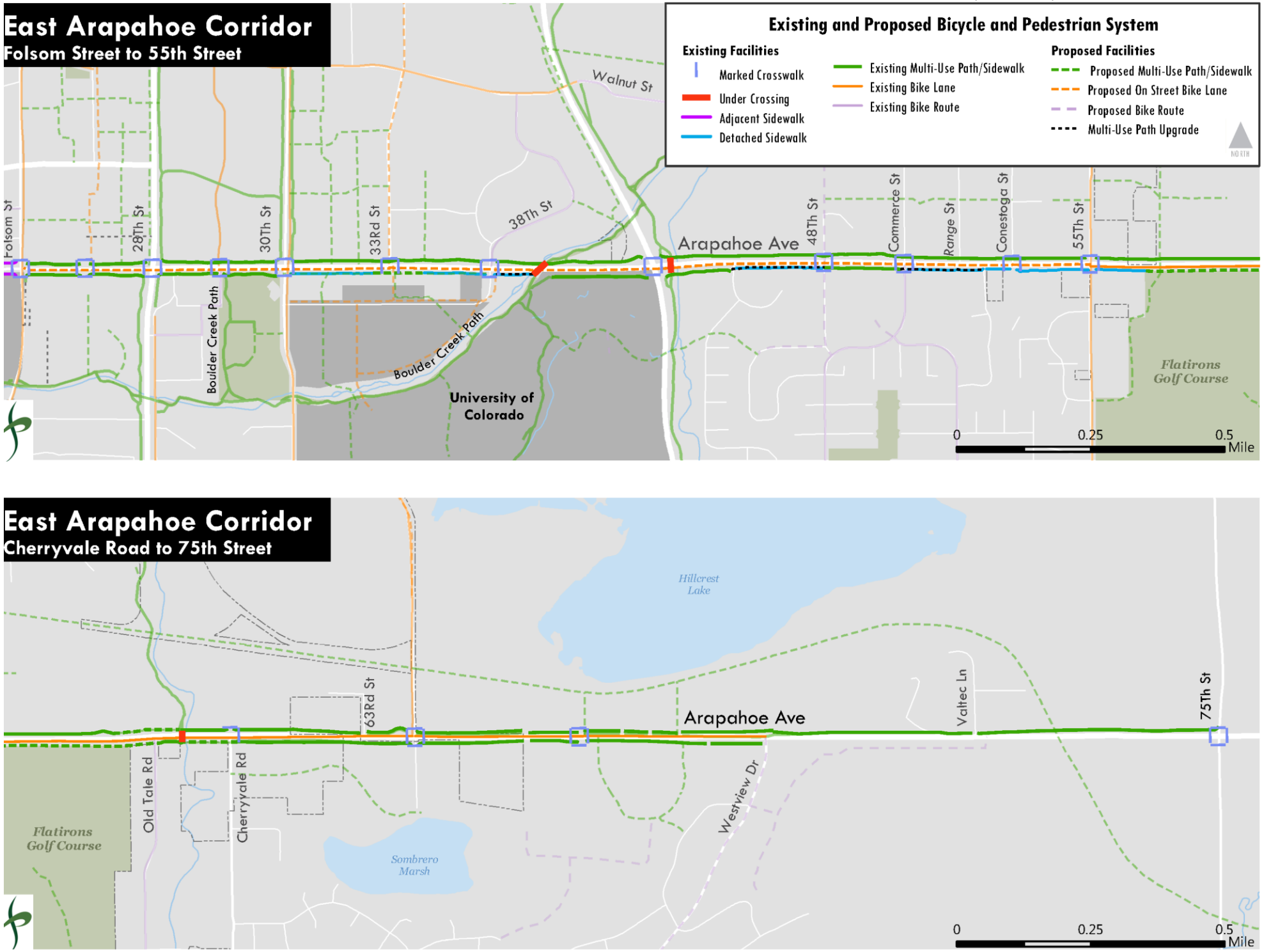


Figure 3-13 B-Cycle Stations

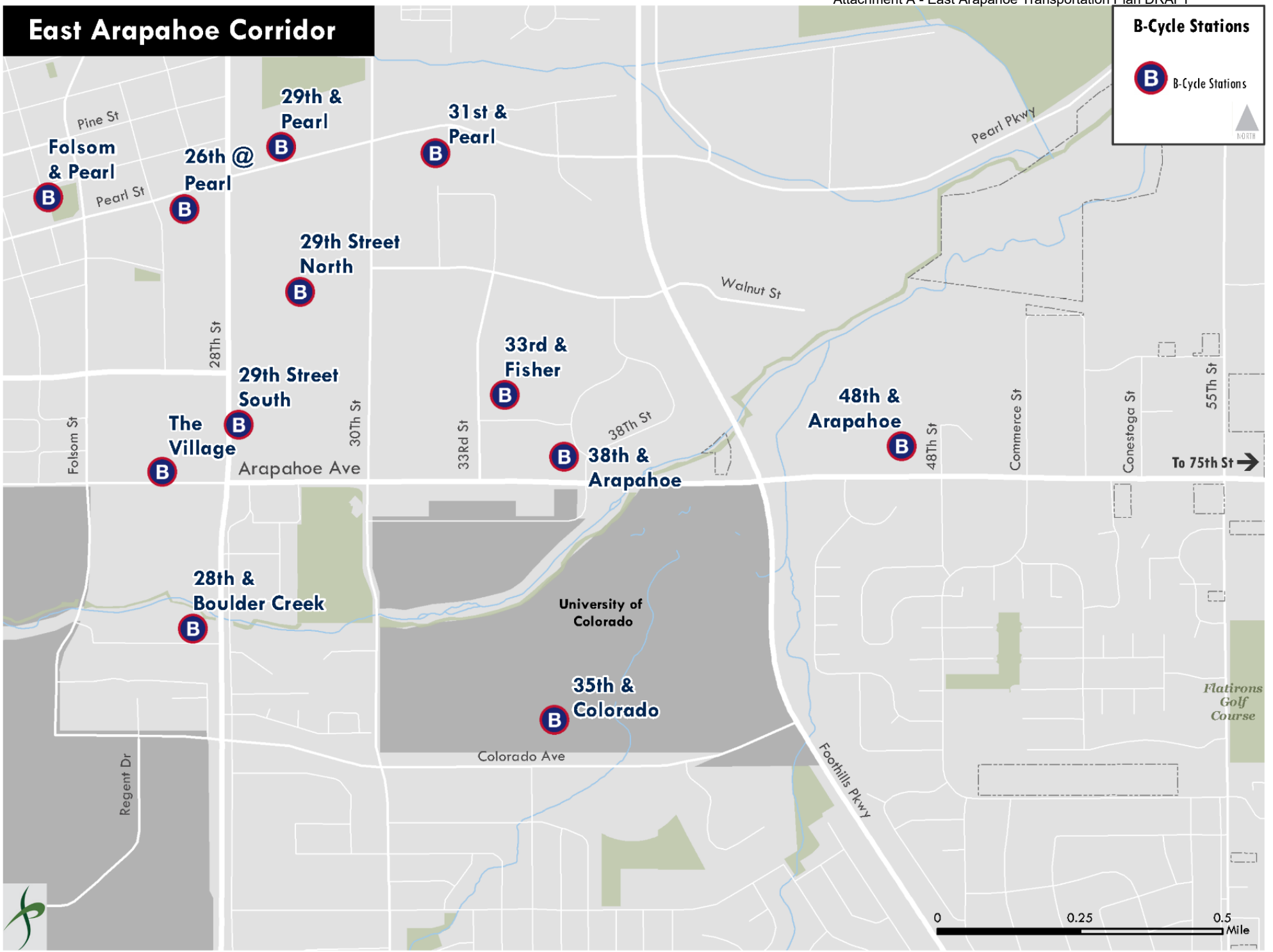
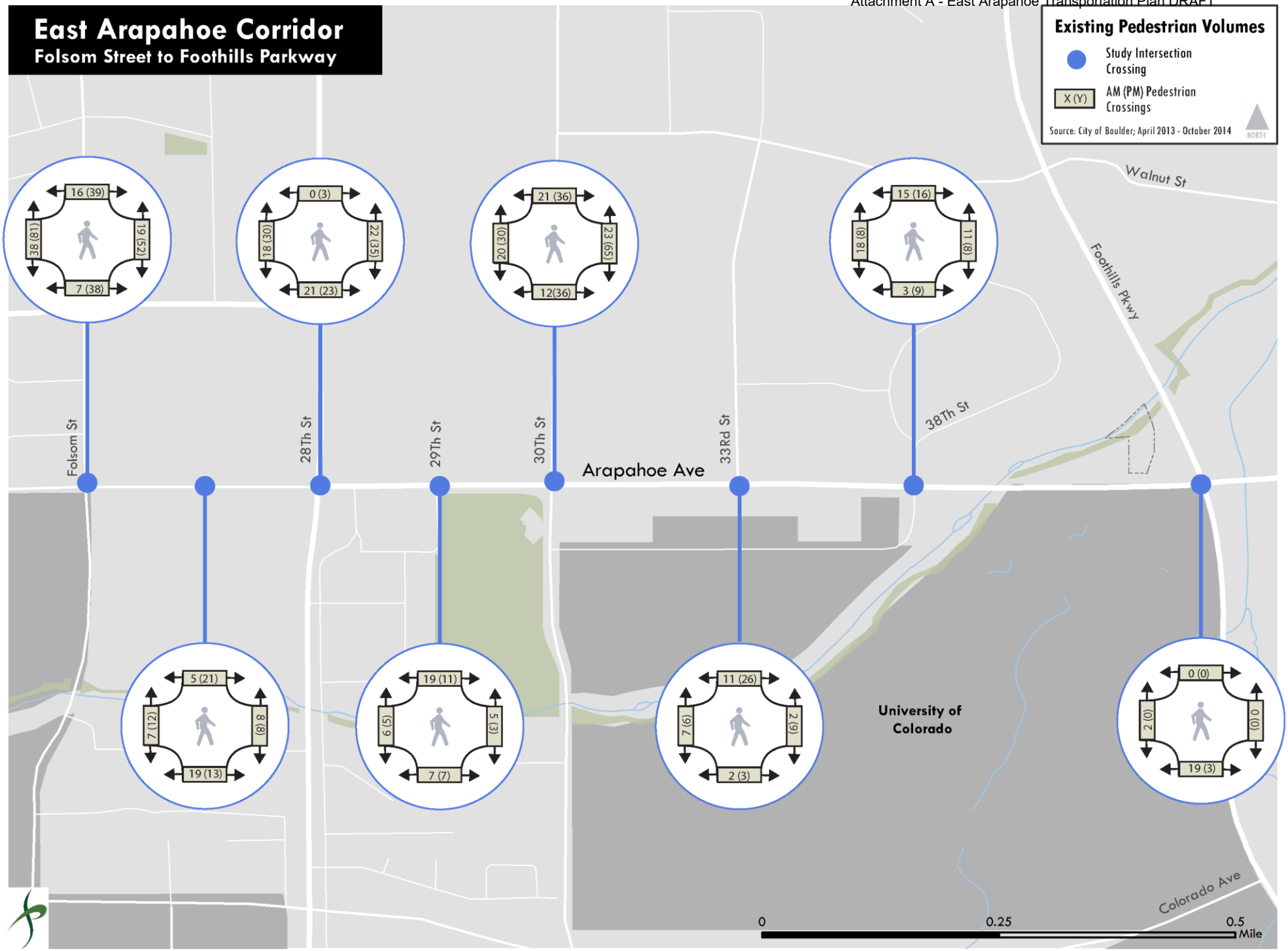
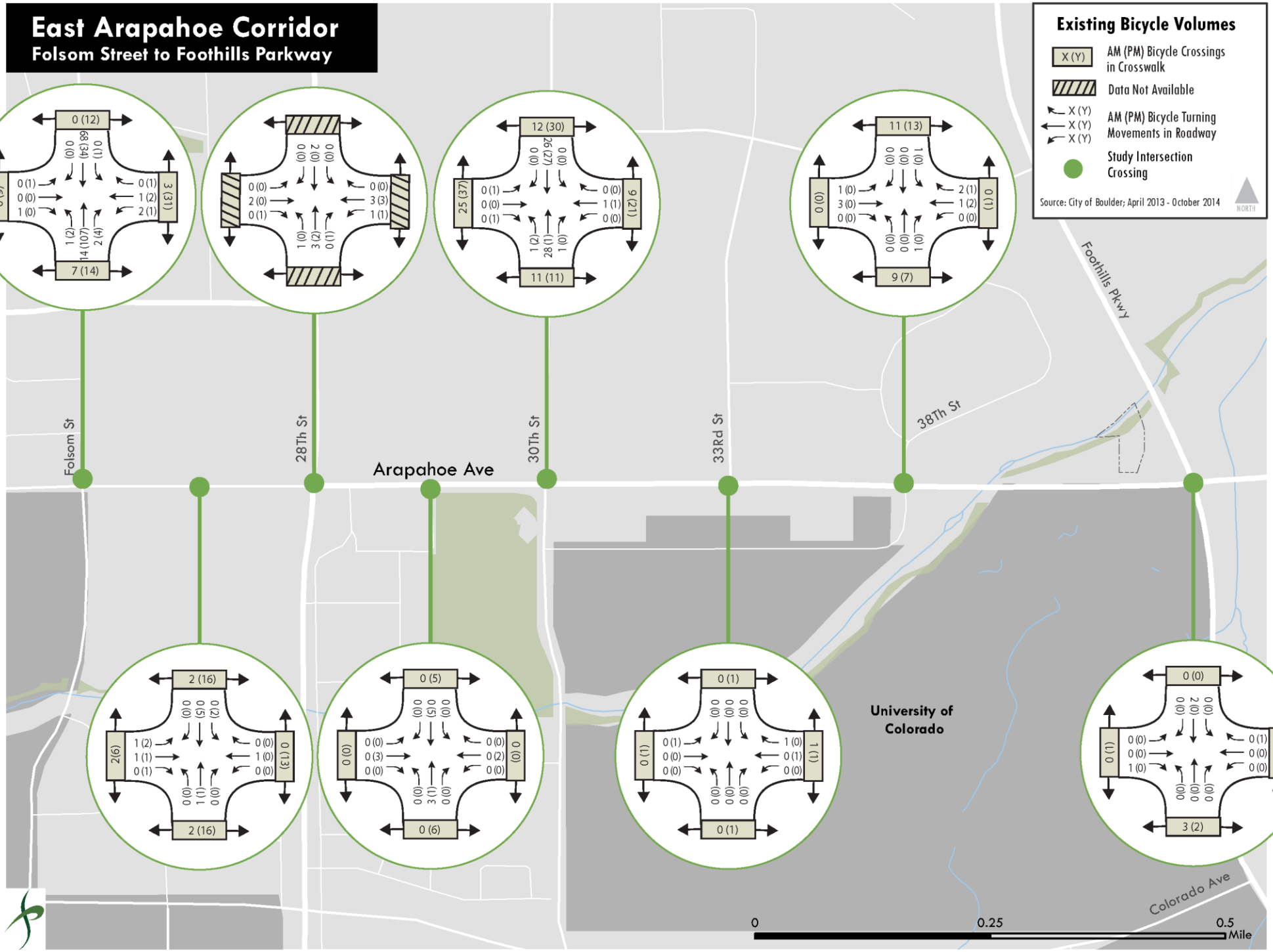


Figure 3-14 Pedestrian Intersection Movements, Folsom Street to Foothills Parkway



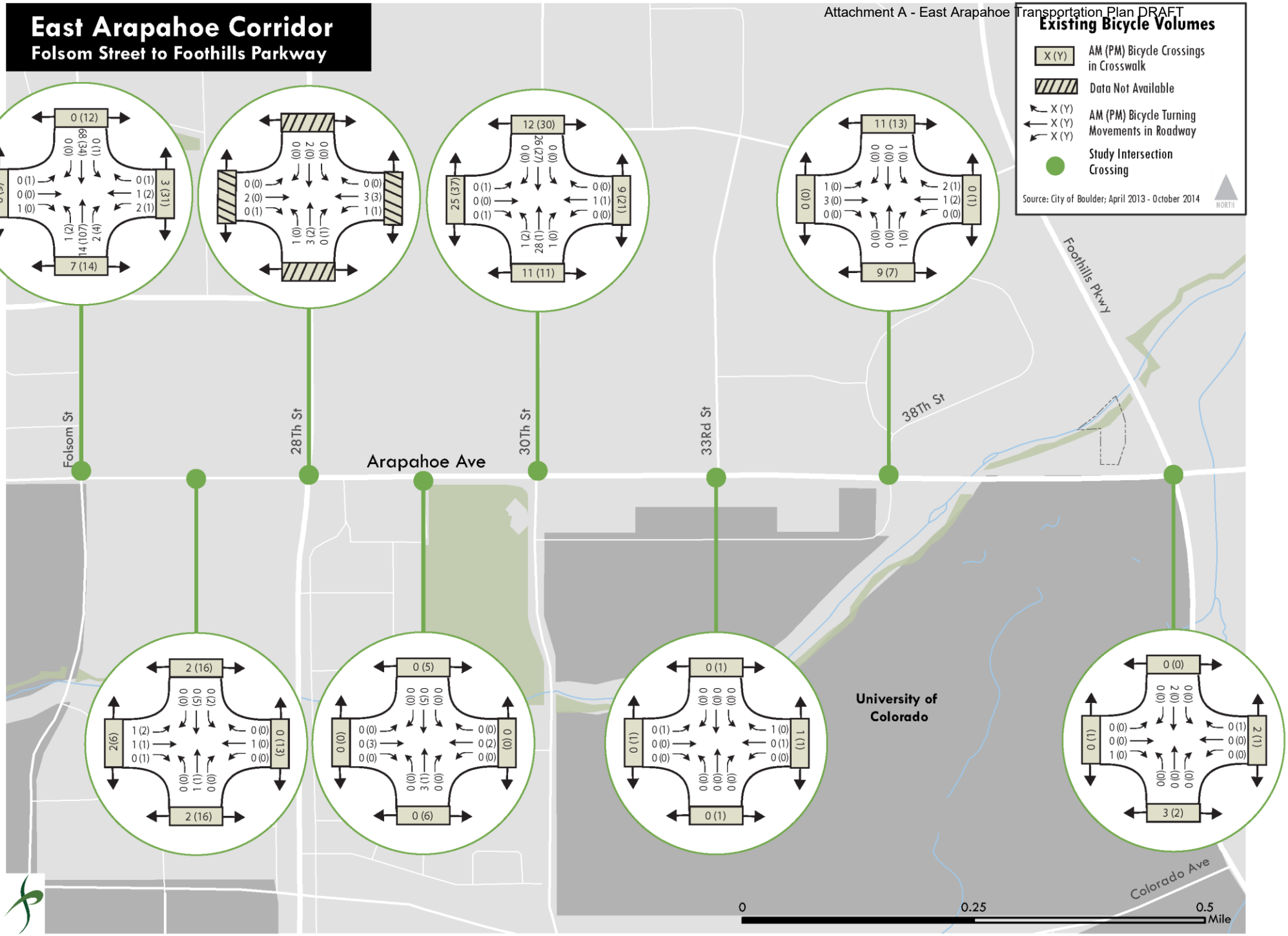
Source: City of Boulder. Data from http://gisweb.ci.boulder.co.us/agswebsites/pds/pds_traffic/

Figure 3-16 Bike Intersection Movements, Folsom Street to Foothills Parkway



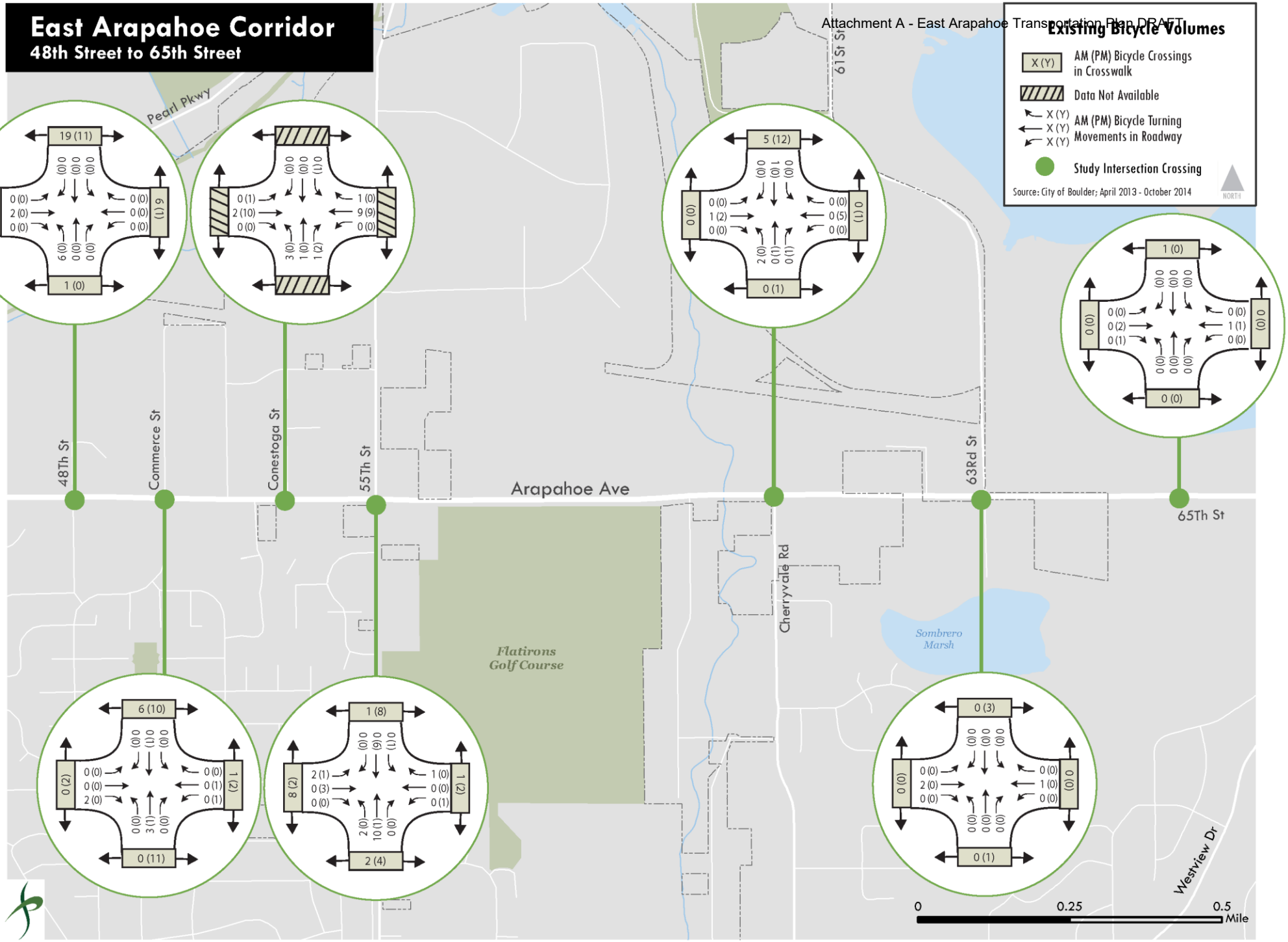
Source: City of Boulder. Data from http://gisweb.ci.boulder.co.us/agswebsites/pds/pds_traffic/

Figure 3-16 Bike Intersection Movements, Folsom Street to Foothills Parkway



Source: City of Boulder. Data from http://gisweb.ci.boulder.co.us/agswebsites/pds/pds_traffic/

Figure 3-17 Bike Intersection Movements, 48th Street to 65th Street



Source: City of Boulder. Data from http://gisweb.ci.boulder.co.us/agswebsites/pds/pds_traffic/

TRANSIT

This section describes existing transit services and facilities in the study area. Transit is an important travel option for short local trips as well as longer-distance local and regional trips. According to the 2012 Boulder Travel Diary, approximately 5% of all trips and 10% of work trips in Boulder are made by public transit.[8]

Key Highlights

- The JUMP Community Transit Network bus route operated by RTD provides frequent service along Arapahoe Avenue (up to every 10 minutes on weekdays when CU is in session) over a long span of service (19 hours on weekdays). It carries 2,400 riders per weekday.
- Transit travel time between Folsom Street and 65th Street ranges from 11 to 16 minutes eastbound and is 15 minutes westbound during the morning and afternoon peak hours, respectively. Service generally runs close to schedules, but is least reliable in the westbound direction in the afternoon peak period.
- Over three-quarters of stops for the JUMP in Boulder have a concrete bus pad, although in some cases the pad is not fully accessible to users with wheelchairs or other mobility devices. Less than half of stops include a bench or other seating, and 26% contain a shelter.

Transit Overview

The JUMP bus route serves the entire East Arapahoe corridor, though other transit lines provide service on portions of the corridor. These services are shown in Figure 3-18.

Route Characteristics

The Regional Transportation District (RTD) operates most transit services within Boulder. RTD serves the entire Denver region, operating transit service from Boulder to Denver International Airport (DIA) including bus, light rail, and bus rapid transit (BRT). Among these services, Boulder's Community Transit Network (CTN) is a set of branded bus routes that specifically operate within Boulder, offering high-frequency service and connecting residents to major destinations and regional routes. The CTN is comprised of six high-frequency bus routes: BOUND, DASH, HOP, JUMP, SKIP and Stampede. The Flatiron Flyer (FF), which opened in January 2016, is a BRT service that operates between Boulder and Denver.

Route Descriptions

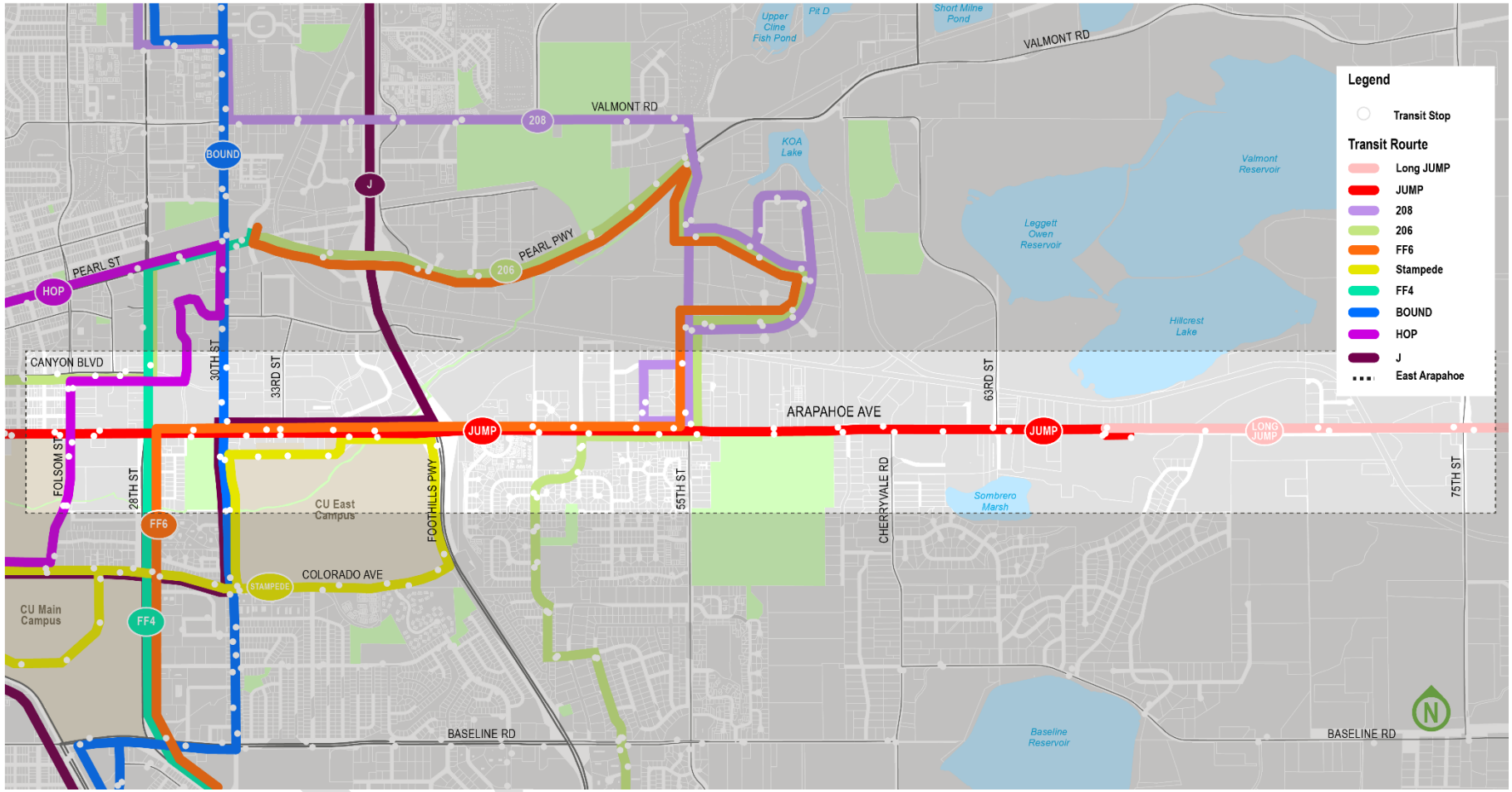
Figure 3-18 illustrates the bus routes that operate along or within the East Arapahoe Transportation Plan Study area. The JUMP route operates for the entire length of the East Arapahoe corridor, traveling between the Downtown Boulder Station and the city's eastern limits. The JUMP is also a vital regional route connecting Boulder to Lafayette and Erie. JUMP trips that travel outside of Boulder (east of 65th Street) are known as the Long JUMP. Other bus routes that operate in the corridor include:

- **Routes FF4 and FF6**: Provides regional connections between Boulder Junction at Depot Square Station and Denver Union Station. Route FF4 operates along the East Arapahoe corridor between 28th Street and 55th Street and serves the Flatiron Business Park along 55th Street. Route FF6 crosses Arapahoe Avenue at 28th Street.

[8] National Research Center, Modal Shift in the Boulder Valley, 1990-2012

- **Route J:** Offers regional connections between the University of Colorado at Boulder (CU), Niwot, and Longmont.
- **The HOP:** Operates a loop circulating between Pearl Street and the University of Colorado campus via the Twenty-Ninth Street Retail Center.
- **The Stampede:** Operates on a section of Arapahoe Avenue, and Marine Drive just south of Arapahoe Avenue, between Foothills Parkway and 30th Street, and provides circulation between the CU East Campus and CU Main Campus.
- **The BOUND:** Offers north-south connections between Diagonal Plaza, the Twenty Ninth Street Retail Center, CU East Campus and CU Main Campus, and Base-Mar Shopping Center via Baseline Road and 30th Street, crossing Arapahoe Avenue at 30th Street.
- **Route 206:** Connects several South Boulder neighborhoods to the Flatiron Business Park along 55th Street, Pearl Parkway, and Boulder Junction at Depot Square Station, where multiple transit connections are available.
- **Route 208:** Offers a connection between Downtown Boulder and the Flatiron Business Park via Broadway, Iris, and Walnut. The route accesses Arapahoe Avenue for one block, at its 55th Street terminus.

Figure 3-18 Existing Routes and Stops



Frequency

Boulder's Community Transit Network features service levels of 10 minutes or less during peak periods. Service that operates every 15 minutes or better is generally considered to be sufficiently frequent that most riders do not need to consult a schedule to plan their trips and simply show up at the bus stop.

Figure 3-19 shows existing weekday frequencies for all bus routes in the study area. The "short" JUMP operates in the midday when the "long" JUMP does not operate to Erie, and maintains frequent JUMP service in Boulder. The CTN frequencies are heavily dependent on CU's academic schedule. Overall service levels decrease when CU and BVSD are not in session during the summer months of May through August.

Figure 3-19 CTN and Other RTD Route Frequencies

Route	Frequencies (minutes) (CU Fall and Spring Semesters)			CU Summer Session Frequencies
	Peak	Midday	Weekend	
JUMP (in Boulder) [1]	10	10	30	15 min. peak and midday from May-Aug
Short Jump	None	30	None	
Long Jump to Lafayette	30	30	60	
Long Jump to Erie	30	None	60	
HOP	7-10	7-10	7-10	
Stampede	7-10	7-10	None	10 min. from May-Aug
BOUND	10	10	30	15 min. peak and midday from May-Aug
206	30	30	None	No Change
208	30	30	60	
FF4	10-15	None	None	No Change
FF6	3 trips	None	None	No Change
J	60	None	None	No Change

Notes: [1] Boulder Transit Station to 63rd and either BVSD stop (turnaround for "short" JUMP) or Arapahoe & 65th stop ("long" JUMP). [2] Short JUMP operates as far east as the BVSD –VoTech Center stop (near 65th)

Service Span (Operating Hours)

Figure 3-20 shows the service span for routes within the study area. Most of the services in the study area start around 6:00 am and end between 5:30 pm and midnight. Most regional routes that operate in the study area end service at 5:30 pm, while local routes operate later at night and enable use of transit for jobs with later evening shifts (including many service sector jobs) and non-work trips including for shopping, social, and entertainment purposes.

Figure 3-20 CTN and Other RTD Route Span

Route	Weekday Service Span (CU Fall and Spring Semester)	CU Summer Session Service Span
JUMP	4:54 AM - 11:43 PM	No Change
Short Jump	8:52 AM – 3:17 PM	No Change
Long Jump to Lafayette	4:58 AM – 11:43 PM	No Change
Long Jump to Erie	6:22 AM – 8:57 AM & 2:52 PM – 10:12 PM	No Change
HOP	7:00 AM – 10:00 PM	
Stampede	7:17 AM - 7:02 PM	No Change
BOUND	5:30 AM - 12:05 AM	No Change
206	6:24 AM - 7:50 PM	No Change
208	6:13 AM – 7:15 PM	
FF4	5:47 AM - 8:30 AM & 3:33 PM - 6:38PM	No Change
FF6	6:07 AM - 7:37 AM & 4:30 PM - 5:30 PM	No Change
J	5:40 AM - 8:40 AM & 3:10 PM - 5:30 PM	No Change

Fares

Figure 3-21 summarizes RTD fares for local and regional bus services. The JUMP requires a local fare, while the Flatiron Flyer accepts a local fare for trips between Boulder and McCaslin Park & Ride but requires a regional fare for trips further east. An EcoPass is an employer-sponsored pass that provides employees with unlimited, free transit trips. Seventy-nine businesses in the study area (within a half-mile of Arapahoe Avenue between Folsom and 75th Streets) participate in the Eco Pass program, providing transit passes for 8,762 employees. The top five of these employers that offer EcoPasses are the Boulder Valley School District, Boulder Community Health, Google, Rally Software Development, and Zayo Group, comprising 6,576 employees. CU provides faculty and staff with an EcoPass and also makes a student pass available. There are approximately 7,900 faculty and 30,000 students that use the EcoPass. Eco Pass programs are also available at the neighborhood level. Within the study area, the Peloton, Wellman Creek, Park East, and Rock Park participate in the EcoPass program, encompassing approximately 425 housing units.

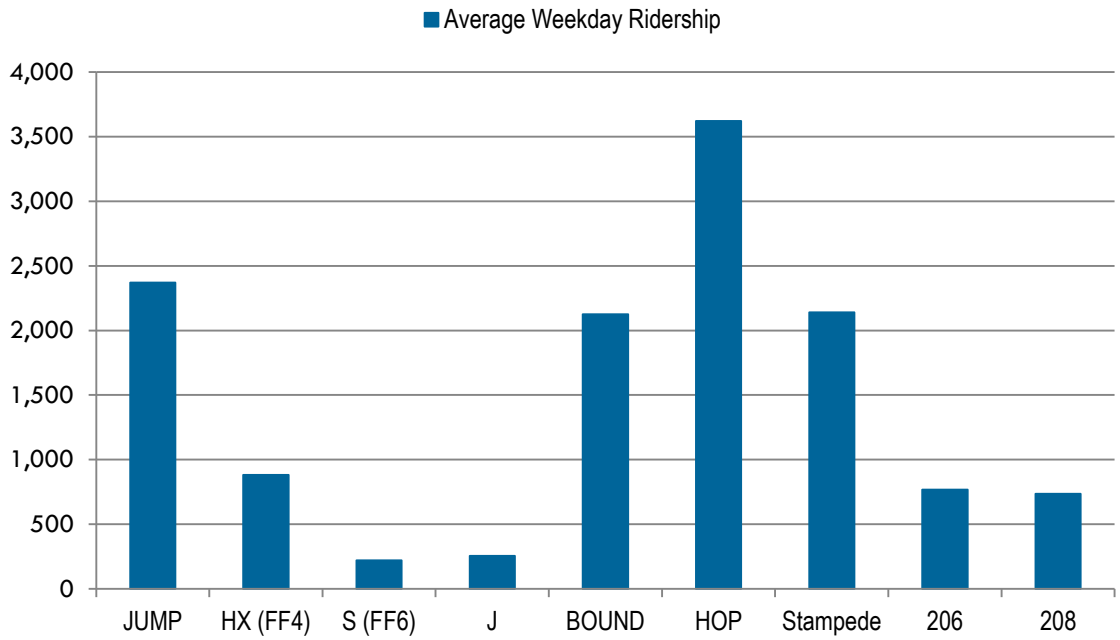
Figure 3-21 RTD Fares (January 2016)

	Local	Regional
One-Way Cash	$2.60	$4.50
Senior Medicare, Student Discount Cash	$1.30	$2.25
Eco Pass	FREE	FREE

System Ridership

Figure 3-22 displays average weekday ridership for all of the bus routes in the study area during January 2015. The JUMP is the only east-west route that provides mobility to most of the eastern area of Arapahoe Avenue and beyond, to Lafayette and Erie. Daily ridership on the BOUND and Stampede CTN routes is comparable to the JUMP.

Figure 3-22 Average Weekday Ridership Chart (East Arapahoe Study Area) (January 2015 RTD data)



Source: Regional Transportation District, January 2015

JUMP Ridership and Performance

JUMP Ridership Patterns

Figure 3-23 identifies the ten highest-ridership stops on the JUMP, which include the Downtown Boulder Station and stops at 30th Street in both directions. Of these stops, only the Lafayette Park & Ride on the east end of the route (fifth highest number of boardings) is located outside of Boulder.

Figure 3-26 illustrates JUMP ridership. Westbound boardings on the JUMP are concentrated at the eastern end of the route, in Lafayette and Erie. Most passengers remain on the bus until Foothills Parkway. West of this point, the number of passengers alighting becomes greater than the number of passengers who board. For eastbound trips, most passengers board at the very start of the route between the Downtown Boulder Station and 28th Street. The on-board load begins to drop after Foothills Parkway when most of the ridership activity becomes alightings.

Figure 3-23 Busiest JUMP Stops (January 2015))

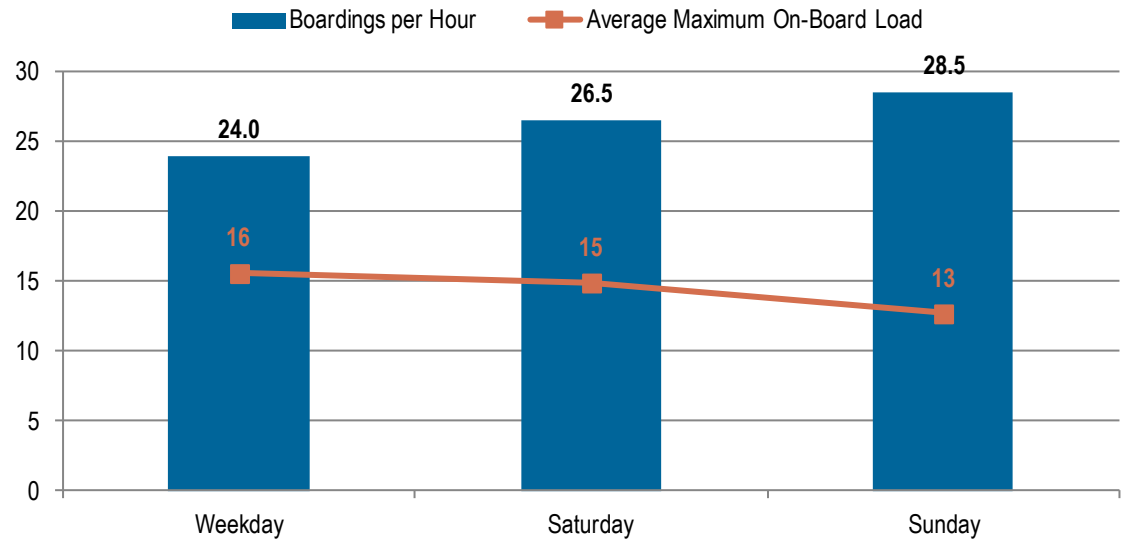
Rank	Stop ID	Stop Name	Direction	Boardings	Alightings	Total Ridership
1	33236	14th/Walnut Gate A	Eastbound	503	0	503
2	12214	Arapahoe Ave/30th St	Eastbound	127	113	240
3	12215	Arapahoe Ave/30th St	Westbound	113	121	235
4	12200	Arapahoe Ave/Broadway	Westbound	3	214	217
5	25903	Lafayette PnR Gate B	Westbound	134	1	134
6	12222	Arapahoe Ave/55th St	Westbound	94	33	127
7	12201	Arapahoe Ave/16th St	Eastbound	121	4	124
8	19386	Arapahoe Ave/Folsom St	Eastbound	76	43	119
9	12208	Arapahoe Ave/28th St	Westbound	41	65	106
10	12221	Arapahoe Ave/55th St	Eastbound	19	78	98

Source: Regional Transportation District, January 2015

Overall JUMP Productivity

Productivity measures how effectively transit performs, in terms of the number of passengers (boardings) carried per vehicle revenue hour.[9] In January 2016, RTD reported average daily boardings of 2,362 on weekdays, 972 on Saturdays, and 691 on Sundays on the JUMP. Productivity ranged from 24.0 boardings per revenue hour on weekdays, to 28.5 boardings per hour on Sundays (productivity is higher on Sundays since less service is provided). The average maximum on-board load for JUMP vehicles was greatest on weekdays—16 passengers. Figure 3-24 shows the productivity and on-board load for each of the service days in January 2016.

Figure 3-24 JUMP Productivity and On-Board Load, January 2016

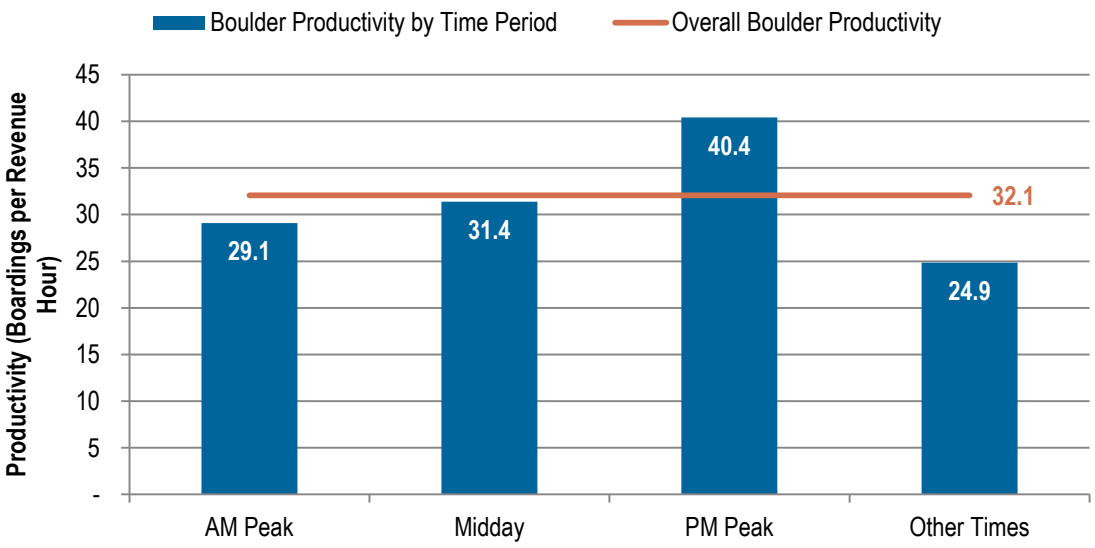


[9] Number of passenger boardings divided by the total number of hours of service provided.

JUMP Productivity in Boulder

However, if JUMP weekday ridership and service hours are broken down by segment, the portion within Boulder (from the Downtown Boulder Station to the Vocational Technical Education Center) has a higher weekday productivity of 32.1 boardings per revenue hour than the route overall. When broken down further by time period, the afternoon peak period is the route's most productive period, carrying 40.4 passengers per revenue hour.[10]

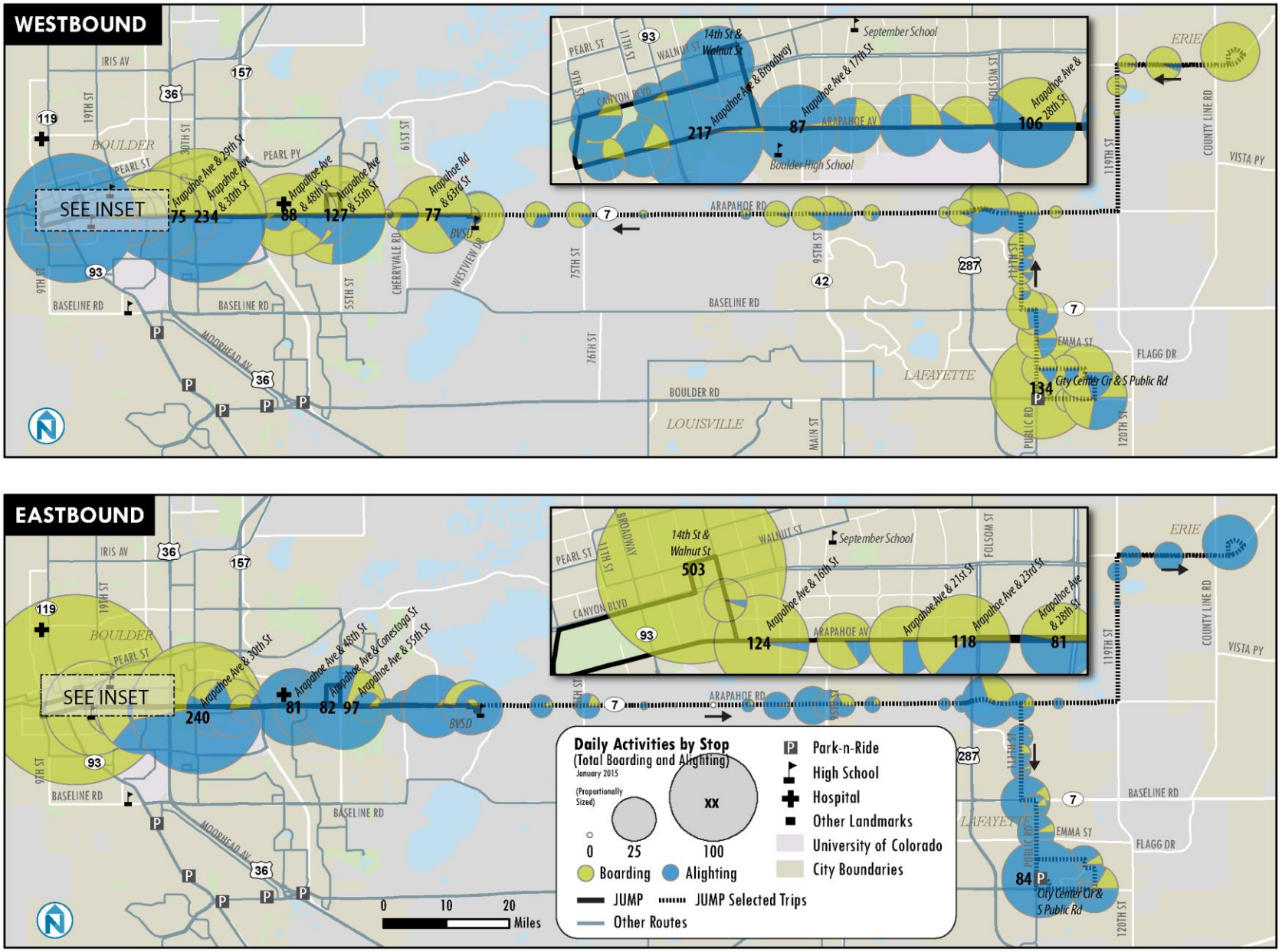
Figure 3-25 Weekday JUMP Productivity within Boulder, January 2016



Source: Based on Data from Regional Transportation District, January 2016

[10] This data is based on ridership by stop from January 2015 and scheduled revenue hours from January 2016. Time periods analyzed are the AM Peak, Midday, PM Peak and Other Times (which includes AM Early, PM Evening, PM Late and Other).

Figure 3-26 Average Daily Boardings, JUMP, January 2015

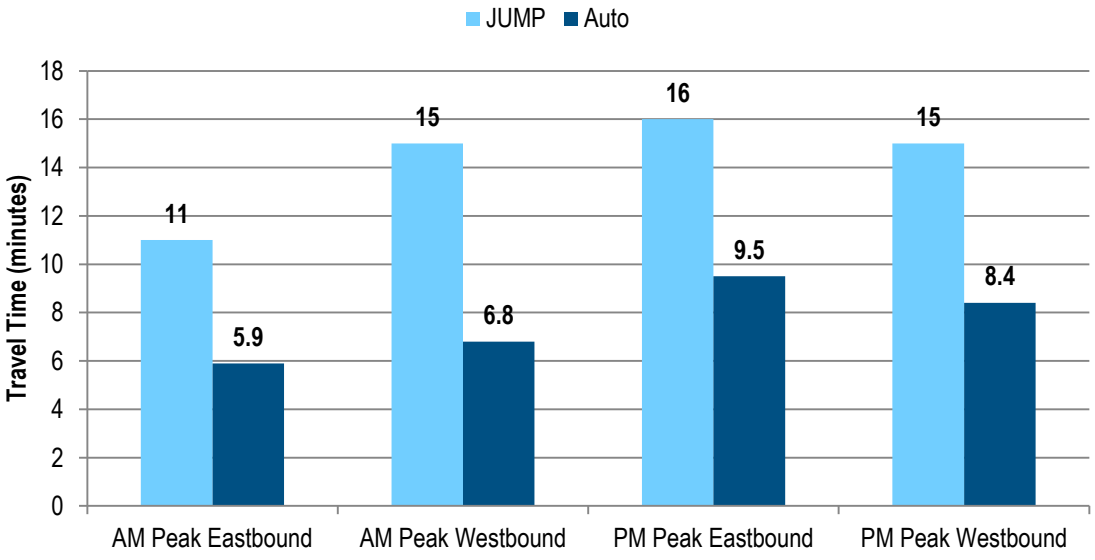


Transit Travel Times and On-Time Performance

Folsom Street - 65th Street: Comparison of Transit and Auto Travel Times

Existing transit travel times along the East Arapahoe corridor between Folsom Street and 65th Street range between 11 and 16 minutes during peak hours. Eastbound travel is quickest during the morning peak (approximately 11 minutes) when buses travel in the reverse commute direction. However, during the afternoon peak, eastbound travel times increase by five minutes. For westbound trips, travel times remain at approximately 15 minutes during the morning and afternoon peak periods. Figure 3-27 compare transit travel times based on the JUMP schedule (including stops) and with travel time estimates for autos.

Figure 3-27 Existing JUMP and Auto Travel Times (Folsom to 65th Street)



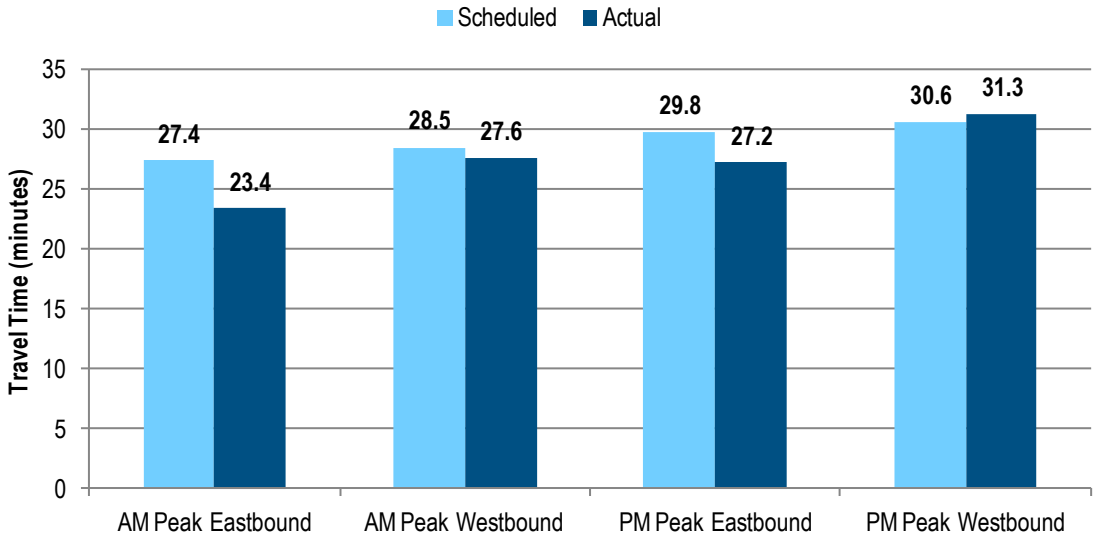
Source: Existing JUMP Schedule; Auto travel times from City of Boulder

Downtown Boulder Station – 95th Street: Comparison of Scheduled and Actual Transit Travel Times

Comparing scheduled and actual JUMP travel times for a broader segment of the JUMP route, the average daily scheduled transit travel time between the Downtown Boulder Station and 95th Street is approximately 26 minutes for eastbound trips, and 31 minutes for westbound trips. In January 2016, the actual average recorded travel times for the JUMP were 25 and 30 minutes, respectively, about 1.8 and 0.7 minutes less than the scheduled time for eastbound and westbound trips. This indicates that, on average, actual JUMP travel times are consistent with schedules.

Peak travel times for this same segment are shown in Figure 3-28. The travel times show buses travel more quickly through the corridor in both directions during the morning peak and during the afternoon peak in the eastbound direction. Only westbound trips during the peak take longer than the scheduled times (approximately 0.7 minutes longer).

Figure 3-28 Scheduled and Actual JUMP Travel Times (January 2016) between Downtown Boulder and 95th Street

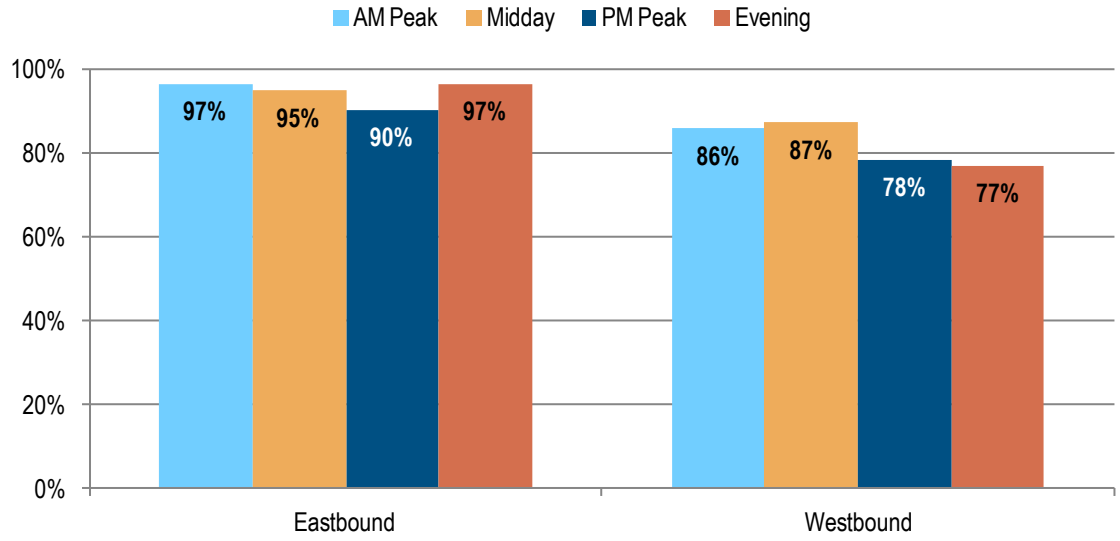


Source: Regional Transportation District

On-Time Performance

RTD classifies a bus as being on-time if it arrives at its stop between one minute early and five minutes late. According to RTD, the JUMP's on-time performance was approximately 87.4% in January 2016. Eastbound trips averaged an on-time performance of 92.5%, while westbound trips had a lower on-time performance of 83.1%. Figure 3-29 shows the on-time performance by direction and the time of day each trip starts. On-time performance is highest during the morning peak and the midday period (6 AM to 3 PM). The lowest on-time performance for eastbound trips occurs during the afternoon peak (3 PM to 8 PM). Westbound trips have the lowest on-time performance during the evening (8 PM to the end of service at 11 PM).

Figure 3-29 JUMP Weekday On-Time Performance (January 2016), by Direction and Time of Day



Source: Regional Transportation District

Bus Stops

The City of Boulder maintains an inventory of the 57 bus stops along the JUMP route within Boulder. Some stops have amenities such as shelters, benches, trash cans, and lighting, but many do not. Figure 3-30 provides an overview of the number and percent of stops that have seven different types of amenities. The vast majority of stops have lighting and over three-quarters have a concrete bus pad, although in some cases the pad is not fully accessible to users with wheelchairs or other mobility devices. Less than half of stops include a bench or other seating, and 26% contain a shelter.

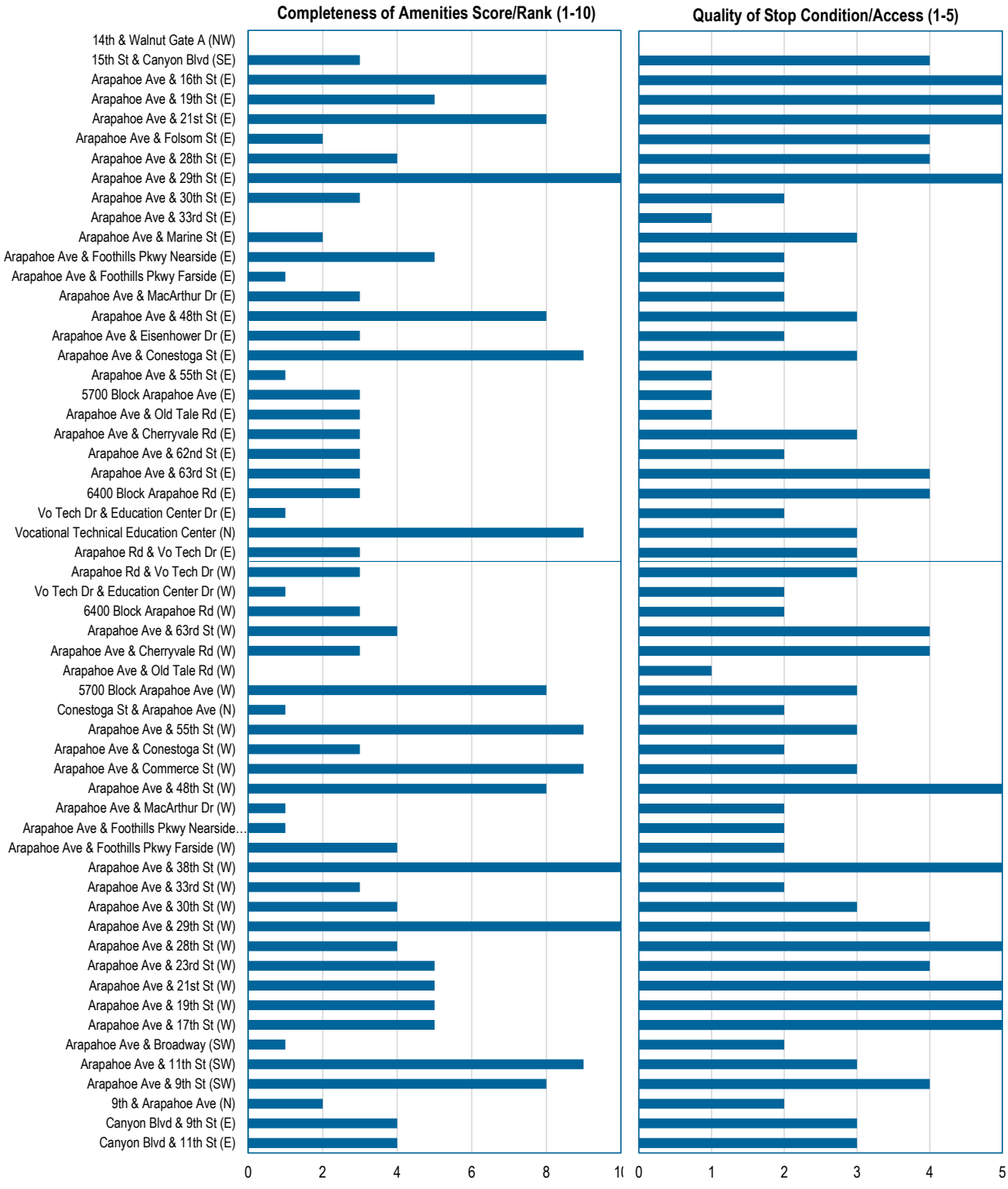
Figure 3-30 Coverage of Bus Stop Amenities

Amenity	Number of Stops	Percent of Stops
Concrete Curb	55	96%
Lighting	49	86%
Concrete Pad	44	77%
Bench	25	44%
Shelter	15	26%
Bike Rack	13	23%
Trash Can	12	21%

The City's inventory includes an assessment of completeness and quality of amenities, illustrated in Figure 3-31:

- **Score/Rank** rates completeness of stop amenities, e.g., shelters, on a scale of 1 to 10.
- **Quality** is a qualitative evaluation of stop condition and accessibility on a 1 to 5 scale.

Figure 3-31 Bus Stop Score/Rank and Quality Ratings



SAFETY ANALYSIS

This section describes safety trends in the study area for all modes. Boulder's Transportation Master Plan goal is continuously improve safety for all modes of travel and strive toward zero serious injury and fatal accidents. The City tracks total crashes, injury crashes and fatal crashes by mode to evaluate progress toward this goal.

Key Highlights

- The vast majority of the 736 crashes that occurred along Arapahoe Avenue between 2012 and 2014 (89%) occurred at intersections, including most crashes involving pedestrian and bicyclists.
- Most crashes (90%) involved only motor vehicles and the majority of crashes (55%) were rear-end collisions.
- Approximately 70% of the crashes occurred at four intersections: 28th Street, 30th Street, Foothills Pkwy, and 55th Street. These intersections also had the highest crash rates.
- Arapahoe Avenue between 30th Street and 33rd Street experienced the highest number and rate of crashes between intersections, accounting for both traffic volumes and distance.
- The highest number of crashes involving bicyclists occurred at Arapahoe Avenue and 30th Street. Thirteen of the crashes involving bicyclists (about 33%) involved conflicts between eastbound bicycles on the north-side multi-use path and vehicles turning right onto Arapahoe Avenue from driveways or side streets.

Crash Data Summary

Figure 3-32 summarizes crash data for Arapahoe Avenue within the study area between 2012 and 2014. There were a total of 736 crashes during this period. The vast majority of crashes (89%) occurred at intersections, including all eight of the pedestrian-involved crashes and 34 of the 40 the bicycle-involved crashes.

Figure 3-32 Crash Summary by Mode, 2012-2014

	Motor Vehicle	Bicycle	Pedestrian	Total
Intersection	616	34	8	**658**
Segment	72	6	0	**78**
Total	**688** **9,168 Citywide**	**40** **570 Citywide**	**8** **186 Citywide***	**736** **9,924 Citywide**

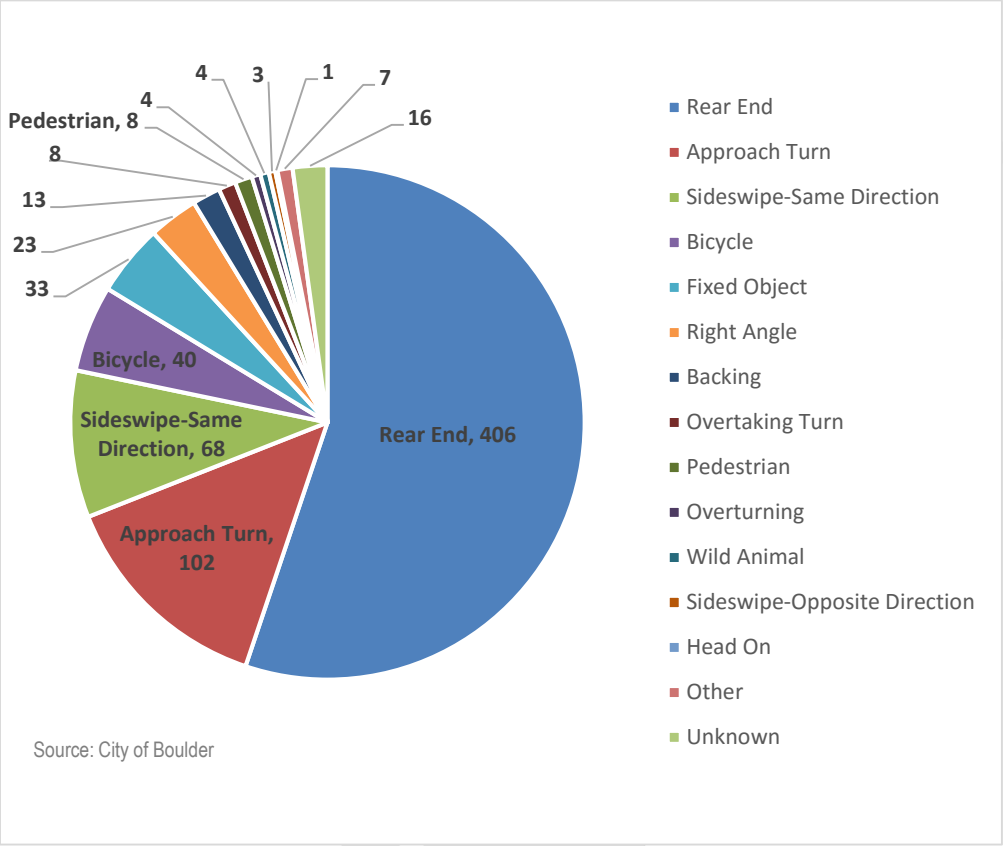
Source: City of Boulder

* Bicycle-Pedestrian crashes are counted under the pedestrian column.

Types of Crashes

Figure 3-33 provides a breakdown of all crashes. Over 400 of the crashes (55%) were rear-end collisions, 14% were approach turn crashes, and 9% were sideswipe-same direction crashes.

Figure 3-33 Crash Summary by Crash Type, 2012-2014



Geographic Distribution of Crashes

Figure 3-34 and Figure 3-35 identify the number of crashes at intersections along Arapahoe Avenue between 2012 and 2014. Approximately 70% of crashes over the three-year period occurred at the following four intersections: 28th Street, 30th Street, Foothills Pkwy, and 55th Street. These intersections also had the highest crash rates after accounting for traffic volumes. The intersection of 28th Street and 30th Street also rank in top 12 intersections with the highest crash rate citywide as of 2016.

Figure 3-36 and Figure 3-37 identify crashes that occurred between intersections along Arapahoe Avenue during the same time period. Arapahoe Avenue between 30th Street and 33rd Street experienced the highest number of crashes and the highest crash rate, accounting for both traffic volumes and distance. The roadway segments highlighted in orange in Figure 3-36 had a relatively high number of crashes and crash rate.

Note: A more detailed discussion of trends at high-crash intersections is provided below

Figure 3-34 Crashes at Intersections by Type, 2012-2014 (Map)

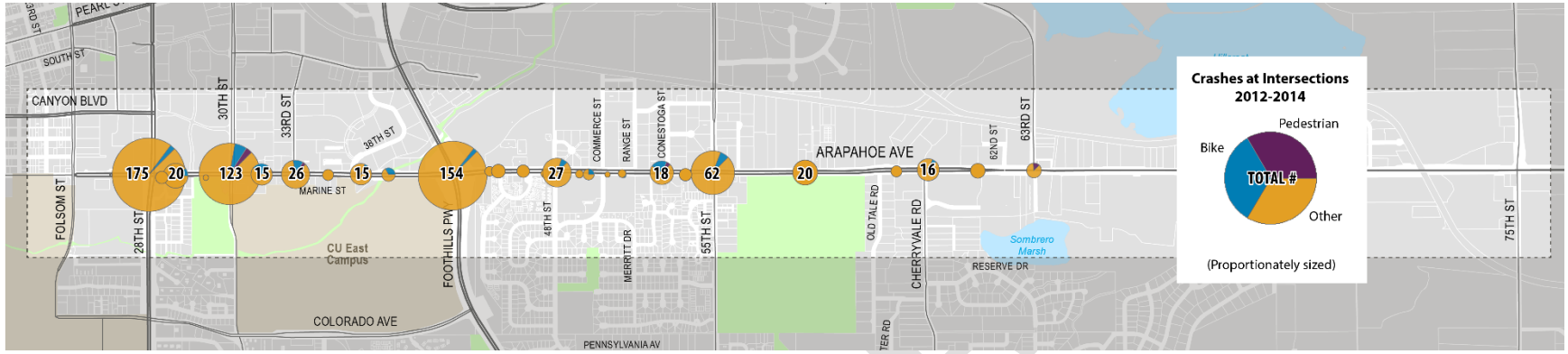


Figure 3-35 Crashes at Intersections by Type, 2012-2014 (Table)

Intersection	Motor Vehicle	Pedestrian	Bicycle	Total
Arapahoe & 28th	171		4	175
Arapahoe & Culver				
Arapahoe & 29th	18		2	20
Arapahoe & 30th	111	4	8	123
Arapahoe & 33rd	22	1	3	26
Arapahoe & 38th	14		1	15
Arapahoe & Foothills	150	1	3	154
Arapahoe & McArthur	6			6
Arapahoe & Riverbend	2			2
Arapahoe & 48th	25		2	27
Arapahoe & Commerce	3		1	4
Arapahoe & Range	2			2
Arapahoe & Patton			1	1
Arapahoe & Conestoga	13	1	4	18
Arapahoe & 55th	58		4	62
Arapahoe & 56th				
Arapahoe & Old Tale				
Arapahoe & Cherryvale	15		1	16
Arapahoe & 62nd				
Arapahoe & 63rd	6	1		7

Figure 3-36 Crashes between Intersections, 2012-1014 (Map)

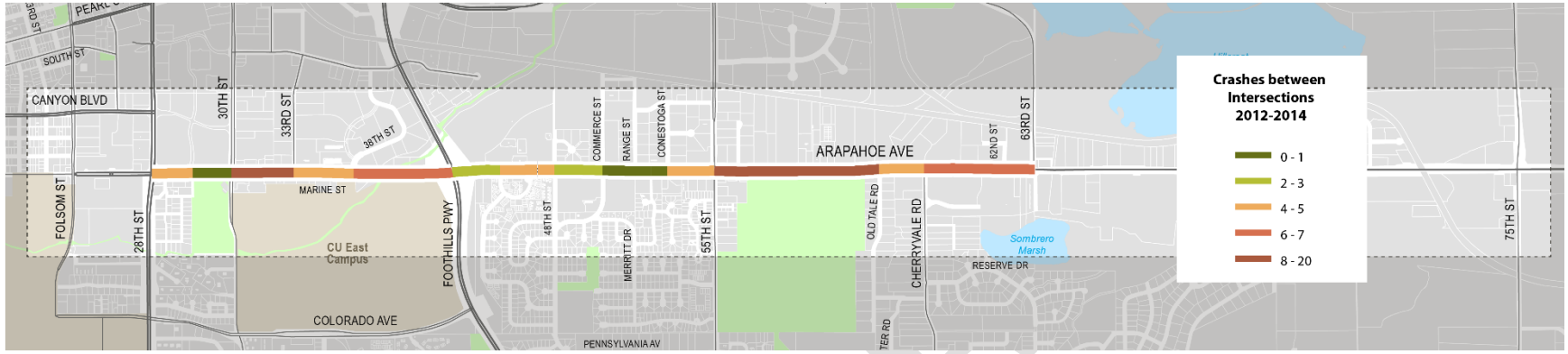


Figure 3-37 Crashes between Intersections by Type, 2012-2014 (Table)

Segment	Motor Vehicle	Pedestrian	Bicycle	Total
28th to 29th	5			5
29th to 30th	1			1
30th to 33rd	11		4	15
33rd to 38th/Marine	4			4
38th/Marine to Foothills	4		2	6
Foothills to MacArthur	3			3
MacArthur to 48th	5			5
48th to Commerce/Eisenhower	2			2
Commerce/Eisenhower to Range	1			1
Range to Patton	0			0
Patton to Conestoga	0			0
Conestoga to 55th	5			5
55th to Old Tale	20			20
Old Tale to Cherryvale	4			4
Cherryvale to 63rd	7			7

Crashes by Mode

Motor Vehicle

About 90% of crashes in the corridor between 2012 and 2014 involved motor vehicles only (not bicyclists or pedestrians). The predominant type of vehicle crash in the corridor is rear-end, which comprised more than half of the total. Approach turn and sideswipe crashes were the second and third most common type of crash overall. The three highest crash intersections along Arapahoe Avenue (28th Street, 30th Street, and Foothills Parkway) had more than 100 crashes each during the three year period.

Bicycle

There were 40 total bicycle-related crashes in the study area between 2012 and 2014. Figure 3-36 (above) illustrates the location of the 34 bicycle-related crashes that occurred at intersections. The highest number occurred at Arapahoe Avenue and 30th Street, which has on-street bike lanes, followed by the intersections of Arapahoe Avenue at 28th Street, Conestoga Street, and 55th Street.

There were an additional six bicycle-related crashes between intersections along Arapahoe Avenue within the study area. Five of these crashes were driveway-access related including four that occurred between 30th and 33rd Streets, a segment with closely spaced parking lot entrances on both sides of the street.

Thirteen of the bicycle-related crashes along the corridor (about 33%) involved conflicts between eastbound bicycles on the north-side multi-use path and vehicles turning right onto Arapahoe Avenue from side streets or driveways. Figure 3-38 summarizes crashes related to the multi-use path.

Figure 3-38 Multi-use Path-Related Bicycle Crashes

Location (West to East)	# of Crashes
Arapahoe & 29th	1
Driveways between 30th and 33rd	4
Arapahoe & 33rd	3
Arapahoe & 48th	1
Arapahoe & Commerce	1
Arapahoe & Conestoga	2
Arapahoe & 55th	1

Pedestrian

Pedestrian-related crashes in the study area are relatively uncommon. There were eight total pedestrian-involved crashes from 2012-2014, which occurred at five separate intersections (see Figure 3-36 above). Half occurred at the intersection of Arapahoe Avenue and 30th Street. There was one crash each at the intersections of Arapahoe Avenue and 33rd Street, Foothills Parkway, Conestoga Street, and 63rd Street.

Detailed Evaluation of High Crash Intersections

The four intersections and the two segments with the highest total crashes between 2012 and 2014 all had a predominant crash type of rear end, but the second most common crash type varied between locations, as did the overall distribution of different crash types. Figure 3-39 summarizes the primary crash types at these locations. Figure 3-40 to Figure 3-43 categorize the crash types at the four highest-crash intersections.

Figure 3-39 High Crash Intersections

Intersection or Segment	Total Collisions	Trip Generators	Primary Crash Types / Trends
Arapahoe Avenue and 28th Street	175	Twenty-Ninth Street Retail Center	▪ Rear end and sideswipe in same direction; see Figure 3-40
Arapahoe Avenue and Foothills Parkway	154		▪ Rear end and sideswipe in same direction; see Figure 3-41
Arapahoe Avenue and 30th Street	123	University of Colorado East Campus	▪ Rear and approach-turn. Highest number of bicycle crashes. See Figure 3-42.
Arapahoe Avenue and 55th Street	62	Flatirons Golf Course	▪ Rear end and approach-turn; see Figure 3-43
Arapahoe, 55th Street to Old Tale Road	20	Flatirons Golf Course	▪ Rear end, sideswipe and right angle
Arapahoe, 30th Street to 33rd Street	15	University of Colorado East Campus	▪ Rear end, bicycle

Figure 3-40 Arapahoe Ave & 28th St Crash Types

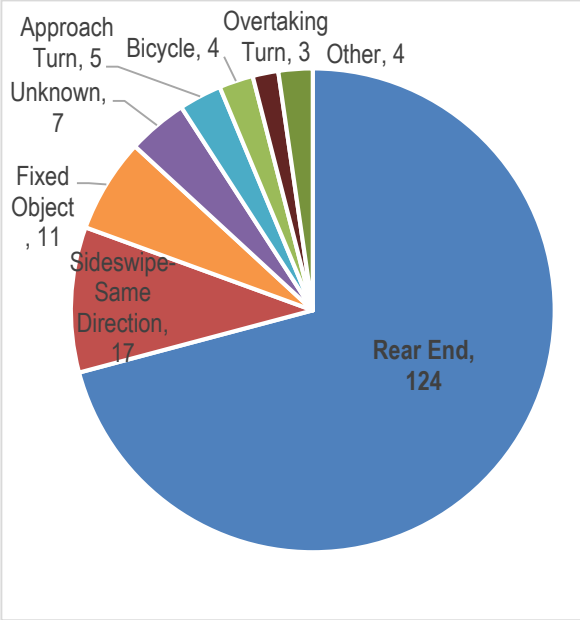


Figure 3-41 Arapahoe Ave & 30th St Crash Types

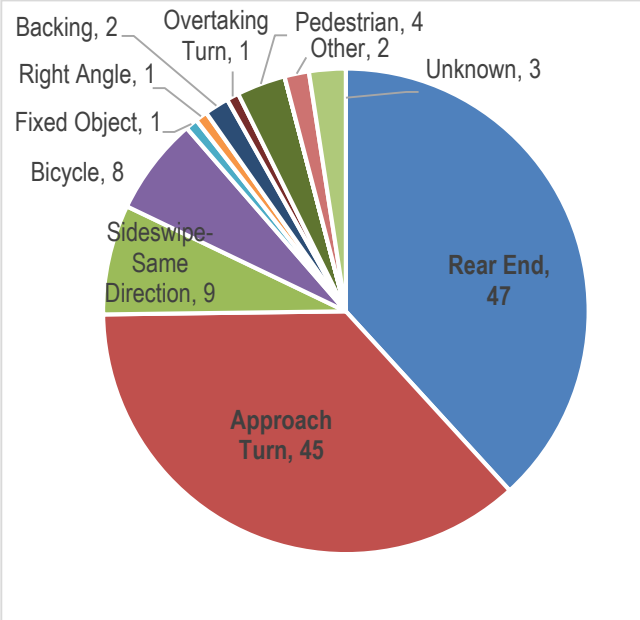


Figure 3-42 Arapahoe Ave and Foothills Pkwy Crash Types

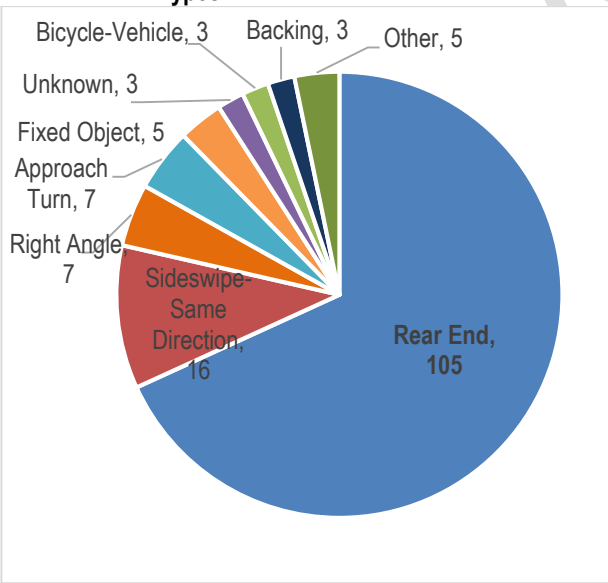
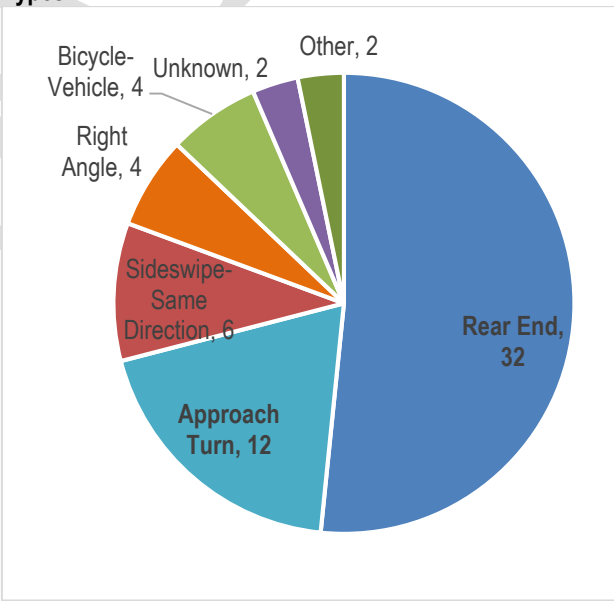


Figure 3-43 Arapahoe Ave and 55th St Crash Types



East Arapahoe
Transportation Plan

CITY OF BOULDER

EAST ARAPAHOE TRANSPORTATION PLAN
Draft Purpose, Goals & Objectives

July 2016 – DRAFT

(7.27.2016)

NELSON NYGAARD

FOX TUTTLE HERNANDEZ
TRANSPORTATION GROUP

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1 PURPOSE OF THE PLAN

Today, the East Arapahoe Corridor is one of the city's busiest regional travel corridors. As we plan for the future, exponential growth in surrounding communities will likely place additional demands on the corridor's existing transportation system. From people commuting into Boulder for work or school, traveling to Boulder for healthcare services, or simply accessing recreational and shopping amenities – forecasted regional transportation demands on the East Arapahoe Corridor will change how the corridor functions today.

Coupled with increased regional transportation demand, are the changing local travel needs for people working, living and accessing services within the East Arapahoe corridor itself. East Arapahoe is no longer seen as a "pass through" corridor for in-commuters; and has, in fact, become one of Boulder's largest employment centers. People are looking for safe and convenient ways to travel between destinations along Arapahoe and other areas of the city. From students traveling between university campuses, to employees wanting to grab lunch – the need for people to move safely and conveniently via walking, biking, transit, ride sharing, driving plus moving goods and services changes how we think about travel and transportation options in this transitioning area of the city.

Recognizing these changing regional and local conditions, the East Arapahoe Transportation Plan is a long-range plan that considers a number of potential transportation improvements within the East Arapahoe corridor, including safety for people using all modes, walking and biking enhancements, improved regional and local transit, efficient vehicular travel, as well as urban design features that work hand in hand with mobility improvements to truly transform the corridor. As East Arapahoe becomes more of a destination, travelers of all modes are looking for a more comfortable experience – with features that are scaled for people and create a place that is attractive to both travel through and spend time in.

Importantly, transportation improvements will support the goals and objectives of the Boulder Valley Comprehensive Plan, the Transportation Master Plan (TMP), Access Management and Parking Strategy (AMPS), and the city's Climate Commitment and Sustainability Framework.

2 DOCUMENT ORGANIZIATION AND STUDY AREA OVERVIEW

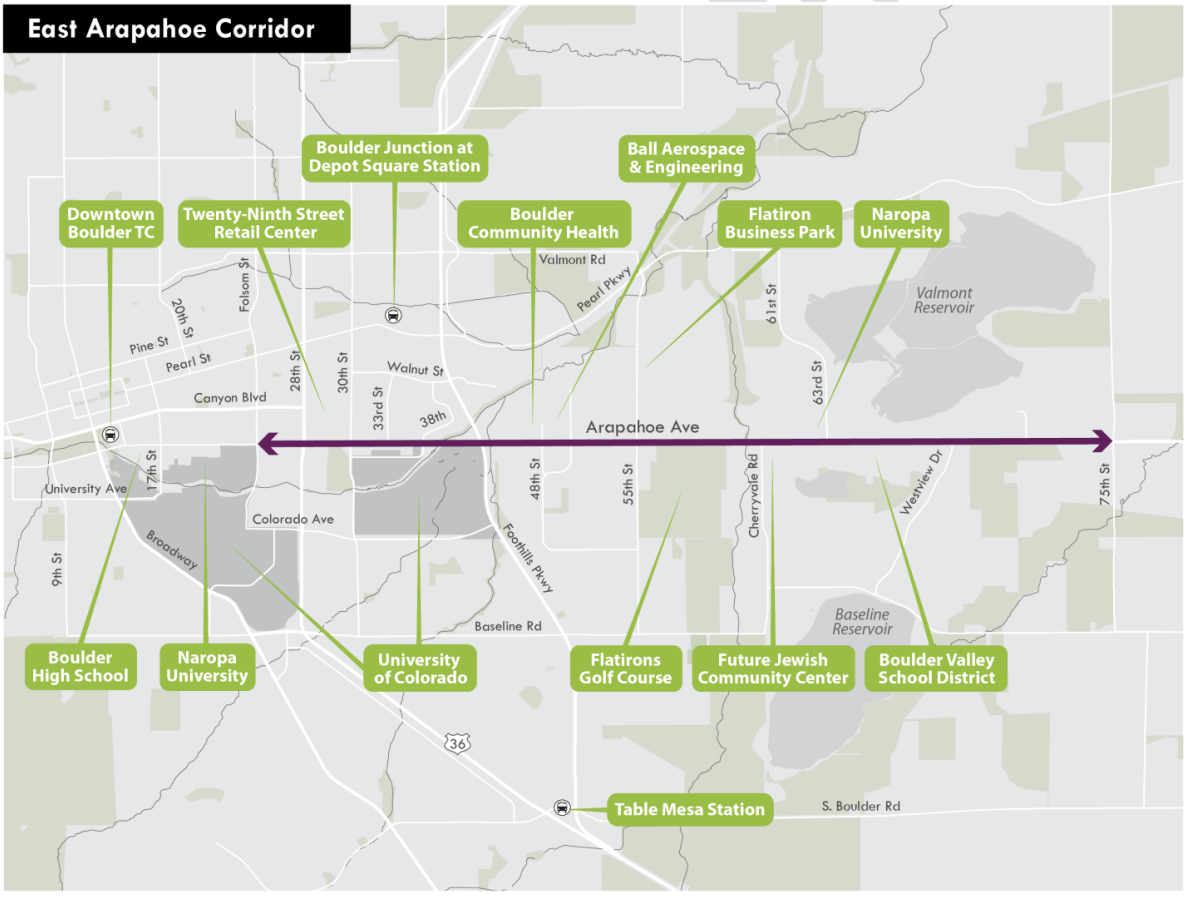
The next sections of this document describe the goals and objectives of the East Arapahoe Transportation Plan and are organized as follows:

Section 3: Summarizes the Plan goals and objectives, which are categorized by the Boulder 2014 Transportation Master Plan (TMP) Focus Areas, including Complete Streets, Regional Travel, Transportation Demand Management (TDM), Funding and Sustainability. While organized by Focus Area, each goal and associated objective is interrelated and needs to be mutually supporting to have the greatest benefit.

Section 4: Further describes each plan goal and associated objectives, including the rationale each objective will address in order to attain the goals.

Figure 1 illustrates the East Arapahoe Transportation Plan study area, which is focused primarily on Arapahoe Avenue between Folsom Street and 75th Street.

Figure 1 East Arapahoe Transportation Plan Study Area



3 SUMMARY OF PLAN GOALS & OBJECTIVES

In support of the Boulder Valley Comprehensive Plan, the Boulder Transportation Master Plan (TMP) and the city's Sustainability Framework, a series of draft goals and related objectives have been drafted and will guide the development of the East Arapahoe Transportation Plan.

Goal 1. Complete Streets: Provide Complete Streets in the East Arapahoe corridor that offer people a variety of safe and reliable travel choices.

- Objective 1.a. Provide safe travel for people of all ages and stages of life using all modes along the East Arapahoe corridor.
- Objective 1.b. Improve the ease of access, comfort and experiences for people walking in the East Arapahoe corridor.
- Objective 1.c. Broaden the appeal of bicycling along the East Arapahoe corridor to people of all ages and bicycling abilities.
- Objective 1.d. Make riding transit a convenient and practical travel option in the East Arapahoe corridor.
- Objective 1.e. Move drivers efficiently through the East Arapahoe corridor.

Goal 2. Regional Travel: Increase the number of person trips the East Arapahoe corridor can carry to accommodate growing local and regional transportation needs.

- Objective 2.a. Improve local travel options within the East Arapahoe corridor for residents, employees, and visitors.
- Objective 2.b. Improve regional travel options between Boulder and communities to the east for work and other regional trips, including access to health care facilities.

Goal 3. Transportation Demand Management (TDM): Promote a more efficient use of the transportation system and offer people travel options within the East Arapahoe corridor.

- Goal 3.a. Improve "first-and-last-mile" connections to help people conveniently and safely walk, bike, or make shorter car trips to and from transit.
- Goal 3.b. Promote the use of multiple transportation options and TDM programs in East Boulder by residents and workers (examples include EcoPass programs, shared use mobility and parking management).

What is Transportation Demand Management (TDM)?

TDM promotes more efficient use of the existing transportation system by influencing the time, route, or mode selected for a given trip. TDM strategies increase travel choices and examples include:

- Incentives such as Eco Passes
- Modal strategies such as ridesharing, carsharing, vanpools, and teleworking
- First- and Final-Mile solutions such as bikesharing

Goal 4. Funding: Deliver cost-effective transportation solutions for the East Arapahoe corridor that can be phased over time.

- Objective 4.a. Coordinate with public and private entities, including adjacent land owners and local and regional agency partners, to implement cost-effective transportation improvements (including capital and operating and maintenance investments).

Goal 5. Sustainability Initiatives: Develop transportation improvements in the East Arapahoe corridor that support and integrate with the Boulder Valley Comprehensive Plan and Boulder's Sustainability Framework *(desired outcomes include a community that is Safe, Healthy & Socially Thriving, Livable, Accessible & Connected, Environmentally Sustainable, and Economically Vital Community and provides Good Governance).*

- Goal 5.a. Reduce greenhouse gas (GhG) emissions and air pollution from vehicle travel within the East Arapahoe corridor.
- Goal 5.b. Improve travel options that promote public health for residents and workers along the East Arapahoe corridor.
- Goal 5.c. Provide access to affordable transit and other travel options to low- and moderate-income residents and workers along the East Arapahoe corridor.
- Goal 5.d. Preserve and enhance economic vitality in the East Arapahoe corridor, working with Boulder businesses.

4 DESCRIPTION OF PLAN GOALS & OBJECTIVES

Goal 1. Complete Streets: Provide Complete Streets in the East Arapahoe corridor that offer people a variety of safe and reliable travel choices.

Objective 1.a. Provide safe travel for people of all ages and stages of life using all modes along the East Arapahoe corridor.

The City of Boulder works to provide a safe transportation system for people using all modes of travel and "Toward Vision Zero" is the city's effort to eliminate fatalities and serious injuries from future traffic collisions. Arapahoe Avenue is one of the higher speed (posted speed limits between 35 and 45 mph) and higher volume roadways within the city. An analysis of crash data from 2012-2014 shows that crashes affect all modes of travel along Arapahoe Avenue and that several intersections have particularly high crash rates. The data indicates a need to minimize conflict points, including intersections and driveways, and identify and mitigate safety issues for people walking, biking, and driving in the corridor.

The need to provide safe travel for all modes is further described here:

High Crash Intersections

Between 2012 and 2014, three intersections in the corridor had over 100 crashes: Arapahoe Avenue and 28th Street, 30th Street, and Foothills Parkway. The predominant crash type for all three was rear end. These high-crash intersections are located in the part of the East Arapahoe corridor that also sees the most bicycle and pedestrian traffic.

Pedestrian and Bicycle Crashes

There were 40 crashes in the corridor that involved bicycles and eight that involved pedestrians in the 2012-2014 time period. The vast majority (85%) of the bicycle crashes occurred at intersections. The intersection of Arapahoe Avenue and 30th Street had twice as many bicycle crashes as any other intersection and was the site of half of all pedestrian crashes. Of the six bicycle-involved crashes that occurred between intersections, five of them were driveway access-related. About a third of the total bike crashes along the corridor involved conflicts between eastbound bicycles on the north multi-use path and southbound vehicles turning right from side streets or driveways.

Figure 2 illustrates crash data at intersections in the corridor, categorized by type of crash.

Figure 2 Crashes at Intersections along Arapahoe Avenue, 2012-2014

Source: City of Boulder

Objective 1.b. Improve the ease of access and comfort for people walking in the East Arapahoe corridor.

The Boulder 2014 TMP prioritizes walking as the fundamental way to travel and aims to increase the share of residents living in complete neighborhoods to 80% by 2035. Currently, only 26% of Boulder's population lives in 15-minute walking neighborhoods, which means they can walk to a variety of destinations, like grocery stores, restaurants and transit stops in 15 minutes. With the East Arapahoe corridor becoming home to more and more destinations, linking residential, commercial and employment areas with continuous and safe pedestrian infrastructure is taking on even more importance. Increasing the number of complete neighborhoods within the corridor will help change long trips into short ones, making walking a reasonable option for a greater share of trips.

The need to improve the ease of access and comfort for people walking is further described here:

Insufficient Crosswalk Spacing

Several segments of the East Arapahoe corridor lack conveniently-spaced pedestrian crossings, which are about two-thirds of a mile apart between Cherryvale and 55th Street and about a third of a mile apart in several other locations. As a result, many destinations, including bus stops, are not in proximity to a safe crossing.

Gaps in the Sidewalks and Multi-Use Path Network

There are sections of Arapahoe Avenue with missing pedestrian facilities, particularly east of 55th Street, including a section without a sidewalk or path on either side of the street. Parallel and connecting streets, such as Marine Drive to the south, also lack sidewalks. In sections where the sidewalk and/or multi-use path are missing, bus stops are not Americans with Disabilities Act (ADA) accessible.[1] Enhanced facilities are needed to address challenges facing people traveling in the corridor by foot or with mobility devices. Pedestrian facilities on connecting and parallel streets also need to be completed.

Figure 3 Sidewalk Abruptly Ends by Flatirons Golf Course

Source: City of Boulder

Proximity of Vehicles to Pedestrians

Many parts of Arapahoe Avenue lack a buffer that separates vehicle travel lanes from pedestrians. For example, on the south side of Arapahoe Avenue between Foothills Parkway and 55th Street, sidewalks narrow to 4 feet and lack a buffer from the roadway. Vehicle speeds over 25 mph affect the perceived safety for pedestrians without such buffers. There is a need to enhance the comfort and attractiveness of pedestrian facilities along Arapahoe Avenue in the study area. For example, street trees planted between the sidewalk and the roadway physically protect pedestrians and provide shade, create a visual enclosure that encourages drivers to slow down, while also providing environmental benefits.

Figure 4 Vehicles Close to Sidewalk, East of Conestoga

Source: City of Boulder

[1] City of Boulder, Sustainable Streets and Center Report, 2013

Lack of a "Sense of Place"

Transportation networks should balance both placemaking as well as the movement of people – or "to" and "through" functions. While Arapahoe Avenue carries a large number of people through the corridor each day, the street itself lacks features that could promote its "to" function as an inviting place to travel and spend time. Higher traffic speeds, large parking areas fronting the street, narrow sidewalks, a lack of landscaping, and signage were all issues noted by community members who participated in a walk audit of the corridor in 2014. Each of these features makes it less attractive for people to bike, walk, and take transit in the corridor. As transportation improvements are considered for the corridor, it will be important to incorporate those urban design features that work hand in hand with mobility improvements to truly transform the corridor. From comfortable and enhanced transit stations, to landscaping, signage and public art, placemaking elements can enhance the travel experience for all users of the corridor, whether by walking, bicycling, transit or car.

And, as the East Arapahoe corridor changes, it will be important to identify land use patterns that support an improved transportation network. By coordinating the East Arapahoe transportation planning process with the ongoing Boulder Valley Comprehensive Plan update, the city can identify opportunities for integrated urban design, land use, and transportation planning.

Objective 1.c. Broaden the appeal of bicycling along the East Arapahoe corridor to people of all ages and bicycling abilities.

Public outreach for the Boulder 2014 TMP indicated that people who are "interested but concerned" about riding a bicycle do not feel comfortable or confident sharing busy roads with motor vehicles. Community input gathered in 2015 and early-2016 for the East Arapahoe Transportation Plan further underscored this concern, emphasizing that much of Arapahoe Avenue does not feel safe, comfortable or convenient for bicycle travel. Streetscape and facility improvements are needed to enhance safety for people riding bikes, particularly in areas where there are known conflict points, and to make a broader segment of the community feel comfortable traveling by bicycle along the East Arapahoe corridor.

The need to broaden the appeal of bicycling is further described here:

Gaps in the Bicycle Network

The East Arapahoe corridor includes several locations where there are gaps in the bicycle network or difficult crossings; and bicycle infrastructure varies widely through the corridor. For instance, there is no on-street bicycle facility on Arapahoe Avenue west of 55th Street, but there are bicycle lanes on a portion of the corridor between 55th and 63rd Streets. And, there are multi-use paths along both sides of the corridor that have several missing segments. The high frequency of driveways also contributes to several points of conflict for bicyclists.

Figure 5 Missing Segment of Multi-Use Path

Source: City of Boulder

Lack of Infrastructure for Long Distance Bicycle Travel

The existing multi-use path generally does not meet the needs of people commuting and traveling by bicycle for longer-distance trips along Arapahoe Avenue. These needs are similar to people driving along the corridor and include a direct, safe, and time-efficient route. There are several issues with using the multi-use path for longer-distance travel, including the lack of a continuous path on one side of the street and the lack of specialized treatments at intersections, where bicyclists must interact with pedestrians and turning vehicular traffic.

Objective 1.d. Make riding transit a convenient and practical travel option in the East Arapahoe corridor.

Making transit an attractive travel option for all residents and visitors is the foundation of the Boulder 2014 TMP and the Renewed Vision for Transit. A complete transit system is one that provides both high-quality transit service and high-quality transit facilities, such as stops/stations that are well coordinated with land use, pedestrian and bicycle access, and other supportive programs like EcoPasses.

Approximately 10,000 people travel via regional or local bus through the East Arapahoe corridor each day. The JUMP is the primary east-west bus route and is one of the city's most heavily used bus routes, connecting destinations such as Boulder High School, Downtown Boulder, Twenty Ninth Street, CU East Campus, the Boulder Valley School District - Arapahoe Campus with and Lafayette and Erie to the East. To provide quality service to these existing bus passengers and attract new transit riders to the East Arapahoe corridor, transit must be perceived as safe and comfortable, with reliable service and travel times that are competitive with the private automobile.

Figure 6 Foothills Parkways and Arapahoe Avenue Westbound JUMP Stop

Source: City of Boulder

The need to make transit a convenient and practical travel option is further described here:

Limited Regional Transit Ridership

High housing costs in Boulder combined with a strong and growing job base have dramatically increased the level of in-commuting in recent years. The Boulder 2014 TMP update set a goal of reducing the number of trips made by one person driving alone in a car (called "single occupant vehicle" mode share, or SOV) to 60% of work trips for nonresidents. While Boulder has achieved a remarkably high mode share for non-single occupant vehicle (SOV) trips for local travel, in-commute travel remains primarily SOV. In-commute travelers are still estimated to be driving alone at a mode share of approximately 80%.

Given the projected growth in travel demand and increased development along the East Arapahoe corridor between Boulder and Brighton, there is a need to attract more regional transit riders to the corridor. This will entail close coordination with Boulder County's SH 7 BRT Study and with the Colorado Department of Transportation (CDOT) to proactively develop a holistic plan for the overall SH 7 corridor to provide fast and reliable transit travel times in the corridor, appropriate bus service hours, and convenient first-and-last-mile travel options.

Shortage of Bus Stop Amenities

Figure 7 Inaccessible Bus Stop Landing

Source: City of Boulder

There is a need within the corridor to ensure safe access to bus stops, for both directions of travel; enhance transit amenities to provide a comfortable passenger experience at bus stops and highly legible signage to other bus routes and first-and-last-mile travel options. As shown in Figure 7, safely accessing bus stops can be challenging along Arapahoe Avenue, since many of the stops are located a distance from convenient street crossings and accessible sidewalks. Transit stops also need to include amenities such as shelters to protect people from the elements, seating to make waiting for the bus more comfortable, and trash cans to help maintain cleanliness. Within East Arapahoe corridor, the JUMP serves 57 stops of which only 26% have a shelter, 44% have a bench, and 21% have a trash can.[2] Another consideration is that bicycling is an important transit access mode. As most buses allow a maximum of two bicycles per bus, bike parking at stops enables more bicyclists to park their bike securely when biking to transit. Currently, 23% of the 57 JUMP stops along Arapahoe Avenue have bike parking.[3]

Limited Real-Time Bus Information

As part of the Boulder 2104 TMP update, community members were asked how they would improve transit and prioritize transit investments. Real-time bus arrival information was prioritized as the most important enhancement needed. Real-time information gives passengers the comfort of knowing exactly when the next bus will arrive. Passengers can look online, on their cell phones, or at a digital sign at the stop or station to know exactly how long they have to wait. In 2016, RTD implemented a pilot real-time information system for local buses – including the JUMP – that can be accessed via the Transit App smartphone application. Expanding real-time information data to regional buses will be an important next step in addressing this need within the corridor and throughout Boulder and the region.

Objective 1.e. Move drivers efficiently through the East Arapahoe Corridor.

Arapahoe Avenue is an important east-west vehicle travel corridor serving downtown Boulder, CU, Boulder Community Health, other major employers, and adjacent neighborhoods. Because there are only a few major east-west and north-south roads in East Boulder, there are limited alternative routes for many trips through and within the East Arapahoe corridor. This only underscores how important it is to increase safety, reliability and the overall person-carrying capacity of Arapahoe Avenue for all vehicle trips in the corridor. This need is also true for trucks serving the businesses in the corridor, and/or carrying freight between Boulder and the communities to the east. In most cases the trucks have no choice but to utilize Arapahoe Avenue.

The need to move drivers efficiently is further described here:

[2] City of Boulder

[3] City of Boulder

Disconnected Street Pattern

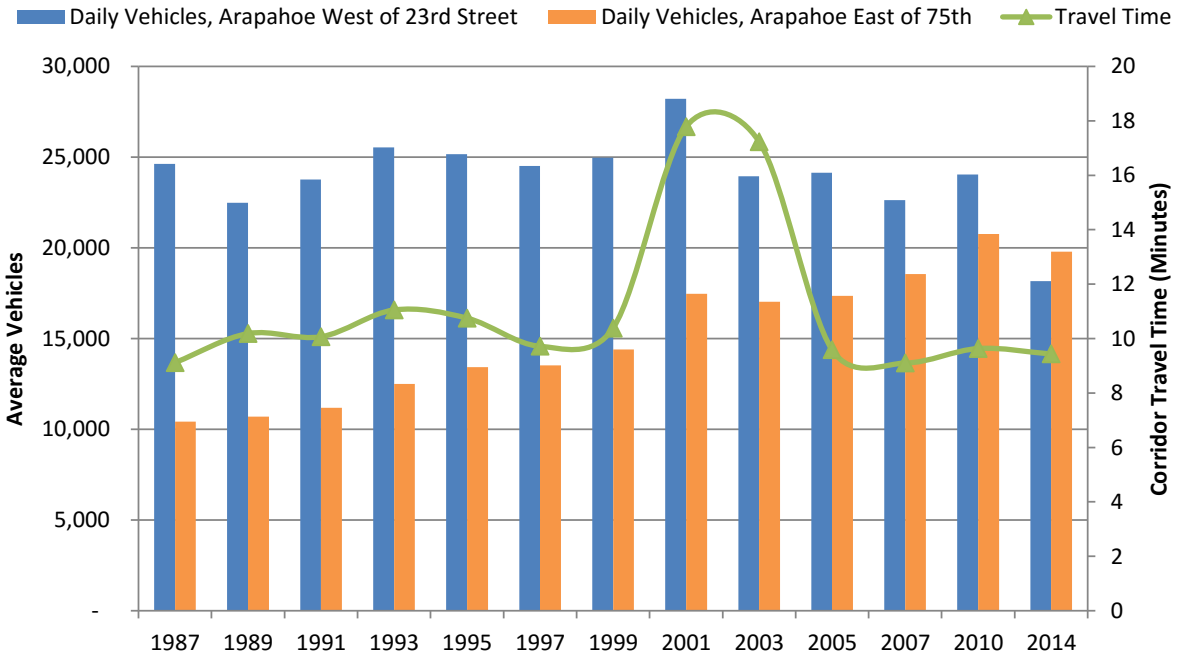
Development east of 28th Street along the East Arapahoe corridor is laid out in a fashion markedly different from downtown Boulder. Much of the north side of Arapahoe Avenue is dominated by commercial or light-industrial uses on larger lots, while the area to the south is a mix of similar larger lot commercial or light-industrial uses and suburban-style residential development. The result is a disconnected street pattern with relatively few through streets and lack of a well-established street grid. This style of development means that many local vehicular trips have few alternatives to using Arapahoe Avenue. Because Arapahoe Avenue then carries both local vehicle trips and regional through-traffic, the safe and efficient movement of vehicles becomes more important.

This disconnected street pattern and lack of an efficient roadway grid is particularly impactful to emergency service providers. Fire trucks have few response route choices except Arapahoe Avenue, and ambulances accessing the hospital have no choice at all but to use Arapahoe, as the hospital is located directly on the corridor. For this reason, it will be critical to anticipate and accommodate emergency service providers when considering alternatives for improving Arapahoe Avenue.

Corridor Travel Times

The City of Boulder 2014 Drive Time Analysis showed that peak period vehicle travel times along Arapahoe Avenue between 23rd Street and 75th Street have remained reasonably steady since 1987.[4] As shown in Figure 8, this has occurred even as traffic volumes on the east end of the corridor have increased. Traffic volumes on the west end have remained relatively steady over time, consistent with relatively flat growth in overall vehicle travel in Boulder, despite growth in population and employment. Considering the trend of increasing traffic volumes on the east end of the corridor (as observed at 75th Street) it will become increasingly important to create an efficient transportation network that maintains efficient vehicle travel in the corridor for both local and regional trips.

Figure 8 Average Daily Traffic & Travel Time 1987-2014*



Note: *The City of Boulder assumes that 2001 and 2003 travel time increases were due to two contributing factors. First, changes in data collection methodology resulted in long observed travel periods. Second, construction at the Broadway & Arapahoe Avenue intersection likely contributed to increased travel times.

Source: City of Boulder Traffic Count Data and Drive Time, 2014

Goal 2. Regional Travel: Increase the number of person trips the East Arapahoe corridor can carry to accommodate growing local and regional transportation needs.

Objective 2.a. Improve local travel options within the East Arapahoe corridor for residents, employees, and visitors.

One of the Boulder 2014 TMP objectives is to increase transportation alternatives commensurate with the rate of employee growth. This is particularly relevant to the East Arapahoe corridor as it is becoming home to a number of regional employment centers and destinations. Recent and ongoing development at Boulder Community Health Foothills Hospital campus, CU East Campus, and other regional employers in East Boulder are increasing the number of employees, and demand for travel, along the East Arapahoe corridor. The area has experienced a surge in new development over the past several years and employment in East Boulder is expected to continue to grow. East Boulder has more capacity to accommodate commercial development than other areas of the city that has reached zoning capacity. It is not surprising then that the area is expected to experience 19% employment growth between 2015 and 2040 – one of the highest employee growth rates in the city.[5]

The need to improve local travel options is further described here:

Growing Local Transportation Demand

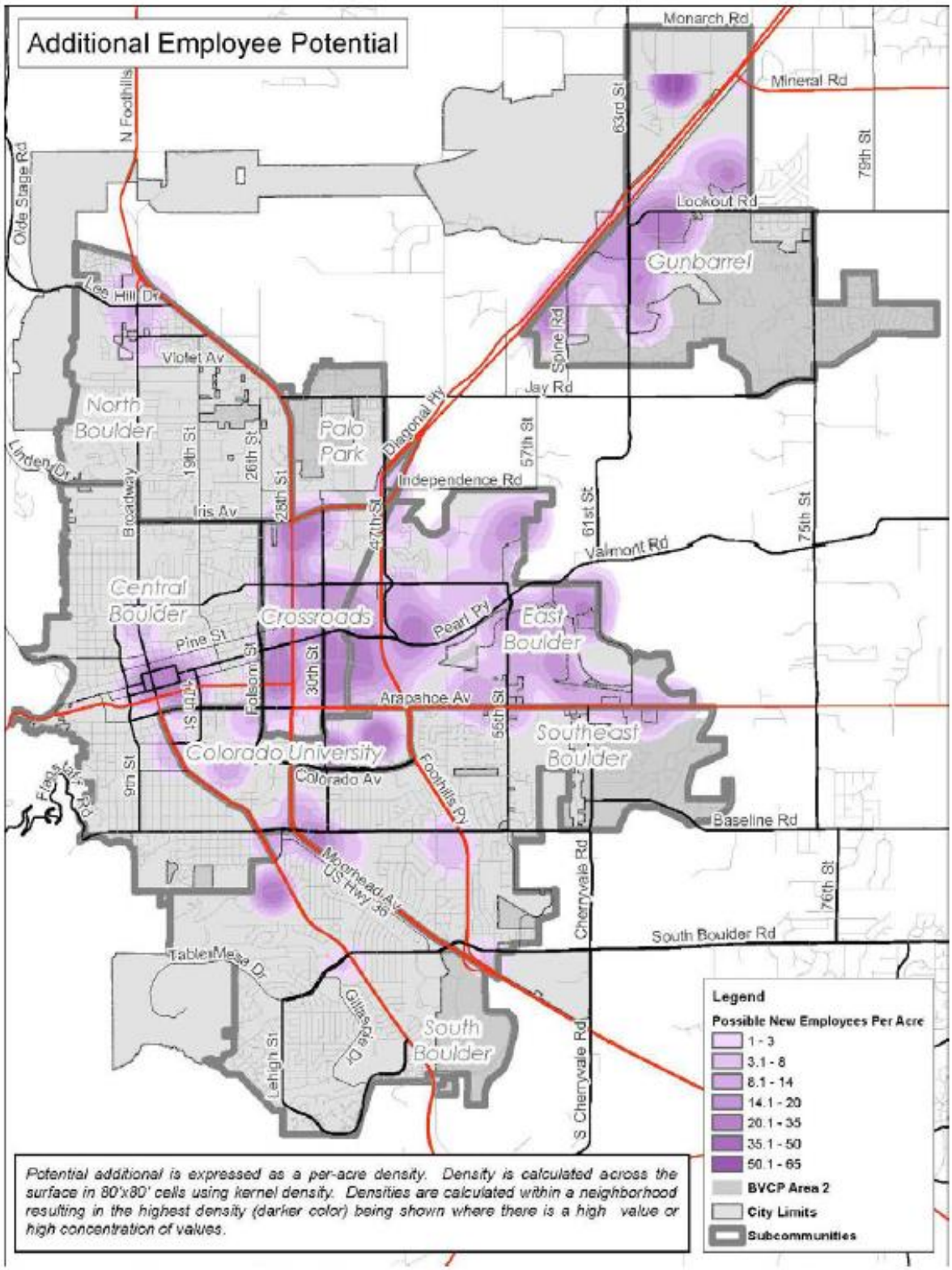
Development along the Arapahoe Avenue corridor is already growing significantly.[6] Of the 2,200 development review applications in the City of Boulder in 2015, nearly 25% were within one-half mile of Arapahoe Avenue. And this trend is expected to continue. Figure 9 shows the potential for employee growth within the East Arapahoe corridor.[7] By 2040, it is expected that most areas of the city will be at 90% or more of their employment capacity. By comparison, employment projections show that East Boulder will be at 61% of its employee zoning capacity in 2040 – indicating the tremendous potential for commercial growth in East Boulder and along the East Arapahoe corridor. With this employment growth, comes increasing demands on the transportation network and the need to develop an interconnected, multimodal travel network in East Boulder that enables safe and efficient access for people walking, biking, riding transit and driving.

[5] Boulder Valley Comprehensive Plan, 2015-2040 Projections. https://www-static.bouldercolorado.gov/docs/BVCP_Projections_Summary_Formatted_082815-1-201508281637.pdf.

[6] https://bouldercolorado.gov/open-data/city-of-boulder-open-development-review-cases/

Boulder Valley Comprehensive Plan 2015-2040 Projections. https://www-static.bouldercolorado.gov/docs/BVCP_Projections_Summary_Formatted_082815-1-201508281637.pdf

Figure 9 Additional Employee Potential



Source: City of Boulder, Boulder Valley Comprehensive Plan 2015-2040 Projections, Figure 2. https://www-static.bouldercolorado.gov/docs/BVCP_Projections_Summary_Formatted_082815-1-201508281637.pdf

Objective 2.b. Improve regional travel options between Boulder and communities to the east for work and other regional trips, including access to health care facilities.

Regional growth is likely to increase future congestion on the limited number of regional facilities connecting Boulder with neighboring communities, including Arapahoe Avenue.[8] As previously mentioned, the Boulder 2014 TMP update set a goal of reducing the number of SOV trips to 60% of work trips for nonresidents. Yet, regional travel is still highly dependent on SOVs. In order to achieve this goal, a larger share of future trips between Boulder and surrounding communities will need to be accommodated by alternative travel choices that are appealing, convenient, and reliable.

The need to manage regional travel demand is further described here:

Growth in Communities to the East

The past fifteen years have already seen large increases in the number of commuters traveling between Boulder and communities to the east, as well as to and from other places in the region. Between 2002 and 2014, there was a greater increase in workers commuting to Boulder from the east than from any other direction (Figure 10), but also growth in commuting from Boulder to the region (Figure 11).[9] Regional projections shown in Figure 12 indicate significant increases in projected person trips to and from Boulder between 2010 and 2035. Figure 12 shows that trips are expected to increase significantly between Boulder and Erie (104.7%), Broomfield (38.5%), and Lafayette (15.9%) by 2035.[10] This is based on the growing population of these communities and the growing interconnectedness of the region.

Figure 10 Increase in Workers Commuting to Boulder from Places in the Region, 2002-2014

Place	2002	2014	Net Increase	% Increase
Longmont	7,158	8,382	1,224	17%
Broomfield	*	4,461	*	*
Lafayette	2,994	3,985	991	33%
Erie	891	2,230	1,339	150%
Superior	1,035	1,602	567	55%
Frederick	263	782	519	197%
Firestone	208	650	442	213%

Notes: * Comparison is not possible due to data limitations
Source: US Census LEHD, 2014.

Figure 11 Increase in Workers Commuting from Boulder to Places in the Region, 2002-2014

Place	2002	2014	Net Increase	% Increase
Denver	2,652	3,838	1,186	44.7%
Louisville	617	1,009	392	63.5%
Westminster	503	839	336	66.8%
Lakewood	470	724	254	54.0%
Aurora	334	579	245	73.4%
Lafayette	283	499	216	76.3%
Longmont	923	1,137	214	23.2%
Broomfield	*	891	*	*

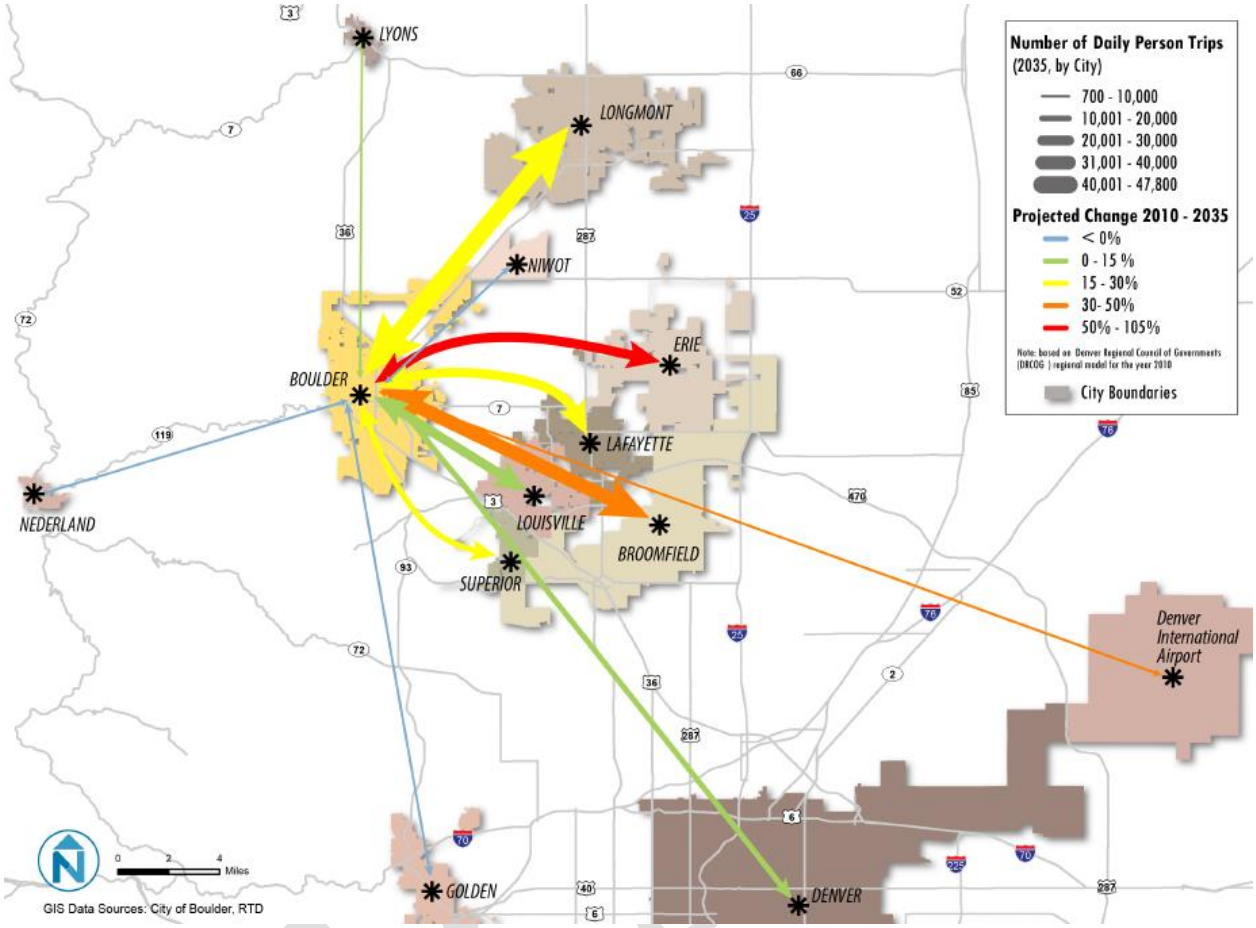
Notes: * Comparison is not possible due to data limitations
Source: US Census LEHD, 2014.

[8] Travel Forecasts based on Regional Travel Demand Model, 2040

[9] US Census Bureau, Longitudinal Employer-Household Dynamics

[10] Boulder Transportation Master Plan, 2014. Analysis of DRCOG Regional Model, 2010-2035.

Figure 12 Origin-Destination Pairs in the Region (Projected Change 2010-2035)

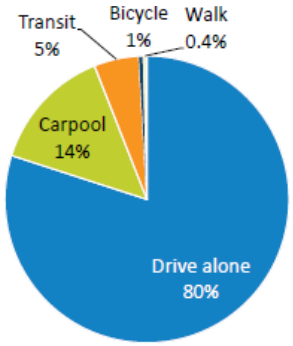


Source: City of Boulder Transportation Master Plan, State of the System Report 2014, Figure 3-22. Data from DRCOG 2010-2035 projections.

Increasing SOV In-Commute Trips

Approximately 55% of Boulder workers are estimated to travel into Boulder for work. While Boulder has achieved a low SOV mode share for local travel (approximately 48% for commute trips), in-commute travel remains primarily SOV at nearly 80% (See Figure 13). Regional travel demand projections from the Denver Regional Council of Governments (DRCOG) indicate growth in traffic volumes of 20% or more along the corridor by 2040, and over 30% on the eastern end of the corridor (east of 55th Street). If future regional travel maintains this 80% SOV mode share as traffic volume grows, the East Arapahoe corridor will see increasing congestion and will be able to carry fewer trips. Due to the distances of regional trips and the need to maintain and expand the number of trips that the East Arapahoe corridor can carry, future travel will need to be balanced among automobiles, transit, and strategies such as ridesharing and first-and-last-mile connections for transit riders.

Figure 13 Boulder In-Commute Mode Share



Source: Source: Census Transportation Planning Products (CTPP). 2006 – 2008 American Community Survey "Journey to Work." Boulder TMP State of the System Report 2014, Figure ES-10

Goal 3. Transportation Demand Management: Promote a more efficient use of the transportation system and offer people travel options within the East Arapahoe corridor.

Objective 3.a. Improve "first-and-last-mile" connections to help people conveniently and safely walk, bike or make shorter car trips to and from transit.

A "trip" is a journey from an origin to a destination. A transit trip most often involves a walking, biking, or other type of trip on one or both ends – in addition to the transit portion of the trip. The first and last miles of a transit trip can be challenging, especially in suburban communities and areas like East Boulder that were originally designed for motor vehicles. If walking or biking to a transit stop is too far, or connections are limited, travelers tend to avoid transit. First-and-last-mile strategies help people comfortably, conveniently, and safely bridge these gaps with solutions like bike sharing, covered and secure bike parking, shuttle and car share services and mobility on demand services like Lyft or Uber.

The 2014 Boulder TMP recommends developing "mobility hubs" throughout the city to better integrate these services, including at several locations along Arapahoe Avenue. The goal of a mobility hub is to provide seamless access between transit, pedestrian and bicycle networks, car/rideshare programs, and context-appropriate parking supply. Mobility hubs emphasize excellent pedestrian infrastructure within a quarter to half-mile of transit stops and connections to the bicycle network. A well-connected system brings people near the locations they wish to access and ensures a comfortable and safe walk to the places they wish to go.

The need to improve first-and-last-mile connections is further described here:

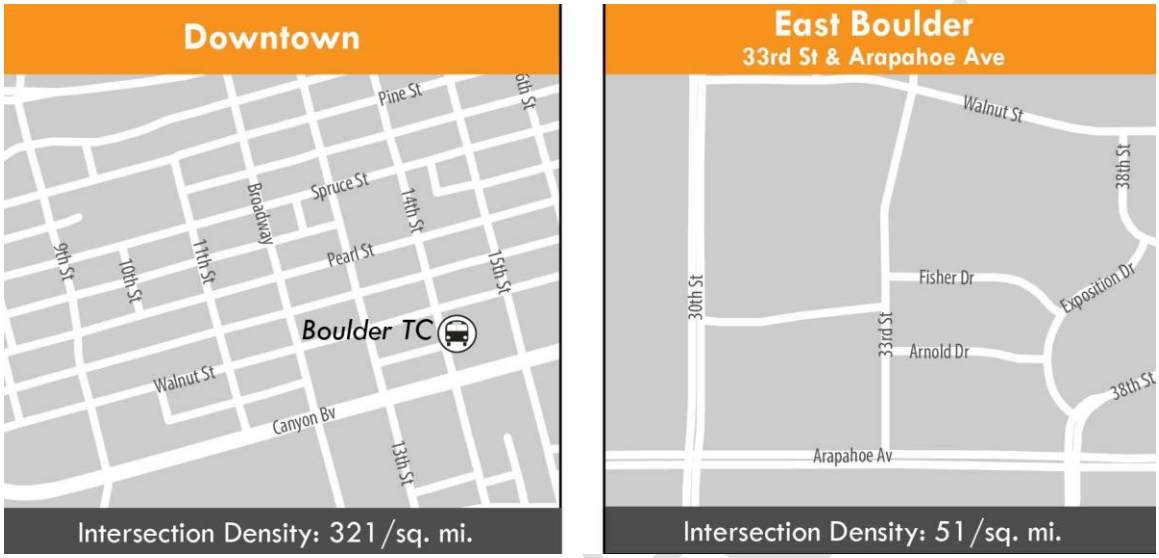
Lack of Pedestrian and Bicycle Connections

Due to the disconnected street grid and large blocks along East Arapahoe, it takes longer and is less convenient to walk or bicycle to destinations and access bus stops. The average block size east of Foothills Parkway is 15 acres, and the area has around 51 intersections per square mile, making for relatively few paths between destinations. For comparison, downtown Boulder has 321 intersections per square mile (see

Figure 14).

Additionally, very limited signage and wayfinding in the corridor mean that walking or biking to transit or other destinations can be challenging. To overcome these barriers, it will be essential to provide complete pedestrian and bicycle connections and provide clear signage to transit stops, a particularly important consideration as properties redevelop in the corridor.

Figure 14 Intersection Density, Downtown Boulder and East Boulder



Intersection density, or the number of street intersections per square mile, is a measure of street connectivity and walkability.
Source: Boulder Transportation Master Plan, State of the System Report, p. 3-6.

Objective 3.b. Promote the use of multiple transportation options and TDM programs in East Boulder by residents and workers (examples include EcoPass programs, shared use mobility and parking management).

The City of Boulder's transportation demand management strategies, such as the EcoPass, have proven to be effective. Expanding the appeal of non-drive alone travel options in East Boulder requires policies and programs to expand access to bike and car sharing, manage the parking supply effectively, coordinate land use, and encourage use of enhanced pedestrian, bicycle, and transit facilities and services.

The need to encourage the use of multiple travel options is further described here:

Limited EcoPass Distribution

The EcoPass, a discounted annual transit pass purchased through group organizations, allows users access to all RTD services. City of Boulder surveys have found that people with an EcoPass are four to seven times more likely to use transit than those without a pass. The changes in travel behavior associated with access to an EcoPass translate into significant reductions in vehicle trips and mobile emissions. For work trips, Boulder employees with an EcoPass travel less than half the annual vehicle commute miles compared to employees without a pass. In 2012, 69,425 people who live, work, or study in Boulder had

access to EcoPasses. Currently, only 25% of employees in the East Arapahoe corridor have access to an EcoPass. [11]

Limited Bike Share and Care Share Options

Transportation options to support first-and-last-mile trips in Boulder include Boulder BCycle and eGo CarShare. In 2014, over 43,000 BCycle trips were made by approximately 7,000 riders, averaging 118 trips per day.[12] Currently, BCycle has three stations along Arapahoe Avenue in the study area – at 26th, 38th, and 48th Streets, as well as at 33rd Street & Fisher (less than ¼ mile north of the corridor). While the East Arapahoe BCycle stations do not have the highest usage from a systemwide basis, there is likely to be an increased demand as the density of employment and other destinations increases. Car sharing in Boulder is available through eGo CarShare, a nonprofit based in the Denver area. Cars are reserved hourly, and can be accessed at a home location. eGo CarShare is available at multiple locations throughout the City, including one location on Arapahoe Avenue at 48th Street.

Expanded bike share and car share options in the East Arapahoe corridor can help people overcome one of the primary concerns with commuting via transit – which is not having a car to access destinations throughout the city. These types of shared use mobility options have the potential to play an important role in bridging some of the existing transportation network gaps as well as encouraging people to use multiple transportation modes. Typically, bike share and car share are transit supportive by providing local mobility options for people who choose to use transit for longer distance commutes. For example, an employee on East Arapahoe Avenue who commutes in from Erie by transit may opt to use eGo CarShare to get to a lunchtime meeting.

Goal 4. Funding: Deliver cost-effective transportation solutions for the East Arapahoe corridor that can be phased over time.

Objective 4.a. Coordinate with public and private entities, including adjacent land owners and local and regional agency partners, to implement cost-effective transportation improvements (including capital and operating and maintenance investments).

The Boulder 2014 TMP's Complete Streets investment strategy focuses on developing the city's system of ten multimodal corridors, which includes Arapahoe Avenue. It also calls for expanding fiscally-viable transportation options for all Boulder residents and employees, including older adults and people with disabilities. The City of Boulder focuses on delivering cost-effective transportation solutions, leveraging resources from regional, state, federal and/or private sector partners, and doing best-value construction by investing once for multiple modes.

The need for cost-effective transportation improvements is further described here:

Lack of Corridor Vision

Currently, there is no community "vision" for planned transportation improvements in the East Arapahoe corridor, which precludes coordinated public and private investment. As property along East Arapahoe redevelops, there is a need to help property owners and developers understand planned transportation improvements and the required commitment for infrastructure improvements along the corridor.

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[11] Based on EcoPass data as of May 2016 and employment from US Census LEHD, within ½ mile of the corridor between Folsom Street and 75th Street.

[8]Boulder BCycle 2014 Annual Report

Communicating a plan for short-term enhancements and Boulder's long-term community vision for the corridor to mobility service providers and Boulder's potential funding partners will also be important to ensure efficient and coordinated efforts.

Limited Funding Resources

Implementing effective multimodal transportation investments in the East Arapahoe corridor will require a significant and sustained effort by the City of Boulder, other jurisdictions, and agency partners to identify, secure, and efficiently utilize new and creative sources of funding. Regional, state, and federal funding sources are, and appear likely to continue to be, increasingly scarce and competitive. Securing additional resources for transportation given this challenging funding environment will require heightened effort, creativity an likely project phasing. Strong partnerships with RTD, Via, CU, Colorado Department of Transportation, Boulder County, neighboring jurisdictions, community institutions, non-profits, private sector partners, and other stakeholders will be essential to leverage the city's limited resources and secure needed funding for improvements.

Goal 5. Sustainability Initiatives: Develop transportation improvements in the East Arapahoe corridor that support and integrate with the Boulder Valley Comprehensive Plan and Boulder's Sustainability Framework (desired outcomes include a community that is Safe, Healthy & Socially Thriving, Livable, Accessible & Connected, Environmentally Sustainable, and Economically Vital Community and provides Good Governance).

Objective 5.a. Reduce greenhouse gas (GhG) emissions and air pollution from vehicle travel within the East Arapahoe corridor.

The City of Boulder has established a goal of an 80% reduction in greenhouse gas (GhG) emissions by 2050, which will require a multifaceted strategy. The challenge of the 80% reduction goal requires that the community increases mode shift, transitions to cleaner fuel sources for both the personal vehicle and transit fleets, houses more of our workers, and creates mixed use neighborhoods where more destinations are closer together and can be reached by walking. As one of the city's largest regional travel corridors, transportation improvements in the East Arapahoe corridor can play a pivotal part in reaching this goal.

The need to reduce GhG emissions and air pollution is further described here:

Meeting Boulder's Climate Commitment

Currently, Boulder residents account for 38% of transportation-related emissions while non-residents account for 23% of emissions. To reduce vehicle miles traveled (VMT), the City of Boulder's Climate Commitment Analysis anticipated reducing resident SOV mode share to 20% of all trips and non-resident mode share to 60% of all trips by 2035.

Achieving the Boulder 2014 TMP goal of reducing VMT by 20% from current levels implies reducing daily VMT from the current 11.2 miles per capita to 7.3 miles per capita for residents, and from 14.3 miles per capita (one-way work trip distance) to 11.4 miles per capita for non-resident employees. Achieving these reductions will require reducing SOV travel among all transportation sectors, as shown in Figure 15, and increasing walking, biking, ride sharing, and transit use.

Figure 15 Climate Commitment Inventory of VMT and GhG Emissions, 2013

Transportation Sector	Annual VMT	% VMT	Annual GhG (MT)	% GhG
Resident	323,769,600	51%	118,809	38%
Non-Resident Employee	192,192,000	30%	70,526	23%
Student	70,200,000	11%	25,760	8%
Visitor	25,550,000	4%	9,376	3%
Transit	10,435,000	2%	31,110	10%
Freight	18,250,000	3%	52,980	17%
Boulder Personal Aircraft			2,188	0.7%
Annual GhG (Metric Tons)			**310,749**	**100%**

Source: Boulder Transportation Master Plan, 2014, Figure 3-1.) Data from Climate Commitment Analysis, 2013.

Objective 5.b. Improve travel options that promote public health for residents and workers along the East Arapahoe corridor.

Use of active transportation, like walking and biking, can provide health benefits for people of all ages, helping reduce the occurrence of conditions such as obesity, asthma, and heart disease. While adults in Boulder County are currently very active, the obesity rate for children is higher than the state as a whole and the health and transportation needs of older adults is changing as their share of the population increases.[13] Transportation facilities combined with urban design and development that supports walking, cycling, and safe access to transit can encourage East Arapahoe corridor residents and employees of all ages to stay healthy and active.

The need to improve travel options that promote public health is further described here:

Rising Obesity Rates, Aging Population and Air Pollution

Bicycling, walking, and reduced automobile traffic through neighborhoods are associated with a variety of health benefits. Increased opportunities for active transportation in the East Arapahoe corridor would provide these benefits for residents, especially children and the elderly. These include:

- Almost 90% of adults in Boulder County reported participating in physical activity in their leisure time, and, as in the rest of Colorado, adult obesity rates are low. However, the obesity rate for children ages 2 to 14 in Boulder County is 21%, higher than the state as a whole. Low-income pre-school aged children in Boulder County are more likely to be obese than in the state as a whole.[14]
- The population of adults over the age of 65 in Boulder County is expected to increase from 13 to 20% by 2030. The 2012 Travel Diary found that older adults were far more likely to drive than any other age group. Heart disease is the second leading cause of death for Boulder County residents.[15]
- Proximity to major roads is associated with an elevated risk of asthma, which is the leading cause of preventable hospital visits for children. Encouraging other modes of transportation on East

[13] Boulder County, Trends: The Community Foundations Report on Key Indicators, 2015-2016

[14] Boulder County TRENDS Report 2015

[15] Boulder County Environmental Sustainability Plan, 2012

Arapahoe could reduce the exposure of nearby residents to the ambient air pollutants that are associated with asthma.[16]

Objective 5.c. Provide access to affordable transit and other travel options to low- and moderate-income residents and workers along the East Arapahoe corridor.

High housing costs in Boulder contribute to in-commuting from neighboring communities, and longer commutes have higher transportation costs for workers. Added to that, nearly 55% of the jobs within a half-mile of the corridor between downtown Boulder and Brighton are considered low and moderate-wage jobs that pay less than $3,333 per month.[17] By comparison, Boulder's median household income is about $4,800 per month.[18] Providing access to convenient, frequent transit service along the corridor, including early morning and later evening hours, that is integrated with well-timed transit transfers and access to a variety of first-and-last-mile mobility options, can increase access to jobs, reduce commuting costs, and improve livability for low and moderate income workers.

The need to provide affordable travel options is further described here:

Large Proportion of Low-and-Moderate Income Workers

There are over 26,000 low income jobs within a half-mile of the corridor, which is 54.7% of the total jobs in that area. Of the workers who live within a half-mile of the corridor 51% are within the two lowest income brackets. Just under 2,000 low income workers both live and work within a half-mile of the corridor, which represents about 23% of the corridor's total low-income residents. This illustrates that low income workers are making longer trips to their place of employment and likely spending larger amounts of their budget on transportation costs.

High Housing and Transportation Costs

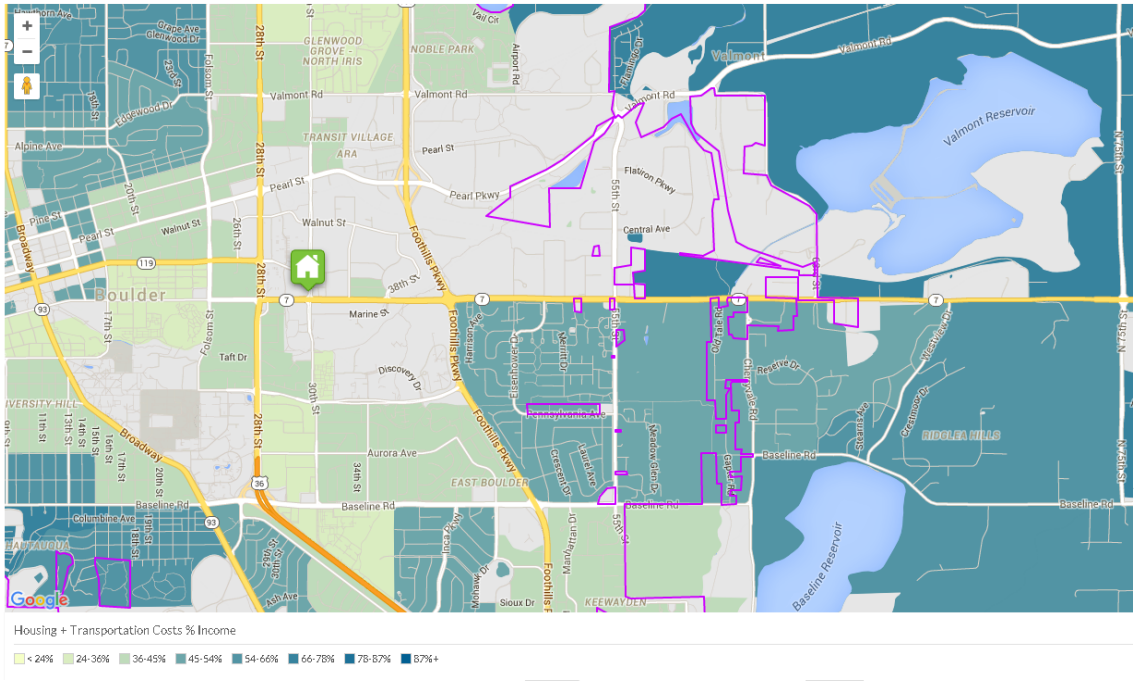
Data from the Center for Neighborhood Technology Housing and Transportation (H+T) Affordability Index for 2014 shows that the average cost of housing and transportation can be a significant burden on households within the East Arapahoe corridor. The blue shaded areas in Figure 16 below are those with combined housing and transportation costs of over 45%, which is considered the affordability threshold. High-quality public transit and other convenient travel options serving the corridor would provide affordable transportation access for low- and-moderate income workers who live and/or work in the East Arapahoe corridor.

[16] Asthma exacerbation and proximity of residence to major roads: a population-based matched case-control study among the pediatric Medicaid population in Detroit, Michigan, 2011

[17] US Census Bureau, Longitudinal Household Employer Dynamics (LEHD), 2013. The LEHD classifies low-to-moderate income jobs as those paying less than $3,333.

[18] U.S. Census Bureau, American Community Survey, 2014.

Figure 16 Housing and Transportation Affordability (H+T) Index, 2014



Source: Housing and Transportation Affordability Index (H+T), 2014

Objective 5.d. Preserve and enhance economic vitality in the East Arapahoe corridor, working with Boulder businesses.

A transportation system that provides convenient, reliable, and affordable travel options for business employees and patrons is vital to supporting and retaining the growing number of local and regional businesses within the East Arapahoe corridor. Corridor projects that enhance the streetscape and improve multimodal access and connectivity have been demonstrated in cities around the country to improve economic vitality, including attracting more investment to the corridor, increasing commercial activity, and improving access to jobs.

The need to support economic vitality is further described here:

Employee Access to Travel Options

Boulder's workforce is drawn to employment areas with a wide variety of amenities, services (e.g. restaurants, retail), recreational amenities, the arts, enhanced walkability, and increased access to public transportation, bicycle, and pedestrian facilities. While the East Arapahoe corridor has seen a diversification of amenities and services in the last several years, there remains an enormous opportunity to provide more travel options in the corridor and human-scaled infrastructure that supports the area's growing economic base. In dozens of conversations with businesses in the area, employers stress the importance of providing convenient, reliable and affordable travel options for their employees as an essential component of their economic vitality.

By coordinating transportation planning and investments with anticipated changes in land use, improvements can support community desires for high quality design and placemaking in the East Arapahoe corridor. A transportation system that is accessible and comfortable and provides convenient travel options will create value by helping to make East Arapahoe a great place – to work, live and visit.

East Arapahoe
Transportation Plan

CITY OF BOULDER

EAST ARAPAHOE TRANSPORTATION PLAN
Task 3: Initial Screening of Corridor Design and Management Elements

July 2016 – DRAFT

NELSON NYGAARD
FOX TUTTLE HERNANDEZ TRANSPORTATION GROUP
FEHR & PEERS

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INITIAL SCREENING OF CORRIDOR DESIGN AND MANAGEMENT ELEMENTS

INTRODUCTION

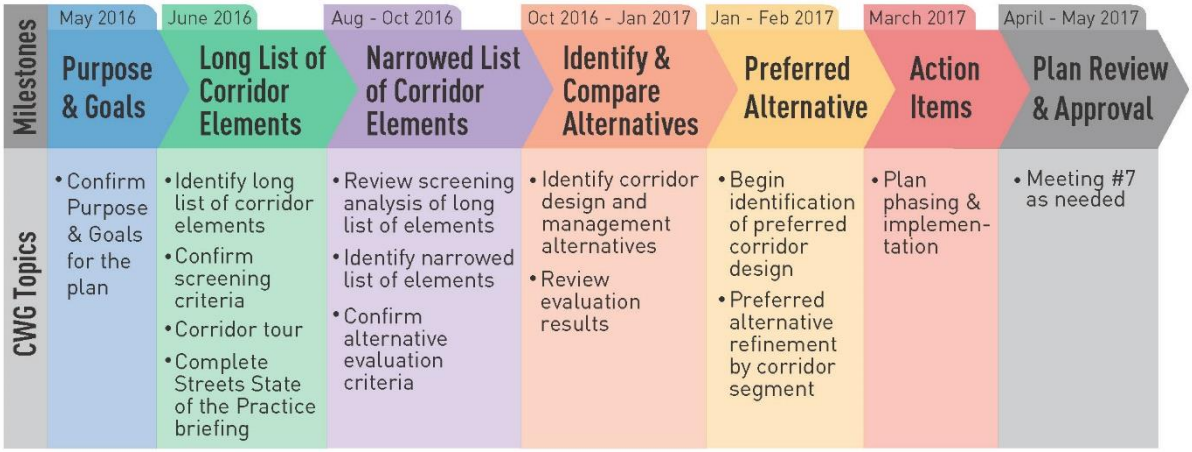
The East Arapahoe Transportation Plan is a long-range plan for multimodal transportation and streetscape improvements within the East Arapahoe corridor. Potential types of improvements being evaluated include: walking and biking enhancements, improved regional and local transit, efficient vehicular travel, as well as urban design features that work hand in hand with mobility improvements to truly transform the corridor. The transportation improvements identified in the plan will support the goals and objectives of the Boulder Valley Comprehensive Plan, the Boulder Transportation Master Plan (TMP) and the city's Sustainability Framework. The Draft Goals and Objectives report (June 2016) describes the purpose of the plan and the goals and objectives that were drafted to guide its development.

This document identifies a long list of potential corridor design and management elements that can help achieve the stated purpose and goals of the East Arapahoe Transportation Plan. The design and management elements included were identified based on national and international best practices, local and regional plans related to the East Arapahoe corridor, previous technical work in this corridor, public and stakeholder outreach completed prior to the formation of the East Arapahoe Transportation Plan Community Working Group (CWG), and input received at CWG Meeting #2 on June 15, 2016.

Following the June 2016 CWG meeting, the project team conducted a "screening" of the long list of potential corridor design and management elements. The purpose of the screening is to eliminate elements that are not aligned with the project purpose and goals or do not meet basic feasibility, cost, or safety criteria. This is the first step in a multi-stage process to develop and refine a set of alternatives, or packages of design and management elements, that can help to achieve the stated purpose and goals for the corridor.

This document describes the screening process and results, which will be discussed at CWG Meeting #3 in August 2016 (see Figure 1).

Figure 1 East Arapahoe Transportation Plan Schedule and Community Working Group Meeting Topics



POTENTIAL CORRIDOR DESIGN AND MANAGEMENT ELEMENTS

Figure 2 provides a list of the corridor design, program, and management elements organized into three categories: (1) Bike/Pedestrian/Streetscape; (2) Transit and Transportation Demand Management (TDM); and (3) Vehicular. For each element, Appendix A (Corridor Design Elements Reference Guide) provides a brief description of its purpose and potential design options, including graphical illustrations.

Appendix A provides a description and examples of each element.

Figure 2 Long List of Corridor Design, Program, and Management Elements

Bike/Pedestrian/Streetscape	
S1	Additional crossings
S2	Intersection enhancements
S3	Multi-use path (off-street bike facility; shared space)
S4	Enhanced multi-use path (e.g., delineation between bikes and pedestrians)
S5	Shared travel lanes with pavement markings (sharrows)
S6	Bike lanes
S7	Buffered bicycle lanes
S8	Protected bicycle lanes
S9	Shared bus & bike lane (11-12' lane that allows bus and bikes)
S10	Amenity zone features (lighting, planters, bus shelters, benches, public art, etc.)
S11	Landscaping
S12	Public art
S13	Gateway features

Transit and Transportation Demand Management (TDM)	
T1	Side running bus in mixed traffic
T2	Enhanced Bus (similar to BRT but without dedicated lanes)
T3	Bus Rapid Transit (side-running in Business Access and Transit Lane)
T4	Bus Rapid Transit (center running in dedicated lanes)
T5	Streetcar
T6	Light rail transit
T7	Commuter rail
T8	Peak-only exclusive transit lanes
T9	Better information and timed transfers
T10	Real-time, app-based information
T11	Expanded EcoPass
T12	Reversible transit lane
T13	Improved transit amenities
T14	Park and rides (assumed to be edge or satellite parking)
T15	Parking management
T16	First/last-mile connections
T17	Shared use mobility

Vehicular	
V1	Three general purpose travel lanes per direction (maintain existing number of lanes)
V2	Two general purpose travel lanes per direction with one lane repurposed for enhanced transit (and/or pedestrian, bicycle and/or streetscape enhancements)
V3	Three general purpose travel lanes with an additional transit lane per direction
V4	Adding general purpose lanes (east end of corridor)
V5	Reversible traffic lane (zipper lane)
V6	Wider general purpose travel lanes
V7	Narrower general-purpose travel lanes (subject to working with CDOT)
V8	High-occupancy vehicle (HOV) lanes
V9	Managed lanes (Express lanes)
V10	Signal timing adjustments
V11	Reduce posted speed limit (assumes reduction of 45 mph segments to 35 mph)
V12	Access management (assumes closing some driveways and converting parking lots to shared use/access)
V13	Roundabout
V14	Grade separated interchange (Foothills & Arapahoe)
V15	Speed humps
V16	Tunnel

SCREENING METHODOLOGY

The long list of design elements summarized in Figure 2 was "screened" using a basic set of criteria. The screening analysis was done iteratively, first with a qualitative assessment based on knowledge of the corridor, peer experience, or professional judgment. For design elements where initial concerns or issues were identified, additional analysis was performed using order-of-magnitude cost estimates or peer data, if necessary.

The intent of this screening was to eliminate design elements that are not aligned with the Project Purpose and Goals, are not feasible based on design or cost limitations, or pose safety hazards to roadway users.

The screening criteria, which were reviewed with the CWG on June 15, 2016, are:

1. **Supportiveness of the East Arapahoe Transportation Plan purpose and goals**

   This criterion assesses whether the design or management element creates an outcome consistent with the stated purpose of the plan and one or more of the goals and objectives for the plan (listed below).

   Goal 1. Complete Streets: Provide Complete Streets in the East Arapahoe corridor that offer people a variety of safe and reliable travel choices.

   - Objective 1.a. Provide safe travel for people of all ages and stages of life using all modes along the East Arapahoe corridor.
   - Objective 1.b. Improve the ease of access, comfort and experiences for people walking in the East Arapahoe corridor.
   - Objective 1.c. Broaden the appeal of bicycling along the East Arapahoe corridor to people of all ages and bicycling abilities.
   - Objective 1.d. Make riding transit a convenient and practical travel option in the East Arapahoe corridor.
   - Objective 1.e. Move drivers efficiently through the East Arapahoe corridor.

   Goal 2. Regional Travel: Increase the number of person trips the East Arapahoe corridor can carry to accommodate growing local and regional transportation needs.

   - Objective 2.a. Improve local travel options within the East Arapahoe corridor for residents, employees, and visitors.
   - Objective 2.b. Improve regional travel options between Boulder and communities to the east for work and other regional trips, including access to health care facilities.

   Goal 3. Transportation Demand Management (TDM): Promote a more efficient use of the transportation system and offer people travel options within the East Arapahoe corridor.

   - Goal 3.a. Improve "first-and-last-mile" connections to help people conveniently and safely walk, bike, or make shorter car trips to and from transit.
   - Goal 3.b. Promote the use of multiple transportation options and TDM programs in East Boulder by residents and workers (examples include EcoPass programs, shared use mobility and parking management).

Goal 4. Funding: Deliver cost-effective transportation solutions for the East Arapahoe corridor that can be phased over time.

- Objective 4.a. Coordinate with public and private entities, including adjacent land owners and local and regional agency partners, to implement cost-effective transportation improvements (including capital and operating and maintenance investments).

Goal 5. Sustainability Initiatives: Develop transportation improvements in the East Arapahoe corridor that support and integrate with the Boulder Valley Comprehensive Plan and Boulder's Sustainability Framework *(desired outcomes include a community that is Safe, Healthy & Socially Thriving, Livable, Accessible & Connected, Environmentally Sustainable, and Economically Vital Community and provides Good Governance).*

- Goal 5.a. Reduce greenhouse gas (GhG) emissions and air pollution from vehicle travel within the East Arapahoe corridor.
- Goal 5.b. Improve travel options that promote public health for residents and workers along the East Arapahoe corridor.
- Goal 5.c. Provide access to affordable transit and other travel options to low- and moderate-income residents and workers along the East Arapahoe corridor.
- Goal 5.d. Preserve and enhance economic vitality in the East Arapahoe corridor, working with Boulder businesses.

Elements that are at odds with the goals and objectives are recommended to be removed from consideration.

2. Design feasibility and cost

This criterion assesses the likelihood that an element can be designed, funded, or constructed without significant impacts to adjacent properties or at a reasonable cost relative to the likely benefits. Questions used to assess feasibility include:

- Is there any element of the design that is not technically feasible?
- Are there national or international peer comparable projects that have been built or implemented?
- Is the element likely to have significant adverse environmental impacts, including to properties outside the public right-of-way corridor?
- Does the cost per user served or cost per user benefit (e.g., net new transit riders, improvement in vehicle travel reliability, bicycle or pedestrian safety, etc.) align with comparable projects that are built and operational?
- Is it a responsible use of limited public funds for the City of Boulder to implement or pursue the element as part of this process?

Elements that are not reasonably feasible, cost-effective, or a responsible use of public funds are recommended to be removed from consideration.

3. Safety

This criterion assesses whether an element is likely to have a negative impact for any mode or user of the corridor. Questions used to assess safety impacts include:

- Is the element likely to reduce safety for corridor users including people on bikes and people walking?
- Are there specific safety hazards that could result from this element?

- Does the element inhibit emergency vehicle access?[1]

Elements that are likely to have a negative safety impact are recommended to be removed from consideration.

The Purpose and Goals document for the East Arapahoe Transportation Plan provides a more complete description of the goals and objectives.

[1] The project team removed two of the vehicular design elements previously discussed with the CWG ("Emergency vehicle access" and "Safety improvements/reduce conflicts"). The team viewed these elements as considerations applicable to all potential design elements and integrated them into evaluation criterion #3 (Safety) so that they could be used to screen other design elements for consistency.

SCREENING RESULTS

Figure 3 provides the results of the screening analysis described above.

Step #1 is the high -level assessment for each design element. Design elements that were identified either as potentially infeasible or as having challenges or concerns were analyzed further to:

1. Confirm the initial assessment and recommend removing a design element from consideration
2. Determine whether additional analysis may be needed and recommend that a design element be forwarded to the next stage of analysis
3. Identify design elements that may be suitable for limited implementation but are not solutions to be applied extensively in the corridor as they do not meet the broad purpose and goals for the plan

The Step #2 portion of the table provides a more in-depth discussion of the rationale along with a recommendation for discussion with the Community Working Group—to remove the element from consideration or carry it forward for more analysis. In some cases, design elements are noted as potentially appropriate for targeted locations in the corridor.

The table also summarizes comments from the Community Working Group, from discussion of the design elements at its June 15, 2016 meeting.

Figure 3 Screening Results

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
Bike/Pedestrian/Streetscape								
S1	Additional crossings	●	●	●	●		**Recommend considering only pedestrian crossing treatments consistent with City Pedestrian Crossing Guidelines in the next stages of analysis.**	▪ Automatic signalized pedestrian crossings are important. ▪ Crossings are very important in additions to walkways. ▪ Flashing lights are not sufficient for pedestrian crossings, needs to be an overhead beacon or signal. ▪ Overhead lights create a much better stop signal.
S2	Intersection enhancements	●	●	●	●		Recommend moving forward for consideration.	▪ Consider curb ramps, including within bus stops themselves. ▪ The plan needs to be safety-focused; the corridor is not safe for bicyclists. ▪ Intersection safety and comfort is a high priority. ▪ Cross-parcel access and access from properties to the sidewalks is important.
S3	Multi-use path (off-street bike facility; shared space)	●	●	△	△	Multi-use paths have some safety concerns, as there are potential conflicts between turning vehicles and bicyclists and pedestrians when a multi-use path crosses a driveway or an intersection. The lack of special pavement markings or signal treatments increases the chances for conflict.	Recommend moving forward for consideration.	▪ Consider more bike paths on East Arapahoe; this would at least be an improvement over the existing condition. ▪ East Arapahoe is not an ideal bicycling route. Are alternative routes available?
S4	Enhanced multi-use path (e.g., delineation between bikes and pedestrians and/or specialized intersection treatments such as pavement markings or signals)	●	●	●	●		Recommend moving forward for consideration.	▪ This [separated multi-use path] is the primo treatment – but is there the demand in this corridor? Would it draw added usage? Maybe if it is longer and well connected. ▪ Consider color-coded sidewalks for visual acuity.
S5	Shared travel lanes with pavement markings (sharrows)	⊗	△	△	△	Given, the traffic volumes and speeds on the Arapahoe corridor, shared lanes would not meet Objective 1.c. (broaden the appeal of bicycling to people of all ages and bicycling abilities). Shared pavement markings are typically intended for low-volume and low-speed roadways (preferably less than 25 mph and generally no more than 35 mph).[1]	**Recommend considering shared lanes only in very short segments to connect bicycle routes where no alternatives exist or where right-of-way is limited, such as a bridge with limited width.**	▪ Element was added after last CWG meeting

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
S6	Bike lanes	●	●	△	△	Given the speed and volume of traffic on Arapahoe, bike lanes serve experienced and confident bicyclists where they exist along the corridor today, but are not an optimal facility choice to enhance comfort for most users. Buffered or protected bike lanes are a preferred design element, but bike lanes may be considered where buffered or protected bike lanes are not possible due to right-of-way constraints.	**Recommend considering bike lanes only where buffered or protected bike lanes are not feasible.**	▪ Some bicyclists prefer on-street to multi-use paths because of driveways and curb cuts (already likely on East Arapahoe). ▪ A bike lane along Arapahoe might not be beneficial.
S7	Buffered bicycle lanes	●	●	●	●		Recommend moving forward for consideration.	▪ These, or conventional bike lanes are okay. ▪ Prefer a buffered or protected bike lane.
S8	Protected bicycle lanes	●	●	●	●		Recommend moving forward for consideration.	▪ Best of the bicycle options. ▪ Need to consider protected bike lanes on the corridor. ▪ Prefer curb/landscaped protected bike lane instead of bollards; bollards aren't sufficient. ▪ Maintenance concerns regarding snow in protected bike lanes.
S9	Shared bus & bike lane (11-12' lane that allows bus and bikes)	●	⊗	△	⊗	Shared bus-bike lanes are not considered appropriate for streets with speeds greater than 25 mph. Such a design poses safety risks to cyclists and sets up a situation where a single cyclist can create significant delay for a bus carrying 40 or more passengers. Dedicated bicycle facilities are a preferred design element.[2]	**Recommend removing from consideration.** Shared lanes could be allowed in very short segments to connect bicycle routes where no alternatives exist.	▪ Too much speed differential between these two modes. ▪ How would this lane work exactly? This is unclear.
S10	Amenity zone features (lighting, planters, bus shelters, benches, public art, etc.)	●	●	●	●		Recommend moving forward for consideration.	▪ This is all important. ▪ Yes – it makes it feel like all modes are valued. ▪ Any amenities should be considered that buffer adjacent travel lanes from sidewalks. ▪ Support all amenities, especially to slow cars down. ▪ All pedestrian-realm amenities should be considered.
S11	Landscaping	●	●	●	●		Recommend moving forward for consideration.	▪ In some cases, landscaping can block important views, such as to transit. ▪ Landscaping needs to be drought-tolerant.
S12	Public art	●	●	●	●		Recommend moving forward for consideration.	▪ This area needs neighborhood naming/branding/identity.
S13	Gateway features	●	●	●	●		Recommend moving forward for consideration.	▪ Not so important

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
Transit/Transportation Demand Management (TDM)								
T1	Side running bus in mixed traffic	△	●	●	△	Transit service along Arapahoe Avenue currently operate in mixed traffic along the outside travel lane. Maintaining this configuration without other enhancements would not make transit more convenient (Objective 1.d) or increase the person-trip capacity of the corridor (Objective 2).	Recommend moving forward for consideration.	▪ This is what we have now. Want to do better, particularly in planning for the future.
T2	Enhanced Bus (similar to BRT but without dedicated lanes)	●	●	●	●		Recommend moving forward for consideration.	▪ Good incremental improvements to be made.
T3	Bus Rapid Transit (side-running in Business Access and Transit Lane)	●	●	●	●		Recommend moving forward for consideration.	
T4	Bus Rapid Transit (center running in dedicated lanes)	●	●	●	●		Recommend moving forward for consideration.	▪ Mid-highway platform safety becomes extremely important. ▪ Nice, but is it viable in this corridor?
T5	Streetcar	⊗	△	●	⊗	This element assumes a side- or center-running streetcar operating in mixed-traffic. Operating characteristics of a streetcar – e.g., designed to serve local circulation at slow speeds – are not consistent with the purpose and goals for this plan, and specifically would not support Objective 2.b (support regional travel). Streetcars are ideal for dense, mixed-use corridors and would not be appropriate considering the existing or projected land use and density of population and employment in the East Arapahoe corridor. Streetcars cost approximately $35-70 million per mile to construct. For the case of this evaluation we distingush two rail modes – streetcar and light rail – by their operational characteristics. Most specifically, streetcar is assumed to operate in mixed traffic (tracks are in a lane shared with vehicles) and light rail is assumed to operate in an exclusive right-of-way.	**Recommend removing from consideration**	

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
T6	Light rail transit	△	⊗	●	△⊗	This element assumes a similar type of facility design as center-running BRT (T8), i.e., repurposing of one travel lane in each direction as a center-running transit lane, with many similar considerations: Additional right-of-way would be necessary at station locations. Median transit lanes could require left-turn restrictions along the corridor, with more complex management of traffic operations. Without regional connections beyond Boulder, the utility of light rail would be reduced and capital cost per rider is likely to be high (e.g., typical construction costs range from $50 to $100 million per mile for at-grade applications). Light rail is not consistent with current regional plans for the State Highway 7 corridor. Other design issues include developing a maintenance facility and potentially providing a connection to downtown Boulder. The Northwest Area Mobility Study (NAMS) forecast daily ridership of approximately 4,600 in 2035 for an 18-mile BRT line costing $57.8 million to construct ($3.2 million per mile) between Boulder Transit Center and I-25. These ridership forecasts (for BRT) suggest that the cost per rider of light rail may be very high for the Arapahoe corridor.	**Recommend removing from consideration**	
T7	Commuter rail	-	-	-	-	The study area of this plan is the Arapahoe right-of-way. Commuter rail projects serve existing heavy-rail corridors; commuter rail would operate outside the right-of-way and is therefore outside the scope of this plan. The existing Burlington Northern rail tracks located within the East Arapahoe study area are part of a proposed RTD FasTracks 4-mile commuter rail corridor that would operate between Denver's Union Station and Longmont, serving north Denver, Adams County, Westminster, Broomfield, Louisville, Boulder, and Boulder County. Therefore, commuter rail in this corridor is consistent with regional plans (Northwest Rail Corridor[3]). However, the alignment and typical commuter rail station spacing of 2 miles or more would not serve local travel demand along the corridor. Connectivity between land uses in the study area and future commuter rail stations may be an important consideration for this study.	**Recommend identifying the RTD Northwest Rail line as a future project in the East Arapahoe corridor, but not forwarding to the next stage of analysis for the East Arapahoe Transportation Plan.**	
T8	Peak-only exclusive transit lanes	●	●	●	●		Recommend moving forward for consideration.	▪ Seems to make sense if corridor travel patterns are "rush hour" oriented as they seem.
T9	Better information and timed transfers	●	●	●	●		Recommend moving forward for consideration.	
T10	Real-time, app-based information	●	●	●	●		Recommend moving forward for consideration.	▪ Important!

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
T11	Expanded EcoPass	●	●	●	●		Recommend moving forward for consideration.	▪ Convenient for travel through many cities. ▪ No excuses for not riding. ▪ Very important, but we need to reduce bus travel times or people won't stay with transit.
T12	Reversible transit lane	△	△	●	△	For a reversible lane to be operationally effective, it would need to be in the median.[4,5] If the transit lanes were served by standard buses with doors on only one side, stations would need to be located on both sides of the transit lane to provide access. This would be ineffective from a cost standpoint and would require additional right-of-way at these locations. Enhanced buses with reversible doors could use a single stop platform. Implementing stops at only limited stops would constrain ridership potential. Separate stops along the curb would also be needed for the off-peak travel direction, which may be confusing to passengers—buses would pick up and drop off passengers at different locations depending on direction and time period. By addressing only peak-direction travel needs, this element also does not fully support the plan's goal of supporting regional travel needs (Objective 2.b). This element could be considered for select, short segments of the corridor, but it is not suitable for the entire corridor.	**Recommend removing from consideration for full corridor.** Could be considered for short segments of the corridor to address specific design issues.	
T13	Improved transit amenities	●	●	●	●		Recommend moving forward for consideration.	▪ Context specific ▪ Excellent inducer to get riders to take the bus during bad weather.
T14	Park and rides (assumed to be edge or satellite parking)	●	●	●	●		Recommend moving forward for consideration.	▪ Important where there is little or no local feeder transit north and south to the corridor.
T15	Parking management	●	●	●	●		Recommend moving forward for consideration.	▪ Important, but how do we get this on private parking lots? Has this been done elsewhere? ▪ Bike parking too.
T16	First/last-mile connections	●	●	●	●		Recommend moving forward for consideration.	▪ Bike shares at stops, particularly at high employment areas. ▪ The last mile improvements needed in Erie, Lafayette, Louisville, and communities farther east.
T17	Shared use mobility	●	●	●	●		Recommend moving forward for consideration.	▪ Context specific ▪ Excellent inducer to get riders to take the bus during bad weather.

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
Vehicular								▪
V1	Three general purpose travel lanes per direction (maintain existing number of lanes)	●	●	●	●		Recommend moving forward for consideration.	▪ This is very important to do. ▪ It is very important that this is not done.
V2	Two general purpose travel lanes per direction with one lane repurposed for enhanced transit (and/or pedestrian, bicycle and/or streetscape enhancements)	●	●	●	●		Recommend moving forward for consideration.	▪ Favored ▪ Please don't create too much congestion. ▪ Please do this. ▪ Please don't do this.
V3	Three general purpose travel lanes with an additional transit lane per direction	●	△	●	△	Adding a transit lane without repurposing existing general purpose lanes would require new right-of-way along the entire corridor, and especially at station locations. Certain locations may be able to accommodate additional lanes.	**Recommend forwarding to next stage of analysis.** Could also be considered for short segments of the corridor to address specific design issues.	▪ See above – related discussion.
V4	Adding general purpose lanes (east end of corridor)	⊗	△	●	△	Does not address goals of reducing air pollution and GhG emmisions (Objective 5.a). Right-of-way impacts or feasibility issues possible. Adding additional lanes would require new right-of-way and could entail feasibility issues. Additional analysis would be required.	**Recommend forwarding to next stage of analysis.** Not an overall solution for corridor but could be considered for this segment of the corridor.	▪ This is very important to do. ▪ It is very important that this is not done.
V5	Reversible traffic lane (zipper lane)	⊗	△	●	⊗	A reversible traffic lane[6] needs to be in the median, and could result in more complex management of traffic operations, including left-turn restrictions. This element does not address goals of reducing air pollution and GhG emisions (Objective 5.a) and serving local travel needs (Objective 2.a). Costs of a reversible travel lane along the full length of the corridor could be in the range of $4 million per mile for construction (assuming use of existing right-of-way), and $140,000 per mile for annual operations. A reversible lane between Folsom and 75th Street could cost in the range of $17 million to construct and $630,000 per year to operate based on comparable projects in other places. Most reversible lane applications are in corridors or on streets where there are limited turns allowed and/or that have limited access design (i.e., Lion's Gate Bridge, British Columbia). There are a few applications in more urban or arterial corridors such as Park Avenue in Montreal or Kapiolani Boulevard in downtown Honolulu.	**Recommend removing from consideration.**	▪ Depending on dedication to BRT (or not). If no BRT, then this would be secondary. ▪ Seems to match the corridor travel pattern. How about a reversible express lane that retains 45 MPG while local traffic slows? ▪ These are not good.

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
V6	Wider general purpose travel lanes	⊗	△	⊗	⊗	Increasing lane width requires reducing width of other facilities or acquiring additional right-of-way to expand the roadway, could preclude enhancements for other modes to support Goal 1 (Complete Streets). Wider lanes encourage higher speeds and may reduce safety for people walking, biking, and driving. Does not support goals of plan, including improving safety for all roadway users (Objective 1.a), promoting multiple transportation options (Objective 3.b), reducing GhG emissions and pollution (Objective 5.a) and improving travel options that promote public health (Objective 5.b).	**Recommend removing from consideration.**	
V7	Narrower general-purpose travel lanes (subject to working with CDOT)	●	●	●	●		Recommend moving forward for consideration.	▪ What is the experience with this on Broadway?
V8	High-occupancy vehicle (HOV) lanes	●	△	●	△	High-occupancy vehicle lanes are typically used on limited-access roadways or highways. HOV lanes are typically restricted to vehicles carrying two or more passengers, including transit vehicles. Roadways with frequent intersections, driveways and turning movements present operational challenges for applying HOV lanes to an arterial corridor. There are limited comparable arterial roadways with HOV lanes. If existing lanes are designated as HOV lanes, enforcement could be challenging, given frequent turning movements at intersections or to access businesses in many parts of the corridor, and are unlikely to be an effective or easily implementable overall strategy for the corridor. Enforcement could involve police patrols, automated vehicle identification systems, or cameras; All options would require staffing and financial resources.[7]	**Recommend removing from consideration.** Could be considered for specific segments of the corridor.	▪ There should be some BRT element, exclusive or managed lane. ▪ Electric Cars.
V9	Managed lanes (Express lanes)	●	⊗	●	⊗	Managed lanes is the use of tolling and pricing to maintain free-flowing traffic. The toll may be adjusted to maintain the desired speed. Managed (express) lanes would likely need to be located in the median and a barrier or special lane striping would likely be used to restrict vehicles' ability to access the lanes to designated locations. Traffic operations considerations could include left-turn restrictions. If some transit service is to utilize these lanes, providing stop access would requires significant additional right-of-way for station platforms and to allow transit vehicles to exit the flow of traffic in the managed lanes). Limited stops could constrain ridership potential. If managed lanes are not barrier-separated, enforcement issues may be similar to HOV lanes.	**Recommend removing from consideration.**	▪ Not sure that tolling makes sense on Arapahoe. ▪ These are not good.
V10	Signal timing adjustments	●	●	●	●		Recommend moving forward for consideration.	▪ Hard to do with 2-way traffic. ▪ Look at doing this at Conestoga St.

Key: ● Likely supportive or feasible. △ May be challenging, or a cause for concern; may only be appropriate in certain locations. ⊗ Likely infeasible, significant adverse impacts, or not supportive.

		STEP #1: Assessment based on Initial Screening Criteria				STEP #2: Analysis of Options not Rated as Supportive or Feasible; Recommendation		Community Working Group Input (from June 2016 Meeting)
ID	Major Facility Elements	1. Support for purpose & goals	2. Design feasibility & cost	3. Safety	Overall Score	Notes / Explanation of Rationale	Recommendation	
V11	Reduce posted speed limit (assumes reduction of 45 mph segments to 35 mph)	●	△	●	△		**Recommend considering speed reduction only in conjunction with other complementary elements.** If implemented, this element would need to be accompanied with other treatments that actually reduce speed.	
V12	Access management (Assumes closing some driveways and converting parking lots to shared use/access)	●	●	●	●		Recommend moving forward for consideration.	▪ Requires much better travel conditions between properties. ▪ In sync with land use plans to facilitate accesses or access management to parcels and properties anticipated to density – don't preclude your options. ▪ Interested in this option.
V13	Roundabout	●	△	△	△	Roundabouts would require right-of-way acquisition and would only solve traffic movement at intersections. Roundabouts typically help reduce vehicle speeds. Multi-lane roundabouts are likely to reduce pedestrian and bicycle comfort and safety more than single-lane roundabouts.	**Recommend removing from consideration.** May be suitable for select locations, but not advisable for the entire corridor. For example, may be suitable to enhance safety on east end of corridor in conjunction with gateway treatments (S13).	▪ Don't preclude future possibility of implementation where it could make sense to remove a signaled intersection and add a roundabout. ▪ Entry Feature.
V14	Grade separated interchange (Foothills & Arapahoe)	△	⊗	△	⊗	A two-level interchange can cost between $10 and 30 million. Right-of-way acquisition can also add an additional cost to the project.[8] May reduce local access and pedestrian and bicycle comfort (Goal 1 – Complete Streets). May increase vehicle speeds in the corridor. However, fewer vehicular conflicts may increase safety and may balance out any safety reduction due to higher speeds.	**Recommend removing from consideration.**	▪ Perfect opportunity to implement an overpass at 55th too. ▪ Interested in this option.
V15	Speed humps	△	⊗	△	⊗	Speed humps are not compatible with posted vehicle speeds on Arapahoe Avenue. Speed humps usually slow vehicles to 15 mph.[9] Speed humps should be avoided on roads frequently used by transit, emergency vehicles, freight and roads with four or more lanes of traffic.[10] This element would not help move driver's efficiently through the corridor (Objective 1.e). If implemented along the corridor, speed tables or raised crosswalks could be used at intersections with right-turn bypass lanes to slow turning speeds and prevent serious injuries for pedestrians.	**Recommend removing from consideration** Could be considered as a treatment for right-turn bypass lanes.	▪ New idea proposed at CWG Meeting
V16	Tunnel	△	⊗	●	⊗	Would primarily serve longer-distance trips in the corridor and tunnel access/egress would be challenging. This element would not address Goal 1 – Complete Streets. Likely high construction costs ($80 to $120 million per mile) and construction impacts.[11]	**Recommend removing from consideration**.	▪ New idea proposed at CWG Meeting

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Notes:
1. NACTO Urban Bikeway Design Guide. http://nacto.org/publication/urban-bikeway-design-guide/bikeway-signing-marking/shared-lane-markings/
2. NACTO Transit Street Design Guide. http://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/shared-bus-bike-lane/
3. RTD FasTracks. Northwest Rail B Line. http://www.rtd-fastracks.com/nw_1
3. Florida DOT. Typical Sections for Exclusive Transit Running Ways. http://www.dot.state.fl.us/transit/Pages/TypicalSectionsExclusiveTransitRunningways.pdf
4. APTA. Designing Bus Rapid Transit Running Ways. http://www.apta.com/resources/standards/Documents/APTA-BTS-BRT-RP-003-10.pdf
6. Texas A&M Transportation Institute. Reversible Traffic Lanes. http://mobility.tamu.edu/mip/strategies-pdfs/traffic-management/technical-summary/Reversible-Traffic-Lanes-4-Pg.pdf
7. Development of Arterial High-Occupancy Vehicle Enforcement Techniques. http://static.tti.tamu.edu/swutc.tamu.edu/publications/technicalreports/72194-2L.pdf
8. Texas A&M Transportation Institute. Grade separation. http://mobility.tamu.edu/mip/strategies-pdfs/added-capacity/technical-summary/grade-separation-4-pg.pdf
9. City of Des Moines. Traffic and Safety Informational Series. http://www.dmgov.org/departments/engineering/pdf/faq9_speed_bumps_and_humps.pdf
10. Berthod, Catherine. Traffic Calming: Speed Humps and Speed Cushions. http://nacto.org/wp-content/uploads/2012/06/Berthod-C.-2011.pdf
11. APTA. Survey of New Tunneling Projects. http://www.apta.com/mc/rail/previous/2011/Presentations/B-Larkin-Survey-of-New-Tunneling-Projects.pdf

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SUMMARY OF SCREENING RESULTS

Figure 4 summarizes the screening results of the corridor design, program, and management elements. The shading of the element indicates the recommendation as follows:

Recommend **moving forward** for consideration
Recommend using in **limited circumstances**
Recommend **removing from consideration**

Figure 4 Summary of Screening Results

Bike/Pedestrian/Streetscape	
S1	Additional crossings
S2	Intersection enhancements
S3	Multi-use path (off-street bike facility; shared space)
S4	Enhanced multi-use path (e.g., delineation between bikes and pedestrians)
S5	Shared travel lanes with pavement markings (sharrows)
S6	Bike lanes
S7	Buffered bicycle lanes
S8	Protected bicycle lanes
S9	Shared bus & bike lane (11-12' lane that allows bus and bikes)
S10	Amenity zone features (lighting, planters, bus shelters, benches, public art, etc.)
S11	Landscaping
S12	Public art
S13	Gateway features

Transit and Transportation Demand Management (TDM)	
T1	Side running bus in mixed traffic
T2	Enhanced Bus (similar to BRT but without dedicated lanes)
T3	Bus Rapid Transit (side-running in Business Access and Transit Lane)
T4	Bus Rapid Transit (center running in dedicated lanes)
T5	Streetcar
T6	Light rail transit
T7	Commuter rail
T8	Peak-only exclusive transit lanes
T9	Better information and timed transfers
T10	Real-time, app-based information
T11	Expanded EcoPass
T12	Reversible transit lane
T13	Improved transit amenities
T14	Park and rides (assumed to be edge or satellite parking)
T15	Parking management
T16	First/last-mile connections
T17	Shared use mobility

Vehicular	
V1	Three general purpose travel lanes per direction (maintain existing number of lanes)
V2	Two general purpose travel lanes per direction with one lane repurposed for enhanced transit (and/or pedestrian, bicycle and/or streetscape enhancements)
V3	Three general purpose travel lanes with an additional transit lane per direction
V4	Adding general purpose lanes (east end of corridor)
V5	Reversible traffic lane (zipper lane)
V6	Wider general purpose travel lanes
V7	Narrower general-purpose travel lanes (subject to working with CDOT)
V8	High-occupancy vehicle (HOV) lanes
V9	Managed lanes (Express lanes)
V10	Signal timing adjustments
V11	Reduce posted speed limit (assumes reduction of 45 mph segments to 35 mph)
V12	Access management (assumes closing some driveways and converting parking lots to shared use/access)
V13	Roundabout
V14	Grade separated interchange (Foothills & Arapahoe)
V15	Speed humps
V16	Tunnel

APPENDIX A

Corridor Elements Reference Guide

East Arapahoe Transportation Plan

CITY OF BOULDER

EAST ARAPAHOE TRANSPORTATION PLAN Corridor Elements Reference Guide

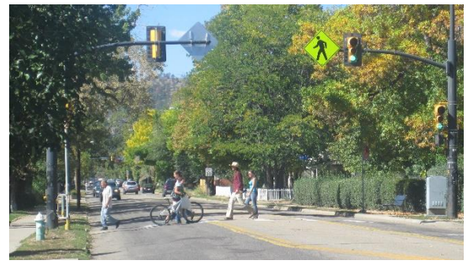
July 2016 – DRAFT

NELSON NYGAARD

FOX TUTTLE HERNANDEZ TRANSPORTATION GROUP

FEHR & PEERS

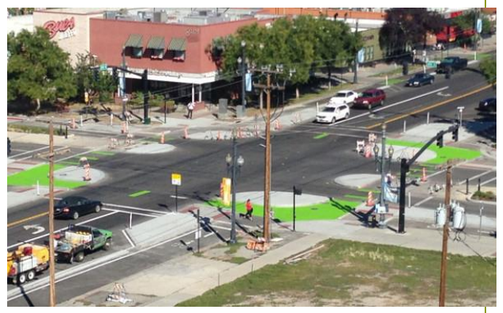
APPENDIX A CORRIDOR DESIGN ELEMENTS REFERENCE GUIDE

	Element	Description / Purpose	Design Options and Examples		
Mode, e.g., Bike, Pedestrian and Streetscape Facilities)					
S1	**Additional crossings**	New marked pedestrian crossings on Arapahoe Avenue to provide opportunities for pedestrians and bicyclists to reach destinations, including transit stops. The city's Pedestrian Crossing Treatment Installation Guidelines[1] provide direction on appropriate treatments based on the width, volume, and speed of the roadway. Crossing treatments include: marked crosswalks, high visibility marked crosswalks, curb extensions, median refuge islands, unprotected beacon crossings (flashing beacon), protected crossings (HAWK and pedestrian traffic signal). Boulder's Crossing Treatment Installation Guildelines recommend crosswalk enhancements at uncontrolled crossing locations be installed only where there are at least 20 pedestrians (young, elderly and disabled pedestrians count as double), or at least 10 school-aged children traveling to/from school cross in any one hour. For locations where pedestrians regularly cross arterials, but do not meet the pedestrian volume threshold and where there is little potential to direct pedestrians to a more defined location within 300 feet, the Guidelines recommend installing curb ramps or a median refuge, but no marked crossing. This is intended to facilitate safer crossings without attracting new users.	**Rectangular Rapid Flashing Beacon (RRFB) with median refuge island.** Pedestrian activated rectangular yellow flashing lights that are deployed with pedestrian crossing warning signs**.** Considered an unprotected treatment. The Guidelines do not recommend using RRFBs where there are both high vehiclular and pedestrian volumes. Use of a conventional pedestrian traffic signal or a HAWK signal is recommended for these locations instead. Thresholds vary depending on vehicle volumes, but generally RRFBs are not recommended when there are 400 or more pedestrians crossing per hour, more than 3,000 vehicles (total of both approaches) per hour, or on a six-lane roadway.  Canyon & 21st (Source: City of Boulder)	**HAWK Signal.** Pedestrian beacon that is a hybrid of a stop sign and pedestrian traffic signal; uses a combination of circular yellow and red traffic signal displays. Considered a protected crossing. HAWK signals are recommended for crossing locations where that is a large volume of pedestrian traffic.  Source: Mike Cynecki, pedbikeimages.org	**Pedestrian Traffic Signal.** Conventional traffic signal with circular red, yellow, and green displays for motorists and Walk/Don't Walk signals for pedestrians. Rests in green for vehicular traffic until a pedestrian activates the signal. Considered a protected crossing.  Source: Fox Tuttle Hernandez

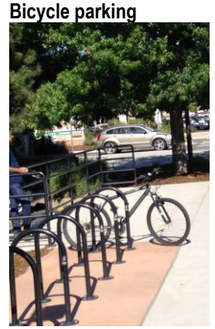
<table>
<tr><th></th><th>Element</th><th>Description / Purpose</th><th colspan="3">Design Options and Examples</th></tr>
<tr><td rowspan="2">S2</td><td rowspan="2">Intersection enhancements</td><td rowspan="2">Safety treatments at intersections to enhance bicycle and/or pedestrian safety.

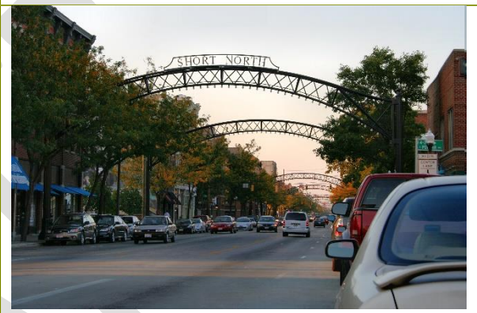
Enhancements can include reduced curb radius to slow turning speeds, high visibility crosswalks, protected turn phases, leading pedestrian intervals, median refuge islands, bike boxes, bicycle intersection crossings, high-visibility pavement markings for bicyclists, and two-stage turn queue boxes..</td><td>Reduced curb radius. Slows turning speeds, promoting greater awareness of crossing pedestrians and bicyclists.
 
Source: NACTO</td><td>High-visibility crosswalks. Increases visibility of pedestrians at intersections.
 
E
Arapahoe Ave & 29th St (Source: Google)</td><td>Median refuge island. Make roadway crossings easier and safer for people walking and biking: 1) limit exposure to through moving vehicles; 2) enable people to cross when there are gaps in traffic from one direction at a time; 3) provide a safe stopping place in the middle of the roadway for people who are not able to make it across both directions before the traffic signal turns red. May be used at signalized and unsignalized intersections or mid-block.

Boulder’s Crossing Treatment Installation Guidelines require that a refuge be 6 feet wide (8 feet is recommended) for mid-block pedestrian crossings. Multi-use paths that cross a roadway mid-block require a minimum 10-foot wide refuge island.
  </td></tr>
<tr><td>Protected turn phase. Protected left or right turn phases separate pedestrian or bicycle crossing movements from those of turning vehicles.
 
Source: City of Boulder</td><td>Leading pedestrian or bicycle interval. Provides pedestrians and/or bicyclists a few second head start to claim the right-of-way ahead of turning traffic.
 
(Source: Nelson\Nygaard)</td><td>Raised crosswalk at right-turn bypass lanes. Raised crosswalk increases visibility of people walking and biking, and encourages turning vehicles to slow down.
 
Arapahoe Avenue & Foothills Pkwy. (Source: Nelson\Nygaard)</td></tr>
</table>

	Element	Description / Purpose	Design Options and Examples		
			Bicycle Box. Increases awareness and visibility of bicyclists at intersections by providing a place for them to assemble in front of queuing motor vehicle traffic during the red signal phase. Right turns on red are prohibited at intersections with bike boxes. May require moving detectors at actuated intersections (where presence of a vehicle activates the traffic signal).  Source: Green Lane Project	**Protected Intersection**. Uses physical barriers at intersections to improve visibility of people crossing the intersection by foot or on a bike. Protected intersections are appropriate at the intersection of two streets with protected bike lanes (cycle tracks).  Davis, CA (Source: Fehr & Peers)	 Salt Lake City, UT (Source: Salt Lake City)
S3	**Multi-use path (off-street bike facility; shared space)**	Shared multi-use paths provide a comfortable facility for people walking and bicycling. Multi-use paths may not have design features to enhance safety along the path and at intersections and conflict points.	**Shared multi-use path** along Arapahoe Avenue 		
S4	**Enhanced multi-use path (e.g., delineation between bikes and pedestrians and/or specialized treatments such as pavement markings or signals)**	Shared multi-use path with special design features to separate space for each mode and minimize conflicts between them, and/ or enhance safety at intersections and conflict points. Enhanced paths include physical separation or pavement markings to separate pedestrians and bicyclists, and intersection treatments (e.g., bicycle signals, right turn on red restrictions, or bicycle crossing pavement markings).	**Physical separation**. Space for people walking and biking is delineated by physical separation and/or pavement markings.  Portland, OR. (Source: Nelson\Nygaard)	**Pavement Markings.** Pavement texture and markings used to delineate multi-use path.  Source: Fehr & Peers	**Intersection Pavement Markings.** Signal and pavement markings to delineate bicycle crossing at multi-use path intersection with roadway.  Source: Green Lane Project

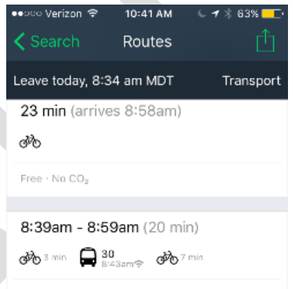
	Element	Description / Purpose	Design Options and Examples		
S5	**Shared travel lanes with pavement markings (sharrows)**	Pavement markings in travel lanes (sometimes referred to as shared lane markings or sharrows) indicate that motorists and people on bicycles share a travel lane. These markings are primarily intended for low volume roadways with speeds of less than 25 mph, and are not appropriate for streets with speed limits above 35 mph. They indicate to motorists that bicyclists are permitted to use the lane, provide wayfinding for bicyclists, and inform bicyclists where to position themselves to avoid car doors (when on-street parking is present). They can also be used on short roadway segments where a bike lane can only be accommodated in one direction.	**Shared lane marking**  Source: Nelson\Nygaard	 Source: Nelson\Nygaard	
S6 S7 S8	**Bike lanes** **Buffered Bike Lane** **Protected Bike Lanes**	Bike lanes provide dedicated on-street space for bicycling. Bike lanes types include standard, buffered and protected lanes.	**Bike Lane**. Dedicated space for bicycling delineated by pavement striping. City of Boulder standards[2] identify a minimum width of 5 feet, 7 feet is desirable.  Arapahoe Avenue (Source: City of Boulder)	**Buffered Bike Lane.** Dedicated space for bicycling enhanced with an additional striped buffer. A striped or hatched buffer, typically 2-3 feet wide, provides separation between the bicycle lane and moving traffic.  Baseline Road (Source: City of Boulder)	**Protected bike lanes.** Dedicated space for bicycling separated from roadway by a physical buffer, which provides an attractive facility for people with a range of riding abilities. A physical barrier separates the bicycle lane from moving traffic using on street parking, curb, landscaping or other delineators.  Source: Green Lane Project

	Element	Description / Purpose	Design Options and Examples		
S9	**Shared bus & bike lane (11-12' lane that allows bus and bikes)**	Travel lane shared by transit vehicles and bicycles. Generally not recommended in high-speed corridors (>25 mph) due to the large speed differential between the bus and bicycles.	**Separated from general-purpose traffic with striping**  Portland, OR. (Source: Nelson\Nygaard)	**Separated from general-purpose traffic with barrier**  Paris (Source: Nelson\Nygaard)	
S10	**Amenity zone features**	To provide various infrastructure to support walking, bicycling and/or transit. The amenity zone is dedicated for this purpose, with a separate clear zone of the sidewalk reserved for walking. Amenities include street lighting, wayfinding, planters, bus shelters, benches, public art, and bicycle parking.	**Pedestrian-scale street lighting and benches**  Lowell, MA	**Wayfinding**  Boulder	**Bicycle parking**  Boulder
S11	**Landscaping**	To provide shade and a sense of psychological and visual comfort for pedestrians. Landscaping can also provide respite from the sun during warm days and improve micro-climates. Landscaping can include street trees, stormwater management (bioswales) and other landscaping elements.	**Median Street Trees**  Boulder	**Street Trees in Planting Strip or Tree Grates**  Boulder	

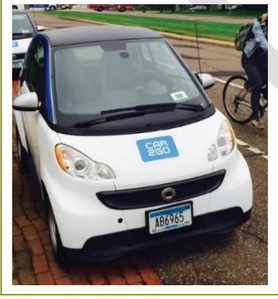
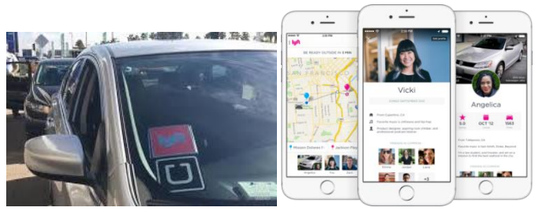
	Element	Description / Purpose	Design Options and Examples		
S12	**Public art**	To provide visual interest and a sense of place. Public art installations are often located in the public right-of-way.	 Portland, OR.	 Eugene, OR	
S13	**Gateway features**	To alert motorists and other users that they have entered a particular corridor or part of town, e.g., east end of East Arapahoe corridor. These features can create an expectation for motorists to drive more slowly and watch for pedestrians or bicyclists when entering a commercial, business, or residential district from a higher speed roadway. They also create a unique sense of place for an area.	 Roosevelt Avenue Concepts, Chicago, IL (Source: site-design.com)	 Columbus, OH. (Source: minneapolisite.wordpress.com)	
Transit and TDM					
T1	**Side running bus in mixed traffic**	Transit and general-purpose traffic in shared lane. This is how transit currently operates along Arapahoe Avenue..	 Arapahoe Avenue		

	Element	Description / Purpose	Design Options and Examples		
T2	**Enhanced bus**	Enhanced bus adds amenities to standard bus operations (in T1). This includes enhanced amenities at stops, such as real-time arrival information and electronic ticketing, and increased frequency and/or service hours. Does not have dedicated lanes. May use transit signal priority to reduce delay to buses, e.g., by extending a green light at a traffic signal to allow an approaching bus to cross the intersection.	 Kansas City, MO		
T3 T4	**Bus Rapid Transit (BRT)**	BRT is meant to provide a high frequency transit option that serves key destinations on a corridor with fast travel times. BRT can be positioned as side-running or center-running. BRT is similar to enhanced bus, but incorporates additional amenities and features that improve speed, reliability and passenger satisfaction. Vehicles are often 60-foot articulated models with doors on both sides to allow for center- and side-running operations. BRT uses all-door boarding to reduce the amount of time vehicles are at stops and to efficiently accommodate larger passenger loads. Bus Rapid Transit systems cost approximately $10-50 million per mile to construct.	**Side running in Business Access & Transit Lane (BAT Lane).** BRT running along the curb, often in a dedicated "business access and transit" or BAT lane that allows right-turns for all vehicles.  Snohomish County, WA. Swift BRT.	**Center running in dedicated lanes.** BRT running in its own lane in the median. This element assumes repurposing of one travel lane in each direction as a center-running transit lane. Additional right-of-way would be necessary at station locations. Median transit lanes could require left-turn restrictions along the corridor, with more complex management of traffic operations. There could be traffic impacts from lane repurposing.  Salt Lake City region. (Source: UTA)	
T5	**Streetcar**	Streetcars are intended to serve short corridors and act as a local circulator, with short stop spacing and relatively slow speeds. Streetcars typically operate in mixed traffic, though dedicated streetcar lanes can be incorporated (usually for short segments). Streetcars consist of a single vehicle, approximately 66 feet in length. Streetcars systems cost approximately $35-70 million per mile to construct.	 Portland, OR		

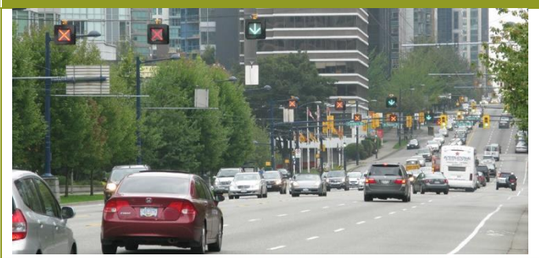
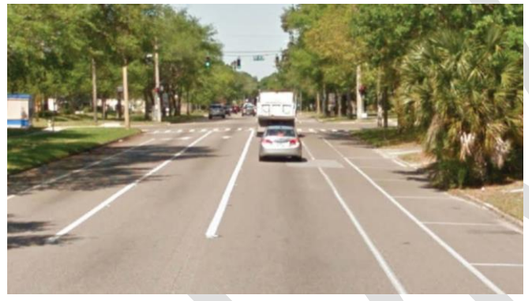
	Element	Description / Purpose	Design Options and Examples		
T6	**Light rail**	Light rail typically has dedicated right-of-way with longer stop spacing. Light rail is better than streetcars for serving long corridors. Most light rail systems operate at-grade or with limited grade-separated segments. Light rail uses two to four vehicles connected into a single train set. Vehicles are longer than streetcars and have more capacity. Construction cost for at-grade systems is between $50-100 million.	 San Francisco, CA. MUNI Light Rail. (Source: Paul Sullivan / Flickr)	 Salt Lake City, UT. (Source: Nelson\Nygaard)	
T7	**Commuter rail**	Commuter rail typically operates in an existing heavy-rail corridor with long stop spacing (usually two miles or longer between stops) Commuter rail systems usually serve large employment centers with heavy in- and out-bound travel flows during the peak commute hours. Commuter rail usually costs $10-60 million per mile.	 Salt Lake City, UT. (Source: Nelson\Nygaard)		
T8	**Peak only exclusive transit lanes**	Lanes reserved for transit during peak hours. May be used for general-purpose travel or on-street parking at other times.	**Peak-only bus lane signage**  Seattle, WA	**Peak-only bus lane used for street parking off-peak**  (Source: NACTO)	

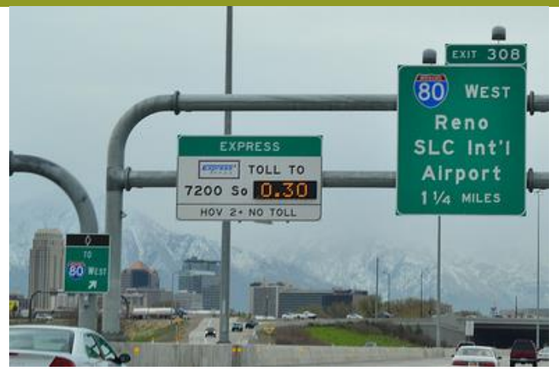
	Element	Description / Purpose	Design Options and Examples		
T9	**Better information and timed transfers**	Enhance the ease of using transit through improved scheduling and user information.	**Better timing of transit connections; real-time information**  New York City		
T10	**Real-time, app-based information**	Enhance the easy of using transit by providing convenient, real time information.	**Stop pole with real-time information display**  Los Angeles, CA. (Source: Nelson\Nygaard)	**App-based information**  (Source: Denver Streetsblog)	**Full real-time information display**  Source: Nelson\Nygaard
T11	**Expanded EcoPass**	EcoPasses are annual bus passes valid for unlimited rides on most transit service offered by RTD. They are provided to downtown Boulder employees, and to residents of participating neighborhoods (neighborhood EcoPass).	 Source: Boulder County		

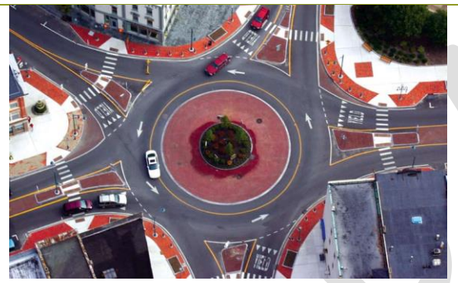
	Element	Description / Purpose	Design Options and Examples		
T12	**Reversible transit lanes**	Enhance transit travel time in peak travel direction. Typically used in limited access roadways (see also high-occupancy vehicle or HOV lanes below). Implies a lane in the street median on a two-way roadway.		 Houston, TX. Reversible, barrier-separated transit (and high-occupancy vehicle—2+ or 3+ occupants) lanes. (Source: FHWA)	
T13	**Improved transit amenities**	Provide amenities that enhance transit user comfort and access to information. Amenities include shelters, benches, maps and schedules.	**Full-featured bus stop**  Boulder	**Enhanced bus stop**  Kansas City	**Full station** 
T14	**Park and rides (assumed to be edge or satellite parking)**	Parking facilities at transit stations, “edge” parking, or shared parking integrated into new development. People could drive to the park and ride and take transit to their destination, e.g., if going to a destination where there is a charge for parking or parking availability is constrained.	 Kansas City, MO		

	Element	Description / Purpose	Design Options and Examples		
T15	**Parking management**	Effective management of parking supply, such as shared parking or district management. Making more efficient use of parking could enable other uses of the space, e.g., commercial development, parks, community gathering spaces, etc.	 Source: Nelson\Nygaard		
T16	**First/last mile connections**	Transportation options used to get people from transit to their final destination. Includes pedestrian and bicycle access improvements and the options highlighted under shared use mobility below.	**Pedestrian Connections**  Arapahoe between 30th and 38th St (Source: Nelson\Nygaard)	**Shuttles**  (Source: Ride Connection)	**Bicycle Connections**  Bus then Bike secure bike parking (Source: Boulder County)
T17	**Shared use mobility**	Refers to on-demand, shared transportation options including bike share, shuttles, car share, and ridesourcing (e.g., Lyft and Uber) that provide people with additional mobility options.	**Car Share** 	**Ridesourcing, e.g. Lyft, Uber, and similar companies** 	**Bike Share** 

	Element	Description / Purpose	Design Options and Examples		
Vehicular					
V1	**Three general purpose travel lanes per direction**	Three general-purpose travel lanes per direction. This roadway configuration is the typical existing condition on much of the East Arapahoe corridor.			
V2	**Two general purpose travel lanes per direction with one lane repurposed for enhanced transit**	Re-allocate street space to provide exclusive transit lanes (and/or pedestrian, bicycle, and/or streetscape enhancements).			
V3	**Three general purpose travel lanes with an additional transit lane per direction**	Maintain three general-purpose travel lanes per direction and add space to provide exclusive transit lanes (and/or pedestrian, bicycle, and/or streetscape enhancements)			
V4	**Add general purpose lanes (east end of corridor)**	Add travel lanes to increase vehicle capacity at east end of corridor. May require right-of-way acquisition.			

	Element	Description / Purpose	Design Options and Examples		
V5	**Reversible traffic lane (zipper lane)**	Provides additional capacity for the peak direction of travel, most likely in the center of the roadway.			
V6	**Wider general purpose travel lanes**	Widen travel lanes, which could improve accommodation for freight, but would also likely lead to increased vehicle speeds and reduced comfort as well as perceived and actual safety for people walking and bicycling.	 Gunnison,CO (Source: Fox Tuttle Hernandez)		
V7	**Narrower general purpose travel lanes**	Narrow travel lanes communicate to drivers that they need to be more careful in passing other vehicles. Narrow travel lanes that still accommodate the types of traffic expected on the street improve safety and comfort for pedestrians, cyclists, transit riders, and motor vehicles by slowing speeds. In some cases the combined effect of narrowing lanes by 1-2' across a roadway opens up the possibility of installing bike lanes, expanding sidewalks, or adding landscaping.	Example of 12-foot lanes narrowed to 10-foot lanes  1st Ave & 49th St N, St. Petersburg, Fl (Source: Google Street View)	Before lane narrowing  1st Ave & 49th St N, St. Petersburg, Fl (Source: Pedestrian and Bicycle Information Center; Image from Michael Frederick)	
V8	**High occupancy vehicle (HOV) lanes**	Dedicating one travel lane in each direction for exclusive use by vehicles with more than one passenger. Incentivizes non- drive alone trips by providing a faster travel time. Enforcement may be a challenge, particularly on roadways with frequent turning movements at intersections or to access businesses.	 HOV lane in Dallas (Source: The Stig / Flickr)		

	Element	Description / Purpose	Design Options and Examples		
V9	**Managed lanes (Express lanes)**	Dedicated travel lanes for exclusive use by transit vehicles, HOVs, or drivers who pay a toll for access to the lane. May require complex traffic operations and signal design in an arterial corridor with frequent left and right turns and business access.	 Salt Lake City (Source: Garrett / Flickr)	 I-25 (Source: Google)	
V10	**Signal timing adjustments**	Improve coordination of signals to improve traffic flow and minimize conflicts between different roadway users	 (Source: UDOT)		
V11	**Reduce posted speed limit (assumes reduction of 45 mph segments to 35 mph)**	Reduce posted speed to enhance safety and comfort for all roadway users. Currently 45 mph on much of Arapahoe Avenue. Would need to be accompanied by measures to reduce actual travel speeds.	 Boulder		

	Element	Description / Purpose	Design Options and Examples		
V12	**Access management**	Minimize driveways and reduce conflict points. Different access management techniques include consolidation of driveways, driveway narrowing and constructing medians to restrict access to right in and right out turning movements only.	**Treatments to increase visibility of people crossing driveways on foot or by bike**  Salt Lake City, UT (Source: Nelson\Nygaard)	**Medians that restrict access to right in and right out turning movements**  Source: Fox Tuttle Hernandez	
V13	**Roundabout**	To slow traffic without requiring vehicles to stop at intersections. It can be challenging to safely accommodate pedestrian and bicycle movements on multi-lane roundabouts.	 Philadelphia, PA. (Source: Nelson\Nygaard)	 Mexico City. (Source: Nelson\Nygaard)	
V14	**Grade separated interchange**	Improve travel times by bypassing the need for traffic to stop at a signalized intersection; an element that has been suggested by members of the community for the intersection of Arapahoe Avenue and Foothills Parkway.	**Aerial View**  Source: Google Maps	**Overpass Example**  Source: Nelson\Nygaard	

	Element	Description / Purpose	Design Options and Examples		
V15	**Speed humps**	To slow vehicle speeds; not appropriate for faster roadways.			
V16	**Tunnel**	To provide fast or direct vehicle access through the corridor by providing a travel option below ground to bypass existing intersections	N/A		

Notes:
1. https://www-static.bouldercolorado.gov/docs/pedestrian-crossing-treamtment-installation-guidelines-1-201307011719.pdf
2. https://www-static.bouldercolorado.gov/docs/chapter-2-transportation-design-table-contents-1-201502190819.pdf