



**INFORMATION PACKET
MEMORANDUM**

To: Members of Transportation Advisory Board

From: Michael Gardner-Sweeney, Director of Public Works for Transportation
Gerrit Slatter, Principal Transportation Projects Engineer
Bryant Gonsalves, Transportation Project Manager
Melanie Sloan, Transportation Planner

Date: September 12, 2016

Subject: **Brief: Community and Environmental Assessment Process (CEAP) brief for the Boulder Creek & Arapahoe Underpass (Arapahoe & 13th) Project**

EXECUTIVE SUMMARY:

The City of Boulder has initiated planning and design for the Boulder Creek & Arapahoe Underpass (Arapahoe & 13th) project to provide a safer, more accessible and less flood prone underpass along the Boulder Creek Path at Arapahoe Avenue, near 13th Street. The planning and design process began in early 2016 and is anticipated to continue through summer, 2016. This project is utilizing the city's Community and Environmental Assessment Process (CEAP) to select the preferred design alternative.

The purpose of this memo is to introduce to and receive feedback from the board on the planning and design process, current proposed design alternatives and proposed evaluation characteristics, which will be used to identify the preferred design alternative. Because this project impacts both transportation and parks and recreation facilities, the project CEAP requires public hearing and approval by both TAB and PRAB in a joint board hearing and so we invite the board to participate in a joint TAB-PRAB meeting (date to be determined) for official review and recommendation of the CEAP process and preferred alternative selection. Additional detail on the project background, planning and design status, timeline, community involvement role and opportunities and current proposed design alternatives are included below.

BACKGROUND:

The City of Boulder initiated planning and design for the Boulder Creek Arapahoe and 13th Underpass Project (Arapahoe Underpass project) for several reasons. The width of the Boulder Creek Path within the existing underpass is too narrow (10') for the volume of users and does not meet the city's standard for minimum width (14'). The grades of the approaches are steeper (8% on the north approach and 14% on the south approach) than the Americans with Disabilities Act standard (less than 5%) and the city's standards for recreational paths (8%). The steepness of the paths creates a barrier to some potential users while also contributes to faster bicycle and skateboard speeds entering into the underpass which creates opportunity for conflict. The visual and physical approaches to the underpass are poor due to tight turns at the entrances, which is especially true for the south approach. Lighting is poor, including during daylight hours, which creates the potential for collisions or close calls and causes some users to avoid the underpass because they do not feel safe. The underpass also closes regularly during high water flows of Boulder Creek. During 2015, the underpass was closed due to high water for three months (May through July). High water closures divert more pedestrians and bicycles to the on-street crossing at Arapahoe Avenue and 13th Street increasing the opportunity for collisions.

The voter-approved 2014 Community, Culture, and Safety Tax (CCS) ballot initiative provides \$2.5 million in project funds. Construction funded by CCS must be completed by the end of year 2018. Current cost estimates for all proposed design alternatives considered for this project are greater than \$2.5 million.

The project is undergoing the Community and Environmental Assessment Process (CEAP), a formal review process to consider the impacts of public development projects and to assess potential impacts of conceptual project alternatives in order to inform the selection of desired elements and the refinement of a preferred alternative.

Concurrent to the Arapahoe Underpass project, the proposed Arapahoe Avenue Reconstruction project from Broadway to 15th Street will reconstruct the on-street crossing at Arapahoe Ave and 13th St. How the on-street crossing on Arapahoe Ave at 13th St is designed and connects to adjacent paths and sidewalks also impacts the goals of the Arapahoe Underpass project. Because of this, the on-street crossing and associated connections have been included in the Arapahoe Underpass project planning and design and CEAP work.

Status of Planning & Design

In early 2016, the project team began reviewing the existing conditions, collected data and related city plans and developed conceptual design options. These initial project concepts were assessed and narrowed to two proposed underpass, north path connection and south path connection design alternatives and four on-street crossing design options based on project goals; geometric site constraints from Boulder Creek, Civic Area Central Park and Arapahoe Avenue; historic, observed and collected pedestrian and bicycle data and movements; relevant master and sub-area plans; engineering, drainage and floodplain considerations and feedback from the public and relevant boards.

Data & Plans

The Arapahoe Underpass project area serves a high volume of pedestrians and cyclists within a complex system of eleven potential origin/destination points (Figure 1). To understand these movements better, the project team conducted site visits, reviewed historic bicycle count data for the Boulder Creek Path and multi-use path to the south and hired a consultant to collect pedestrian and bicycle counts and their travel routes within the project area.

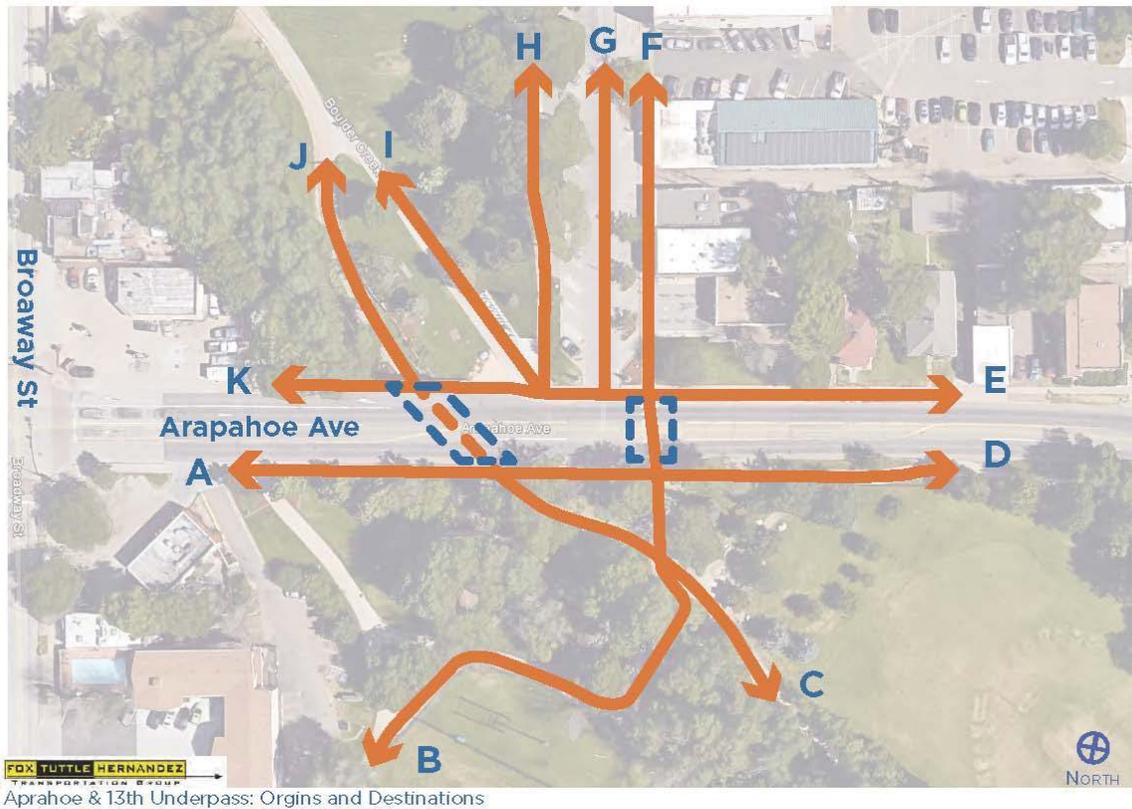


Figure 1: Eleven potential origin/destination points within the project area.

The consultant collected data on two weekdays (April 19, 2016 and July 21, 2016) over three observation periods: 7:15 a.m. – 8:30 a.m.; 11:00 a.m. – 1:00 p.m.; and 3:00 p.m. – 5:00 p.m. These time periods captured the typical morning, lunch and evening peak travel periods, including the arrival and departure periods of adjacent schools (April 19, 2016 count).

Table 1: Data collection counts by observation period and mode

Time Period	Pedestrians		Bicycles & Skateboarders		Total	
	April	July	April	July	April	July
7:15 – 8:30 AM	156	200	96	213	252	413
11:00 AM – 1:00 PM	562	327	182	329	744	656
3:00 – 5:30 PM	511	357	303	448	814	805
Total:	1,229	884	581	990	1,810	1,874

Around 1,800 travelers were observed on each of the two days of data collection. Pedestrians represented 68% of observed travelers in April and 44% in July. Bicyclists and skateboarders represented 32% of observed travelers in April and 53% in July.

On both data collection days (Table 2), about 30% used the on-street crossing on Arapahoe Ave at 13th St (30% in April and 28% in July). However, the percentage of people who traveled east-west along Arapahoe Ave but did not cross it decreased from April to July (40% to 22%) while the percentage of those who used the existing underpass increased over the same time period (30% to 50%).

Table 2: Proportion of movement along or across Arapahoe Avenue

	On-Street Crossing, Arapahoe Ave & 13 th St	Existing Underpass	Did Not Cross Arapahoe Avenue	Total
<i>April 19, 2016</i>	548 (30%)	538 (30%)	724 (40%)	1,810
<i>July 21, 2016</i>	532 (28%)	932 (50%)	412 (22%)	1,874

The decrease in use of the on-street crossing is likely due to the April data collection occurring during the adjacent schools' academic year and the July collection when the schools were on summer break, resulting in less students walking through the project area. The increase in use of the underpass between the April and July counts is likely due to the higher number of bicyclists and skateboarders observed in July combined with that count occurring in the peak recreational cycling season.

Figure 2 illustrates the pedestrian and bicycle/skateboard crossing volumes and movements during the observed travel periods. On both data collection dates, the largest volume of pedestrians, bicyclists and skateboarders were along the Boulder Creek Path. (The full reports for the two days of data collection can be found in the attachments).

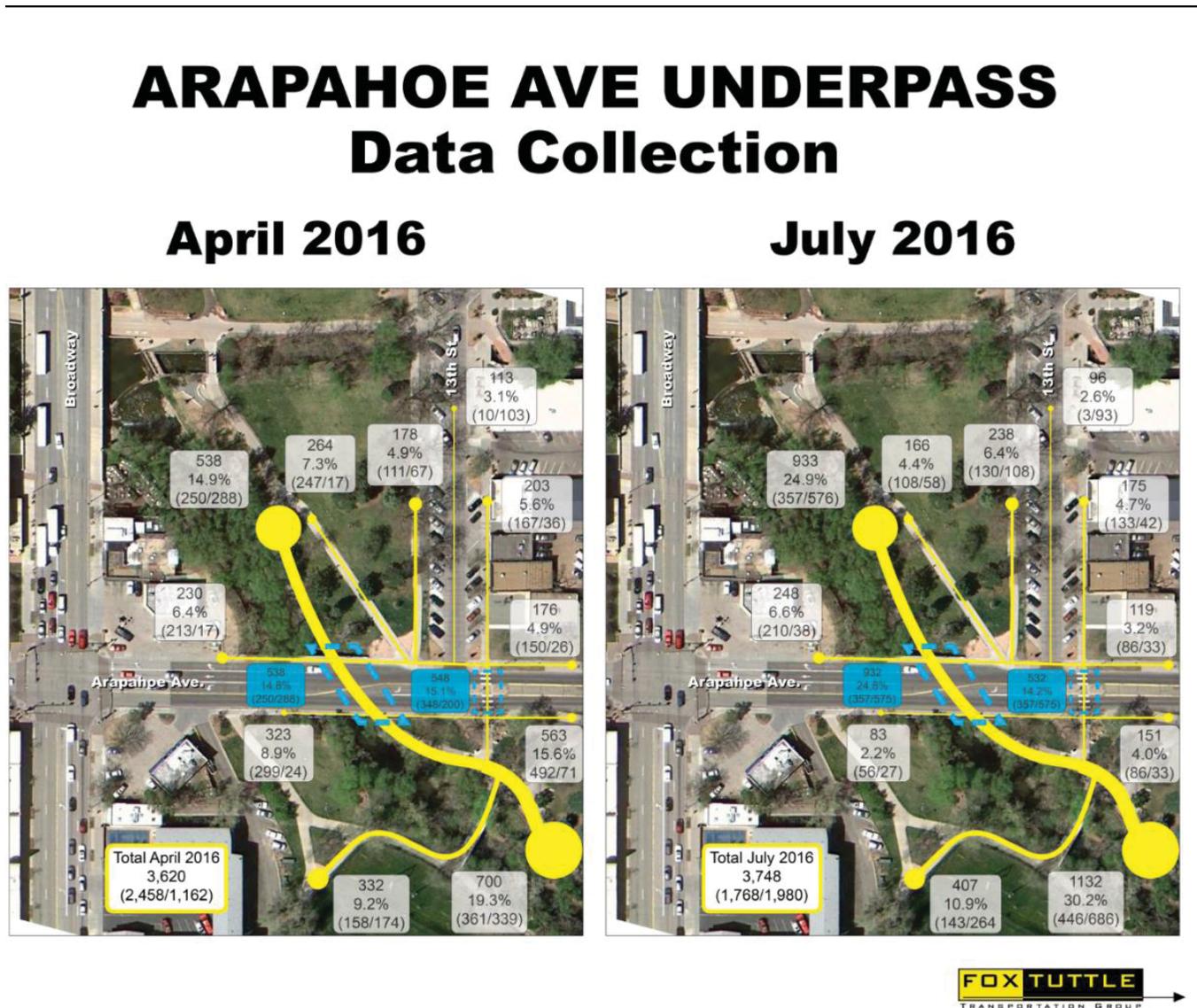


Figure 2: Pedestrian and bicycle/skateboard counts by origin/destination, April 19 & July 21, 2016

Between 2009 and 2015, a total of 21 crashes within the on-street crossing on Arapahoe Avenue at 13th Street were reported (Table 3). Within this same time period, one bicycle-bicycle collision within the existing Arapahoe Underpass was reported. Sixteen of these 21 crashes were rear-end collisions at the on-street crossing on Arapahoe Ave at 13th St. The data observation reports note several, likely unreported, near misses at this location.

Table 3: Crashes in crossing at Arapahoe Ave and 13th Street, 2009 – 2015

<i>Type of Crash</i>	Number (2009 – 2015)
<i>Vehicle-Bicycle</i>	4
<i>Vehicle Skateboarder</i>	1
<i>Vehicle-Vehicle (rear-end collisions from stops for bicycles/pedestrians)</i>	16
Total:	21

A single transit stop is located within the project area on the northwest corner of Arapahoe Avenue and 13th Street. This stop serves 190 alighting and 40 boarding passengers each day (as of January, 2015).

A B-cycle station is located on the northwest corner of Arapahoe Avenue and 13th Street. This station is the fifth-most-popular station in the Boulder B-Cycle 40-station system. An average of 30-40 checkouts and returns (combined) occur at this station each day.

Master Plans

The Arapahoe Underpass project is guided by several adopted city plans, specifically the Boulder Valley Comprehensive Plan (BVCP), the Transportation Master Plan (TMP), the Civic Area Master Plan, the Boulder Civic Area Vision Plan and the Greenways Master Plan.

The BVCP calls for creating an accessible multimodal transportation system with safe travel options and connections. The proposed design alternatives, path connection options and on-street crossing options support this goal through the improvement of existing facilities for travelers of all modes and abilities.

The proposed design alternatives also support the TMP goals of creating an accessible multimodal transportation system with safe travel options and connections, improving facilities for all modes, decreasing single-occupant vehicle use thus reducing and minimizing the use of non-renewable energy resources and greenhouse gas emissions and the Toward Vision Zero safety goal of preventing fatal and serious injury crashes.

The Civic Area Master Plan calls for continued improvement to the existing bicycle and pedestrian experience and amenities of the civic area, and calls for resolution of the conflict and connectivity along the Boulder Creek Path, identified as a significant transportation route and recreational amenity, and reducing the barrier-effect of Arapahoe Avenue. The project helps achieve these goals by providing a safer, more accessible and less flood prone underpass along the Boulder Creek Path at Arapahoe Avenue near 13th Street.

The Civic Area Vision Plan is the founding document for the re-design and activation of Boulder’s Civic Area. The Arapahoe Underpass project supports several Vision Plan goals, including supporting the activation of Civic Area Central Park and of 13th Street, maintaining the ability to host events and programs within Civic Area Central Park and 13th Street, a pedestrian scale 13th Street, expansion of the Boulder County Farmer’s Market and is supportive of the outcomes of the Market Hall Feasibility Study.

The Greenways Master Plan (2011) provides a summary of existing conditions along Boulder Creek. The riparian habitat was evaluated based on the quality of vegetation (native or non-native), the vegetative structure and the quality of the habitat based on the presence of bird species. Each stream reach was rated for each of these criteria, with a rating of very poor to excellent. Habitat restoration ranked high in the reach of the project area, based on the average ranking of the existing habitat and the ability to easily

replace and enhance the existing vegetation. Water quality was ranked high for the potential the project area offers for improving storm water outfalls, sediment collection and removal and non-point source pollution filtering. Recreation ranked high in recognition of the opportunities the Boulder Creek Path and the Civic Area Central Park offer within the project area. Flood ranked high due to the project area being within the 100 and 500 year floodplains. The project will include habitat restoration, water quality improvements and recreation opportunities where feasible.

The Arapahoe Underpass project also helps achieve the city's Climate Change goal of reducing greenhouse gas emissions by 80 percent by 2050 through encouraging residents and employees of Boulder to increasingly use non-vehicular means of transportation.

This project helps the city achieve its social sustainability goals by improving the transportation options for all members of the community and by improving public safety with underpass improvements that address the visual (sightlines) and physical approaches to the underpass, improving accessibility for users of all abilities by meeting Americans with Disability Act guidelines, improves lighting and reduces the flood risk of the underpass.

Community Involvement

It is important that the planning and design process for the Arapahoe Underpass project is conducted with the community and that feedback received from multiple project stakeholders is incorporated throughout the planning process. The proposed design alternatives have been shared with the community this spring and summer at three public meetings, youth outreach, two community walks, an open house and presentations to community advocacy groups and as an informational item to TAB. Information on the project, including open house presentation boards and public comment form, is also available on the project webpage (<https://bouldercolorado.gov/pages/boulder-creek-arapahoe-and-13th-underpass>). The current design options for the underpass, north and south path connections and on-street crossings were influenced by the feedback received through this outreach.

Process Timeline

Planning and preliminary design is anticipated to be completed by the first quarter of 2017. The project team will identify the preferred alternative through combination of the presented options using the evaluation criteria (a draft list of evaluation criteria can be found in the attachments). In early fall, the final CEAP will be reviewed by the city's CEAP Committee and a joint boards meeting between TAB and Parks and Recreation Advisory Board (PRAB) to provide official review and recommendation of the CEAP process and preferred alternative selection. When the official recommendation is received by these committee and boards, the Arapahoe Underpass CEAP will be sent to City Council for potential call-up. Once this process is complete, the project will begin the permitting process (wetland and floodplain).

To comply with the CCS' deadline for the completion of construction (end of 2018) and for coordination to occur with nearby projects (Arapahoe Avenue Reconstruction, Civic Area Vision Plan, Boulder Creek Path & Lighting Improvements projects and the University of Colorado proposed convention center and hotel (Grandview Avenue near Broadway)), the Arapahoe Underpass project is currently scheduled to begin construction in winter, 2017 and be completed in spring, 2018. Extending the project construction schedule risks possible increased costs due to year-over-year construction cost inflation (greater than 10% in 2016).

Proposed Design Alternatives

The following design alternatives can be found in the attachments.

Underpass

Two proposed underpass design alternatives have been identified. Option 1 would make changes to the existing crossing under the Arapahoe Avenue at Boulder Creek vehicular bridge that would shift the Boulder Creek Path closer to Boulder Creek. This option is shown in the attachments with the north path connection option 1 & south path connection option 1 as an example.

Option 2 would construct a new underpass between the vehicular bridge and 13th Street. With this option, the existing underpass would be removed and this section of the Boulder Creek embankment would be restored. The existing structure that carries Boulder Creek would remain in place for flood conveyance

purposes. This underpass option may impact existing ditch utilities within Civic Area Central park. This option is shown in the attachments with the north path connection option 1 and south path connection option 1 as an example.

Two options for connecting the paths on the north and on the south side of the underpass to the underpass and to the on-street crossing and four options for how the on-street crossing will be re-constructed during the Arapahoe Avenue reconstruction are presented below. Each of these connection and crossing options could be combined with either underpass option.

North Path Connections

North Path Connection 1 (NPC1) is similar to the existing connections of the Boulder Creek path and the path connection to the Arapahoe Ave and 13th St intersection. This option would use a series of tiered retaining walls to accommodate the slope between the two paths which provides opportunity for more landscaping.

North Path Connection 2 (NPC2) would move the path connection to the Arapahoe Ave and 13th St intersection closer to the Boulder Creek Path and would provide more space within the Civic Area Central Park for events and programming. This option would require a single, tall retaining wall with a handrail to accommodate the greater elevation difference between the underpass entrance and the path connection to the Arapahoe Ave and 13th St intersection. The tall retaining wall face provides an integrated public art opportunity.

South Path Connections

South Path Connection 1 (SPC1) is similar to the existing multi-use paths and connections on the south side of the underpass. To achieve the project goal of reducing the approach to the underpass to a grade of 5% or less, the convergence of the paths and the existing pedestrian and bicycle bridge over Boulder Creek would move downstream. This option does not change the current north-south mobility for pedestrians and bicyclists.

South Path Connection 2 (SPC2) would change the convergence of the paths on the south side of the underpass. The existing pedestrian and bicycle bridge over Boulder Creek would be replaced and moved upstream. This new pedestrian and bicycle bridge crosses over Boulder Creek and the Boulder Creek Path connecting the multi-use path on the south to the on-street crossing on Arapahoe Ave at 13th St. The Boulder Creek Path would remain at creek level further downstream to provide clearance under this new pedestrian and bicycle bridge.

On-Street Crossing

During the proposed Arapahoe Avenue reconstruction, the on-street crossing at Arapahoe Ave and 13th St will be widened from eight to a minimum of 10 feet. The sidewalk on the northeast corner of Arapahoe Ave and 13th St is proposed to be detached further from the road, from four feet to eight feet. These changes are proposed to better accommodate the volume of pedestrian and bicycle traffic, bicycle turning movements and to provide greater visibility between those crossing Arapahoe Avenue and vehicles travelling along it.

On-Street Crossing 1 (OSC1) would re-construct the existing on-street crossing and pedestrian refuge median.

On-Street Crossing 2 (OSC2) would re-construct the existing pedestrian refuge median to include a z-crossing, where the crossing is offset on either side of the median to turn those crossing Arapahoe Avenue to face oncoming traffic to increase visibility across modes.

On-Street Crossing 3 (OSC3) would remove the existing pedestrian refuge median and re-construct the intersection of Arapahoe Ave and 13th St as a raised intersection crossing. This crossing would accommodate diagonal crossing through the intersection.

On-Street Crossing 4 (OSC4) would remove the existing pedestrian refuge median and re-construct the intersection of Arapahoe Ave and 13th St as a raised intersection and reduce Arapahoe Avenue from three to two lanes through incorporation of a curb extension from the south side multi-use path.

Design Similarities

Each alternative will:

- Have an underpass traveling surface width of 24 feet;
- Increase the Boulder Creek Path width to 15 feet (6' pedestrian path, 9' bike path);
- Increase lighting;
- Reduce curves and flatten the grades of the north and south approaches;
- Reduce the number of high water closure days through flood walls, berms and a pump system designed to accommodate creek flow levels experienced during the extended 2015 closure;
- Replace and widen the pedestrian and bicycle bridge over Boulder Creek south of the underpass;
- Re-construct the on-street crossing at Arapahoe Ave and 13th St;
- Remove the existing seating area on the south side of the underpass;
- Remove mature trees and vegetation;
- Incorporate public art;
- Take approximately one year to construct (including the Arapahoe Avenue reconstruction);
- Not reduce the current flood carrying capacity of Boulder Creek and
- Not require new property acquisition.

Design Differences

To assess the two underpass, two north path connection, two south path connection and four on-street crossing options in order to ultimately identify a preferred design alternative, a draft list of evaluation characteristics were identified by the CEAP and project team (attached). A final list of evaluating characteristics will be developed using input received from the public and relevant boards. This final list of evaluation characteristics will be used to identify the preferred project alternative by evaluating how each design alternative supports the project goals; improves safety, accessibility and mobility of all modes; impacts the environment and the user experience; impacts infrastructure; supports city projects and plans; and its cost-benefits.

Request to the Board

The project team requests feedback from TAB on (1) the planning and design process, (2) the current proposed design options and (3) the proposed evaluation characteristics. Feedback received from TAB and PRAB will inform the selection of the preferred alternative through combination of the presented options, the next step in the CEAP. This is also the opportunity for the board to request additional information from the project team.

Additionally, we ask for the board to participate in a joint TAB-PRAB meeting (November, 2016--date to be determined) for official review and recommendation of the CEAP process and preferred alternative selection.

Attachments

MEMORANDUM

To: Bryant Gonsalves

From: Bill Fox

Date: May 4, 2016

Project: Arapahoe and 13th intersection area bicycle and pedestrian origin/destination counts

Subject: Preliminary data summary

At your request the Fox Tuttle Hernandez completed a detailed set of bicycle and pedestrian counts in the vicinity of the intersection of Arapahoe Avenue and 13th Street intersection. In this area there is not only the roadway intersection, but also the intersection of the Boulder Creek Path and the Broadway Path, and the underpass of the Creek Path beneath Arapahoe Avenue. A sidewalk connects the two multi-use paths to the 13th Street crossing at-grade across Arapahoe Avenue, and finally, there are east/west sidewalks along both sides of Arapahoe. This complicated intersection area includes eleven different entry or exit points for the bicyclists and pedestrians that are traveling along or across Arapahoe Avenue. These access points (labeled A – K) are illustrated on the attached Base Map. The net result is that there are a total of 121 possible origin/destination pairs for pedestrians and bicyclists traveling through this area.

The pedestrians and bicycles traveling through this area were observed on April 19th, while both CU and Boulder High School were in session, during the time periods listed below. The weather started off cool but was generally sunny and seasonal.

- 7:15 AM to 8:30 AM
- 11:00 AM to 1:00 PM
- 3:00 PM to 5:00 PM

These time periods captured the typical AM, Noon, and PM peak travel periods, and also included the arrival and departure periods for the adjacent Boulder High School. The breakdown of users by travel mode and time period was as follows:

Time Period	Pedestrians	Bicycles	Skateboarders	Total
7:15 – 8:30 AM	156	93	3	252
11:00 AM – 1:00 PM	562	176	6	744
3:00 – 5:30 PM	511	294	9	814
Total:	1,229	563	18	1,810

It was noted that of the 1,810 travelers observed:

- 548 (30%) crossed Arapahoe Avenue at-grade in the marked crosswalk on the east side of 13th Street
- 538 (30%) crossed Arapahoe using the path underpass along Boulder Creek
- 724 (40%) moved through the study area but did not cross Arapahoe Avenue.

Figure 1 includes an illustration of the detailed arrival and departure pattern for all 1,810 travelers that were observed throughout the day. It shows the total number of travelers who arrived or departed at each of the eleven access points and also provides the percentage of the total access that occurred at each station. The remaining Figures 2 – 10 illustrate the travel pattern to/from the individual access points (excluding G and H since they had relatively low access traffic). The weight or width of the lines in each figure represent the proportional amount of travel in each area.

At this point the attached figures illustrate the travel pattern for pedestrians, bicyclists and skateboarders combined over the entire day. Data is available to provide this same information for each time period separately, and for bicyclists and pedestrians separately within each time period, but this would result in 60 additional figures, which would likely be too much information.

Some significant observations include:

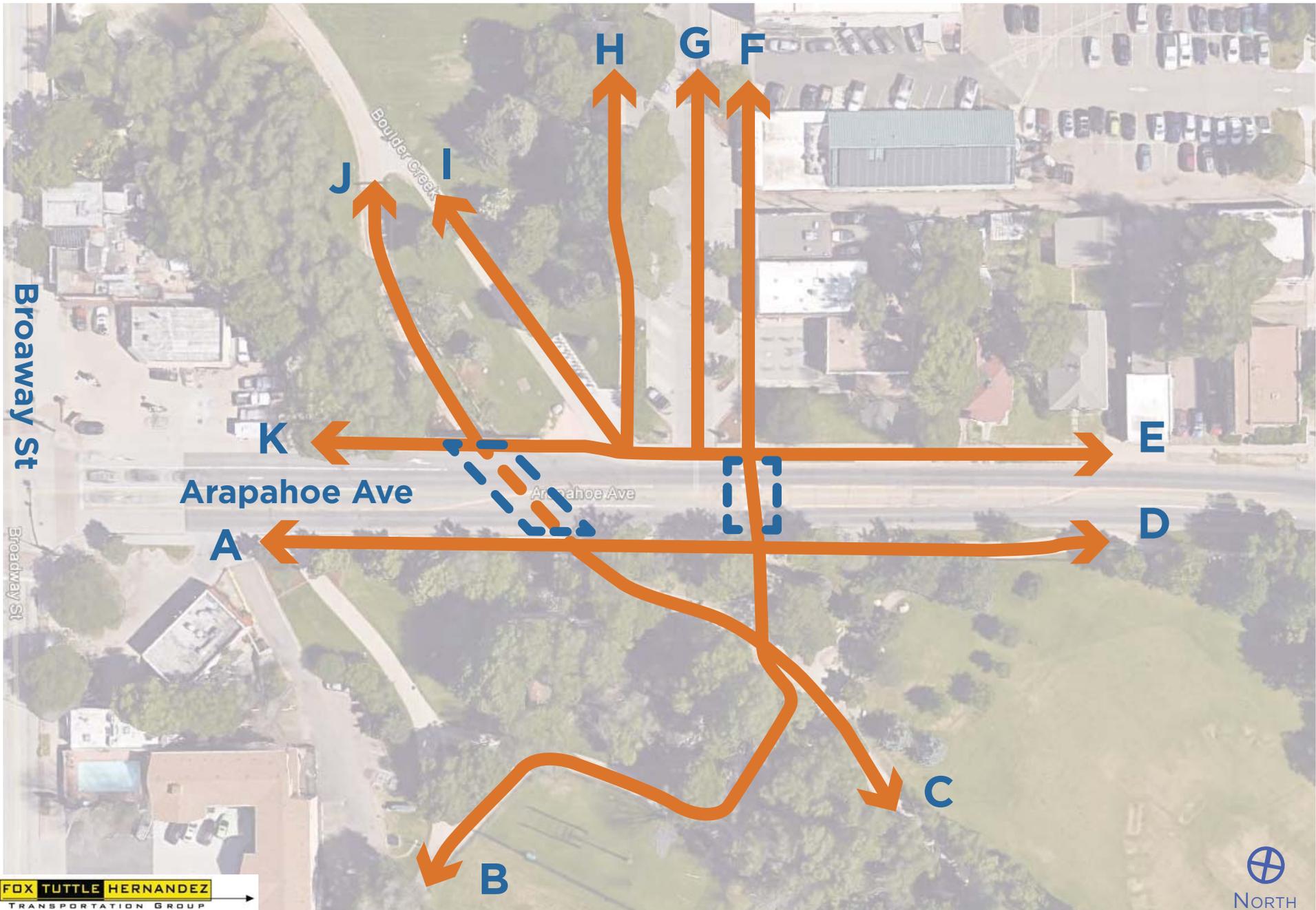
- Most people traveling along Arapahoe on the north or south sidewalks did not cross the street. However, there was a pattern of high school students traveling between accesses D and I, using the crosswalk at 13th Street as part of their route to/from school. This is likely influenced by the location of the transit stop adjacent to the Civic Park on Broadway just south of Canyon Boulevard.
- Most of the northbound bicyclists who crossed Arapahoe in the crosswalk were accessing the crosswalk from the Boulder Creek Path (C) or the Broadway Path (B), and many arrived at the south edge of the crosswalk at a speed well in excess of a walking speed. This speed coupled with the poor sight distance between motorists and approaching bicyclists resulted in many motorists having to abruptly yield to the crossing bicyclist. Most motorists appeared alert and ready to yield at the crosswalk if needed, but a number of “near misses” in the crosswalk were observed.

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- During the mid-day period there was a significant amount of pedestrian traffic traveling along the south sidewalk between accesses A and D. Most pedestrians appeared to be high school students traveling to/from Alfalfa's Market for lunch.
 - The most predominant movement through the study area was the travel along the Boulder Creek Path between accesses C and J.

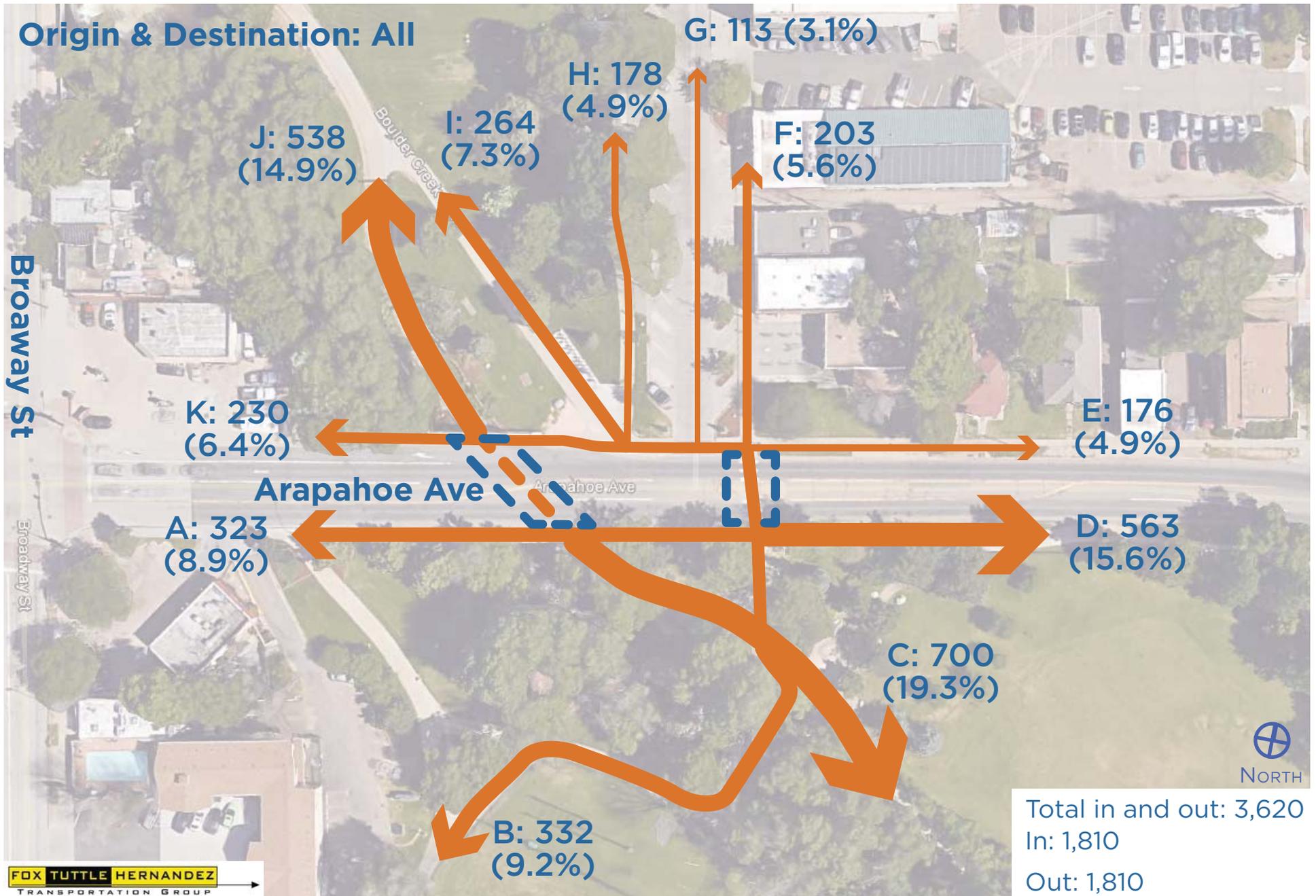
Please review this summary and let us know if this answers the questions you have regarding future underpass and sidewalk alignments. And let us know if we can be of further assistance reviewing the data and helping to determine the best alignment of these facilities in the future.

BF/

Attachments: Base Map
 Figures 1 - 10



Arapahoe & 13th Underpass: Origins and Destinations



Arapahoe & 13th Underpass: Origins and Destinations
All Trips

Origin & Destination

A

Broadway St

Broadway St

Boulder Creek Path

Arapahoe Ave

**A: 316
(48.9%)**

**F: 22
(3.4%)**

**E: 9
(1.4%)**

**D: 270
(41.8%)**

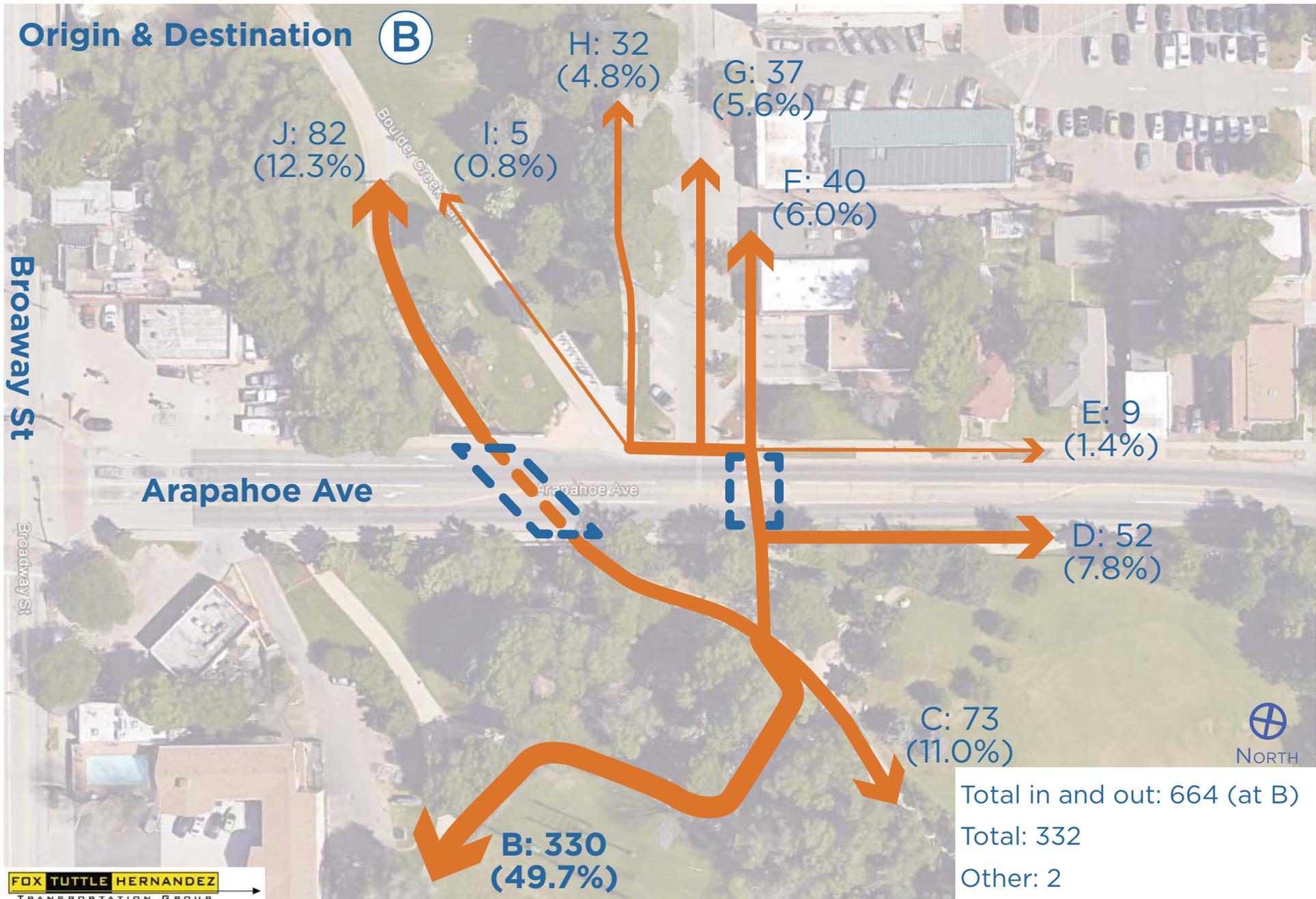
**C: 15
(2.3%)**



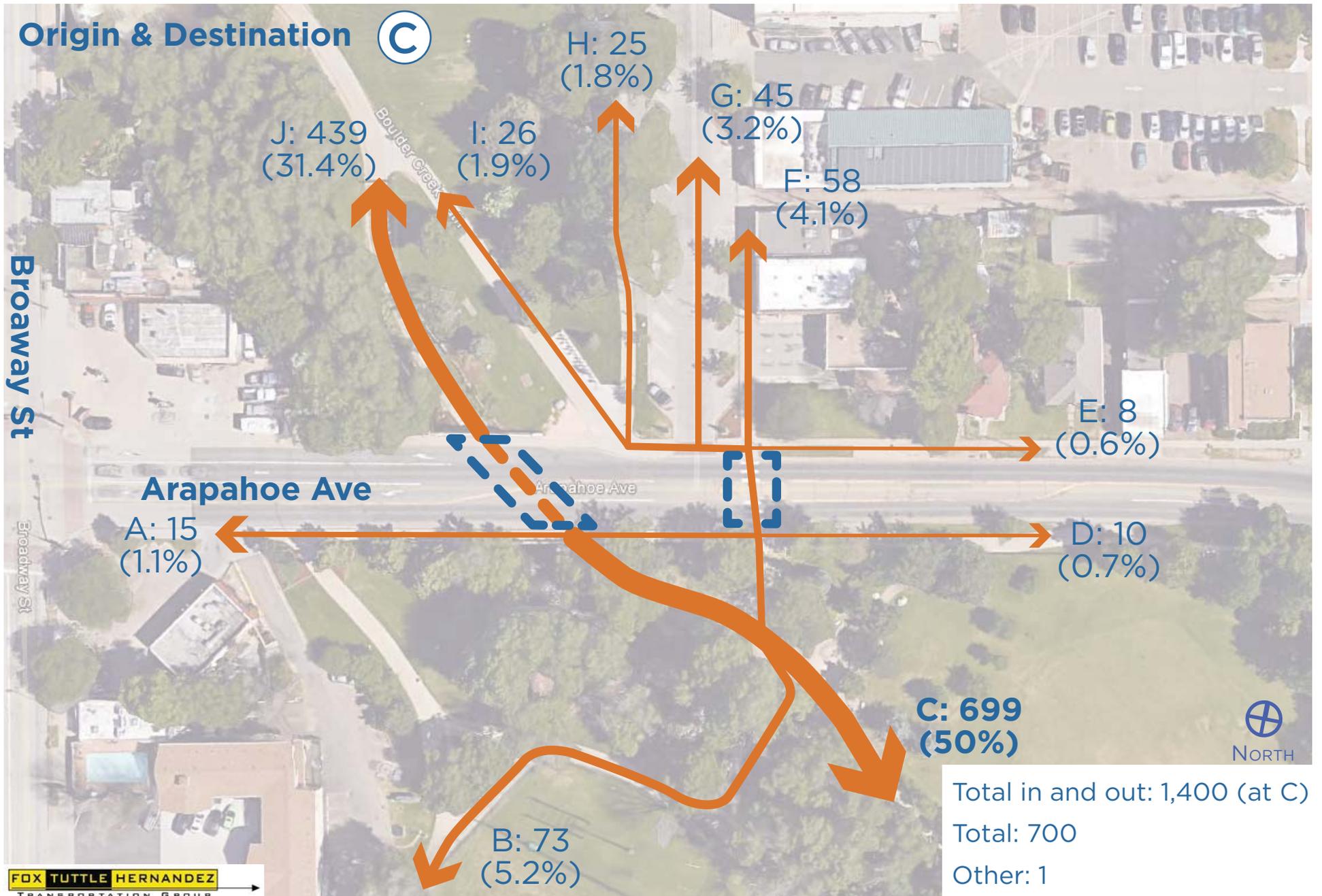
Total in and out: 646 (at A)
Total: 323
Other: 7



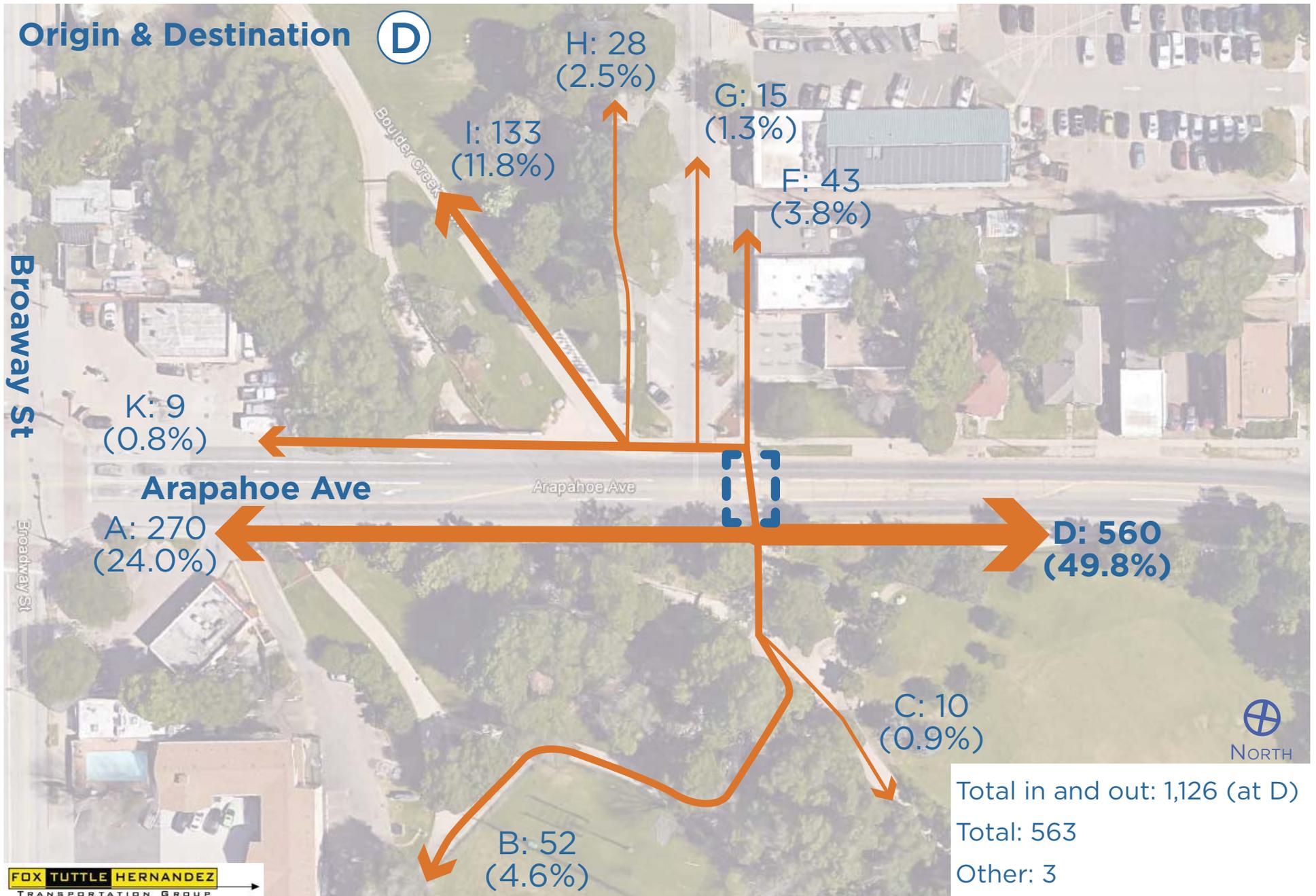
Aprahoe & 13th Underpass: Orgins and Destinations
Trips in and out of "A"



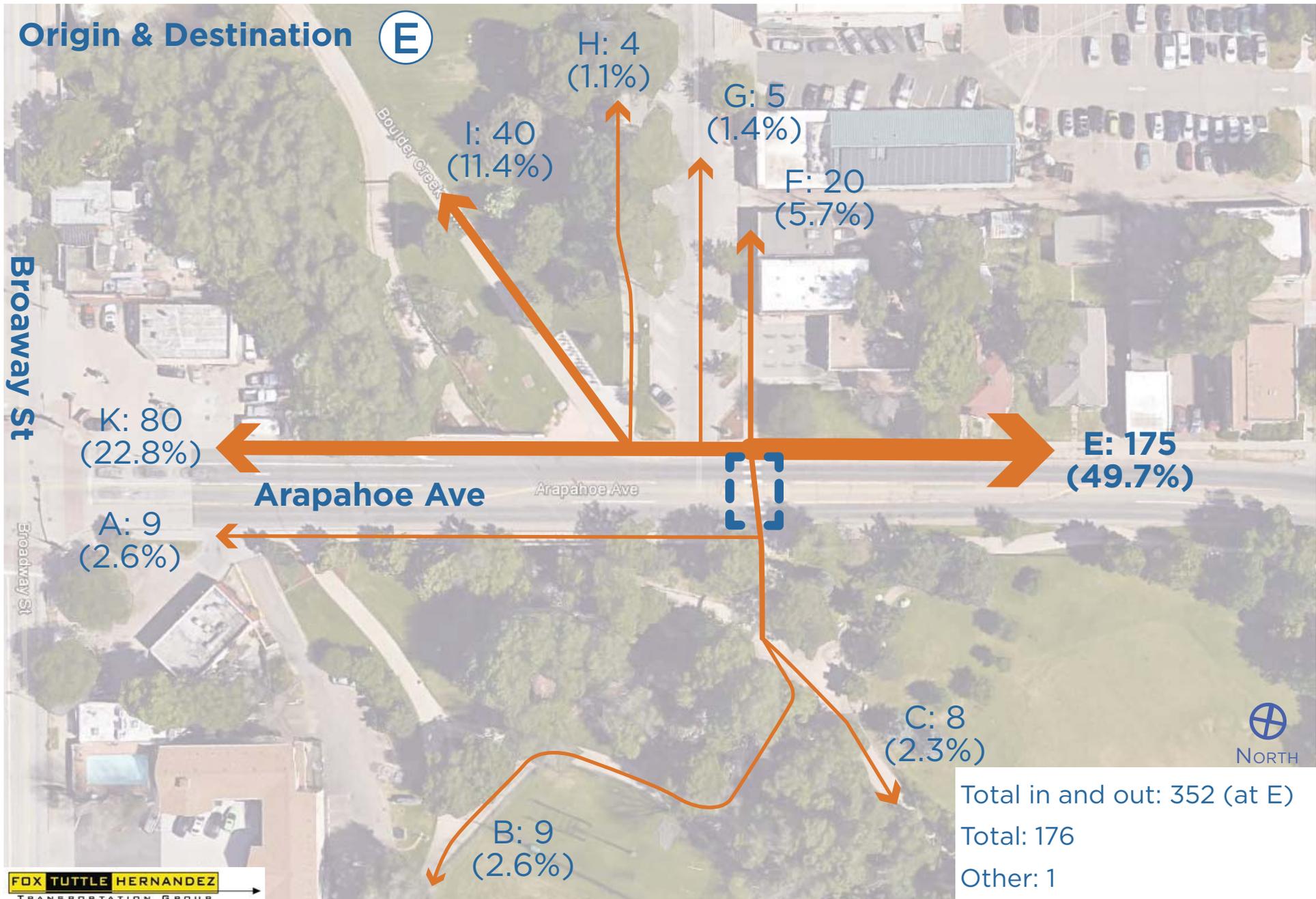
Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "B"



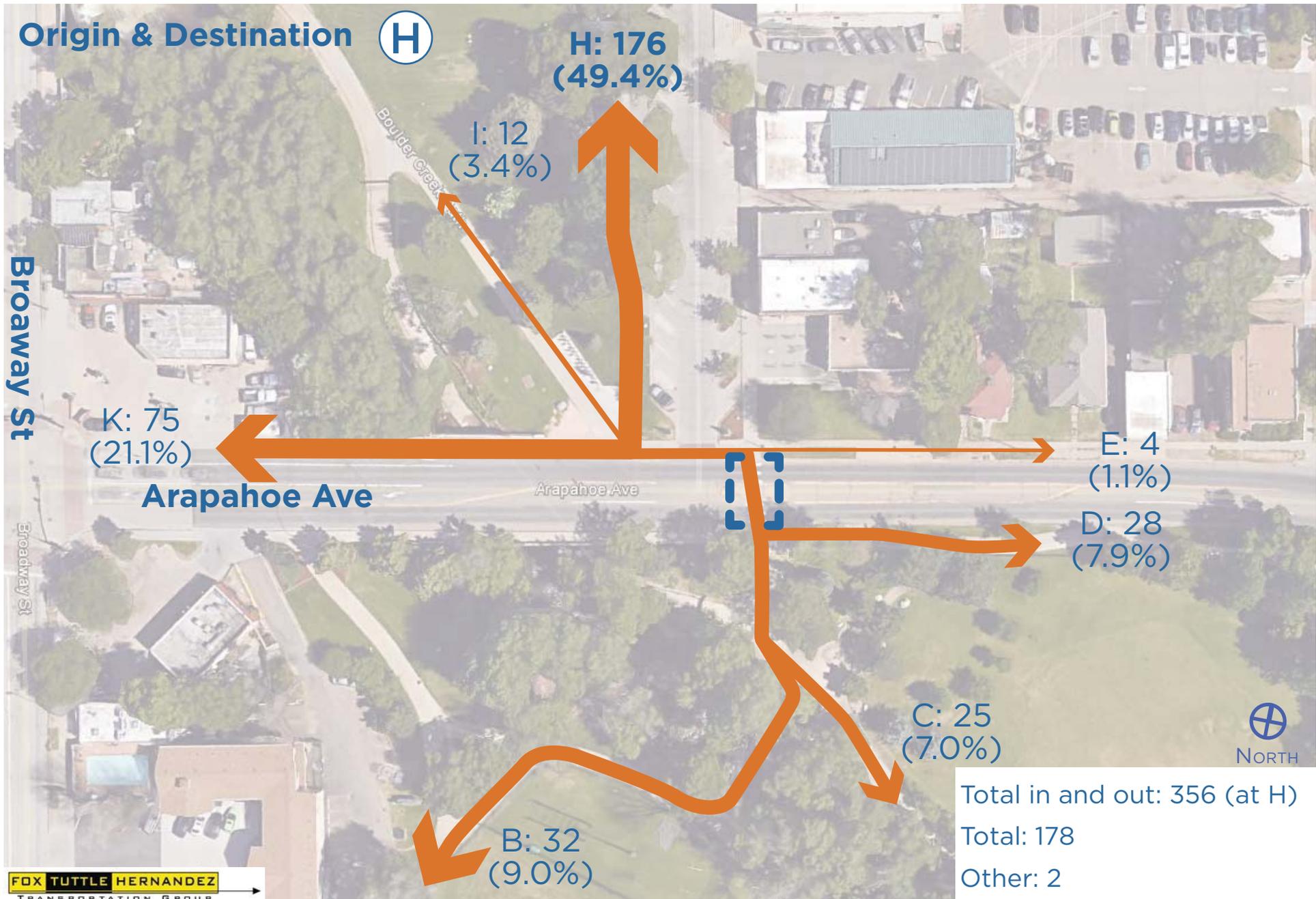
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "C"



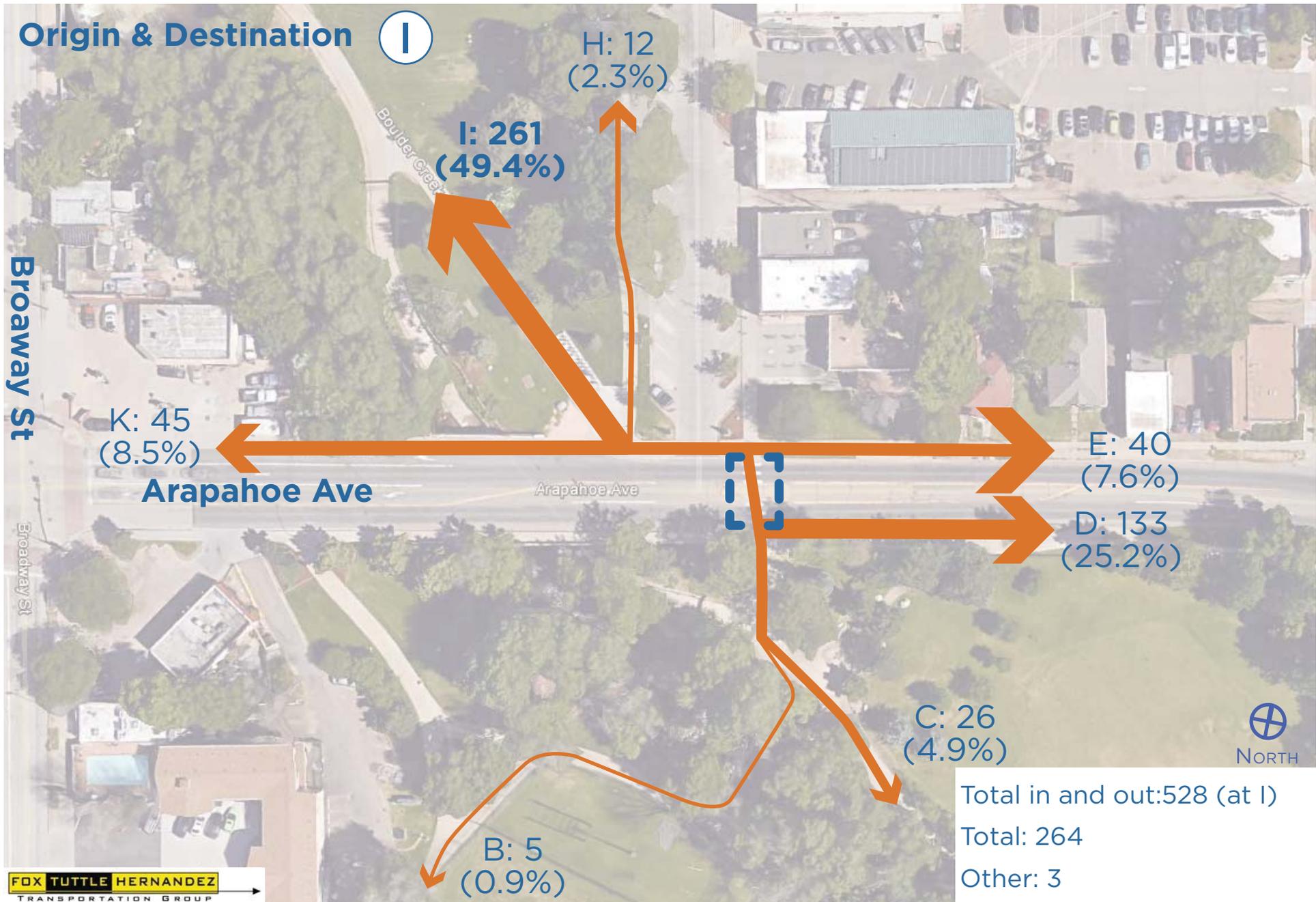
Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "D"



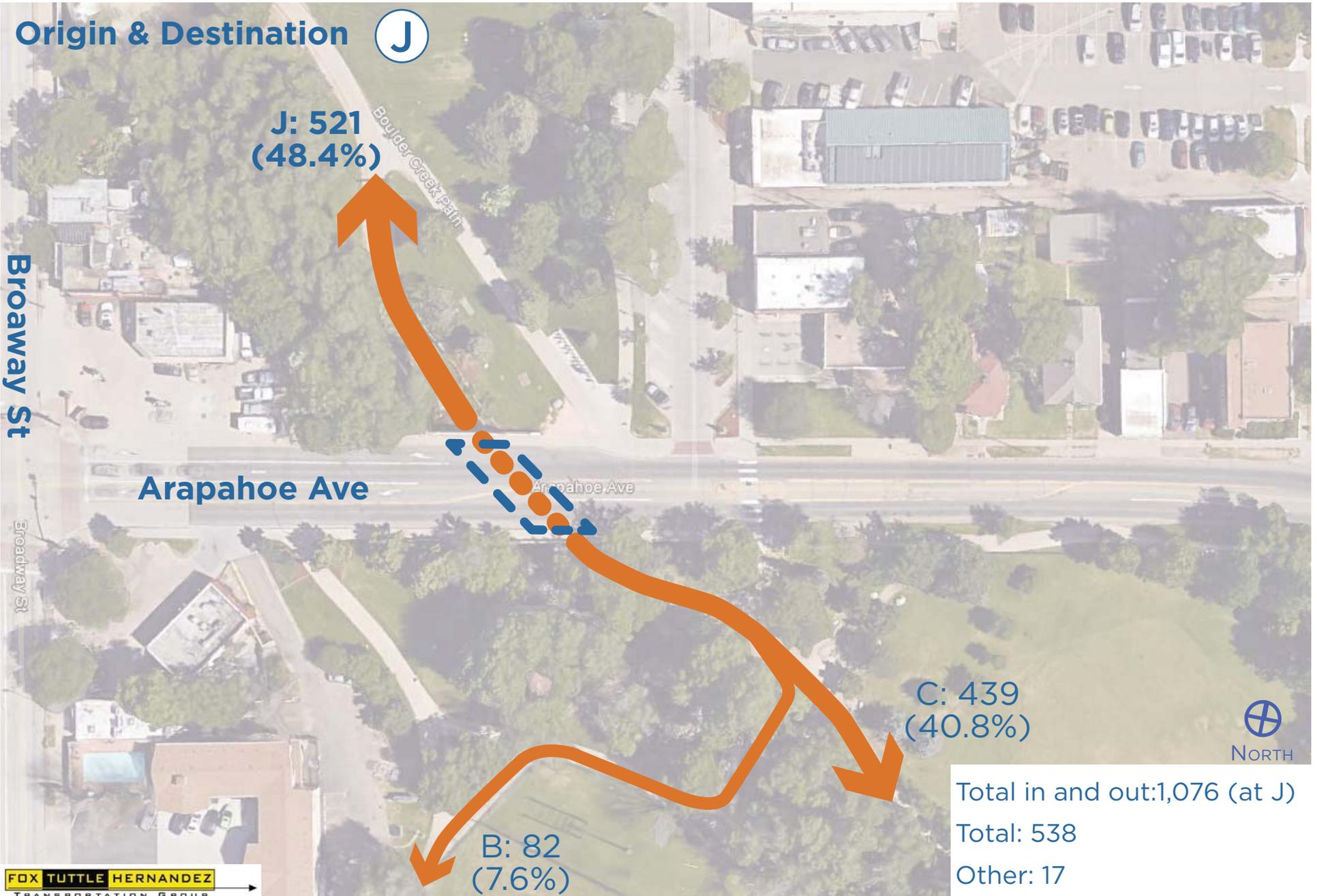
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "E"



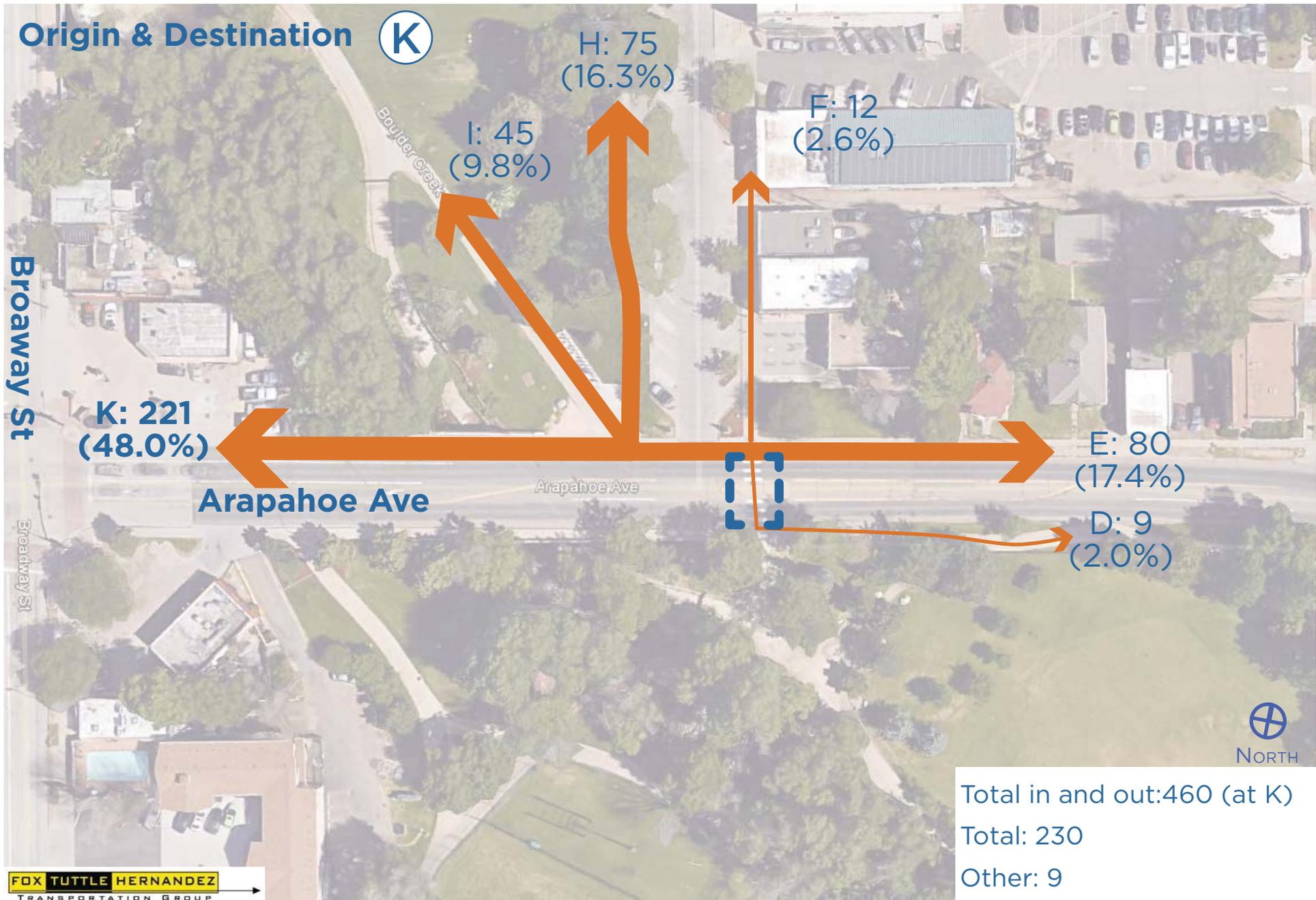
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "H"



Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "I"



Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "J"



Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "K"

MEMORANDUM

To: Bryant Gonsalves

From: Bill Fox

Date: September 2, 2016

Project: Arapahoe and 13th intersection area bicycle and pedestrian origin/destination counts

Subject: Summary of April and July counts

At your request the Fox Tuttle Hernandez completed a detailed set of bicycle and pedestrian counts in the vicinity of the intersection of Arapahoe Avenue and 13th Street intersection on weekdays in both April and July. In this area there is not only the roadway intersection, but also the intersection of the Boulder Creek Path and the Broadway Path, and the underpass of the Creek Path beneath Arapahoe Avenue. A sidewalk connects the two multi-use paths to the 13th Street crossing at-grade across Arapahoe Avenue, and finally, there are east/west sidewalks along both sides of Arapahoe. This complicated intersection area includes eleven different entry or exit points for the bicyclists and pedestrians that are traveling along or across Arapahoe Avenue. These access points (labeled A – K) are illustrated on the attached Base Map. The net result is that there are a total of 121 possible origin/destination pairs for pedestrians and bicyclists traveling through this area.

The pedestrians and bicycles traveling through this area were observed on April 19th, while both CU and Boulder High School were in session, during the time periods listed below. The weather started off cool but was generally sunny and seasonal.

- 7:15 AM to 8:30 AM
- 11:00 AM to 1:00 PM
- 3:00 PM to 5:00 PM

These time periods captured the typical AM, Noon, and PM peak travel periods. The counts in April also included the arrival and departure periods for the adjacent Boulder High School. The

results of the April observations were summarized in a memorandum and set of origin/destination figures in a memo dated May 4, 2016.

This same data, during these same time periods was again collected on July 21st, capturing the summer season while both Boulder High School and CU were not in regular session.

The breakdown of users by travel mode and time period was as follows:

Time Period	Pedestrians		Bicycles and Skateboards		Total	
	April	July	April	July	April	July
7:15 – 8:30 AM	156	200	96	213	252	413
11:00 AM – 1:00 PM	562	327	182	329	744	656
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Total:	1,229	884	581	990	1,810	1,874

It was noted that of the 1,810 travelers observed in April:

- 548 (30%) crossed Arapahoe Avenue at-grade in the marked crosswalk on the east side of 13th Street
- 538 (30%) crossed Arapahoe using the path underpass along Boulder Creek
- 724 (40%) moved through the study area but did not cross Arapahoe Avenue.

It was noted that of the 1,874 travelers observed in July:

- 532 (28%) crossed Arapahoe Avenue at-grade in the marked crosswalk on the east side of 13th Street
- 932 (50%) crossed Arapahoe using the path underpass along Boulder Creek
- 410 (22%) moved through the study area but did not cross Arapahoe Avenue.

It is interesting to note that a surprisingly similar total number of travelers (pedestrians and bicyclists combined) were observed in April and July, and a similar number of travelers were observed crossing Arapahoe at grade. However, a number of key differences were observed between April and July:

- When Boulder High School is not in session, the number of east/west sidewalk users that moved through the study area without crossing Arapahoe was significantly lower;
- High School students resulted in significantly more pedestrians than bicyclists being observed in April;
- Far more bicyclists were observed in July than in April, and a much higher percentage of all travelers used the underpass to cross Arapahoe in July than in April.

Detailed July Observations:

Figure 1 includes an illustration of the detailed arrival and departure patterns for all 1,874 travelers that were observed throughout the day in July. It shows the total number of travelers who arrived or departed at each of the eleven access points and also provides the percentage of the total access that occurred at each station. The remaining Figures 2 – 12 illustrate the travel pattern to/from the individual access points. The weight or width of the lines in each figure represent the proportional amount of travel in each area.

At this point the attached figures illustrate the travel pattern for pedestrians, bicyclists and skateboarders combined over the entire day. Data is available to provide this same information for each time period separately, and for bicyclists and pedestrians separately within each time period, but this would result in 60 additional figures, which would likely be too much information.

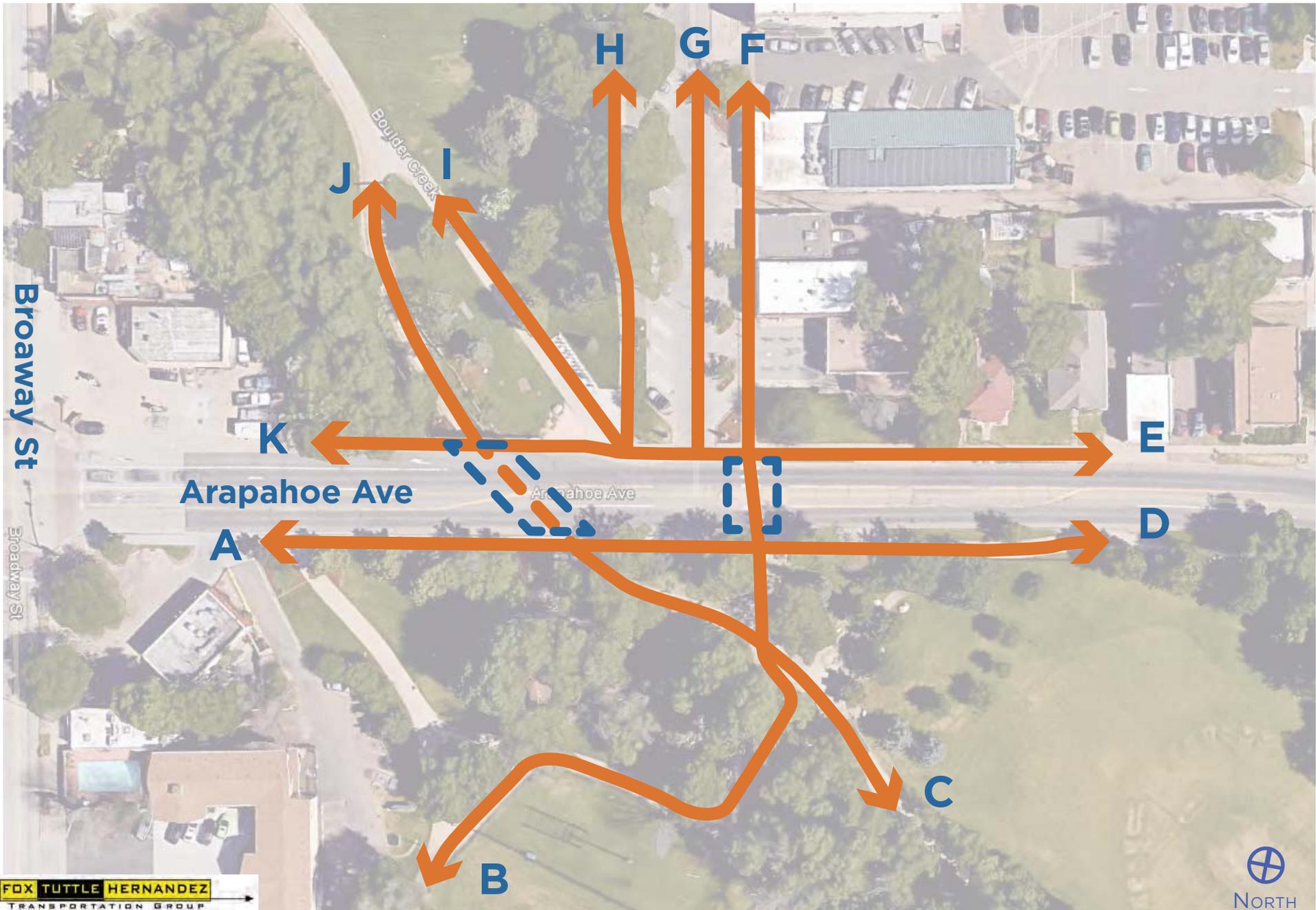
Some significant observations include:

- As was observed in April, most of the northbound bicyclists who crossed Arapahoe in the crosswalk were accessing the crosswalk from the Boulder Creek Path (C) or the Broadway Path (B), and many arrived at the south edge of the crosswalk at a speed well in excess of a walking speed. This speed coupled with the poor sight distance between motorists and approaching bicyclists resulted in many motorists having to abruptly yield to the crossing bicyclist. Most motorists appeared alert and ready to yield at the crosswalk if needed, but a number of “near misses” in the crosswalk were observed.
- The most predominant movement through the study area was the travel along the Boulder Creek Path between accesses C and J, which accounted for 41% of all travelers observed.

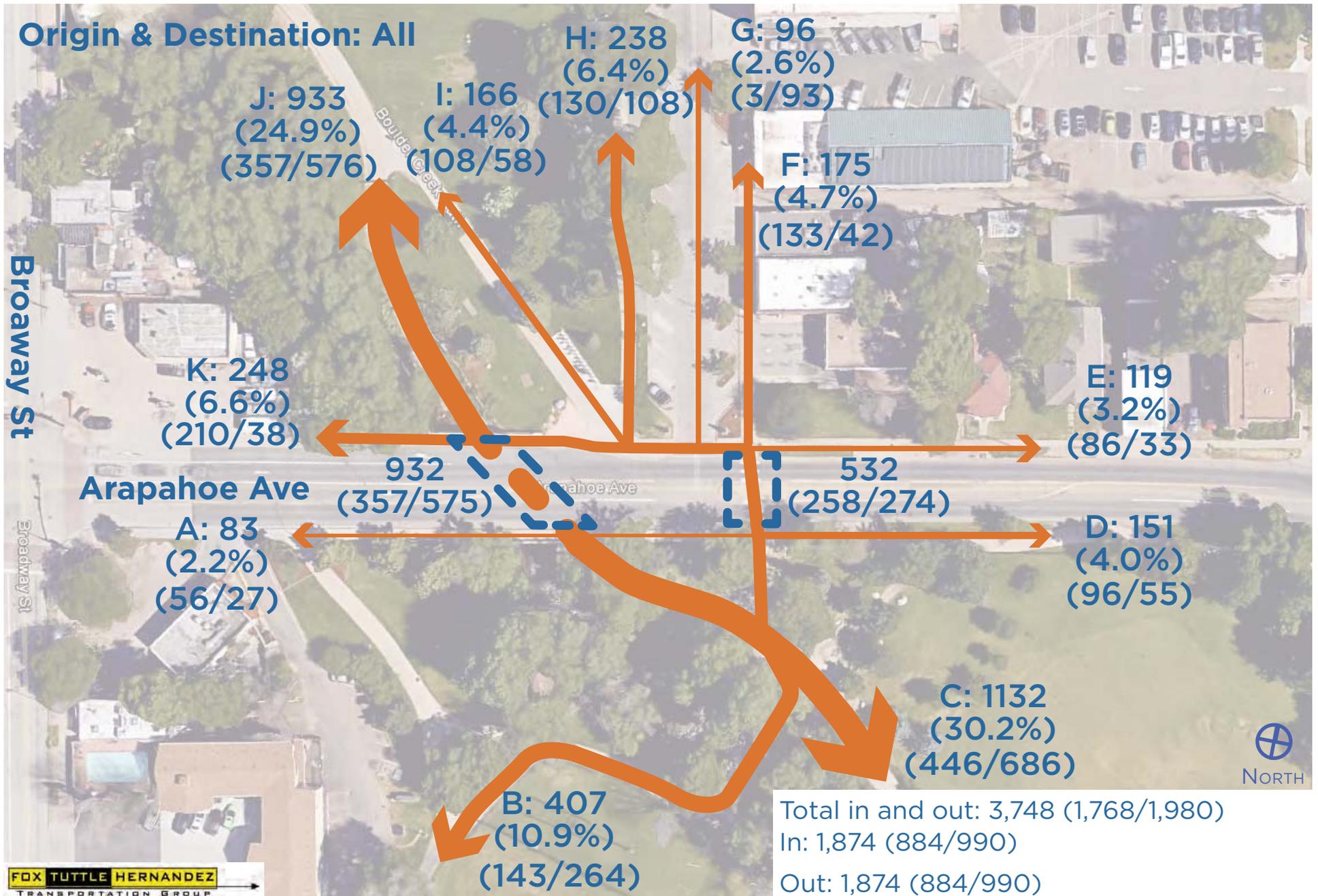
Please review this summary and let me know if you have any questions.

BF/

Attachments: Base Map
 July Figures 1 – 10
 Excel spreadsheet with detailed data tabulations for reference



Arapahoe & 13th Underpass: Origins and Destinations



Aprahoe & 13th Underpass: Orgins and Destinations
 All Trips



Origin & Destination

A

Broadway St

Broadway St

Boulder Creek path

Arapahoe Ave

F: 13
(7.8%)
(12/1)

E: 6
(3.6%)
(6/0)

A: 83
(50.0%)
(56/27)

D: 36
(21.7%)
(22/14)

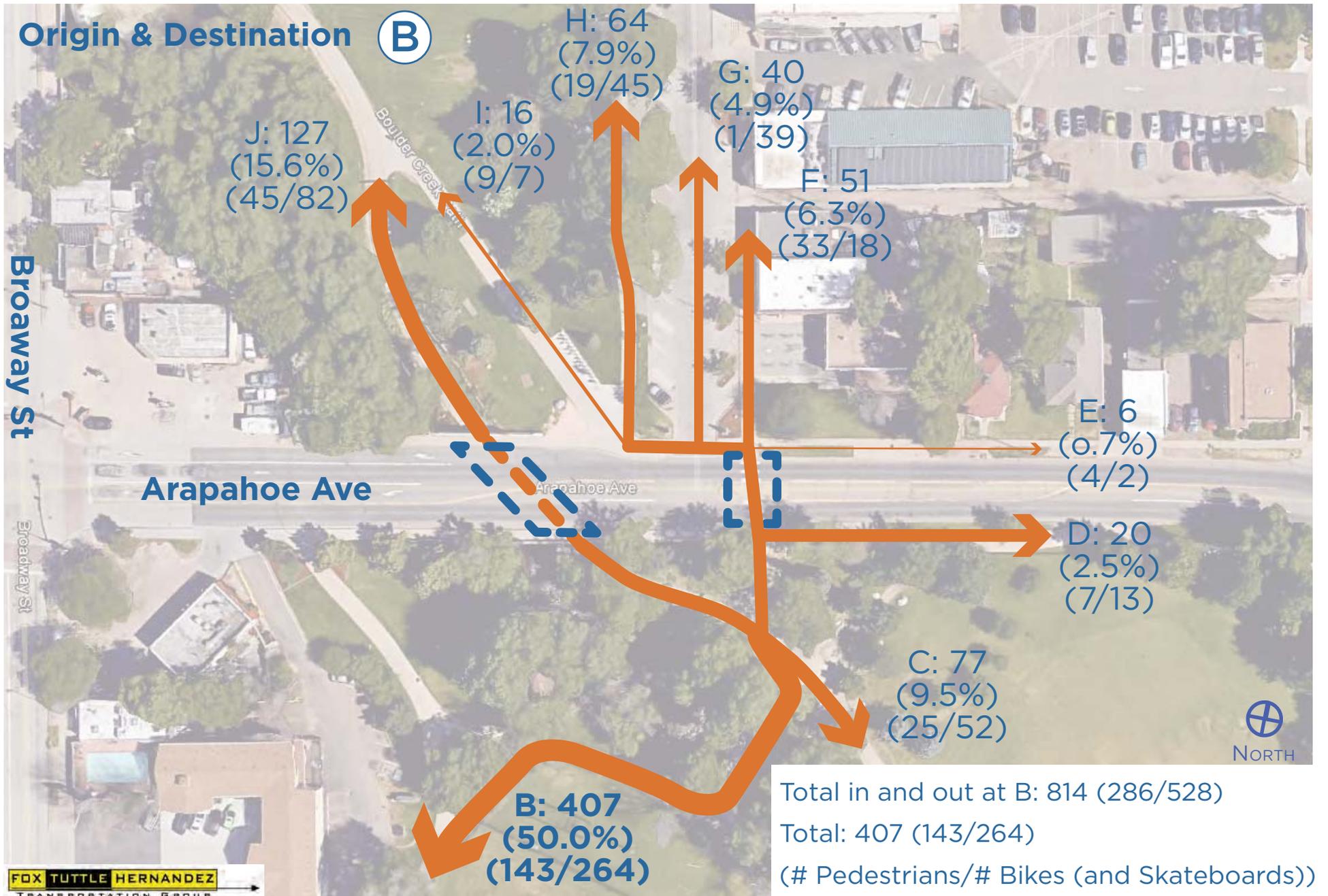
C: 17
(10.2%)
(11/6)



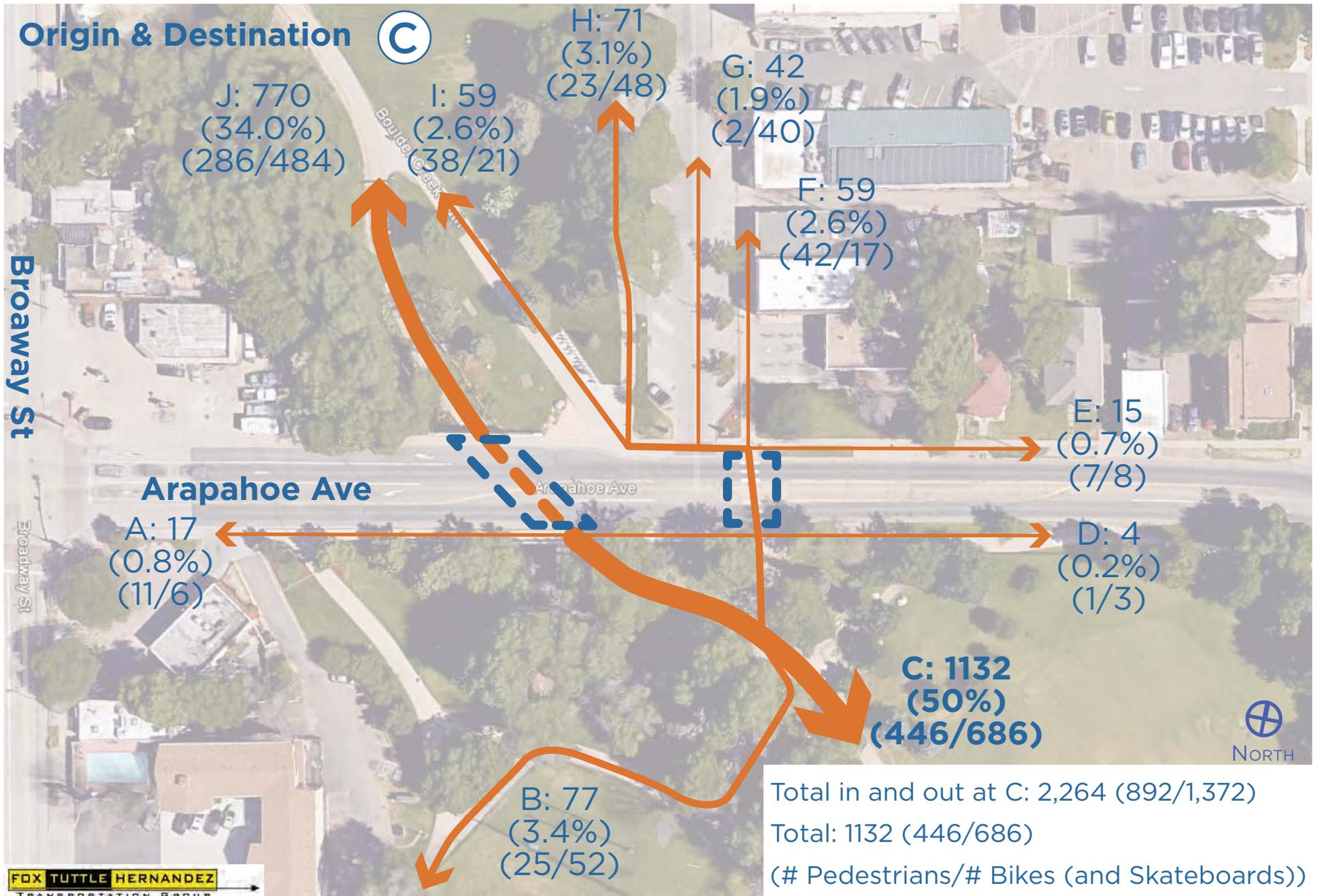
Total in and out at A: 166 (112/54)
Total: 83 (56/27)
(# Pedestrians/# Bikes (and Skateboards))



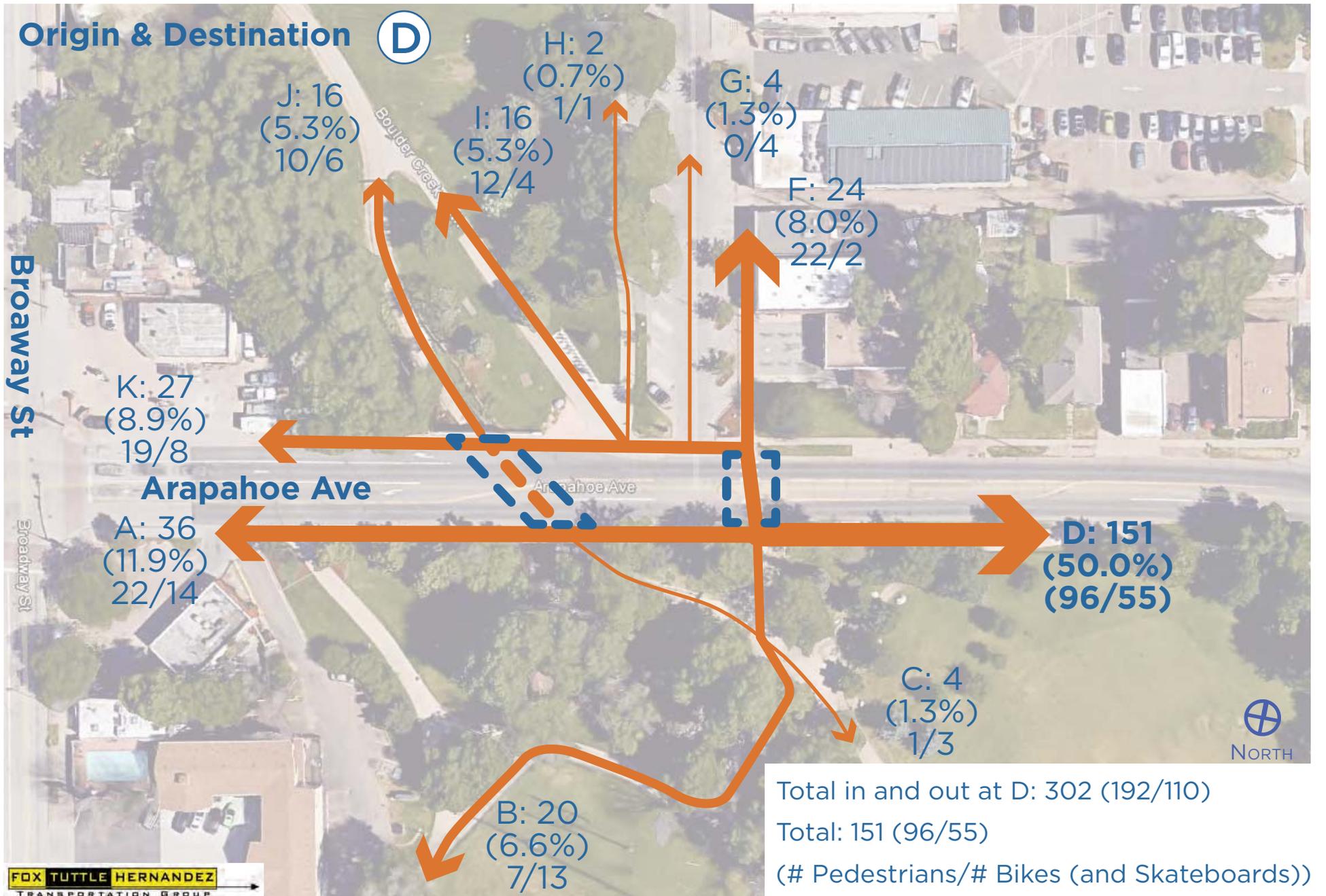
Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "A"



Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "B"

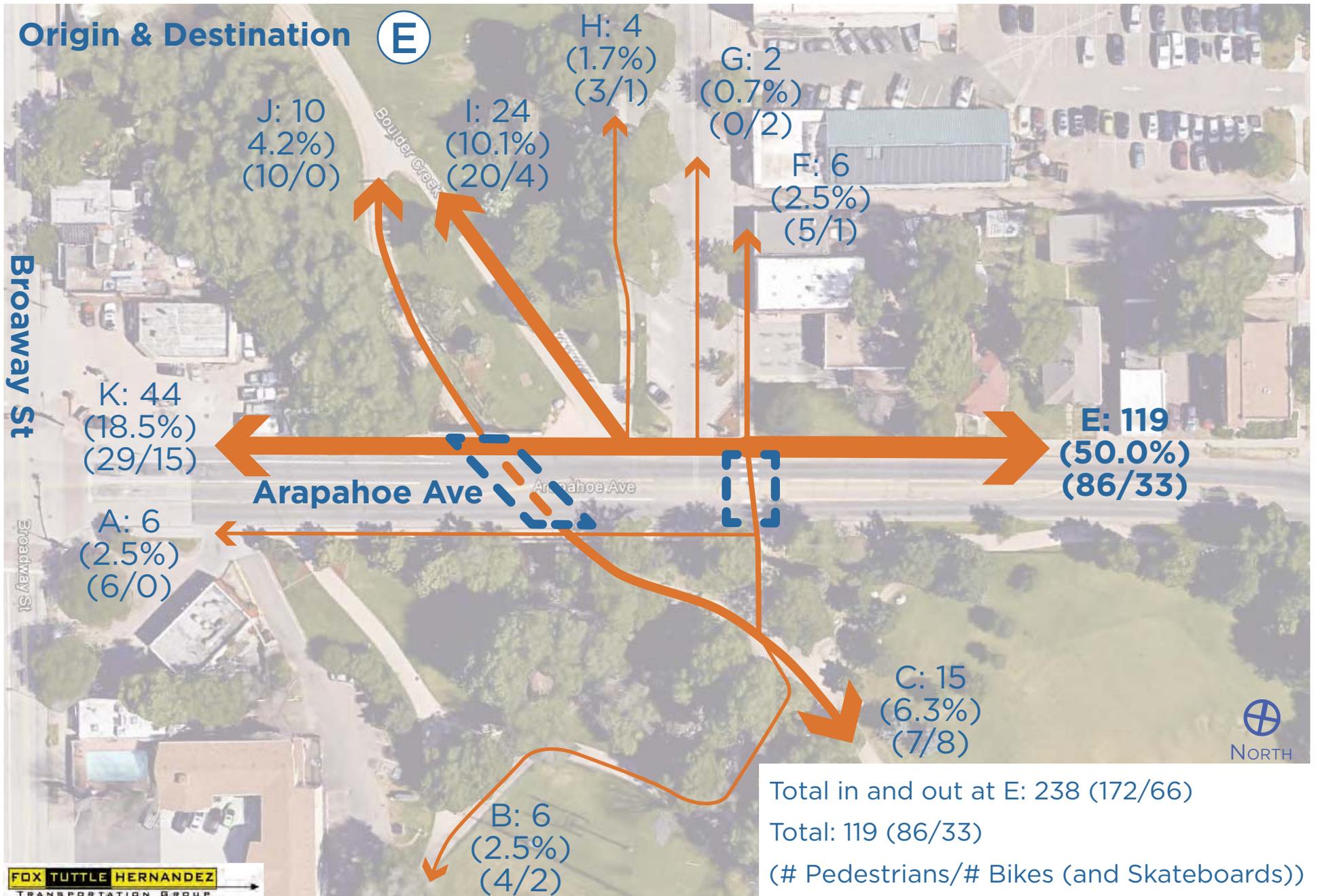


Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "C"



FOX TUTTLE HERNANDEZ
 TRANSPORTATION GROUP

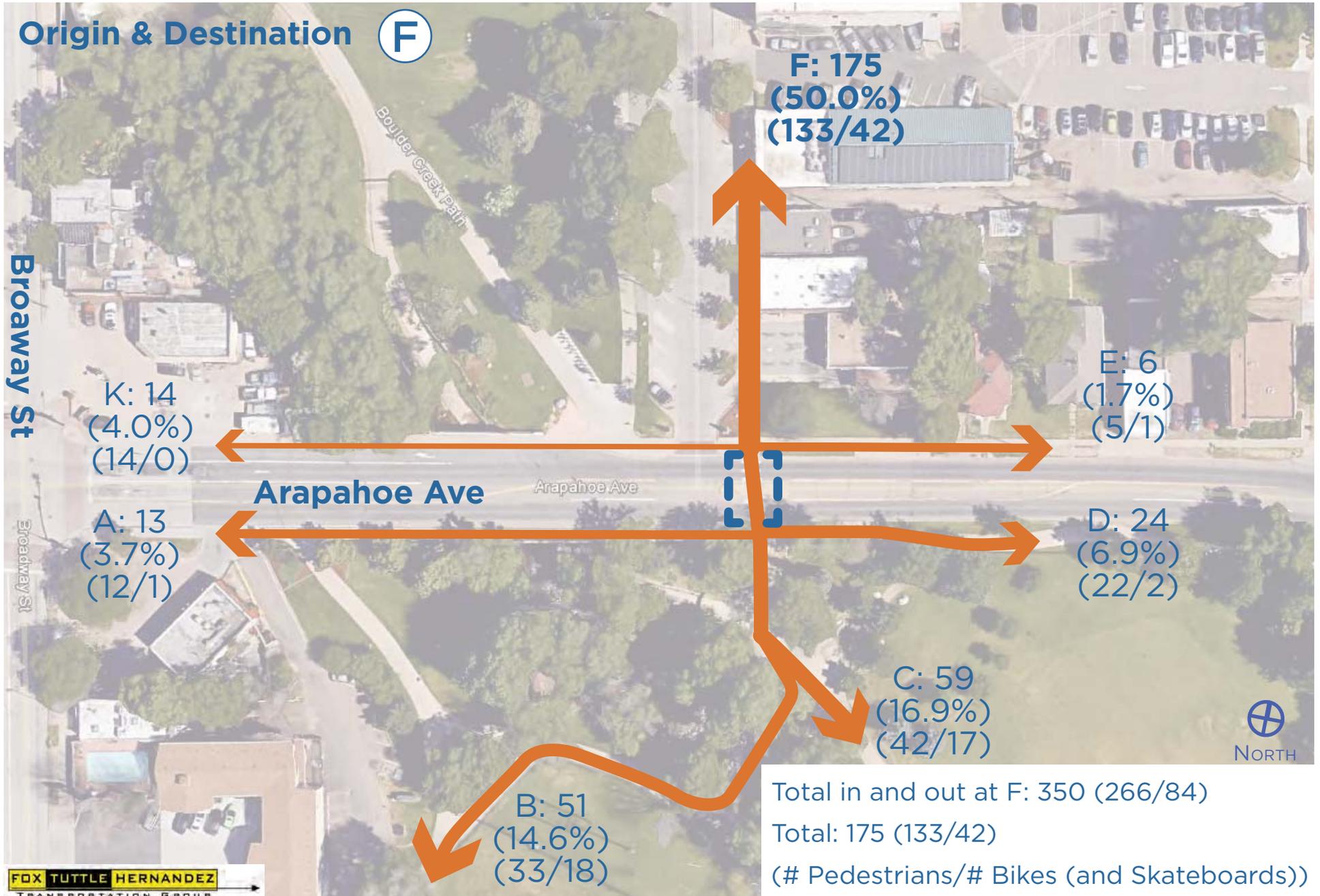
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "D"



Arapahoe & 13th Underpass: Origins and Destinations Trips in and out of "E"

Origin & Destination

F



Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "F"

Origin & Destination



Broadway St

Broadway St

Arapahoe Ave

Arapahoe Ave

Boulder Creek Path

**G: 96
(50.0%)
(3/93)**

**E: 2
(1.0%)
(0/2)**

**A: 3
(1.6%)
(0/3)**

**D: 4
(2.1%)
(0/4)**

**C: 42
(21.9%)
(2/40)**

**B: 40
(20.8%)
(1/39)**

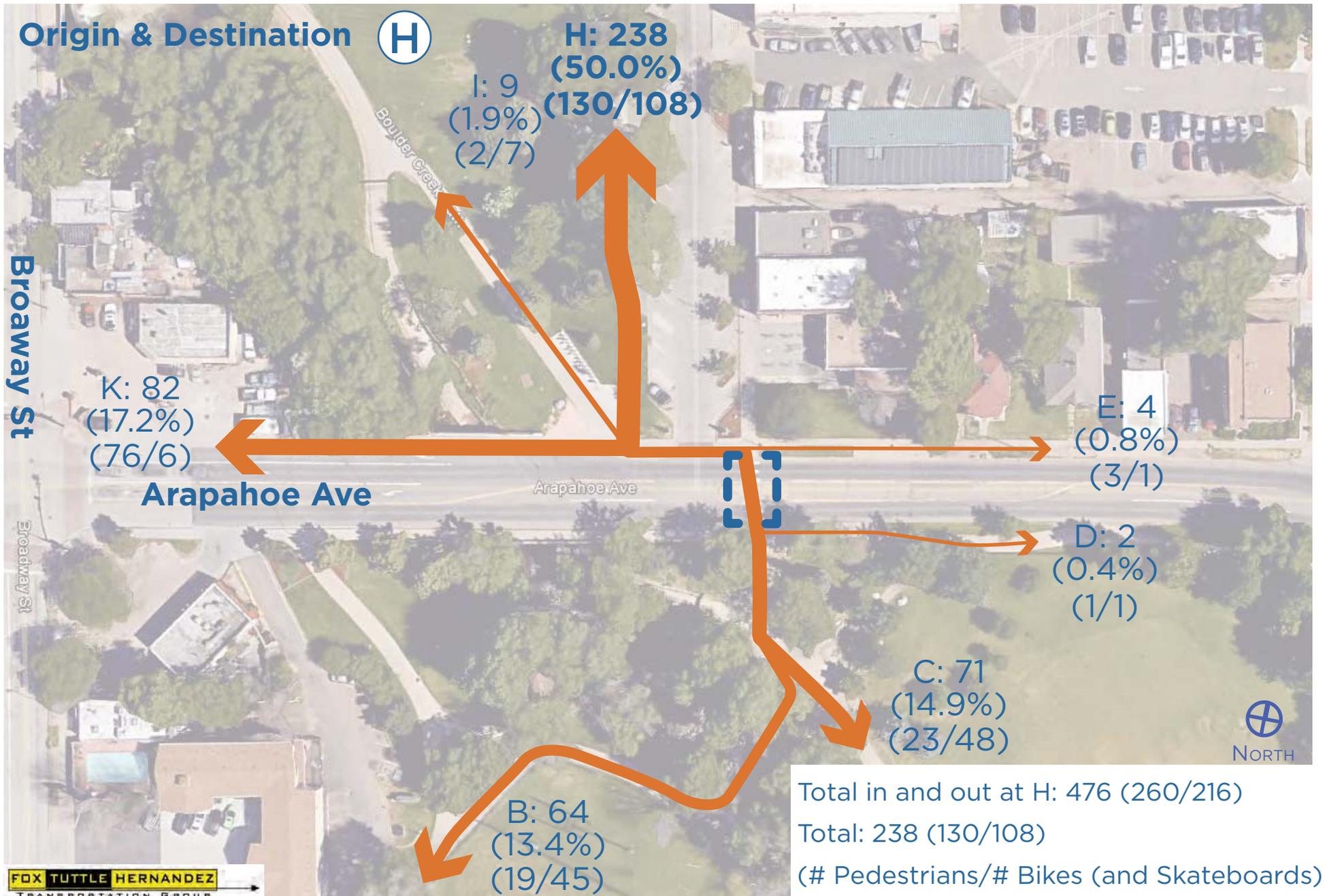
Total in and out at G: 192 (6/186)

Total: 96 (3/93)

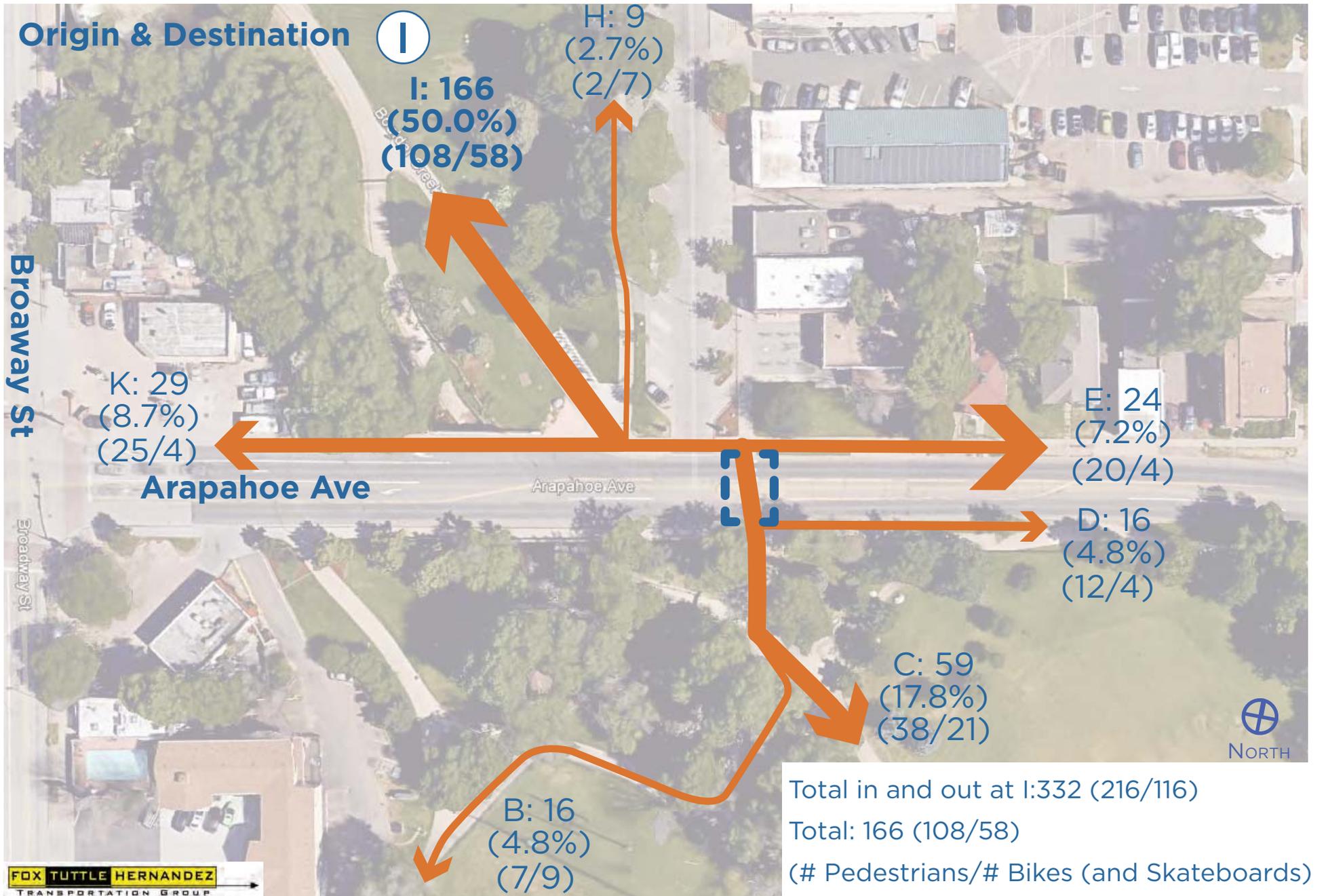
(# Pedestrians/# Bikes (and Skateboards))



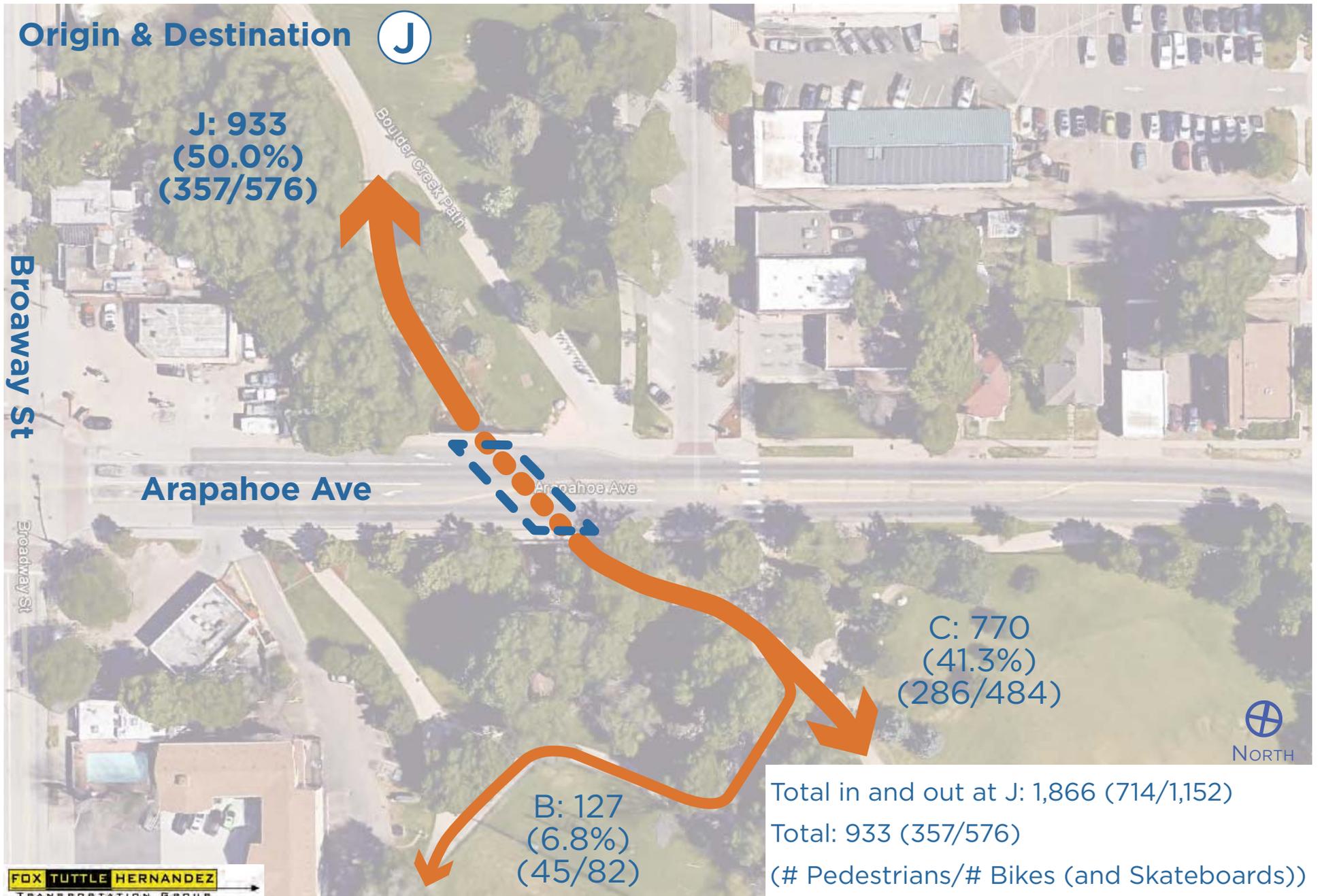
Aprahoe & 13th Underpass: Orgins and Destinations
Trips in and out of "G"



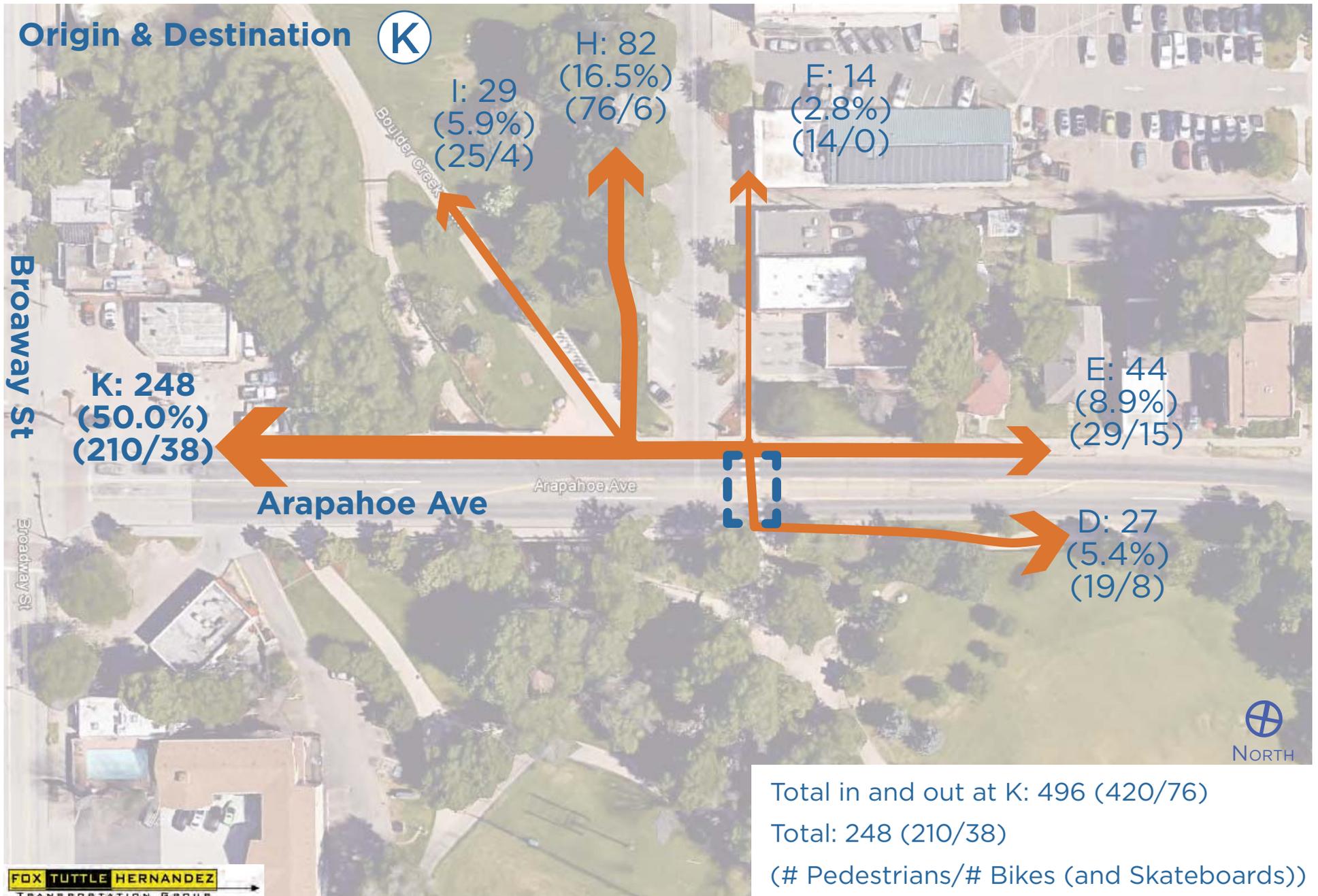
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "H"



Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "I"



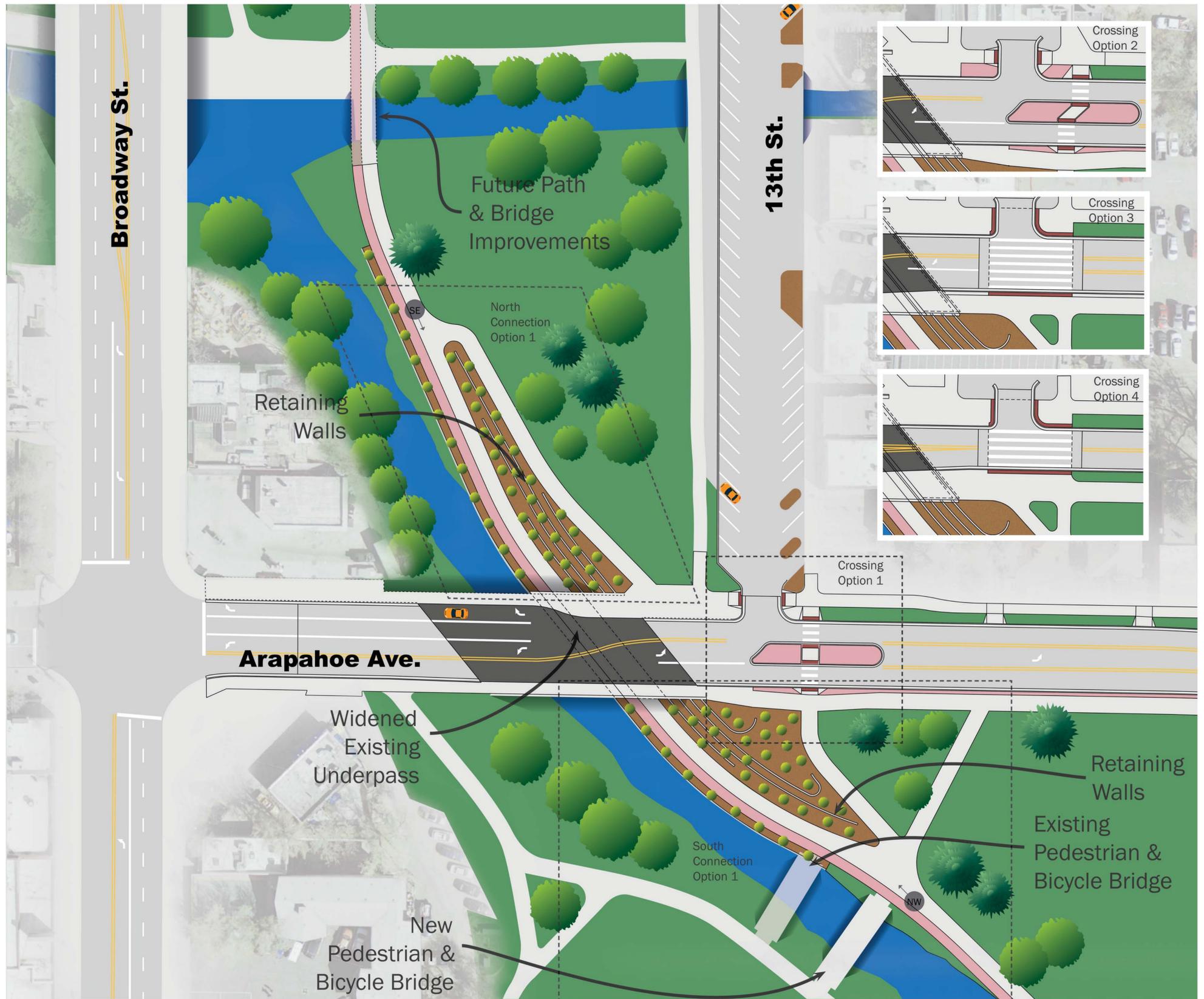
Arapahoe & 13th Underpass: Origins and Destinations
 Trips in and out of "J"



Arapahoe & 13th Underpass: Origins and Destinations
Trips in and out of "K"

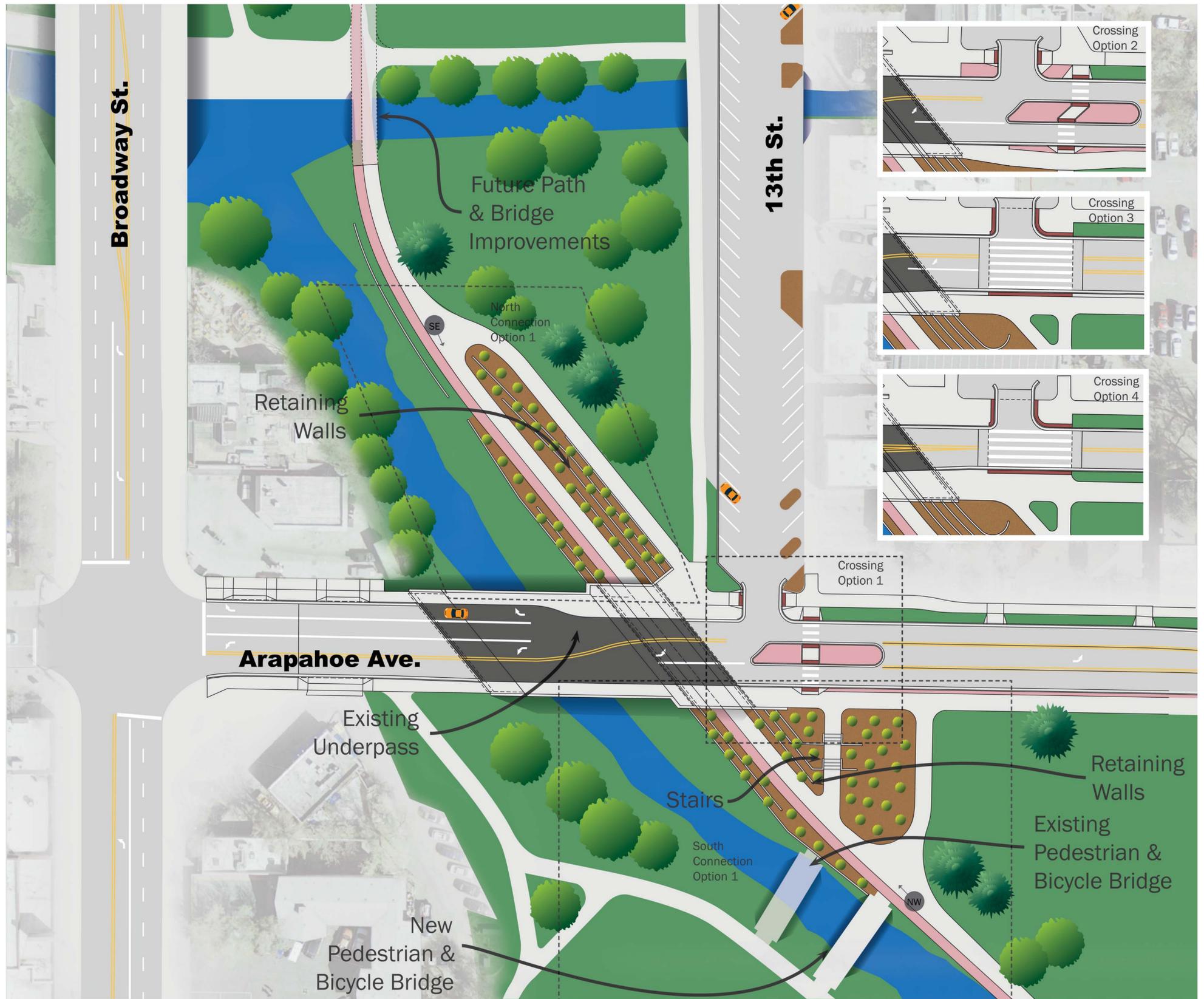
Underpass Option 1

North Connection Option 1 & South Connection Option 1



Underpass Option 2

North Connection Option 1 & South Connection Option 1



Broadway St.

13th St.

Future Path
& Bridge
Improvements

North
Connection
Option 1

Retaining
Walls

Arapahoe Ave.



Broadway St.

13th St.



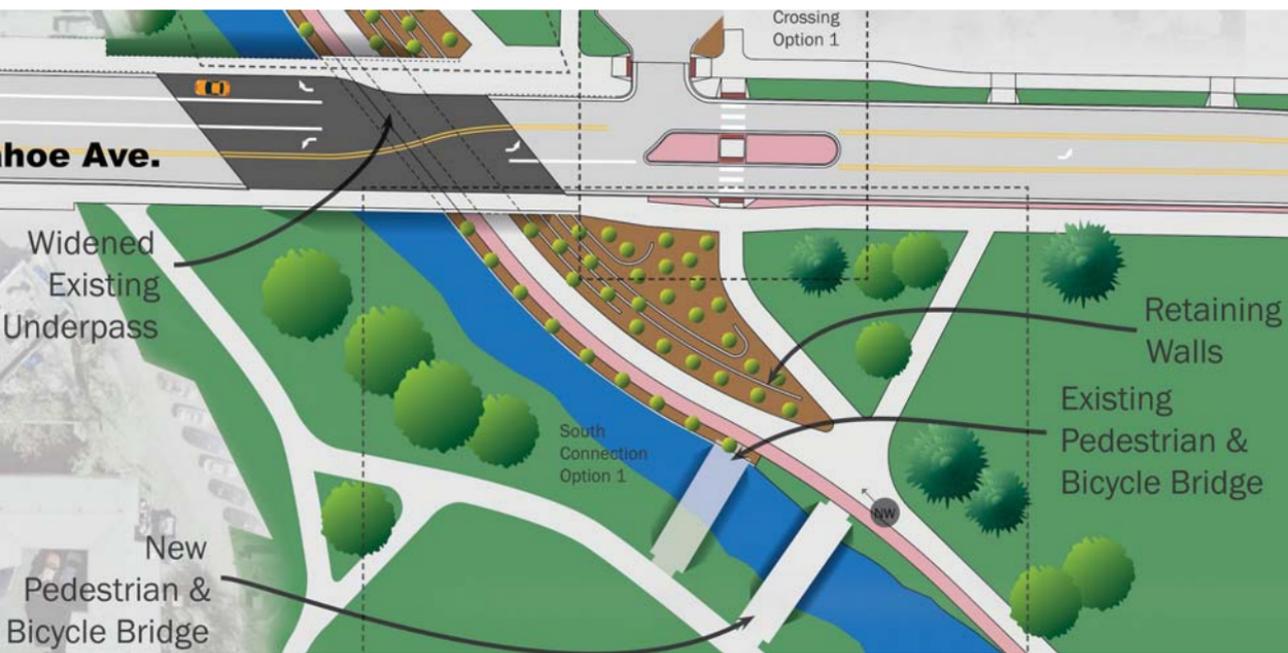
Future Path
& Bridge
Improvements

North
Connection
Option 2

Retaining
Walls

Arapahoe Ave.

Widened



hoe Ave.

Crossing
Option 1

Widened
Existing
Underpass

Retaining
Walls

South
Connection
Option 1

Existing
Pedestrian &
Bicycle Bridge

New
Pedestrian &
Bicycle Bridge

NW



hoe Ave.

Crossing
Option 1

Widened
Existing
Underpass

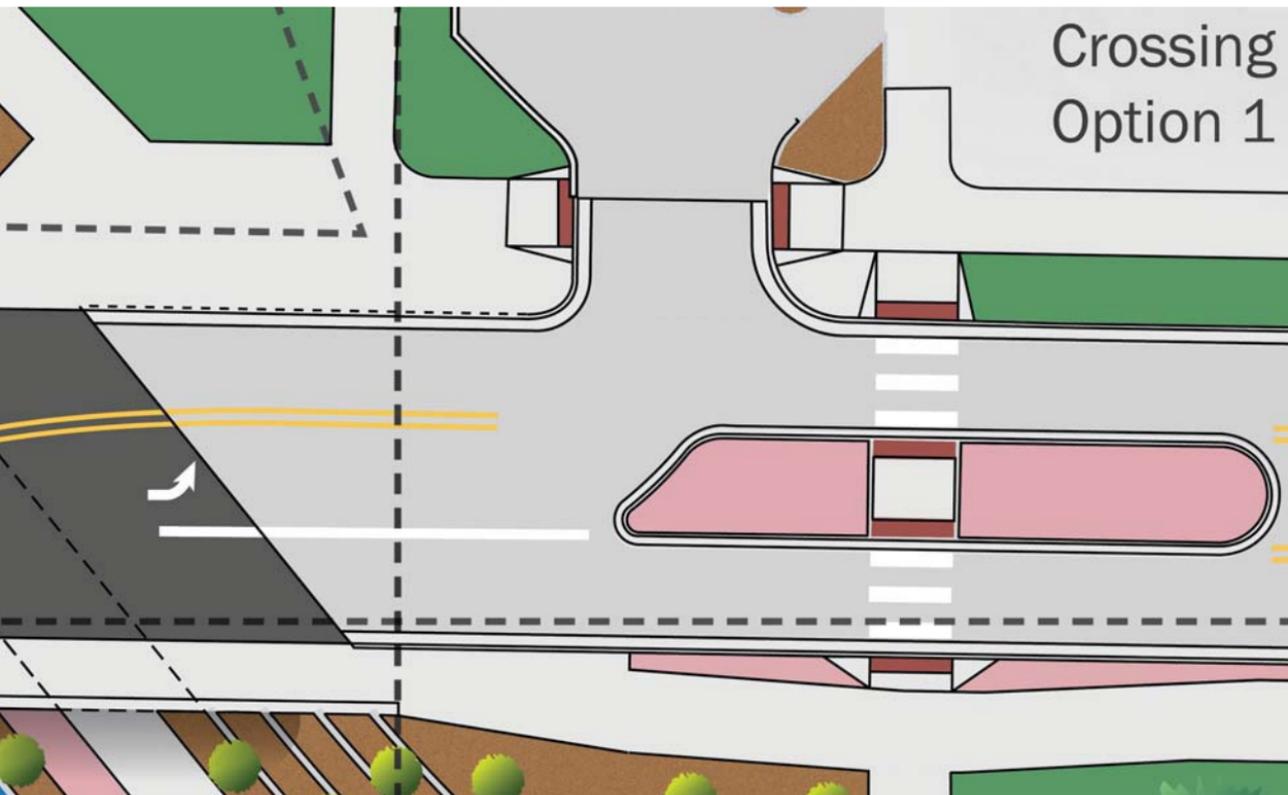
Retaining
Walls

South
Connection
Option 2

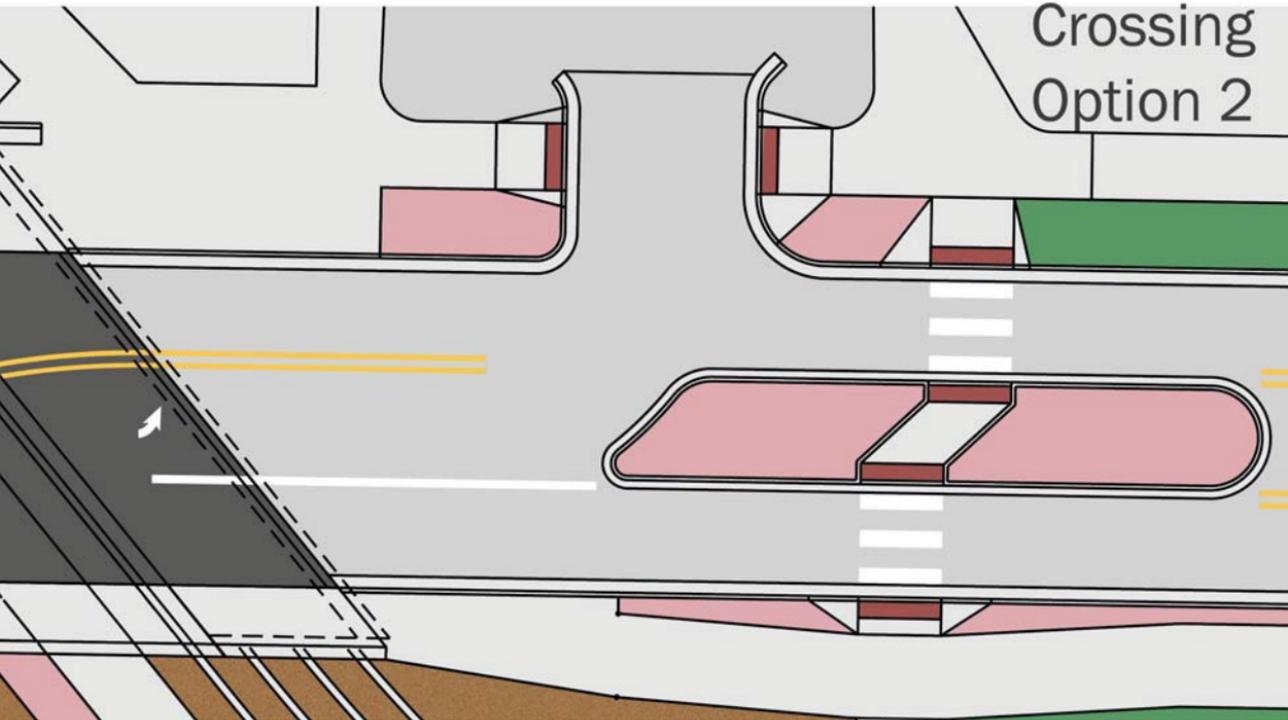
Existing
Pedestrian &
Bicycle Bridge

New
Pedestrian &
Bicycle Bridge

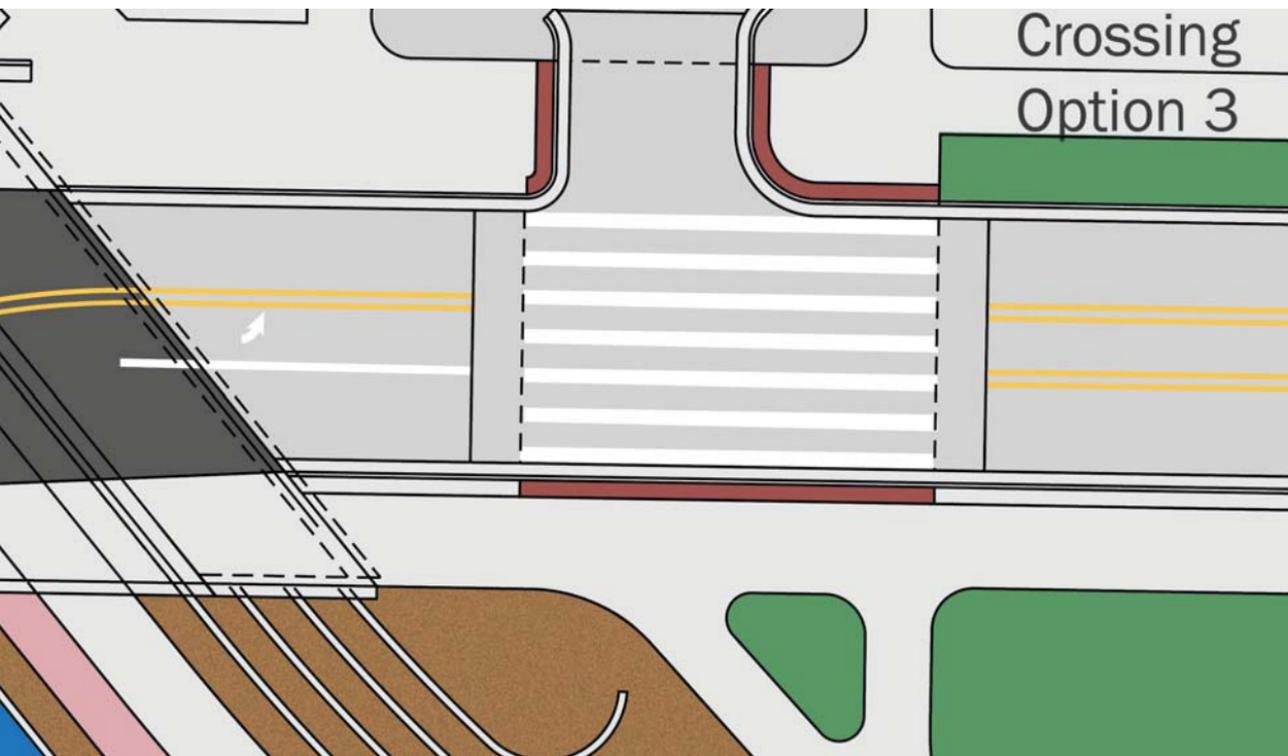
Crossing
Option 1



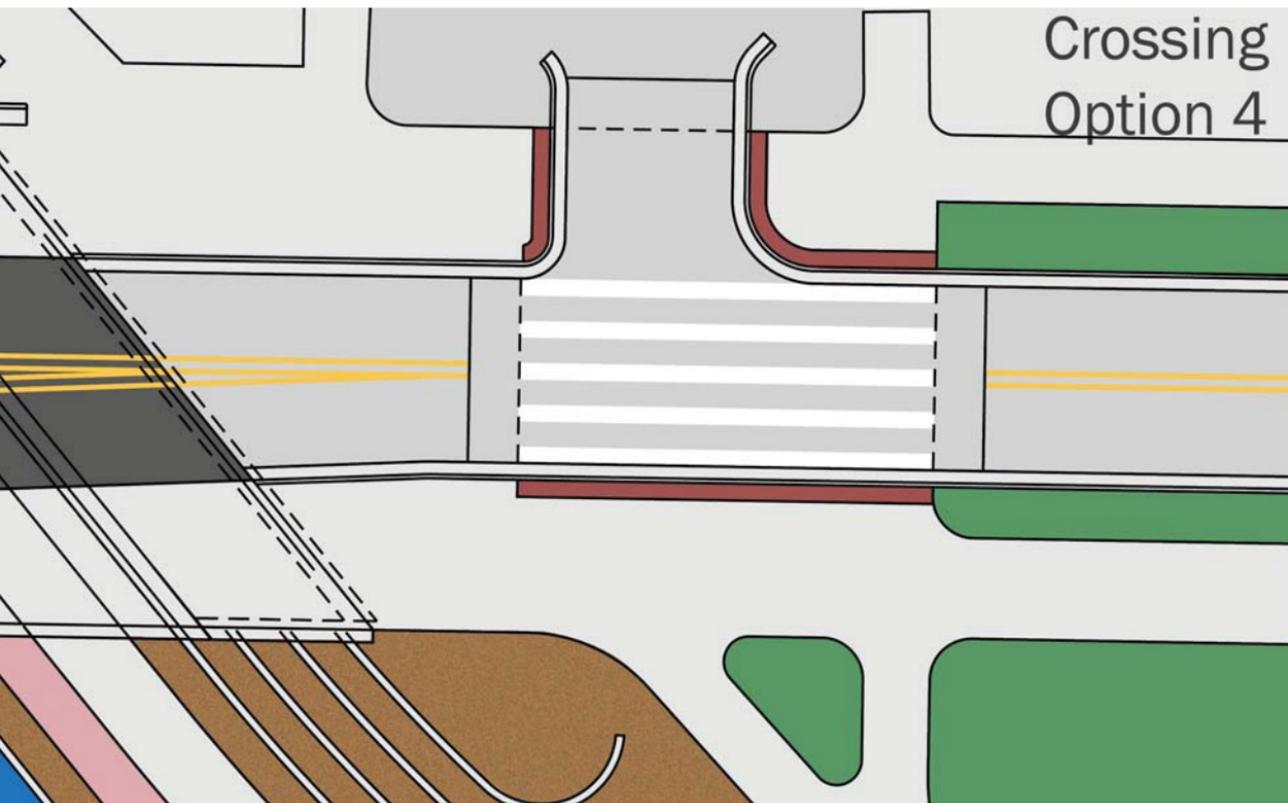
Crossing
Option 2



Crossing
Option 3



Crossing
Option 4



Project Evaluation Criteria

Safety

Reduces curves of path approaches to the underpass

Encourages use of the underpass over the on-street crossing

Encourages a bicycle entry speed of no more than 8mph at the on-street crossing of Arapahoe & 13th

Improves visibility of travelers entering the crosswalk

Accessibility & Mobility

Simplifies path connections

Simplifies crossing movement for pedestrians & bicycles

Impacts on persons with disabilities, senior populations, youth

Supports existing patterns (pedestrian, bicycle, vehicle [including emergency vehicles]):

- Boulder Creek Path to Boulder Creek Path
- Boulder Creek Path to on-street crossing at Arapahoe Avenue
- Boulder Creek Path to Broadway multi-use path
- Broadway multi-use path to on-street crossing at Arapahoe Avenue
- Arapahoe Avenue eastbound travel
- Arapahoe Avenue westbound travel
- Emergency vehicles

Environmental Impacts & User Experience

Minimizes encroachment on Boulder Creek

Isolates users from Boulder Creek

Habitat removal

Restores portions of streambank habitat from removal of existing underpass

Removes mature trees by Boulder Creek

Removes native vegetation

Impacts wildlife

Substantial changes in topography

Clearing, excavation, grading or other construction activities

Change in hardscape

Effects on the aesthetics of a site open to public view

Preserves contiguous green space in Central Park

Minimizes opportunities for unwanted activities in Central Park Builds retaining walls within Central Park

Opportunity to incorporate art into infrastructure improvements

Impacts users during construction

Infrastructure

Impacts to existing water utility and ditch infrastructure

Creates a new structure with a different service life than the vehicular bridge

Supports future replacement or reconditioning of existing vehicular bridge

Modifies existing vehicular bridge

Increased maintenance

Requires relocation of underground utilities

City Plans & Program

Supports Civic Area Vision Plan goals:

- Addressing conflict & connectivity along the Boulder Creek Multi-Use Path
- Reducing barrier-effect of Arapahoe Avenue
- Supports activation of Civic Area Central Park & 13th Street
- Maintains ability to host events and programs within Civic Area Central Park & 13th Street
- Supports Civic Area Vision Plan goal of pedestrian scale 13th Street
- Supports the conceptual plans for expansion of the Boulder County Farmers' Market
- Supports outcomes of the Market Hall Feasibility Study

Supports Boulder Valley Comprehensive Plan (BVCP) goal:

- Creating an accessible multimodal transportation system with safe travel options and connections

Transportation Master Plan (TMP) goals:

- Creating an accessible multimodal transportation system with safe travel options and connections
- Improving facilities for all modes
- Towards Vision Zero safety goal of reducing serious injury or fatal crashes

Decrease single-occupant vehicle use thus reducing and minimizing the use of non-renewable energy resources and greenhouse gas emissions.

Other Considerations

Estimated project cost

Estimated project duration