

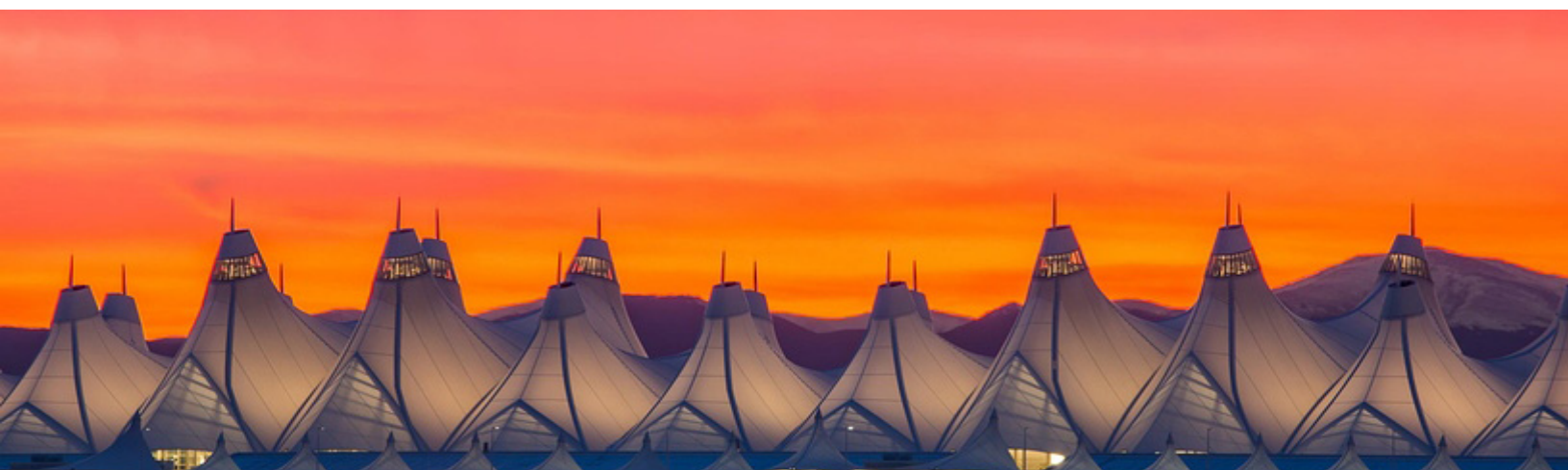
# Exploring Policy Alternatives for Reducing Single- Occupancy Vehicle Use Among Denver International Airport Employees

University of Colorado Denver

College of Architecture and Planning

URPL 6560 Transit, Pedestrian, and Bicycle Planning

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# Acknowledgements

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This project is the culmination of a semester-long engagement with the Denver Airport. This report is, therefore, a product of learning the knowledge and skills required to explore policy questions. The authors make no representation that these ideas are fully examined and ready for execution. However, the authors stand behind this work and feel reasonably sure that the suggested policy moves will benefit Denver Airport employees.

# Table of Contents

<b>Executive Summary</b>	3
<b>Introduction</b>	5
<b>Best Practices</b>	7
<b>Market Identification</b>	29
<b>Asset Creation</b>	55
<b>The New Commute</b>	81
<b>Conclusion</b>	85

# Executive Summary

Roughly 2.9 million people live in the Denver-Aurora-Lakewood Metro Area, with 700,000 individuals in the City and County of Denver (U.S. Census Bureau, 2020). Single-occupancy vehicle (SOV) trips, or driving alone, are a contributor to the region's daily traffic congestion and high levels of air pollution. According to the American Community Survey's five-year estimates for 2016-2020, approximately 66% of Denver's workforce reported that they drive alone for their commute to work (U.S. Census Bureau, 2021). Shifting commuting habits of Denver's workforce can positively impact environmental sustainability, public health, quality of life, and lessen the negative affect on the region's transportation network.

One of the largest employers in Colorado is the Denver International Airport (DEN), which employs roughly 38,000 individuals. Most employees and passengers drive to the airport, while others ride an RTD bus or train to access the airport. With so many people in the region needing to travel to the airport, it is essential that individuals have options to change their mode of transportation to the airport for regional improvements in environmental and public health outcomes.

Between August and December 2023, University of Colorado Denver students in the Master of Urban and Regional Planning (MURP) program's graduate elective course URPL 6560 Transit, Pedestrian, and Bicycle Planning partnered with the DEN Mobility Plan Working Group, Regional Transportation District (RTD), and the Denver Regional Council of Governments (DRCOG) for their term project. The primary goal of this engagement was to help identify opportunities for DEN employees to reduce single-occupancy vehicle travel to the airport. Students worked in three teams –Best Practices, Market Identification, and Asset Creation.

The Best Practices team identified innovative cases in the industry as they related to employee commute mode shifts and non-SOV travel alternatives. Thirty-four strategies were recommended and supported by case studies and published research. A mix of cases from municipalities and state governments, private companies, academic research, and non-profit organizations were used. These best practices were split into two main categories – programmatic strategies and infrastructure and technology improvements. The identified cases highlighted ways to discourage driving and parking of SOVs and targeted a range of alternative modes such as transit, carpool, vanpool, rideshare, walking, and bicycling. Some best practices also included additional employee support and education.

The team then created matrices for these best practices that identified the incentive type, potential impact, approximate cost, and elements of equity and accessibility for each approach ([Programmatic Matrix](#), [Infrastructure and Technology Matrix](#)). The incentive type for each best practice was financial, logistical, behavioral, or a mix of these types. The potential impacts were rated on a scale of 1 to 3, where 1 suggested little impact and 3 indicated a high impact. The approximate costs of each were identified by a scale of \$ to \$\$\$\$; these are notional. Each best practice then received a check for equity and accessibility if certain criteria were met.

The Market Identification team ascertained groups of employees who might be open to switching their travel mode and could benefit from specific types of programs or strategies. This group used multiple data sources to identify areas of the Denver Metro Region that DEN employees were traveling from to get to work. This team's goal was to identify DEN employees that were most likely to not drive to and/or from work. The group analyzed several data sources to ensure the most accurate target markets were identified. First, a literature review of four pieces of research and case studies was conducted. Next, the team created walkshed and bikeshed maps around transit stops that connect to the airport. Census tracts with more than seventy DEN employees, the top hundred origin census tracts for DEN employees, and the top origin zip codes were highlighted using maps. To determine where DEN employees lived, the US Census *LEHD On the Map* tool and a survey of the airport's employees, conducted and provided by DEN, were used. The team then examined the transportation habits of the residents in the top origin

# Executive Summary

census tracts. American Community Survey (ACS) data tables were used to evaluate means of transportation to work and household size by vehicles for census tracts with 70 or more DEN employees.

Data from the DEN employee survey, conducted from October 2022 to January 2023, had questions such as employer, income, commute mode, reasons for mode choice, travel time, parking, and transit incentives. The Market Identification team reviewed the responses to the employee survey in depth and developed three unique cohorts of employees. These included peak Peña Blvd. eastbound commuters and drivers from 7:00am to 3:00pm, peak Peña Blvd. westbound commuters and drivers from 4:00am to 12:00pm, and non-peak Peña commuters. Each cohort had different needs and preferences when commuting, therefore the team identified future initiatives based on each cohort's attributes. Initiatives proposed for peak Peña eastbound commuters and drivers from 7:00am to 3:00pm included transit subsidies, bike infrastructure, promoting carpool, vanpool, and rideshare options, employer involvement, and last-mile infrastructure. Initiatives recommended for peak Peña westbound commuters and drivers from 4:00am to 12:00pm included employer involvement, peak-hour transit discounts, carpool, vanpool, and rideshare programs, infrastructure improvements, Eco-Pass subsidies, tailored education strategies, and flexibility in work hours. Initiatives suggested for non-peak Peña commuters included transit incentives, parking management, flexible work hours, and Eco-Pass promotion.

Based on research from the Best Practices and Market Identification teams, the Asset Creation group then recommended the best solutions for DEN employees. Their recommendations included both programmatic strategies and infrastructure/technology improvements, which were further split into short-term and long-term solutions. Specifically, Asset Creation recommended that DEN and regional partners including RTD, CDOT, and DRCOG should explore implementing non-cash incentives, improving onboarding education for transportation options, flexible parking passes, secure bicycle parking, wayfinding signs, casual carpool programs, circulators and microtransit, take advantage of windows of opportunity with the new ConRAC facility, implement a first mile / last mile gap analysis, create HOV lanes on Peña Boulevard, and supply expanded transit options for bus and train commuters.

To help guide their recommendations, the Asset Creation team crafted three personas that represent each of the three cohorts identified by the Market Identification team. Belinda represents the Peak eastbound commuter and is a flight attendant who lives in the Lowry neighborhood in Denver. Belinda is interested in carpooling but does not know where to start or how this can benefit her. Rob represents the Peak westbound commuter and is a barista who lives in the Green Valley Ranch neighborhood in Denver. Rob is interested in bicycling to the RTD A-Line but is concerned about safely biking to the station and secure bike storage. Theo represents the non-peak commuter and typically works from 6:00pm to 2:00am; he lives along East Colfax Avenue in Aurora. Theo is interested in taking transit to work, but there is a lack of transit options by the time he gets off work. The Asset Creation Team then illustrated how each recommended intervention can make a difference in each of these personas' lives. Belinda was most impacted by solutions such as an HOV lane, casual and facilitated carpooling, taking advantage of windows of opportunity, and flex parking passes. Rob was most impacted by solutions such as secure bicycle parking, a gaps analysis, wayfinding, and non-cash incentives. Theo was most impacted by flexible parking, Eco-Pass subsidies, additional or adjusted transit, and non-cash incentives.

While some of the proposed interventions could be implemented by themselves, many of them would be more effective in combination with other recommendations. The efficacy of each recommended intervention would depend on how much planning, time, and funding are invested into each. While additional research is needed for each proposed intervention, this report is intended to serve as a broad guide for the DEN Mobility Plan Working Group. When phased and marketed thoughtfully, these interventions could make a real difference in the lives of DEN employees as they choose how to get to work.



# Introduction

Shifting the paradigm of commuting habits amongst Denver's workforce is a pressing concern that not only shapes the city's transportation networks but also has the potential to transform environmental sustainability, public health, and the overall quality of life for the roughly 700,000 individuals that call Denver home. Single-occupancy vehicle (SOV) trips, or driving alone, are a significant contributor to the region's daily traffic congestion and high levels of air pollution. According to the American Community Survey's five-year estimates for 2016-2020, approximately 66% of Denver's workforce reported that they drive alone for their commute to work (U.S. Census Bureau, 2021).

The Denver International Airport (DEN) is located on the far eastern edge of the City and County of Denver and employs roughly 38,000 individuals, making it one of the largest employers in Colorado. Employees at DEN represent a range of sectors and could work within the City and County of Denver Department of Aviation, airline services, security, administration, restaurant, retail, or concessions. There are various ways that employees and airline passengers can access the airport. Many people drive down Peña Boulevard, ride an RTD bus, or take the RTD's A-Line train which includes eight stops starting at Denver's Union Station and ending directly at the south gates of DEN. In a recent survey sent out to DEN employees, 69% of respondents indicated that they commute by driving alone, compared to only 12% who ride the train and 5% who commute by transit. This survey data represented all types of DEN employees including concessionaires, TSA agents, and airline workers.

During the fall of 2023, University of Colorado Denver students in the Master of Urban and Regional Planning (MURP) program graduate elective course URPL 6560 Transit, Pedestrian, and Bicycle Planning partnered with the DEN Mobility Plan Working Group, Regional Transportation District (RTD), and the Denver Regional Council of Governments (DRCOG) for their term project. The goal of this project was to identify opportunities for DEN employees to reduce SOV travel to work. Students worked in three teams to identify best practices in the industry as they relate to employee commute transportation mode shifts; the target market of employees that would benefit from specific types of programs or strategies; and the programmatic strategies, focusing on infrastructure and technology improvements needed for incentivizing travel mode shifts amongst DEN employees.

The team of students that outlined best practices in the industry found 34 potential strategies to reduce SOV travel at DEN. Based on research and case studies, key elements for each strategy include incentive type, potential impact, cost, and equity/accessibility considerations.

To accurately highlight best practices, students collected a roughly equal number of case studies from municipalities and state governments, private companies, academic research, and non-profit organizations. Case studies that reduced SOV trips were selected for this report. The incentive type for each strategy was described as financial, logistical, or behavioral (see appendix/table xx). Some strategies fell into more than one category. Potential impacts of each strategy were rated on a scale of 1-3, where 1 was little impact and 3 was high impact. These



Image Source: Denver Post

# Introduction

ratings were based on the success of the strategies for the organizations who employed them and their applicability to DEN. The costs of each strategy were identified on a scale of \$ - \$\$\$, based on the cost to employers who implemented the strategy and the estimated cost to DEN. These costs were also notional and did not rely on actual cost numbers since finding such costs was beyond the scope of this project. Accessibility and equity of strategies were also considered. Accessibility encompasses not only physical infrastructure that aligns with ADA standards, but also digital platforms and information dissemination that allow everyone to easily plan and use alternative modes of transportation. Equity encompasses the ability for all members of the community, regardless of income, background, or location, to have access to reliable and affordable modes of travel. Strategies received a check for equity and accessibility if any elements of these criteria were included. While not mutually exclusive, these best practices offer DEN and its partners a comprehensive toolbox to tailor initiatives for their unique needs.

With these best practices in mind, the Market Identification team analyzed several sources to identify the employees most likely to benefit from more options to get to work and most likely to shift their primary travel mode from SOV. They first conducted a literature review that included similar market identification analyses and typical user demographics of people that use shared mobility options. Next, they created walkshed and bikeshed maps around transit stations that served routes to DEN. They also used LEHD's On the Map tool to identify the top 21 census tracts that employees travel from to the airport. U.S. Census data was then examined for these top census tracts to identify population characteristics centering around equity considerations. In the last portion of the market identification, they analyzed the Denver Airport employee survey conducted in late 2022 and early 2023.

The Market Identification team found that the overall peak travel times on Peña Boulevard for eastbound travelers was from 7AM – 3PM, and the peak for westbound travelers was from 4AM – 12PM. With these peaks in mind, the team identified three main cohorts of employees based on the Denver Airport employee survey and 2022 Annual Peña Utilization Summary:

- Peak Eastbound Commuter: Arriving at DEN between 7am-3pm
- Peak Westbound Commuter: Departing DEN between 4am-12pm
- Non-Peak Commuters: All other survey respondents

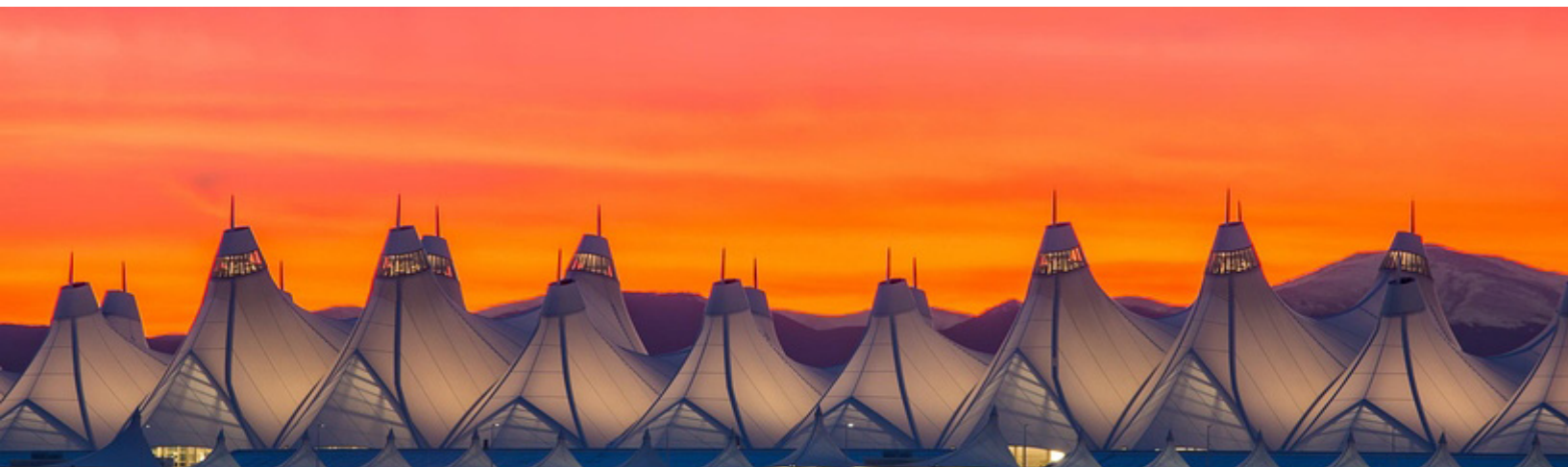
Three personas were then created to represent a typical commuter in each cohort with their commuting patterns and priorities described. Based on the Asset Creation team's recommended commuting improvements for DEN, a new commute for each persona was proposed. The interventions recommended in this report will likely require concurrent implementation to address commuter concerns and to shift travel modes away from SOVs. When phased and marketed thoughtfully, these interventions could make a real difference in the lives of DEN employees through their commute decisions.

# Best Practices

DEN is far from the only airport and major employment hub grappling with how to best connect their employees from their work to their homes without increasing traffic congestion and negative environmental impacts. This section identifies best practices implemented by leading airports and employment centers to successfully reduce SOV dependence with more mode choices for their employees.

Drawing inspiration from case studies showcasing innovative transit partnerships, robust carpool incentives, and engaging commuter programs, we aim to guide the development of a comprehensive strategy for DEN. These initiatives illuminate potential pathways toward a more sustainable and accessible commuting landscape for airport employees, one that prioritizes both individual needs and collective well-being.

Each strategy and at least one case study supporting it is detailed in the following section, with matrices serving as a tool for the reader to quickly assess applicability for DEN. These matrices also include rough estimates of cost, relative impact, accessibility, and equity implications. Broadly, the best practices are either programmatic strategies or infrastructure and technology improvements. Whether programmatic or infrastructure-related, all strategies are further organized as they relate to transit, carpool, van-pool, and rideshare, active travel, parking, and a mix of travel modes, with employee education also considered as a programmatic category.

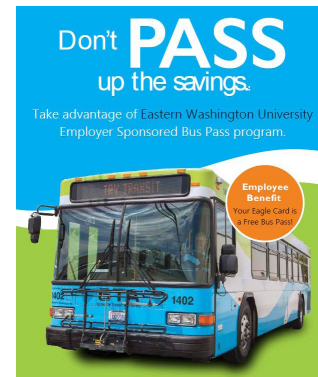


# Programmatic Best Practices

## Transit

### Employer-Provided Transit Pass

Providing free or reduced transit passes to employees is a proactive approach to curbing employee SOV travel. In this initiative, employers offer their employees subsidized or fully-covered transit passes as part of their benefits package, incentivizing the use of public transportation. This not only reduces the carbon footprint associated with daily commutes but also promotes a culture of sustainability, cost-efficiency, and reduced traffic congestion, benefiting both employees and the environment.



### Case Study: [City of Boston's Employee Incentive Program](#) (Dolven, 2023)

The City of Boston pays 65% of each employee's monthly transit pass and offers free Bluebikes memberships to employees, a total monthly value of \$245. This is a change from the previous benefits offered, which included the option to purchase full-price transit passes using pre-tax dollars and Bluebikes membership for \$60. The City of Boston employs 18,000 people. In the first six months of the program, monthly transit pass enrollment jumped from 730 to 1,300 and Bluebikes membership grew from less than 100 to 550.

### Decreased Transit Fares

Reducing transit fares and increasing transit frequencies are powerful methods to reduce SOV travel. Both require working in partnership with RTD to lower the cost of public transportation fares to make them more affordable and attractive to commuters, and to increase the frequency of transit to make transit more convenient and reliable. By offering discounted or subsidized fares and increased transit frequencies, DEN can encourage individuals to choose transit more often than SOV travel. While these strategies achieve the greatest results when combined, DEN can also consider pursuing them individually.

### Case Study: [Modeling Airport Employees Commuting Mode Choice](#) (Tsamboulas et al., 2012)

Tsamboulas et al. (2012) modeled Athens International Airport employees' commuting mode choice and found that transit prices and times are particularly important to employees who choose to commute by transit. Competitive transit fares and travel times can attract a significant share of employees to use transit rather than SOVs.

### Transit Cash Incentive

Employers can give their employees cash rewards for opting to use public transportation. Employees are required to document their use of public transportation, which can be done through mobile apps or ticket stubs. Cash incentives can be disbursed in direct deposits or gift cards. Some programs offer real-time incentives for each trip, while others provide periodic payouts. DEN can employ a transit cash incentive to make public transportation a more attractive and financially rewarding option.

# Programmatic Best Practices

## Transit

Case Study: [Google's Boulder Campus](#) (Boulder Daily Camera, 2018)

Employees at Google's Boulder Campus receive \$5/day when they do not park their car on campus. Google developed the program at the request of the City of Boulder to reduce traffic and environmental impacts of the 1,000-person campus. In the first seven months of the program, they eliminated 200,000 employee passenger vehicle miles.

## Carpool, Vanpool, and Rideshare



Image Source: Missouri Department of Natural Resources

### Casual Carpooling/Slugging

Slugging is often referred to as casual carpooling. Slugging occurs at predetermined spots, where a driver seeking passengers will allow 1-3 passengers to carpool with them. Typically, slugging systems work best when there are strong incentives to carpool, such as taking an HOV lane that saves significant time and/or money on the commute. Slugging is not prearranged and is based on a shared need and trust between several people.

Case Study: [DC Metro Slugging](#) (About Slugging, 2020 and Scherr, 2023)

In the Washington DC metro area, there is a robust slugging system that has assisted commuters for roughly 40 years. To meet the 3-person requirement for taking the HOV lane into the city, a car needing additional passengers will pull up to one of the slug lines, display a sign with the destination or call out the destination, and the first people in line with a matching destination will enter the car. This car can now take the HOV lane and bypass SOV traffic into the city. According to the Metropolitan Washington Council of Governments' 2019 State of the Commute report, 20% of all carpools were slugs.

A study published about slugging in Houston found that people are more likely to "slug" if they:

- Are 25-34 years old.
- Have a professional/managerial or administrative/clerical occupation.
- Have a household income above \$35,000/year.

### Vanpool Seat Insurance

Vanpools often employ drivers or companies as operators. Vanpool empty seat insurance is a strategy to maintain service amidst employees' changing schedules. When a vanpool has been organized between participating employees, an employer can offer empty seat insurance to cover the cost of a vanpool seat if a member drops out. This may sustain the longevity of the vanpool and prevent the vanpool from being disbanded due to increased costs or insufficient commuters.



# Programmatic Best Practices

## Carpool, Vanpool, and Rideshare

Case Study: [Vancouver's Employee Trip Reduction Program](#) (Kassirer, 2000)

The Greater Vancouver Regional District's (GVRD's) Employee Trip Reduction Program was an integrated, multi-modal approach aiming to reduce vehicle trips in the Vancouver region. Vancouver commuters had access to a vanpool service operated by the Jack Bell Foundation. When vanpools members dropped out, some vanpools were forced to disband and/or increase the cost per person. The GVRD decided to offer empty seat insurance to cover the cost of an empty seat for a period of up to two months. This helped sustain vanpools until a replacement could be found and prevented cost increases for participants.

## Active Travel

### E-Bike Rebates

Studies about e-bike buying behavior show that large rebates proportional to the retail cost of a bike are most effective at incentivizing the purchase. Programs that provide prepaid debit cards or vouchers are the easiest for retailers to process. Other programs such as Denver's E-Bike and E-Cargo Bike Rebate Vouchers have shown that point-of-sale rebates, redeemable at register, are best. Qualified retailers must be brick and mortar so that the rebate money stays in the local economy.



Image Source: Sheri Van Dijk MSW

Case Study: [What Makes a Good Electric Bike Incentive Program?](#) (Herbert, 2022)

This article is a resource by researchers with a table tracking every e-bike incentive program in North America to provide a point reference for new policies and future research. E-bike incentive programs with the highest rates of participation tend to have a larger rebate amount because they induce new purchases and can support people that would otherwise be priced out of the e-bike market. A simple application process is also necessary as well as partnering with local bike shops and local organizations.

# Programmatic Best Practices

## Parking

### Increased Parking Fees

Parking costs can directly correlate with commuter behavior. By having cheap and/or free parking, there is little disincentive, other than lot capacity, to discourage SOV trips. By increasing parking costs in parking lots and/or reducing current subsidies for parking, organizations can influence commuter behavior through financial disincentives. This strategy is best paired with other programs that help to provide alternative transportation options.

#### Case Study: [Cornell University](#) (United States Environmental Protection Agency, 2005)

In 1990, Cornell University considered building up to 2,500 additional parking spaces to keep up with increasing demand. Instead, Cornell decided to brainstorm alternative, cost-efficient techniques. One of the strategies used was a simple fee-hike for existing parking facilities. This created a disincentive for faculty and staff to drive alone and resulted in 600 fewer cars being driven to campus each day.

### Off-Peak Parking Incentives

Introducing off-peak parking incentives is a strategy that offers rewards to commuters for driving during off-peak times. Peak times are typically defined as 8am - 9am and 5pm - 6pm, although this may vary per organization and by location. It may also ask employees to utilize alternative modes during peak holiday travel time. By doing so, traffic and parking congestion at the facility can be relieved which may increase convenience and time-savings.

#### Case Study: [Stanford University Study](#) (Charette, 2012)

Researchers at Stanford University conducted an experiment using cash incentive strategies to influence commute time and peak-period traffic congestion on their campus. The study incentivizes users by giving them a small, daily pay-out or an entry into a lottery system for cash prizes for entering and leaving campus on off-peak hours (an hour before or after 8am-9am and 5pm-6pm on weekdays). While the study is still ongoing, initial results are promising. They found that even a small number of commuter changes can impact peak-time congestion.

### Flex Parking Permits

Flex parking permits are parking passes issued in conjunction with a transit pass program. One of the barriers for employee buy-in in a transit program is that, on occasion, commuting by car may be necessary. Flex parking permits are day passes for parking that are typically sold at a discounted rate to transit pass holders. By doing so, it allows employees to selectively use their parking passes when the need arises. This type of strategy acknowledges that commuters who otherwise use transit may need to drive in special cases, and it does not penalize them for doing so.



# Programmatic Best Practices

## Parking

**Case Study:** [U-PASS University of Washington](#) (Yerichuk, 2001)

The University of Washington implemented a comprehensive program called U-PASS that encouraged commuters to reduce the number of SOV trips made to work. The program used a handful of strategies which centered around a free, unlimited transit pass. Staff and faculty who were U-PASS holders could purchase up to 26 commuter tickets every quarter at approximately half the usual parking rate. This increased employee buy-in into the program by reducing the friction that may come with changing commuter modes.

## Mix of Travel Modes

### Emergency Ride Home Program

Emergency Ride Home programs, also called Guaranteed Ride Home programs, provide a safety net for commuters who may be hesitant to use transit or carpool due to concerns about unexpected emergencies or unscheduled overtime. Employers can provide free or reduced-pricing on these emergency rides to their employees. To be eligible for these programs, employees typically must demonstrate that they commute by transit, carpooling, vanpooling, ridesharing, or active transportation.



Image Source: Denver Regional Council of Governments

**Case Study:** [DRCOG's Guaranteed Ride Home Service](#) (Denver Regional Council of Governments, 2023)

In DRCOG's Way to Go program, the Guaranteed Ride Home service provides a free ride home to employees during an emergency at a reasonable cost to the employer. To qualify for this program, employees must generally commute to work by carpool, vanpool, public transit, bike, or foot. Emergency rides can either be provided by Uber or taxis. While DRCOG already provides this service to TSA agents, expanding this program to all DEN employees could serve as a viable way to decrease single-occupancy vehicle dependency.

# Programmatic Best Practices

## Mix of Travel Modes

### Flexible Start Time

Flexible Start Time is a strategy that allows employees to have flexibility for the start of their shift or workday when using non-SOV commute modes. This strategy is dependent on job type and subject to many constraints that may prevent flex-time. However, for positions that qualify, this strategy can help accommodate logistical nuances that may arise when employees switch to non-SOV commute methods such as carpooling or transit.

#### Case Study: [Vancouver's Employee Trip Reduction Program](#) (Kassirer, 2000)

The Greater Vancouver Regional District's (GVRD's) Employee Trip Reduction Program was an integrated, multi-modal approach aiming to reduce vehicle trips in the Vancouver region. One of the strategies the program used was flex time. Eligible employees could change the start and end of their workday by up to 30 minutes to accommodate carpooling, transit, or multimodal transportation. Flex time could not interfere with the department's operational requirements.



Image Source: Electronic Merchant Services

### Competitions, Prize Drawings, and Cash Incentives

Incentives such as competitions, prize drawings, and cash reimbursements can be effective methods for inducing behavior change. Competitions are usually time-limited and tend to use gamified techniques and prizes to encourage SOV drivers to try an alternative transportation mode. These can be company-wide or department-wide and target a specific mode-share, if desired. They pair well with educational workshops that help overcome real or perceived barriers to switching commute mode. Cash incentives and reimbursements may also be utilized to encourage behavior change.

#### Case Study: [CommuteSM, Santa Monica](#) (Dembo & Kassirer, 2015)

CommuteSM ran a city-wide challenge in Santa Monica to encourage alternative transportation modes such as transit, carpooling, and micromobility. They partnered with advocacy organizations and companies to provide educational workshops, outreach events, and marketing strategies to encourage non-SOV transportation. Teams within companies were formed to create a social component, and participants were entered into weekly prize drawings for every logged non-SOV trip. In 2015, CommuteSM reported engagement with 22 companies and had 1,770 non-SOV trips logged, equating to 10,718 miles of non-SOV trips.

# Programmatic Best Practices

## Mix of Travel Modes

### Leave Time Travel Incentive

A Leave Time Travel Incentive allows employees to earn additional paid time off in the form of accrued PTO hours by taking alternative modes of transportation for their commutes. Additional PTO hours are sometimes viewed as a stronger incentive than other rewards, such as cash.

#### Case Study: [City of Austin's Leave Time Travel Incentive](#) (Kassirer, 2021)

The City of Austin has introduced a Smart Commute Rewards program to reward its 13,000 employees for taking voluntary actions to reduce their SOV work trips. In 2017, the city piloted what they considered their most innovative and engaging incentive, the Leave Time Reward (LTR), which allowed employees to qualify for additional paid time off. Employees would log their alternative trip modes in the RideAmigos app or web platform. For 50 trips, employees earned 4 PTO hours, 150 trips earned 6 PTO hours, and 220 trips earned 8 PTO hours. The City of Austin reduced employee commute travel by one million vehicle miles within six months of making LTR a permanent incentive, and the percentage of drive-alone trips fell from 53% to 41% during this period.

### Commuter Benefit Program

Commuter Benefit Programs are typically state, regional, or municipality-sponsored programs that require employers of a certain size within their geographic boundaries to offer benefits to their employees that reduce SOV commutes. These programs most often provide a combination of many of the strategies highlighted above, such as transit passes and carpool or vanpool services. They serve as a pivotal bridge between public policy and private/public sector engagement, fostering a culture of sustainable transportation and reducing SOV travel for the largest employers in a region.

#### Case Study: [Bay Area Commuter Benefit Program](#) (Metropolitan Transportation Commission, 2021)

Bay Area businesses with 50 or more full-time employees are required to offer one of the following five benefits:

- A pre-tax benefit that allows employees to exclude their transit expenses from taxable income.
- Employer subsidies that provide money to reduce or cover employees' transit costs.
- Employer-provided transit that provides a free or low-cost transit service for employees.
- Telework options that allow employees to work from home at least one day per week.
- An alternative benefit that is as effective at reducing SOV commutes as the other options.

### International Competitions

Worldwide privately funded competitions can reward cities or groups who have demonstrated effective and groundbreaking projects towards building an expansive and inclusive cycling network. This incentivizes continuing progress and support from the organization.

# Programmatic Best Practices

## Mix of Travel Modes

**Case Study:** [Bloomberg Initiative for Cycling Infrastructure](#) (Bloomberg Philanthropies, 2023)

Bloomberg Philanthropies announced the first ever 10 winners of the Bloomberg initiative for cycling infrastructure (BICI). BICI is designed to help city leaders meet the urgent need to build connected and expansive cycling infrastructure that serves as many residents as possible.

### Employee Traffic Reduction Program

Employee Traffic Reduction Programs are typically state-sponsored programs that provide resources to employers to implement programs that reduce employee SOV trips. There are at least 27 successful mandatory programs throughout the United States, as well as numerous voluntary programs. Programs implement a range of measures, such as telecommuting, flexible/compressed work schedules, public transit benefits/subsidies, ridesharing, employee shuttles, parking management, and bike commuting services.

**Case Study:** [Seattle Department of Transportation](#) (Spicer, 2023)

The State of Washington passed the Commute Trip Reduction (CTR) law in 1991 that focused on shifting commuting behaviors from SOV trips to other modes. As of 2023, there are over 1,000 employers across the state who participate in the CTR program. Through a business-oriented approach, the program works by providing education, special events, mass communications, and data to participating employers and employees. When comparing reports from 2007-2008 to 2019-2020, SOV rates among participating employees in Seattle fell from 37.0% to 28.4%. While Colorado has tried to pass similar laws in the past, ongoing efforts at the local, regional, and state level among legislatures, advocates, and employers are needed to assist with policy change.

## Employee Education

### Employee Transportation Coordinators

The role of an Employee Transportation Coordinator is to assist employees with identifying various sustainable options to commute to work instead of driving alone. These individuals can either be hired by an employer or the responsibilities can be appointed to an existing employee who is well informed on the commute programs, transit routes, and incentives already available to employees. In general, people are more likely to alter their commuting behaviors when they begin a new job or move. Because of this, it is recommended



Image Source: SHRM

# Programmatic Best Practices

## Employee Education

that Employee Transportation Coordinators work with new employees upon hire, as well as throughout every employee's tenure, in order to facilitate the highest organization-wide impact on commuting behavior.

### Case Study: [Boulder Transportation Connections](#) (2023)

Boulder Transportation Connections (BTC) is a non-profit organization that partners with businesses to promote sustainable transportation options to employees. They provide consultation services to businesses to identify a company's unique employee transportation needs, provide tools to tackle those needs, and follow up after plan implementation. BTC recommends that Employee Transportation Coordinators collect as much information from each new hire as possible relating to their current commute patterns and whether they are interested in learning about the transportation options available to them. All Employee Transportation Coordinators in the area are invited to quarterly workshops to network and to continuously share best practices from the field.

### Public Awareness Campaigns

Campaigns promoting cycling can be beneficial if done thoughtfully. These campaigns are heavily dependent on timing, level of trust in government, and the extent to which they are partnered with other measures. User-centered design is crucial, stressing the benefits of well-being and improved health. Who delivers this message is important as well. The message should be non-judgmental and memorable. Commuter interventions have the greatest impact in windows of opportunity such as during job transitions, construction of new infrastructure, and other changes in commuting patterns. Demand for transport options depends on a range of factors: perception of risk, cost, confidence, and availability of alternative transport modes.

### Case Study: [Awareness Campaigns That Help Improve Road Use Behavior](#) (Cherry, 2023)

Public awareness campaigns can be created during times of crises, such as during a major health event or natural disaster. Such campaigns are useful in informing the public to make choices based on sound analysis of the risks.

### Case Study: [Changes in Transport Behavior During the COVID-19 Crisis](#) (Sung & Monschauer, 2020)

While dangerous and disruptive, crises can also present windows of opportunity to change mobility patterns. Supporting policies are needed to promote sustainable behaviors and avoid negative consequences. These crises include: Covid-19, SARS in 2003, and the London bombing terrorist attack in 2005 where multiple bombs exploded in 3 underground trains, 1 bus, killing 56 and injuring 700.

# Programmatic Best Practices

## Employee Education

### Driver Education

The creation and/or marketing of a more comprehensive driving course to encourage motorists and other users of the airport to prioritize the safety of employees or cyclists' general safety can be effective. Course modules could include sharing the road, infrastructure understanding, illegal road behaviors, intersections usage, and passing rules. Incentives to passengers and employees could be offered while in the airport or as new hire training when commuting habits are most malleable.



Image Source: Sparklight

### Case Study: [Nonprofit Driving Education Course](#) (Bicycle Colorado, 2023)

A Denver-based non-profit organization, Bicycle Colorado, created a free 2-hour driving course called Shift Driving that certifies drivers on best practices and laws regarding driving around pedestrians and infrastructure and seeks to fill in the knowledge gaps in existing driving education.

# Infrastructure and Technology Best Practices

## Transit

### Increased Transit Frequencies

Reducing transit fares and increasing transit frequencies are powerful methods to reduce SOV travel. Both require working in partnership with RTD to lower the cost of public transportation fares to make them more affordable and attractive to commuters, and to increase the frequency of transit to make transit more convenient and reliable. By offering discounted or subsidized fares and increased transit frequencies, DEN can encourage individuals to choose transit more often than SOV travel. While these strategies achieve the greatest results when combined, DEN can also consider pursuing them individually.

**Case Study:** [Modeling Airport Employees Commuting Mode Choice](#) (Tsamboulas et al, 2012)  
Tsamboulas et al. (2012) modeled Athens International Airport employees' commuting mode choice and found that transit prices and times are particularly important to employees who choose to commute by transit. Competitive transit fares and travel times can attract a significant share of employees to use transit rather than SOVs.

## Carpool, Vanpool, and Rideshare

### Carpool and Vanpool Ride-Matching Apps and Software

Carpool and vanpool ride-matching are strategies that identify commuters with similar travel patterns and geographic locations as well as facilitate carpool arrangements or van/shuttle services. Implementing ride-matching depends on apps or software developed for this specific purpose, like RideAmigos, reducing the burden on the employer to start a ride-matching service. Ride-matching services evaluate several commuter characteristics, including shift times, home locations, and preferences for being a driver or passenger. Vanpool or shuttle services may hire drivers for the specific purpose of picking up employees.

**Case Study:** [Smart Commute GTA](#) (Rowell, 2016).

The Smart Commute program was a multi-pronged commuter options program implemented by the Black Creek Regional Transportation Management Association and backed by multiple governmental entities. More than 170 organizations and 430,000 employees participated. The program employed a system called Carpool Zone that automatically matched commuters who lived and worked near each other, or along the way, and suggested carpooling options to facilitate a reduction in SOV travel. More than 7,000 people used Carpool Zone to arrange carpooling. Between November 2005 and March 2010, the program eliminated an estimated 26 million vehicle kilometers (VKT) and 380,000 trips.



# Infrastructure and Technology Best Practices

## Carpool, Vanpool, and Rideshare

### Increased Rideshare Allowances

Expanding rideshare options can include increasing the cap for the number of rideshare vehicles permitted or expanding the geofencing to allow rideshare vehicles to access more drop-off and pick-up points where employees need to go. It can also be behavioral - offering incentives, like free or reduced rides, to encourage employees to use rideshares to commute to work.

#### Case Study: [Airport Analyses Informing New Mobility Shifts: NREL](#) (Henao et al., 2018)

NREL conducted research on four Smart City finalists - Portland, San Francisco, Denver, and Kansas City - to understand their adoption of rideshare services. They found that when rideshare services accounted for at least 18% of ground transportation to and from airports, parking revenues peaked 12-14 months after rideshare was introduced and then declined, indicating a mode shift from driving to rideshare.

### Carpool Only Lanes

Peña Boulevard serves as the main route to the airport for many people who choose to drive. While it would be a major transportation infrastructure investment, dedicating lanes of traffic to carpooling vehicles on Peña Boulevard can likely lead to more successful carpool programs at DEN. These lanes provide a faster and more efficient route during congested periods, making carpooling a practical and time-saving option for these commuters. Additionally, the visible presence of carpool lanes serves as a constant reminder of the benefits of shared transportation, further encouraging more people to consider carpooling as a viable alternative to driving alone.



Image Source: Ani Chaudhuri

#### Research: [The Impact of High-Occupancy Vehicle Lanes on Carpooling](#) (Cohen et al., 2022)

This study examines the impact of high-occupancy vehicle (HOV) lanes on carpooling behaviors, providing valuable insights for cities considering their implementation. Researchers found that HOV lanes attract new users to carpooling platforms and these lanes positively influence carpooling intent on and off HOV lane routes. Two-thirds of HOV lanes studied showed substantial increases in carpooling.

#### Case Study: [CDOT's Express Lanes](#) (CDOT, 2022)

The Colorado Department of Transportation (CDOT) has implemented express lanes on a variety of highways across the state. Drivers can utilize the express lanes for free when carpooling. Drivers must have a Switchable HOV Transponder device and at least three individuals in the car to qualify. Previously, the transponders cost \$18 for all drivers, but CDOT updated the price to \$0 to make carpooling easier for those who are dedicated to that mode of travel.

# Infrastructure and Technology Best Practices

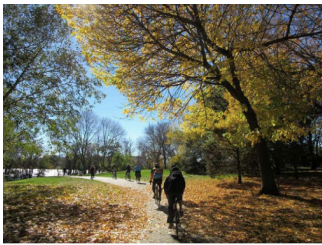
## Active Travel

### Cycle Highway / Fast Bicycle Routes

The European Cyclists' Federation judges the quality of bicycle infrastructure using five criteria. These are Safety, Coherence, Directness, Comfort, and Attractiveness. A Cycle Highway is designed to maximize all five of these criteria and connect relatively distant destinations, such as residential areas to remote employment centers Denver International Airport. To accomplish this, they are as long and straight as possible, separated from motor traffic and pedestrians, avoid steep climbs and sharp curves, avoid frequent stops and where they do cross streets with traffic, are given priority, are well-maintained, receive winter service, are well lit for commutes that happen after sundown, and have service stations along the route for cyclists that break down. It is possible to upgrade an off-street trail into a cycle highway. This level of infrastructure is intended mostly for bicycle-only journeys, from origin to destination.

#### Case Study: [F15 Cycle Highway - Netherlands](#) (Reyneri, 2019)

The planned F15 Cycle Highway shows how a high-quality bicycle facility can be built bundled with other projects to significantly decrease cost. This new route will save bicycle commuters reduced from 1 hour and 12 minutes to less than one hour and remove conflicts with motorists that used to exist along the route.



### IMPACTS OF SHARED USE PATHS

A study of the economic, health, transportation, environmental, safety, and accessibility impacts of four shared use paths in Massachusetts.

### Multi-Use Path

This type of facility is similar in length to a bicycle highway, but without the single-minded focus on moving bicycles only as fast as possible. Here we acknowledge that most bicycle journeys to DEN will most likely not be bicycle-only, but also involve mode-share. Most likely these journeys will start with a bicycle and transition to transit. So, the multi-modal path is highlighted here to increase bicycle access to transit stations. We know that people are more likely to use bicycles if they feel they have a safe, comfortable, and pleasant route, and these facilities can be designed to meet those criteria. These are best when wide enough to allow overtaking and users of various speeds.

#### Case Study: [Multi-Use Paths - Massachusetts](#) (MassTrails et al., 2021)

In this 2021 study of four multi-use paths in Massachusetts, MassTrails observed several beneficial effects of the presence of these trails. These included a decrease in SOV trips and the resulting reduction in emissions, as well as positive health and economic effects for the areas surrounding these trails.

### Bike Boulevard / Neighborhood Bikeway

This approach to bike network connectivity, championed in Denver by Bike Streets, reduces the cost of new bicycle facilities by adapting existing infrastructure to create high-comfort bicycle routes. This is another first-mile consideration: how do commuters safely get to transit stations where they will transfer to transit to complete their journey to DEN. The adaptation can occur through the installation of inexpensive materials like flex-posts, diverters, signage, and road paint, though traffic on the route must be discour-

# Infrastructure and Technology Best Practices

## Active Travel

aged, and drivers must be slowed significantly. The adaptation must be significant enough to signal to drivers that they are guests on this street. One advantage of this type of facility is that since the elements are inexpensive, they can also be modular in that if a certain arrangement is not working, a different arrangement can be tested without tearing up permanent installations. Once a high-comfort route is established, it can be upgraded with permanent infrastructure in the future.

### Case Study: [Bay Area Bike-And-Ride](#) (Cervero et al., 2013)

This study from UC Berkeley examines how the presence of various types of bicycle infrastructure including bike boulevards and neighborhood bikeways affect the share of people accessing transit by bike. In this case, they are looking at the Bay Area Rapid Transit rail system.

### Public Path Lighting

Lighting on paths has been shown to increase the path's use by bicyclists at night. Since worker's shifts will begin and end outside of daylight hours year-round, this element is critical to bicycle infrastructure meant to attract commuters. Some design considerations apply such as how to ensure adequate lighting and how to reduce light pollution.



### Case Study: [Birmingham, UK](#) (Uttley et al., 2020)

This comprehensive study using bike counters along paths in Birmingham, UK, found that controlling for other factors, well-lit paths increase their use after dark. Lighting can be considered a critical part of bike infrastructure rather than an optional amenity.

### Service Stations

Service stations can be placed strategically along paths and near transit stations to help reassure commuters who worry about getting stranded due to an issue with their bike. Air pumps and tools help commuters keep rolling. This can be paired with tool rental or check-out at the workplace for repairs more complex than what can be handled at a public bike repair stand.

### Case Study: [Boston](#) (Fix Your Bike, 2016)

It is difficult to find studies / case studies about public bike stands, even though many cities have them. On this webpage, the City of Boston asks residents to submit the locations of public bike repair stands and tire pumps to develop a map of their locations for commuters to use. It also has some bike shops listed with their contact information and hours. A website like this would be beneficial to Denver cyclists as a resource.

# Infrastructure and Technology Best Practices

## Active Travel

### Bike Stations

A Bike Station is a bike-parking strategy for bike and transit journeys. Commuters will leave their bike at a bike storage facility within or at the entrance of a transit station and complete their journey on transit. Egan et al. (2023) identified six elements of effective bicycle parking. First is visibility: how visible is the parking to the public? Second is protection: how is the facility secured to prevent theft? The researchers note that there is a relationship between these first two elements: if the facility is highly visible to the public, it needs less protection. They also note that the duration of parking is a factor as well; the longer bikes will be stored, the more they need protection from theft and shelter from weather. The third element is accessibility. This means including considerations for disabled cyclists and making space for specialist and adapted bicycles. The fourth element is proximity, i.e., the facility should be located close to the entrance or within the destination. This element also has a relationship to visibility and protection. Usually, closer proximity to a destination will mean higher visibility, but people will park farther away for more protection if their parking will be more long term. The fifth element is integration, i.e., this is both designing the facility with a knowledge of local cycling and locking practices, but also encouraging use through design. For instance, a facility at a light rail station is more likely to be used if the cycling network allows access by bike. Last is diversification i.e., by providing more than one type of parking, individuals can make choices about the type of trip. This factor is probably less important for DEN, because most of the use will be employees locking their bike for the duration of their shift, versus people stopping for twenty minutes for coffee or to shop.



Image Source: Bloomberg

#### Case Study: [Bike Stations in the Netherlands](#) (Martens, 2007)

Researchers found that even in cities with excellent bike networks, adding bike parking to stations can help encourage mode-share journeys rather than SOV trips by giving greater access to more remote locations without good connections to the bike network or that are too far to bicycle or walk alone.

# Infrastructure and Technology Best Practices

## Active Travel

### Bicycle Parking

This serves as a brief note that bicycle parking at the destination for journeys that end with a bicycle is a distinct category and may be used differently than parking at stations. Employee parking at DEN can be access-controlled through badging or another means; this may not be feasible at a transit station. The same elements apply here as with bicycle stations, but the elements can be applied differently at the workplace versus a transit station.

**Case Study:** [Companhia Riograndense de Saneamento](#) (Rodrigues et al., 2021)

The case study involving employees of Companhia Riograndense de Saneamento explores many factors influencing whether employees commute by bike, one of which is providing bicycle parking inside the facility. This was shown to encourage bicycle commuting.

### Cargo Bike Rental

Some automobile trips can be replaced by bikes using a bike-share model with either docked or dock-less cargo bikes. This could be targeted at both employees who come to work with luggage, or business travelers coming to the airport with luggage. Cargo bikes could be stored at each end of a path.

**Case Study:** [Cargo Bike Rental for Airport Travelers](#) (Zipkin, 2018)

The increased presence of cargo bikes and electric bikes have made going to the airport with luggage by bike feasible.

## Parking

### Preferred Parking Options

Preferred parking is a strategy that reserves parking spaces for carpool-only vehicles. These parking spaces tend to be at a preferred location on the facility and/or at a reduced rate, creating convenience and time savings for carpool commuters. At a facility as large as DEN, this could be an effective approach to incentivize carpooling.

**Case Study:** [Nike Campus](#) (U.S. Department of Transportation, 2022)

On the Nike campus in Beaverton, Oregon, carpool vehicles receive a parking pass from the security guard at the main gate. This pass is placed in their car and allows them to park in the carpool-only parking area at a preferred location. The preferred parking helps to encourage carpool trips and reduce SOV commutes.



# Infrastructure and Technology Best Practices

## Mix of Travel Modes

### Locker Rooms and Showers

Adding locker rooms and showers at commuters' destinations may help more drivers switch to active travel modes. There are some bicyclists who, either because of personal preference or work requirements, cannot show up to their shifts after the physical exertion required for bike commuting. Lockers reduce the amount they must keep at their work site where they may not have any storage for excess belongings. Existing restroom facilities should be examined for the potential of being converted to locker rooms and showers for employees.

#### Case Study: [Washington, DC](#) (Buehler, 2012)

After controlling for other factors contributing to bicycle commuting, researchers concluded that lockers and showers are associated with higher levels of bicycle commuting. Showers and lockers should also be considered critical to the success of shifting people from SOVs, and not merely an amenity.

### Rewards App

Employees can be incentivized to take alternative transport to work by paying them in an easy-to-use format such as an app interface. Points earned could be redeemed for real cash value, exchanged for vouchers, or donated to charity as shown in the Way2GO pilot program at the Heathrow Airport. Functions within the app could be push notifications, in-app messages and an app dashboard showing progress made toward rewards.

#### Case Study: [Heathrow Airport Way2GO App](#) (Grimes, 2023)

In a recent pilot program, Heathrow Airport created an app called Way2Go targeting mode shifts among their employees. Useful data was collected about CO2 emissions, transport mode choices, and targeted routes that were encouraged and rewarded.



Image Source: Heathrow Airport

## Best Practices Matrices

The matrices on the following pages provide a structured representation of key information for the strategies and their associated best practices previously outlined. Each of the best practices, whether programmatic or infrastructure and technology-related, have been evaluated on whether the practice can be classified as a financial, logical, or behavioral incentive or disincentive to employees. Additionally, considerations for equity and accessibility and implementation costs are included. All this data contributes to an overall potential impact score of either low, medium, or high reflecting the impact of each strategy on shifting employee commuting habits.

Programmatic Best Practice	Financial	Logistical	Behavioral	Equity & Accessibility	Cost	Potential Impact (3 = highest)	Case Studies & Resources
<b>Transit Strategies</b>							
Employer-Provided Transit Pass	X			X	\$\$	2	<a href="#">City of Boston's Employee Incentive Program (Dolven, 2023)</a>
Decreased Transit Fares	X	X		X	\$	2	<a href="#">Modeling Airport Employees Commuting Mode Choice (Tsamboulas et al., 2012)</a>
Transit Cash Incentive	X			X	\$	2	<a href="#">Google's Boulder Campus (Boulder Daily Camera, 2018)</a>
<b>Carpool, Vanpool, and Rideshare Strategies</b>							
Casual Carpool / Slugging	X	X	X	X	\$	2	<a href="#">DC Metro Slugging (Scherr, 2023)</a>
Vanpool Empty Seat Insurance		X			\$	1	<a href="#">Vancouver's Employee Trip Reduction Program (Kassirer, 2000)</a>
<b>Active Travel Strategies</b>							
E-bike Rebates	X	X		X	\$	3	<a href="#">What Makes a Good Electric Bike Incentive Program? (Herbert, 2022)</a>
<b>Parking Strategies</b>							
Increased Parking Fees	X				\$	2	<a href="#">Cornell University (United States Environmental Protection Agency, 2005)</a>
Off-Peak Parking Incentives	X	X			\$	1	<a href="#">Stanford University Study (Charette, 2012)</a>
Flex Parking Permits			X		\$	1	<a href="#">U-PASS University of Washington (Yerichuk, 2001)</a>
<b>Mix of Travel Modes</b>							
Emergency Ride Home Program	X	X	X	X	\$\$-\$	3	<a href="#">DRCOG's Guaranteed Ride Home Service (Denver Regional Council of Governments, 2023)</a>
Flexible Start Time					\$	1	<a href="#">Vancouver's Employee Trip Reduction Program (Kassirer, 2000)</a>
Competitions, Prize Drawings, and Cash Incentives	X		X		\$\$\$\$	2	<a href="#">CommuteSM, Santa Monica (Dembo &amp; Kassirer, 2015)</a>



Programmatic Best Practice	Financial	Logistical	Behavioral	Equity & Accessibility	Cost	Potential Impact (3 = highest)	Case Studies & Resources
<b>Mix of Travel Modes</b>							
Leave Time Travel Incentives	X		X		\$\$	3	<a href="#">City of Austin's Leave Time Travel Incentive (Kassirer, 2021)</a>
Commuter Benefit Program	X	X		X	\$\$	3	<a href="#">Bay Area Commuter Benefit Program (Metropolitan Transportation Commission, 2021)</a>
International Competitions	X		X	X	\$	2	<a href="#">Bloomberg Initiative for Cycling Infrastructure (Bloomberg Philanthropies, 2023)</a>
Employee Traffic Reduction Program	X	X		X	\$	3	<a href="#">Seattle Department of Transportation (Spicer, 2023)</a>
<b>Employee Education</b>							
Employee Transportation Coordinators		X	X	X	\$\$\$	2	<a href="#">Boulder Transportation Connections (2023)</a>
Public Awareness Campaigns			X	X	\$\$	3	<a href="#">Awareness Campaigns That Help Improve Road Use Behavior (Cherry, 2023); Changes in Transport Behavior During the COVID-19 Crisis (Sung &amp; Monschauer, 2020)</a>
Driver Education			X	X	\$\$	2	<a href="#">Nonprofit Driving Education Course (Bicycle Colorado, 2023)</a>

Infrastructure and Technology Best Practice	Financial	Logistical	Behavioral	Equity & Accessibility	Cost	Potential Impact (3 = highest)	Case Studies & Resources
<b>Transit Strategies</b>							
Increased Transit Frequencies	X	X		X	\$	2	<a href="#">Modeling Airport Employees Commuting Mode Choice (Tsamboulas et al. 2012)</a>
<b>Carpool, Vanpool, and Rideshare Strategies</b>							
Carpool and Vanpool Ride-Matching Apps and Software		X	X		\$\$	3	<a href="#">Smart Commute GTA (Rowell, 2016).</a>
Increased Rideshare Allowances		X			\$	1	<a href="#">Airport Analyses Informing New Mobility Shifts: NREL (Henao et al., 2018)</a>
Carpool Only Lanes		X	X	X	\$\$\$	3	<a href="#">The Impact of High-Occupancy Vehicle Lanes on Carpooling (Cohen et al., 2022); CDOT's Express Lanes (CDOT, 2022)</a>
<b>Active Travel Strategies</b>							
Cycle Highway / Fast Bicycle Routes		X		X	\$\$\$	3	<a href="#">F15 Cycle Highway - Netherlands (Reyneri, 2019)</a>
Multi-Use Path		X		X	\$\$	2	<a href="#">Multi-Use Paths - Massachusetts (MassTrails et al., 2021)</a>
Bike Boulevard / Neighborhood Bikeway		X		X	\$\$	1	<a href="#">Bay Area Bike-And-Ride (Cervero et al., 2013)</a>
Public Path Lighting		X		X	\$\$	3	<a href="#">Birmingham, UK (Uttley et al., 2020)</a>
Service Stations		X		X	\$	2	<a href="#">Boston (Fix Your Bike, 2016)</a>
Bike Stations		X		X	\$ - \$\$\$	3	<a href="#">Bike Stations in the Netherlands (Martens, 2007)</a>
Bicycle Parking		X		X	\$ - \$\$\$	3	<a href="#">Companhia Riograndense de Saneamento (Rodrigues et al., 2021)</a>
Cargo Bike Rental		X		X	\$\$\$	3	<a href="#">Cargo Bike Rental for Airport Travelers (Zipkin, 2018)</a>
<b>Parking Strategies</b>							
Preferred Parking Options		X			\$	2	<a href="#">Nike Campus (U.S. Department of Transportation, 2022)</a>
<b>Mix of Travel Modes</b>							
Locker Rooms and Showers		X		X	\$\$-\$\$\$	3	<a href="#">Washington, DC (Buehler, 2012)</a>
Rewards App	X	X	X	X	\$	2	<a href="#">Heathrow Airport Way2GO App (Grimes, 2023)</a>

# Best Practices

## Conclusions

Overall, a multifaceted approach to reducing SOV commute trips is essential for creating change among DEN's employees. Transit commute strategies combine employee incentives with more attractive and reliable transit services to encourage employees to choose public transportation over SOV trips. Car-pool, vanpool, and rideshare strategies leverage the power of shared rides and geospatial proximity to significantly cut down on SOV commutes. Alternatively, parking-focused strategies offer alternatives to influence employee commute behavior through financial incentives or disincentives. Further, employee support and education strategies add a layer of behavior change incentives by offering educational resources and personalized support to employees, making it easier for people to transition to non-SOV commute modes.

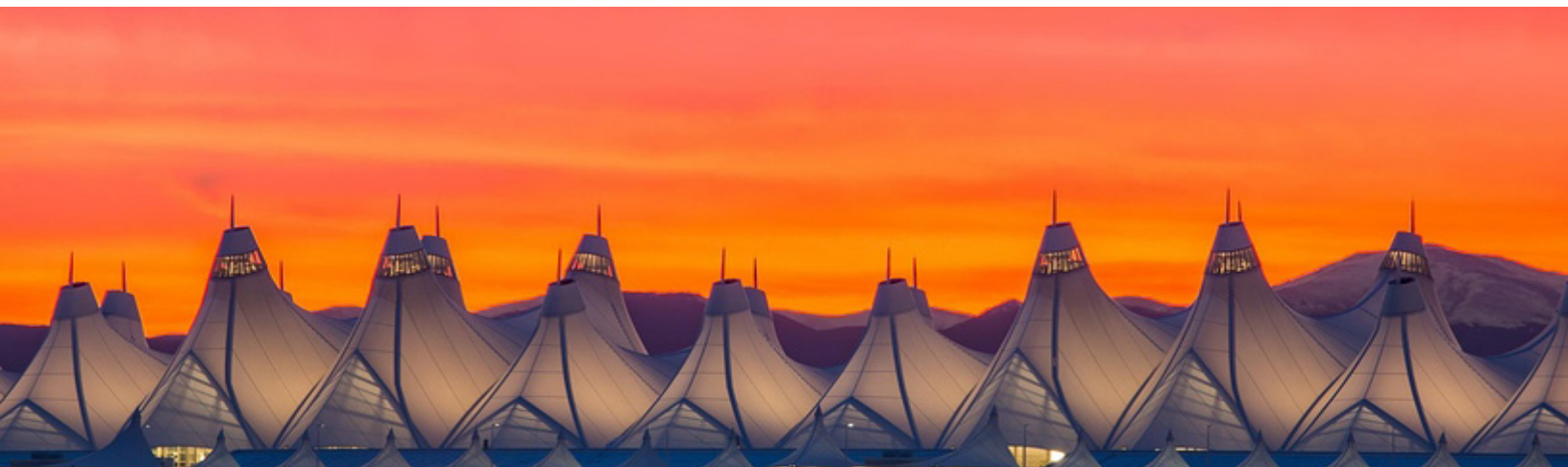
Active travel should also be an important consideration for DEN. Currently, the campus-style airport is distanced from the bulk of development in Denver. However, this is changing, and a forward-looking approach will recognize that future development around the airport would create opportunities for active commute and travel options. After the initial investment is made, active travel infrastructure can be upgraded or adjusted over time, and policies, incentives, and programs can be added or changed to get the biggest rate of return on the physical infrastructure. Best practices around active travel infrastructure include comfortable bike paths, direct routes, and well-lit areas. Provisions such as bike lockers, showers, repair stations, and tool rentals will likely increase the share of commuters who might shift to bicycle commuting. Additionally, the State of Colorado and the City of Denver currently have one of the most comprehensive and largest e-bike rebate programs. This is an excellent example of a program that can encourage a mode-shift, and it is possible that building out infrastructure to make it easy to get to the airport on a bicycle will attract workers who intend to use their e-bike for commuting to apply for jobs at the airport.

This section of the report has provided a wide array of strategies ranging from physical infrastructure, various incentives, and tech-enabled solutions. While there is no silver bullet to reduce SOV commuter trips, combining multiple strategies listed above may allow DEN to make progress in its goals while simultaneously promoting healthier and more sustainable transportation modes. The following sections will help to narrow the recommended strategies to those most appropriate to meet DEN employees' needs.

# Market Identification

A wide range of employees work at DEN, all with varying mobility needs and accessibility constraints. Our goal is to identify the DEN employees that are most likely to not drive to and from work. By identifying the primary market for a commute mode shift, we can recommend effective infrastructure, policies, and marketing strategies for implementation at the Denver Airport.

Our team analyzed several sources for this market identification. We first conducted a literature review that included market identification case studies and typical user demographics of people that use shared mobility options. Next, we created walkshed and bikeshed maps around transit stations. We then used LEHD's On the Map tool to identify the top 21 census tracts that employees travel from to the airport. U.S. Census data was then examined for these top census tracts to identify population characteristics centering around equity considerations. In the last portion of our market identification, we analyzed the DEN Mobility Survey conducted in late 2022 and early 2023.



# Market Identification

## Literature Review

To position our approach in the available data on best practices, we reviewed four pieces of research and case studies, including:

- Transit Cooperative Research Program (National Research Council, 2000)
- Target Market Identification and Data Collection Methods (Curtis and Allen, 2018)
- Travel Behavior Shared Mobility and Transportation Equity (Shaheen et al., 2017)
- LAX Transit Management Organization (TMO) Study (Steer, 2020)

### **Transit Cooperative Research Program (National Research Council, 2000)**

Chapter 3 of this report provides guidance to transit agencies seeking to provide more transportation options to airport employees. Key findings are consistent with those found in the DEN Mobility Survey, indicating that airport employees are most concerned about dependable travel times (even at what are typically off-peak hours) and cost. The study recommends categorizing the airport employee market into flight crews (commute infrequently) and non-flight crews (commute frequently). The study also recommends identifying the geography of the market area by size and number of ground access trips originating from different locations. This is important since airports with most trips originating from more than 30 miles away will have different travel mode options than airports with most trips originating from less than 10 miles away.

Analyzing results of a market study, such as the survey conducted by the Denver Airport in late 2022 and early 2023, requires identification of the specific travel needs that can be met by public transportation, and geographical concentration of airport employee homes who have characteristics associated with those needs. This data is essential to develop a public transportation service schedule, analyze potential for alternative services, locate transit stops and terminals, and identify suitable levels of access and features. Boston-Logan International Airport's Ground Access Program is a particularly good case study of a market research application.



Image Source:  
Transit Cooperative  
Research Program

# Market Identification

## Literature Review

### **Target Market Identification and Data Collection Methods (Curtis and Allen, 2018)**

Curtis and Allen emphasize that when developing a new product or service, it is important to first identify the primary consumer group to be served. To identify this target market, the first step is to isolate key characteristics such as demographics, psychographics (hobbies, interests, goals), and needs/preferences/values. The second step is to collect consumer data. This can be done through surveys, interviews, focus groups, observational studies, or existing research. Once the target market is identified, the next steps are in product/service development. This is relevant to the market identification for DEN because the employee survey, tenant survey, and focus groups with employees at DEN can help identify employee demographics, goals, needs, preferences, and values.

### **Travel Behavior Shared Mobility and Transportation Equity (Shaheen et al., 2017)**

This publication identified the typical user demographics for shared mobility. Shared mobility is an umbrella term that can apply to car sharing, bike sharing, formal/informal carpooling, vanpooling, company shuttles, micro transit, scooter sharing, and more. In the past, people that carpooled typically had lower incomes and were the non-primary income earner of their household. In 1970, carpooling and ridesharing represented 20.4% of commute travel in the US.

As of 2014, carpooling and ridesharing dropped to only 9.2% of commute travel in the US. Currently, the user demographics for shared mobility are typically less diverse than the demographics of the general population. Shared mobility users have higher incomes, are younger, and have higher levels of educational attainment. In many places, older, low-income individuals and those living in minority or rural communities are less likely to use shared mobility options despite it being a possible solution to address inequity in regional transportation networks. This is due to a lack of access to technology, the location of shared mobility services, and marketing and outreach that is not culturally inclusive enough.

Understanding the typical demographics of shared mobility users and the potential of shared mobility to improve regional equity may help us while examining data about DEN employees.

### **LAX TMO Study (Steer, 2020)**

This study initiated the first steps to create a Transportation Management Organization (TMO) at the Los Angeles Airport (LAX). After an employer/employee survey, stakeholder meetings, and interviews, the LAX TMO study organizers analyzed local regulations, best TMO practices, origin-destination data, and analysis of current transit connections available to the airport. This case study is relevant to the Denver Airport as DEN staff are effectively seeking to do the work of a TMO by enhancing transit and transportation connectivity for DEN employees.

Key takeaways include the need to identify a target group based on size, industry sector, and/or location. Once these groups are established, the scope of work, internal organization, funding sources, and budget can be determined. The study also recommends including only employers/employees in transit solutions to comply with FAA funding requirements.



# Market Identification

## **GIS Data and DEN Employee Survey**

The maps in the following pages draw a correlation between where DEN employees live, and transit stop walksheds on lines running to the airport. The current lines that run to the airport are the A-line commuter rail as well as the R-line light-rail that connects to that line, the AB1, the AT and ATA, the 169L, the 104L, and the 145X. The walksheds have half-mile radii that accurately internalize accessibility of the existing street network. The bikesheds have two-mile radii and are only along the rail lines.

To determine where DEN employees are living, we used the US Census LEHD's On the Map tool. The first map below shows the census tracts with over 70 DEN employees (see Figure 1). The four census tracts with the highest number of employees are in the Denver neighborhoods of Montbello and Greenwood Valley Ranch. Three out of the four census tracts touch walksheds to either the A-line rail stop, or 169L bus stops. Furthermore, the census tract in Commerce City (85.38) straddles the walksheds for the 104L bus line stops. Looking at Aurora, there is a cluster of four census tracts, 820, 821, 822, and 826 that straddle the walksheds for the 169L bus line and touch the bike-sheds to the R-Line light rail. Finally, in southwest Aurora there is a census tract with almost 100 DEN employees that is on the R-Line and the AT & ATA bus lines.

Zooming out to the scale of top 100 hundred origin census tracts for DEN employees, we see an increased number of census tracts that indicate a correlation between their placement and the existing transit lines (see Figure 2). The third map showing the top zip codes with DEN employee survey respondents also corresponds to the transit lines (see Figure 3). These findings make a compelling case for an employee's transit demand within walking and biking distance to rail/bus lines that run directly to the airport. Both the bus and the rail lines must be considered, as there are several top census tracts within walking distance of an airport bus line than a rail line.



# Origin Census Tracts with 70 or More DEN Employees

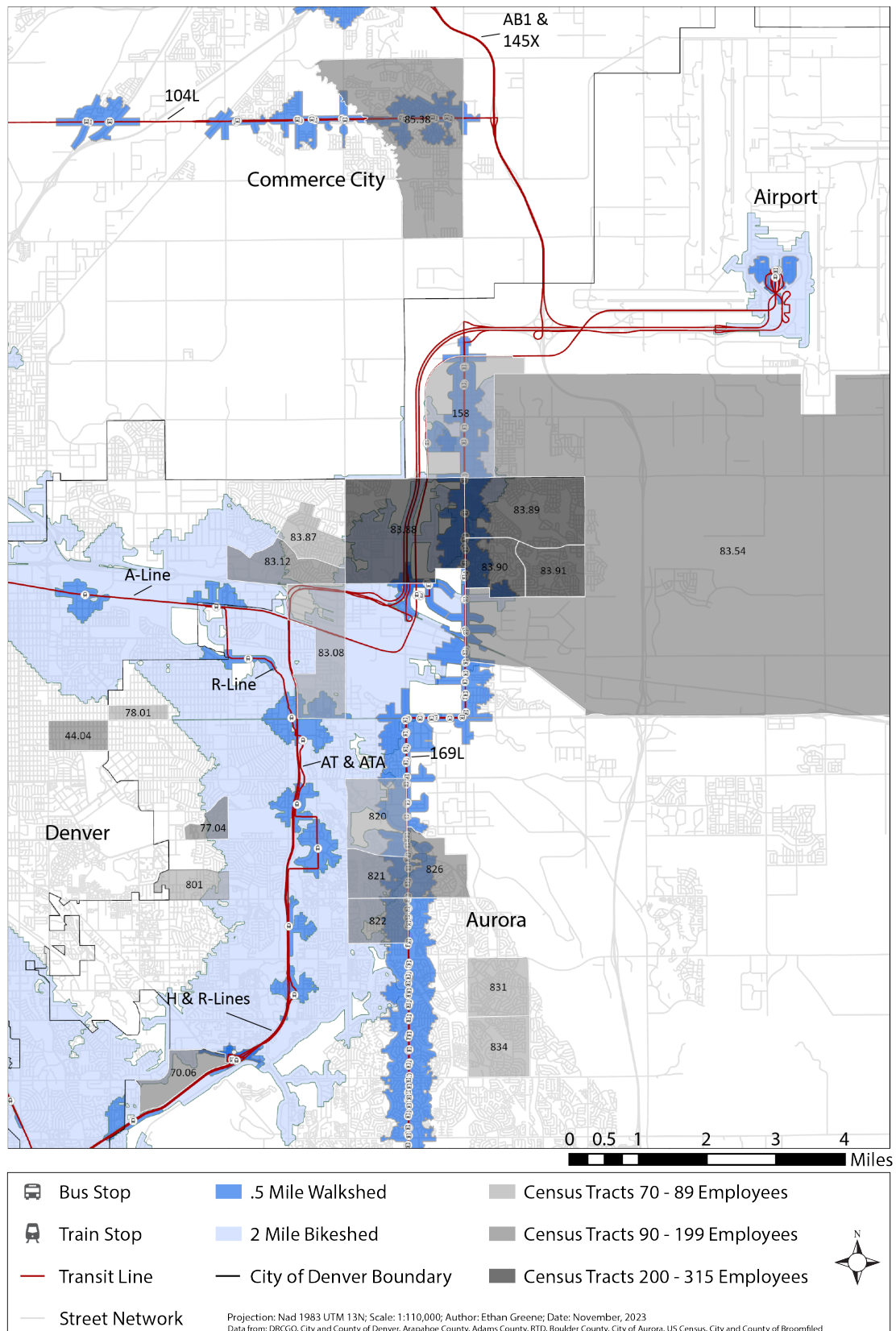


Figure 1: Top 20 Origin Census Tracts for DEN Employees

# Top 100 Origin Census Tracts for DEN Employees

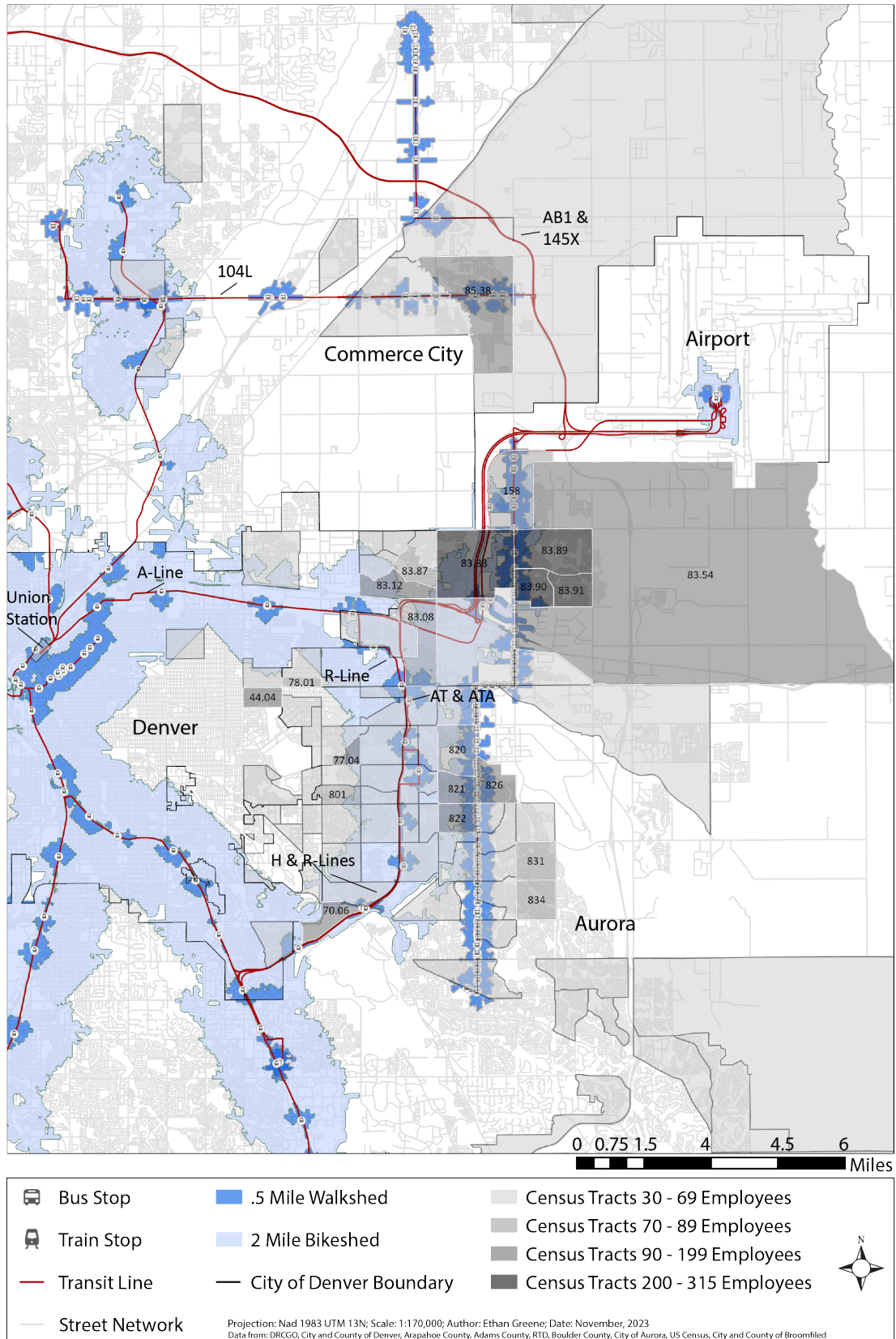


Figure 2: Top 100 Origin Census Tracts for DEN Employees

## Top Origin ZIP Codes (more than 50 Survey Respondents) for DEN Employees

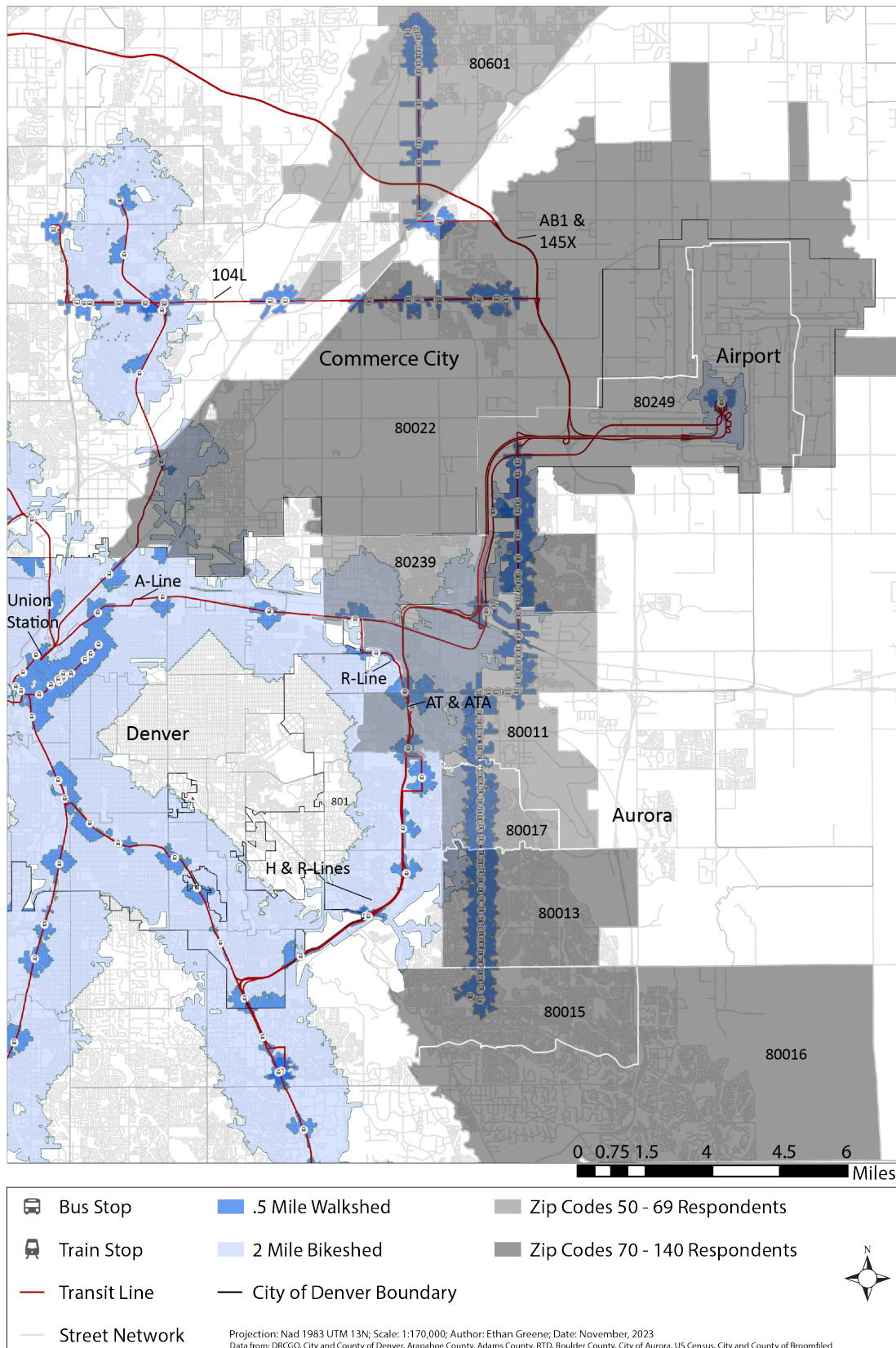


Figure 3: Top Origin Zip Codes for DEN Employees

# Market Identification

## GIS Data – ACS Data Tables

To gain a better understanding of the transportation habits of the residents in the top origin census tracts, we explored various American Community Survey (ACS) data tables. We evaluated both the means of transportation to work and the household size by vehicles available data tables for the top origin census tracts with 70 or more DEN employees.

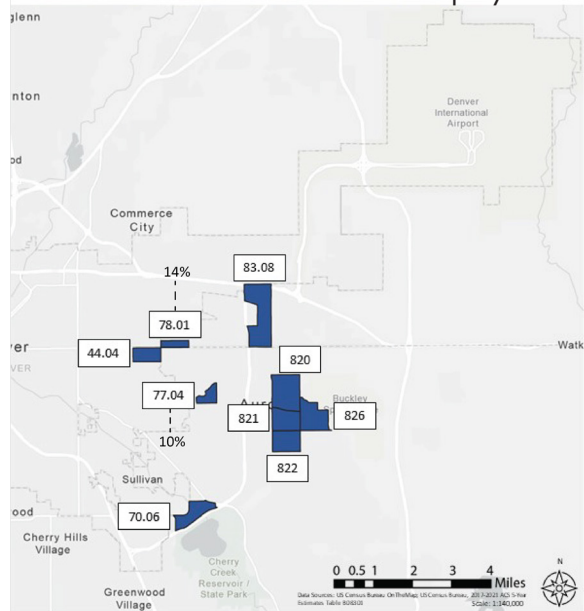


First, we looked at the means of transportation to work for workers 16 years and older. Only 2%, 2%, and 4% of residents who commute to work in Adams, Arapahoe, and Denver counties respectively, stated they took the bus to work. Out of the nine census tracts where workers took the bus to work at higher rates than their corresponding county, there were a few standouts. In Census Tract 78.01 in Adams County, 14% of their workers reported taking the bus to work, which is seven times the county's rate. In Arapahoe County, 10% of the workers in Census Tract 77.04 take the bus to work, eight percentage points higher than Arapahoe County as a whole. See right for a map showing the nine census tracts.



The use of trains as a mode of transportation to work is less popular than buses. Only 1%, 1%, and 2% of commuting workers in Adams, Arapahoe, and Denver counties respectively, stated they took a train to work. Only three total census tracts' workers used trains at a higher rate than their county. One standout was Census Tract 70.06 in Denver with a reported 14% of workers taking the train to work, twelve percentage points higher than all of Denver. Below is a map showing the three census tracts.

High Bus Commuting Rates for Origin Census Tracts with 70 or More DEN Employees



High Train Commuting Rates for Origin Census Tracts with 70 or More DEN Employees

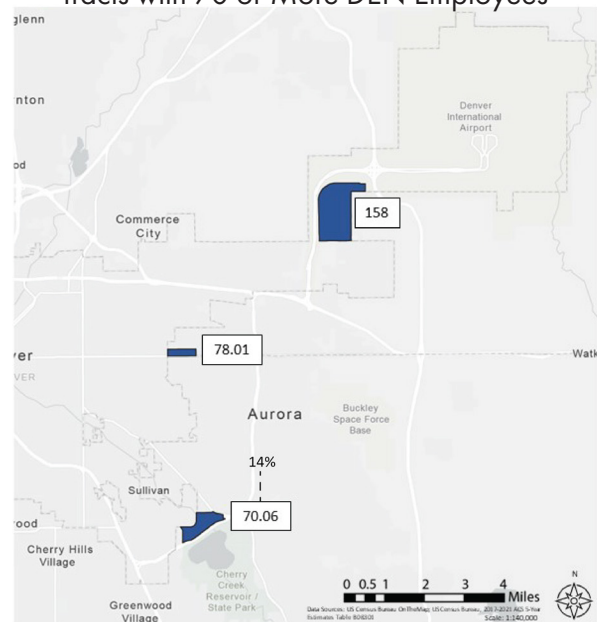


Figure 4 (Top): High Bus Commuting Rates; Figure 5 (Bottom): High Train Commuting Rates in Top DEN Census Tracts



# Market Identification

## GIS Data – ACS Data Tables



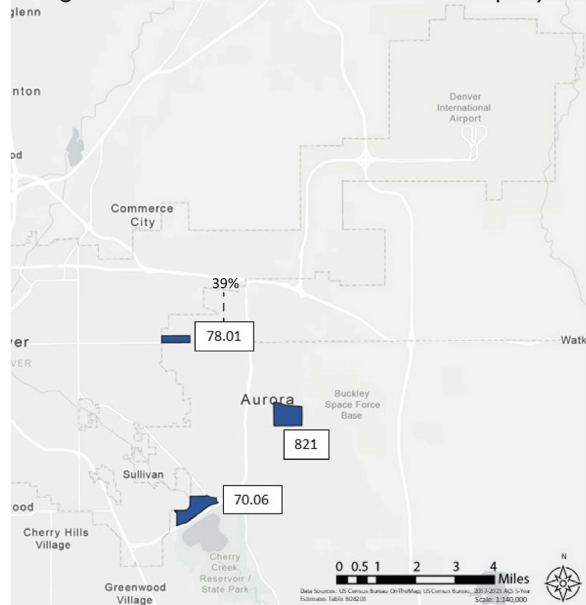
Next, we evaluated the number of vehicles available in households. The ACS data table presents the information as household size by vehicles available. However, we chose to look at the number of vehicles available, regardless of the household size. In Adams, Arapahoe, and Denver counties, 4%, 5%, and 10% of households respectively, do not have access to a vehicle. There were three census tracts that had higher rates of households with no vehicle availability than their corresponding county. Census Tract 78.01 in Adams County was the biggest outlier, however, with 39% of households reporting they did not have a vehicle available to them. The census tracts with higher percent totals than their county of households with no vehicle available present an opportunity for further evaluation. These census tracts may be the areas that need more transit investment. To the right is a map showing the three census tracts.



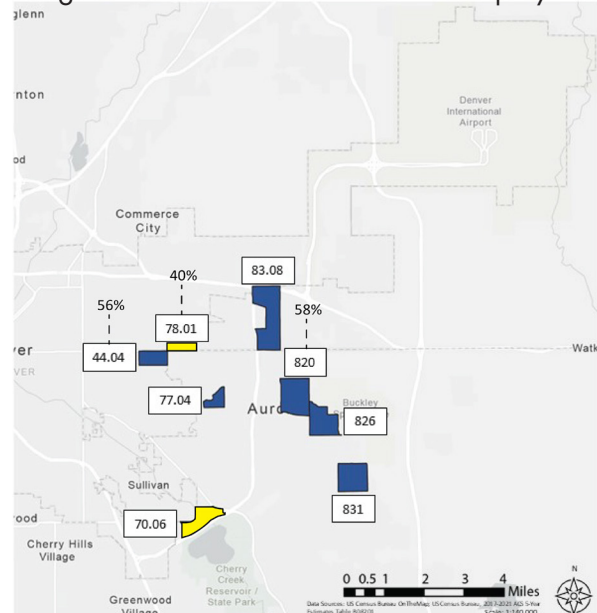
Ultimately, there were two census tracts that met the criteria for all four groups we evaluated. Census Tract 70.06 (Denver County) and Census Tract 78.01 (Adams County) had both higher percent totals of workers that took the bus or the train to work and higher percent totals of households with access to one or no vehicles than their respective counties. These two census tracts, highlighted in Figure 7, present the ripest opportunity for alternative transportation modes beyond vehicles.

Figure 6 (Top): No Vehicle Ownership; Figure 7 (Bottom): One Vehicle Ownership in Top DEN Census Tracts

Increased Rates of No Vehicle Ownership for Origin Tracts with 70 or More DEN Employees



Increased Rates of One Vehicle Ownership for Origin Tracts with 70 or More DEN Employees



# Market Identification

## Introduction to DEN Employee Survey

From October 2022 to January 2023, a mobility survey was available for Denver Airport employees to take. Questions in this survey covered employer, income, commute mode, reasons for mode choice, travel time, parking, and transit incentives. The results of this survey are intended to inform the DEN Mobility Plan and future transportation policy at the Airport. Paper and online versions of the survey were available, and the survey was distributed through Denver Airport employer and DEN communication channels. 2,702 useable survey responses were received.

It is important to note the margin of error with this survey. Not all employers offered the survey to their employees, therefore the survey sample is not truly random. Survey results are not statistically valid or representative of all Denver Airport employees. Hence, the generalizability of the survey findings to DEN employees is limited yet shows a series of insights for further analyses.

### Survey Responses at a Glance

First, we examined survey responses that gave us a better understanding of which Denver Airport employees took the survey and peak employee commute times. Responses were received from employees representing many different employers. United Airline employees are the most represented in this survey and make up 48% of respondents. Below is a graph showing the top 10 employers represented in survey responses, as well as a category for all other employers outside of the top 10 responses.

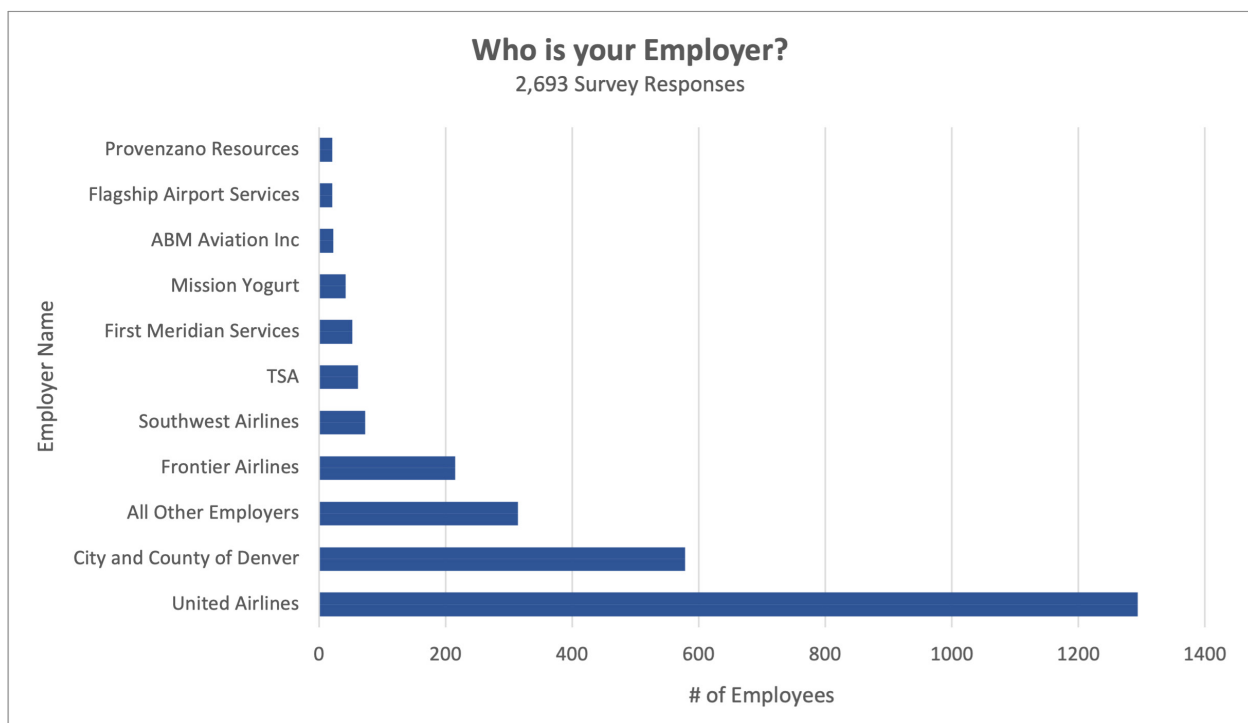


Figure 8: Employers of Survey Respondents



# Market Identification

## Introduction to DEN Employee Survey

Survey respondents have a wide range of estimated yearly income. Many respondents earn between \$50,000 to \$74,999 per year, but there are employees that make anywhere from less than \$15,000 to over \$150,000.

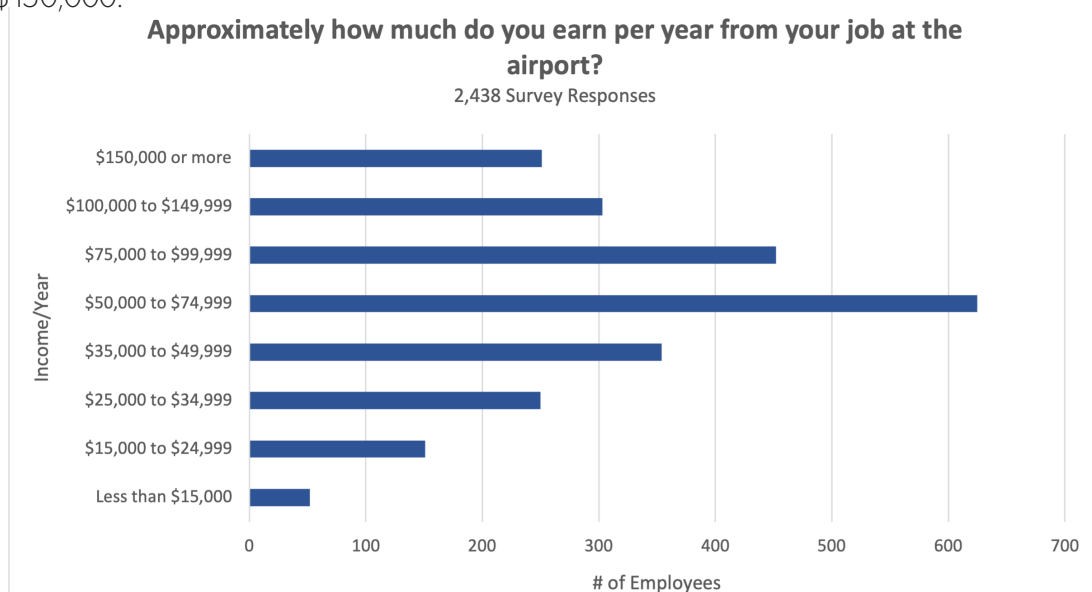


Figure 9: Annual Income of Survey Respondents

Employees that took the survey were asked their work start time and work end time for the most recent day that they worked at the airport. This gave us an understanding of peak commute times for employees at the airport. The largest peak in start time was seen at 6:00 AM, with 14% of respondents reporting they started work at that time. 5:00 AM to 8:00 AM is the range that 51% of survey respondents started work. A smaller peak in work start time is seen around 2:00 PM (see Figure 10).

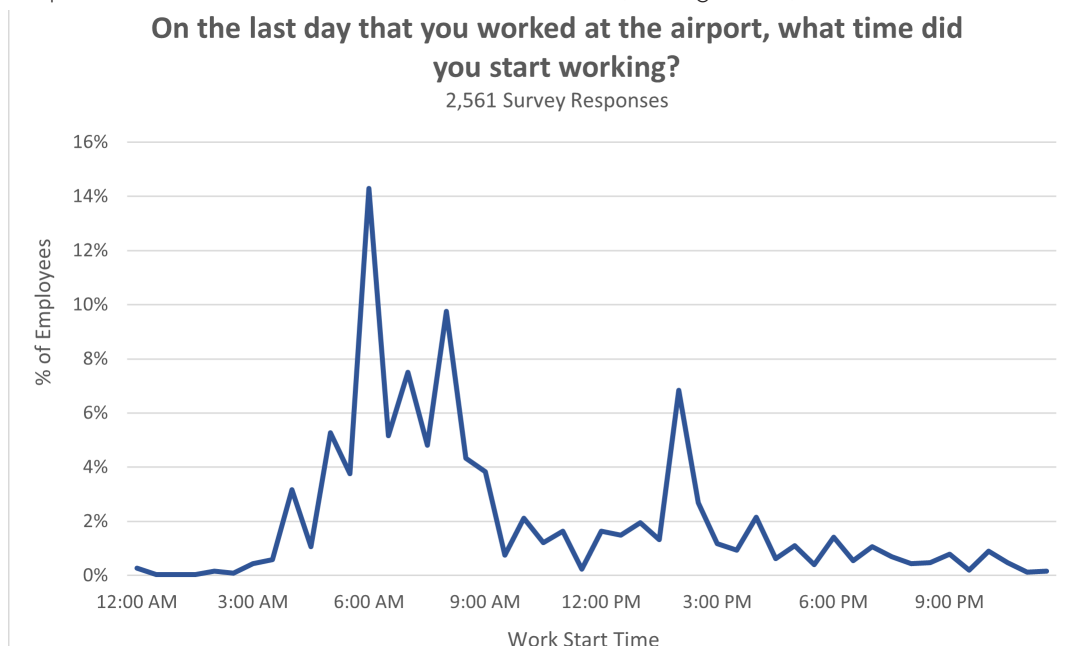


Figure 10: Employee Work Start Times Throughout the Day

# Market Identification

## Introduction to DEN Employee Survey

The largest peak in end time was seen at 4:30 PM, with 9% of respondents reporting they got off work at that time. 2:30 PM to 5:00 PM is the range that 39% of survey respondents got off work. A smaller peak in work end time is seen around 9:00 PM and 10:30 PM (see Figure 11).

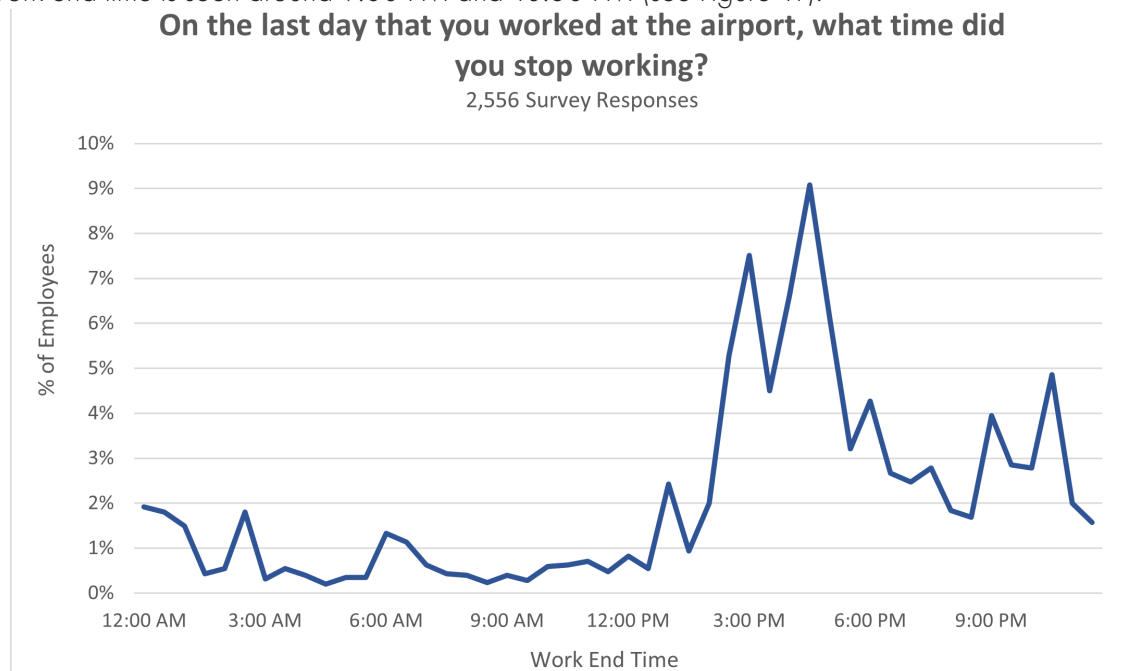


Figure 10: Employee Work Start Times Throughout the Day

### Cohorts Identified in Survey Responses

The market identification team reviewed the responses to the employee survey in depth and developed cohorts of employees that have similar characteristics described below. These cohorts are based primarily on employees' behavior, such as primary mode choice and when employees commute. The main groups identified are as follows:

- Peak Peña Eastbound Commuters and Drivers 7:00am – 3:00pm
- Peak Peña Westbound Commuters and Drivers 4:00am – 12:00pm
- Non-Peña-Peak Commuters

In addition to the above, characteristics of survey respondents based on their primary commute mode were also identified. As the survey captured employees' travel mode for each of the previous seven days, we cannot guarantee that employees' primary commute mode is representative, as it could be influenced by factors specific to that week. To better understand each cohort, we looked at the employer, self-reported income, time of commute, and other metrics collected in the survey. Finally, we note that many of these metrics are provided with the survey-wide data for context. As the survey is not fully representative of all DEN employees, these comparisons should be taken as rough estimates of how each group compares to the overall DEN employee population. The team has provided these as there are no more representative alternatives to the team's knowledge.

# Market Identification

## Peak Peña Eastbound Commuters

We reviewed the 2022 Annual Peña Utilization Summary provided by DEN to find what times of day experience peak traffic for each direction on the street. Reviewing the data for eastbound Peña (towards DEN) revealed a large range of 7:00am to 3:00pm where the street saw above 4,500 vehicles per hour on the busiest day of 2022. Using a field collected in the survey where employees could describe their most recent arrival time at work, the market identification team identified the employees who likely commute during these hours and further segmented the group by those who primarily commute by single-occupancy vehicles. Characteristics of the peak eastbound commuters can be seen in the matrix below.

Peak Eastbound Commuter Analysis Matrix - Comparisons Relative to Total Survey Respondents

	<b>Peak Eastbound Commuter – All Travel Modes</b>	<b>Peak Eastbound Commuter – Primary Travel Mode of Drive Alone</b>
<b>Number of Survey Respondents</b>	1,364	1,010
<b>Most Common Primary Commute Mode</b>	Drive alone (76%)	Drive alone (100%)
<b>Second Most Common Primary Commute Mode</b>	Train (12%)	N/A
<b>Third Most Common Primary Commute Mode</b>	Bus (6%)	N/A
<b>Employers</b>	CCD	CCD
<b>Pay for Parking</b>	Employer-provided parking	Employer-provided parking
<b>Wage Type</b>	Salary	Salary
<b>Income</b>	>= \$75,000	>= \$75,000
<b>Overtime</b>	Less likely	Less likely
<b>Eco-Pass Possession</b>	More likely	Less likely
<b>Likelihood to Use Transit If Cheaper</b>	More likely	More likely
<b>Reason for Commute Mode</b>	Fastest option, most reliable option, can run errands	Fastest option, most reliable option, can run errands

# Market Identification

## Peak Peña Eastbound Commuters

### Peak Peña Eastbound Summary

- The cohort is defined as those who arrive at work between 7am to 3pm.
- A total of 1,364 survey respondents arrived at DEN during this time, 76% of which drive alone, and 12% who take the train.
- This group is more likely to be City and County of Denver (CCD) employees than the total survey population.
- For those who most often drive alone, but change up their commute during the week, they are more likely to use some other mode of commute. The train and carpool are the most common alternatives to driving alone.
- These eastbound peak commuters are more likely to have employer-provided parking, and those who drive alone are even more likely.
- The group is more likely to be paid a salary wage, with drivers even more likely to be salary earners.
- Those earning over \$75,000 comprise 45% of the group; for those who drive alone, 51% earn over \$75,000.
- The cohort is less likely to work overtime than survey-wide respondents.
- Over half of the eastbound cohort has an Eco-Pass.
- The entire eastbound cohort is more likely to take transit if it were cheaper, though drivers are slightly less likely to.
- Those who drive alone in the cohort see driving a car as faster, more reliable, and more flexible.



### Meet Belinda

Belinda is a flight attendant who lives in a townhouse she recently purchased in the Lowry Neighborhood in Denver. Due to her varying, and sometimes early, work schedule, Belinda drives to work to make sure that she can get there on time. The commute to the employee parking lot is almost entirely on Peña Blvd., and takes her about 30-45 minutes, depending on traffic.

She is just one of the many Peak Peña Eastbound Commuters. Later in this report, we will revisit her current commute patterns and how future interventions could positively impact her life.

# Market Identification

## Peak Peña Westbound Commuters

Like the previous cohort, the market identification team identified peak westbound (away from DEN) times on Peña Boulevard using the 2022 Annual Peña Utilization Summary as 4am to 12pm. Using employee's self-reported departure time, the team identified 238 employees who commute during this peak time, 74% of whom drive a single occupancy vehicle. Characteristics of the peak westbound commuters can be seen in the matrix below.

Peak Westbound Commuter Analysis Matrix - Comparisons Relative to Total Survey Respondents

	Peak Eastbound Commuter – All Travel Modes	Peak Eastbound Commuter – Primary Travel Mode of Drive Alone
Number of Survey Re- spondents	238	170
Most Common Primary Commute Mode	Drive alone (74%)	Drive alone (100%)
Second Most Common Primary Commute Mode	Train (12%)	N/A
Third Most Common Pri- mary Commute Mode	Bus (4%)	N/A
Employers	United/Frontier	United/Frontier
Pay for Parking	Pay for parking/free parking lot	Free lot
Wage Type	Hourly	Hourly
Income	<= \$35,000	\$50,000-\$100,000
Overtime	Less likely	Less likely
Eco-Pass Possession	Less likely	Less likely
Likelihood to Use Transit If Cheaper	More likely	More likely
Reason for Commute Mode	Only option, safer option	Safer option, fastest option

# Market Identification

## Peak Peña Westbound Commuters

### Peak Peña Westbound Summary

- The cohort consists of 238 individuals who departed DEN between 4am to 12pm; 74% of the group drive a single occupancy vehicle.
- The cohort is more likely to be United and Frontier employees compared to all surveyed employees.
- They are also less likely to have more than one mode of commute than all survey respondents.
- Among those who drive single-occupancy vehicles most often, they use some other method, being dropped off and the train as their second-most common commute mode.
- Compared to the overall survey respondents, the westbound cohort is more likely to pay for their own parking or rely on the free parking lot.
- The group is also more likely to earn an hourly wage compared to the overall survey.
- The cohort is more likely to be in the lower income ranges (less than \$35,000) than survey respondents overall, though drivers among the cohort are more likely higher income.
- The peak westbound commuters are less likely to work overtime than the total survey respondents as well.
- This cohort is less likely to have an Eco-Pass than the survey respondents as a whole.
- Members of this cohort commute the way they do because it is the fastest and most reliable option, though they are more likely to say it is because it is the only and safer option, compared to the total survey respondents.



### Meet Rob

Rob is in high school and lives in Green Valley Ranch with their parents. They are a barista at a coffee shop at the airport, where they work a morning shift every Saturday and Sunday. Their typical shift starts at 5AM and ends around noon. If they have time, Rob's parents might drive them 20 minutes to work, but mostly Rob will catch the 45 bus to the 169L, which takes about 30-40 minutes.

They are just one of the many Peak Peña Westbound Commuters. Later in this report, we will revisit their current commute patterns and how future interventions could positively impact their life.



# Market Identification

## Non-Peak Peña Commuters

To provide a full picture of survey respondents and ensure we are equitably describing the DEN employee population; we created a cohort of all respondents who do not fall into the above two peak commuter cohorts. This cohort consists of 1,090 survey respondents, 76% of whom drive single-occupancy vehicles. Characteristics of the non-peak commuters can be seen in the matrix below.

Non-Peak Commuter Analysis Matrix - Comparisons Relative to Total Survey Respondents

	<b>Non-Peak Commuter – All Travel Modes</b>	<b>Non-Peak Commuter – Primary Travel Mode of Drive Alone</b>
<b>Number of Survey Respondents</b>	1,090	805
<b>Most Common Primary Commute Mode</b>	Drive alone (76%)	Drive alone (100%)
<b>Second Most Common Primary Commute Mode</b>	Train (11%)	N/A
<b>Third Most Common Primary Commute Mode</b>	Bus (6%)	N/A
<b>Employers</b>	United/Frontier	United/Frontier
<b>Pay for Parking</b>	Free parking lot	Free parking lot
<b>Wage Type</b>	Hourly	Hourly
<b>Income</b>	\$50,000-\$75,000	\$50,000-\$75,000
<b>Overtime</b>	More likely	More likely
<b>Eco-Pass Possession</b>	Less likely	Less likely
<b>Likelihood to Use Transit If Cheaper</b>	Less likely	Less likely
<b>Reason for Commute Mode</b>	Only option available, easier to work overtime	Fastest option, most reliable option, easier to work overtime

# Market Identification

## Non-Peak Peña Commuters

### Non-Peak Peña Commuters Summary

- This cohort are all respondents who do not fall into the above two peak commuter cohorts and consists of 1,090 survey respondents, 76% of whom drive single-occupancy vehicles.
- This cohort is more likely to be United and Frontier Airlines employees than the survey respondents as a whole.
- Most members only having one method of commuting, though single-occupancy vehicle drivers are more likely to only have one mode of commuting.
- For cohort members who drive alone most frequently, they are more likely to use some other commute mode, carpooling, and the train as their second-most common commute mode.
- The cohort is slightly more likely to rely on the free parking lot than all survey respondents.
- The non-peak commuter cohort is more likely to be paid an hourly compared to the total survey.
- The off-peak commuter cohort is more likely to be middle-income.
- This cohort is more likely to work overtime than the peak commuters.
- Off-peak commuters are less likely to have an Eco-Pass than the total survey respondents.
- This cohort is less likely to use a train or bus if it was discounted.
- This cohort is more likely than all respondents to say they commute the way they do because it is the only option available, and it makes it easier to work overtime.



### Meet Theo

Theo lives along East Colfax in Aurora with his partner. They have one car that they share. His partner is a nurse at the Children's Hospital on the Anschutz Medical campus nearby and gets a ride with friends. Theo's 6PM to 2AM shifts, as well as having the farther commute, means he takes the car to work most nights. His commute to the employee lot takes him about a half hour.

He is just one of the many Peak Peña Eastbound Commuters. Later in this report, we will revisit his current commute patterns and how future interventions could positively impact his life.

# Market Identification

## Peak / Non-Peak Commuter Summary

We prepared the below analysis matrix that simplifies the above analysis in a way that allows for comparisons between cohorts. It should be noted that the figures below are in relation to survey respondents as a whole. So, for example, '<= \$35,000' for the westbound cohort means the cohort has a higher share of those making less than \$35,000 a year than the survey respondents overall.

Non-Peak Commuter Analysis Matrix - Comparisons Relative to Total Survey Respondents

	Peak Eastbound Commuter	Peak Westbound Commuter	Non-Peak Commuters
Number of Survey Respondents	1,364	238	1,090
Most Common Primary Commute Mode	Drive alone (76%)	Drive alone (74%)	Drive alone (76%)
Second Most Common Primary Commute Mode	Train (12%)	Train (12%)	Train (11%)
Third Most Common Primary Commute Mode	Bus (6%)	Bus (4%)	Bus (6%)
Employers	CCD	United/Frontier	United/Frontier
Pay for Parking	Employer-provided parking	Pay for parking/free parking lot	Free parking lot
Wage Type	Salary	Hourly	Hourly
Income	>= \$75,000	<= \$35,000	\$50,000-\$75,000
Overtime	Less likely	Less likely	More likely
Eco-Pass Possession	More likely	Less likely	Less likely
Likelihood to Use Transit If Cheaper	More likely	More likely	Less likely
Reason for Commute Mode	Fastest option, most reliable option, can run errands	Only option, safer option	Only option available, easier to work overtime

# Market Identification

## **Additional Primary Commute Cohorts**

Finally, it is important to identify the characteristics of airport employee commuters by their mode. These cohorts are separated by those who drive alone, primarily take the bus, primarily take the train, people who pay for their own parking, and people who walk to their train or bus stop. Understanding more about the characteristics of these groups will help to cater to the needs of those taking transit and potentially convince those who are driving alone to use a different mode in the future.



### **Drive Alone Summary**

Most airport employees, 1,932 in total, drive alone to get to work. Because this is such a large portion of the survey respondents, the income of these commuters is not significantly different from the survey as a whole. Drivers are also more likely to indicate speed and reliability as the primary reasons they choose to drive alone to the airport.



### **Primarily Take Bus Summary**

142 survey respondents indicated that they primarily take the bus to get to the airport for work, or about 5% of employees who took the survey. Bus riders are much more likely to be lower income compared to survey respondents overall.

Very few bus riders who took the survey indicated they get to their bus stop by walking there, with most people driving alone or being dropped off by someone else. This is a significant difference from people who take the train to get to the airport, of which about half walk from their home to the train station.

For bus riders, they indicate that they take the bus because it is the least stressful, least expensive, and/or because they do not have a car. Bus commuters are also much more likely to have an Eco Pass provided by their employer (over 60% compared to 30% of survey takers overall).



### **Primarily Take Train Summary**

In total, 294 survey respondents indicated that taking the train to the airport was their primary way to commute. This cohort is slightly more likely to be a newer employee to the airport compared to the survey as a whole, with 24% of train commuters working at the airport for fewer than 6 months compared to 13% of all survey respondents. Train commuters are also less likely to have their employer pay for their parking at the airport.

Airport employees taking the train into work are more likely to have lower incomes compared to the rest of survey respondents. Most people taking the train drive alone to

# Market Identification

## **Additional Primary Commute Cohorts**

Finally, it is important to identify the characteristics of airport employee commuters by their mode. These cohorts are separated by those who drive alone, primarily take the bus, primarily take the train, people who pay for their own parking, and people who walk to their train or bus stop. Understanding more about the characteristics of these groups will help to cater to the needs of those taking transit and potentially convince those who are driving alone to use a different mode in the future.

the train station, but there is a significant portion (over 100 employees) who choose to walk to the station.

Most train commuters choose to take the train because it is the least expensive and because they do not have a car. This contrasts starkly with most survey respondents driving alone choosing this mode because it is the fastest and most reliable option.



### **Walk to Train or Bus Stop Summary**

In total, 157 survey respondents indicated that they walk to a bus or train stop. Employees in this cohort are more likely to be newer airport employees compared to the whole survey. This cohort has 34% of respondents working at the airport for fewer than 6 months compared to 13% of all survey respondents. The top zip codes this cohort commutes from are 80202, 80205, and 80249. Employees that walk to a bus or train stop have lower incomes compared to the rest of survey respondents. Most employees in this cohort earn less than \$50,000 per year.

Most employees that walk to a bus or train stop do not have a car. This cohort also uses this commute method because it is the least expensive option.



### **Pay for Their Own Parking Summary**

In total, 151 survey respondents pay for their own parking. 89% of this cohort primarily drives alone to work. Only 30% of this cohort are provided with a discounted transit pass. The income of those that pay for their own parking is less than all survey respondents.

Most of this cohort answered why they use their current mode in similar ways to all survey respondents. Employees that pay for their own parking use their current mode because it is the most reliable option and it is the fastest option.

# Market Identification

## Additional Commute Cohorts Summary

Separating out survey respondents based on characteristics about their primary mode of travel reveals many differences in priorities. For employees that primarily drive alone or must pay for their own parking, getting to work in a way that is the fastest and most reliable is important. They are also less likely to have an EcoPass and less likely to use transit if it were cheaper. For employees that primarily use transit, they get to work because they might not have a car and it is the least expensive way to get to work. Overall, they are less likely to work overtime, more likely to have an EcoPass, and more likely to use transit if it were cheaper. Many employees that primarily take transit to work fall under the 'Other' category for employer, so it is important for the DEN team to identify where these employees work.

Additional Primary Commute Cohort Analysis Matrix – Comparisons Relative to Total Survey Respondents

	Primarily Drive Alone	Primarily Take Bus	Primarily Take Train	Walk to Train or Bus Stop	Pay for Own Parking
<b>Number of Survey Re-spondents</b>	1,932	142	294	157	151
<b>Most Common Primary Com-mute Mode</b>	Drive alone (100%)	Bus (100%)	Train (100%)	Train (67%)	Drive alone (89%)
<b>Second Most Common Primary Com-mute Mode</b>	N/A	N/A	N/A	Bus (22%)	Train (5%)
<b>Third Most Common Primary Com-mute Mode</b>	N/A	N/A	N/A	Drive alone (9%)	Carpool (3%)
<b>Employers</b>	CCD/United	Other/CCD	Other	Other	Frontier / Southwest
<b>Pay for Park-ing</b>	Employer-pro-vided parking/ free parking lot	Pay for parking	Pay for parking	Employer-pro-vided parking	Pay for parking
<b>Wage Type</b>	Salary	Salary	Hourly	Hourly	Hourly
<b>Income</b>	>= \$50,000	\$15,000-\$35,000	<= \$50,000	<= \$50,000	<= \$50,000
<b>Overtime</b>	More likely	Less likely	Less likely	Less likely	Less likely



# Market Identification

## Additional Commute Cohorts Summary

<b>Eco-Pass Possession</b>	Less likely	More likely	More likely	More likely	Less likely
<b>Likelihood to Use Transit If Cheaper</b>	Less likely	More likely	No survey responses	More likely	Less likely
<b>Reason for Commute Mode</b>	Fastest option, most reliable option	Least expensive option, least stressful option, don't have a car	Don't have a car, least expensive option	Don't have a car, least expensive option	Fastest option, most reliable option

## Conclusions

The cohort commuting along Peña eastbound during peak hours consists of individuals who arrive at work between 7 am and 3 pm, with 1,364 survey respondents falling into this category. Most of them, 76%, commute alone by car, while 12% opt for the train. This group is primarily comprised of City and County of Denver (CCD) employees and often use alternative modes of transportation like the train and carpool, with a higher likelihood of having employer-provided parking and receiving a salary wage. Over half of them have an Eco-Pass and are more inclined to take transit if it were cheaper, although those who drive alone prioritize the convenience, reliability, and flexibility of their cars.

Based on the data for the defined cohort of employees arriving at work between 7 am and 3 pm, future initiatives should focus on:

- **Transit Subsidies:** Targeting subsidies and incentives specifically at employees making less than \$75,000, as 51% of those driving alone fall into this income bracket, could effectively increase transit use. This cohort also indicated a likelihood of using transit if it was cheaper.
- **Bike Infrastructure:** Expanding bike infrastructure and providing secure bike storage would be beneficial, given that some employees are open to alternative modes of commuting.
- **Promoting Carpool, Vanpool, and Rideshare Strategies:** Encouraging carpooling through initiatives such as preferential parking for carpoolers could be effective, especially since a significant portion of the cohort drives alone but could be open to alternatives.
- **Employer Involvement:** Employers, particularly the City and County of Denver (CCD), should play a role by offering incentives and flexible work arrangements, considering that the cohort is more likely to be CCD employees.
- **Last-Mile Infrastructure:** Focusing on pedestrian and bicycle infrastructure near transit hubs can facili-

# Market Identification

## Conclusions

tate seamless transfers from cars to alternative modes, promoting car-less multi-modal commuting.

A peak westbound commuter group, consisting of 238 employees, commutes from 4 am to 12 pm on Peña Boulevard, with 74% driving alone. They are more likely to be United and Frontier employees, have fewer commute options, and a preference for paying for parking. This cohort generally earns hourly wages, with some having lower incomes and others higher. They work less overtime, have fewer Eco-Passes, and would consider transit if it were more affordable. Their commute choices focus on stress reduction and safety, with drivers valuing speed and reliability.

Based on the data, here are data-backed strategies to boost transit, biking, and pedestrian modes while decreasing single-occupancy vehicle use on Peña Boulevard:

- **Employer Involvement:** Partner with employers like United and Frontier, who have a higher presence in the westbound cohort, to offer transit incentives or bike storage facilities.
- **Peak-Hour Transit Discounts:** As indicated in the data, the westbound cohort is responsive to discounted transit fares. Implement fare reductions during peak hours to make public transportation a more attractive option.
- **Carpool, Vanpool, and Rideshare Programs:** Given the low percentage of carpooling, initiate carpooling incentive programs. The data also reveals that among solo drivers, only 7% use alternative modes. Target this group with carpooling options.
- **Infrastructure Improvements:** Improve biking and walking infrastructure along Peña Boulevard, responding to the data that suggests these modes are underutilized. Create safe bike lanes, bike highways, pedestrian pathways, and crossings.
- **Eco-Pass Subsidies:** The data indicates that the westbound cohort is less likely to have Eco-Passes. Offer discounted or subsidized Eco-Passes, especially for high-frequency transit users.
- **Tailored Education Strategies:** Emphasize the reduced stress and increased safety for transit users and the speed and reliability for solo drivers in messaging.
- **Flexibility in Work Hours:** The data shows that westbound commuters are less likely to work overtime. Encourage employers to provide flexible working hours or remote work options to disperse peak commute times.

For commuters traveling during non-peak times, this cohort includes 1,090 survey respondents, with 76% driving alone. They are more likely to be United and Frontier Airlines employees, and their commuting patterns resemble the overall survey population. This group often relies on single-occupancy vehicles, earns hourly wages, works overtime, but lacks Eco-Passes. Their choice of commute is often influenced by necessity and work requirements.

The data on non-peak commuters can inform various policies and infrastructure enhancements:

- **Transit Incentives:** Tailored incentives for employees, particularly those from United and Frontier Airlines, can encourage the use of public transit. This includes subsidized passes and improved connec-

# Market Identification

## Conclusions

tions during off-peak hours.

- **Parking Management:** Efficient management of parking facilities, such as pricing strategies and/or incentives for these off-peak drivers, can reduce trip times on Peña Boulevard.
- **Flexible Work Hours:** To accommodate overtime, employers can explore flexible work hours.
- **Eco-Pass Promotion:** Promoting Eco-Passes can encourage transit use, especially among single-occupancy vehicle drivers.

The primary commute cohorts at the airport include those who drive alone (1,932 employees), primarily take the bus (142 employees), primarily take the train (294 employees), walk to the bus or train stop (157 employees), or pay for their own parking (151 employees). Drive-alone commuters have income levels similar to the survey population, and they prioritize speed and reliability. Bus commuters are generally lower income, choose the bus due to not having a car, cost, and it being the least stressful option. They often have employer-provided Eco Passes. Train commuters are slightly newer employees, have lower incomes, and choose the train for its affordability and not having a car. Those who walk to bus/train stops are more likely to be newer employees, have lower incomes, and favor this mode for its affordability and not having a car. Lastly, employees who pay for their own parking prioritize reliability and speed in their commute choices and have a slightly lower income than the overall survey population.

Understanding these differences between cohorts is crucial to identify data-driven interventions that reduce travel times and costs for airport employees commuting to Denver Airport, reduce congestion on Peña Boulevard, and increase the number of employees taking transit and/or walking and biking to their bus and train stations.

Future actions based on this market data could include:

- **Drive Alone Commuters:** Given that a significant portion of employees drive alone, investments in road infrastructure and traffic management may be essential to maintain efficient access to the airport. Programs focusing on carpooling, ride-sharing, or incentives for alternative modes may encourage some of these drivers to switch to more sustainable transportation options.
- **Bus Commuters:** Lower-income bus commuters prioritize low stress and affordability. This suggests the importance of maintaining and improving bus services to ensure convenience and comfort for these employees. Additionally, offering further discounts or subsidies for bus passes may incentivize more people to opt for this mode, especially considering a significant portion of the top employee home census tracts are within walksheds of bus stops.
- **Train Commuters:** Train commuters value affordability and are likely not to have a car. Investing in train station accessibility and reliable train services can enhance their commuting experience. Subsidizing train passes or providing shuttle services for the first and last miles can also attract more employees to choose trains.
- **Walking to Bus/Train Stop:** Pedestrian infrastructure is crucial for those who walk to transit stops. This may involve improving sidewalks, crosswalks, and ensuring well-lit and safe pathways. Enhanced

# Market Identification

## Conclusions

pedestrian access, especially in the areas with a higher representation of walking commuters, is essential for the success of this mode.

- **Employees Paying for Their Own Parking:** For this group, ensuring sufficient parking facilities and efficient traffic flow is important. However, to encourage a shift towards more sustainable commuting, incentives like discounted transit passes or carpooling programs could be implemented.

Overall, focusing on improving the infrastructure and programs that align with the preferences and needs of each cohort can help reduce single-occupancy vehicle usage, alleviate congestion, and promote more sustainable transportation options. Tailoring initiatives to match the specific characteristics of these cohorts will likely yield more successful results in promoting transit, pedestrian, and bicycle usage at the Denver Airport.

In the future, it would be useful to conduct a market identification survey with more specific location data than zip codes. If confidentiality is a concern, software such as Social Pinpoint can be used to gather more precise data that can be used to clip to census tracts in ArcGIS Pro. If software is not available, asking survey respondents what the nearest intersection to their home is would also be extremely useful while masking the identity of the respondent. Marketing could also be improved in the future to ensure a more representative population is surveyed, as it was mostly United Airlines and City and County of Denver employees who took the survey.

For future applications of this market data, it is important to recognize that there is a strong correlation between the top census tracts for airport employees and access to both bus and train transit lines even if most employees are driving alone to get to work today. Initiatives such as increasing the frequency of existing bus lines from every 1 hour to every 30 minutes, or even every 15 minutes during peak periods, could have a significant impact on reducing congestion on Peña Boulevard and increasing accessibility to the airport through different modes.

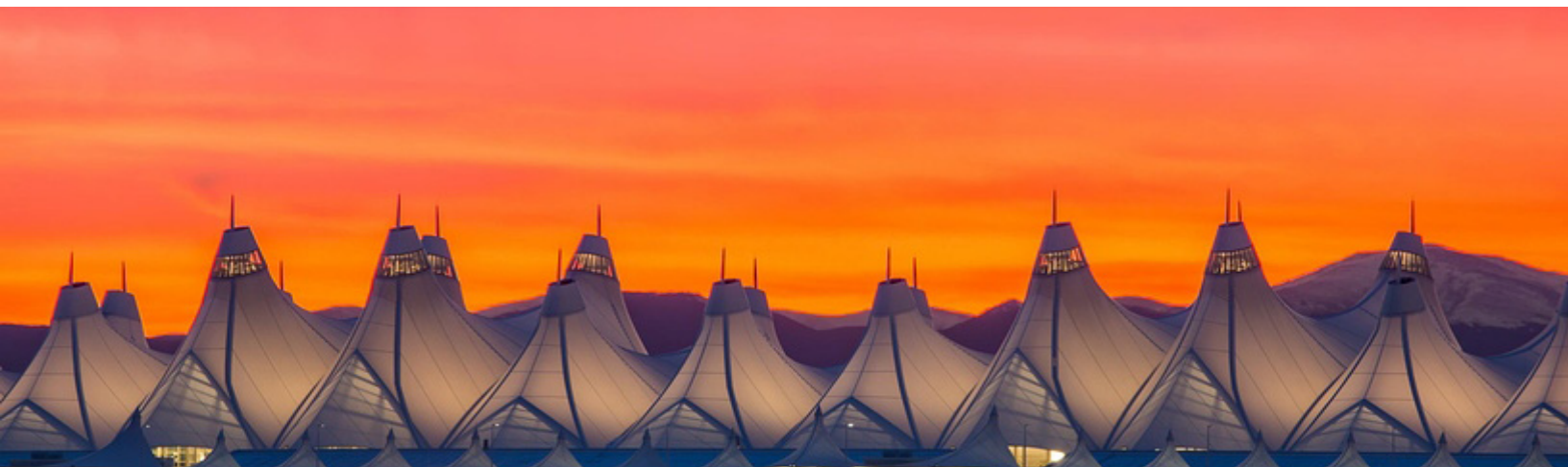
# Asset Creation

Both a review of best practices and analysis of the current market led us to make the recommendations detailed in this section. All recommendations, both programmatic and infrastructure, are related to the following categories identified in previous sections:

## Peak/Non-Peak Commuting Cohorts

- Peak Eastbound Commuter: Arriving at DEN between 7am-3pm
- Peak Westbound Commuter: Departing DEN between 4am-12pm
- Non-Peak Commuters: All other survey respondents

Based on the identified best practices and research into the target markets for improvements, our team has come up with 11 recommendations for the DEN team to consider. These improvements fall under 4 categories: Short Term Recommendations – Programmatic, Short Term Recommendations – Infrastructure and Technology, Long Term Recommendations – Programmatic, and Long Term Recommendations – Infrastructure and Technology.



# Asset Creation

## The Current Commute

Market studies are not just about data and numbers, but the people that the data represents and the real decisions that they face every day. To delve deeper into the potential motivations and challenges commuters to DEN may face, we crafted three personas. Each person represents one of the three commuter groups identified in the market study.

### PEAK EASTBOUND COMMUTER



**BELINDA**

### PEAK WESTBOUND COMMUTER

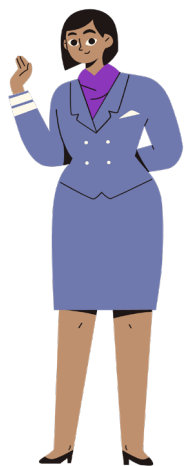


**ROB**

### NON- PEAK COMMUTER



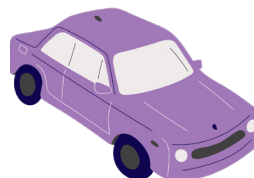
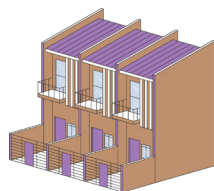
**THEO**



#### **Belinda – Peak Eastbound Commuter**

Peak Eastbound Commuters arrive at DEN between 7AM and 3PM.

Belinda is a flight attendant who lives in a townhouse she recently purchased in the Lowry Neighborhood in Denver. Due to her varying, and sometimes early, work schedule, Belinda drives to work to make sure that she can get there on time. The commute to the employee parking lot is almost entirely on Peña Blvd., and takes her about 30-45 minutes, depending on traffic.



**DEN**



# Asset Creation

## The Current Commute

While she currently drives to work alone in her vehicle, Belinda thinks about taking up carpooling. She loves the idea of being able to help other people get to work, and to have people listen to her great taste in music on the way. However, she is concerned about the following:

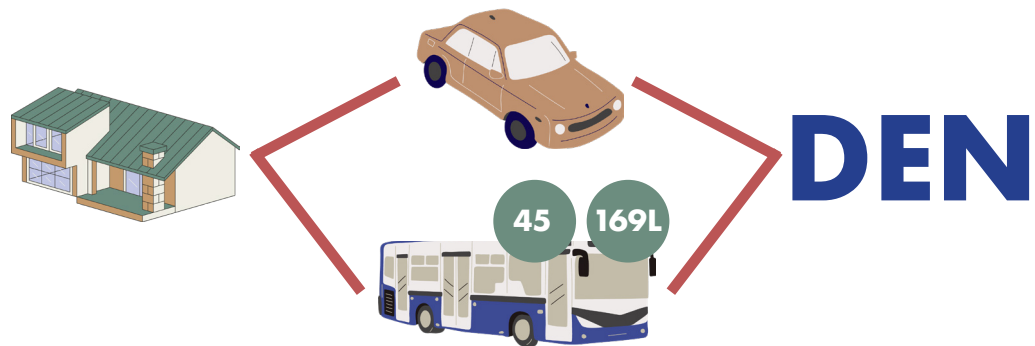
1. She does not know where to start. How would she find people to carpool with?
2. While she would get a priority parking spot, there are no other major incentives to organize the carpool. What if it adds time to her commute?
3. She wants to ensure there is some level of security with her carpooling, but is not sure how to verify if the people she would be carpooling with also work at DEN.



### Rob – Peak Westbound Commuter

Peak Westbound Commuters depart DEN between 4AM and 12PM.

Rob is in high school and lives in Green Valley Ranch with their parents. They are a barista at a coffee shop at the airport, where they work a morning shift every Saturday and Sunday. Their typical shift starts at 5AM and ends around noon. If they have time, Rob's parents might drive them 20 minutes to work, but mostly Rob will catch the 45 bus to the 169L, which takes about 30-40 minutes.



Rob wishes that they could have more freedom with their commute and would be excited to go to the museum or vintage shopping in downtown Denver after work with friends. While they can take the A-Line all the way downtown after work, Rob wishes they could take their bike with them so they could easily go anywhere downtown they wanted to after reaching Union Station. Rob is interested in biking to the 40th & Airport Boulevard A-Line Station that is near their house, but they have the following concerns:

1. Rob's bike is new and they are nervous about it being stolen. The current facilities to lock their bike up, either at the station or at the airport, are out in the open and not secure.

# Asset Creation

## The Current Commute

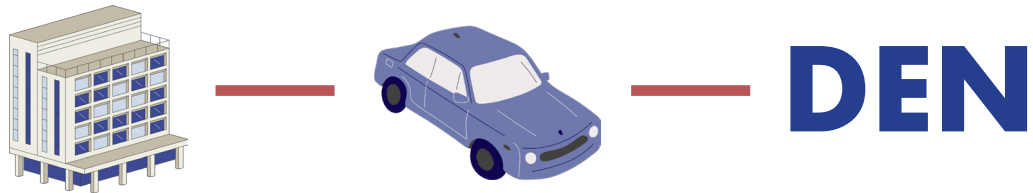
1. There is a protected bike lane near Rob's house, but it stops along Tower Road, and Rob is not sure what would be the way to get to the station on protected bike lanes or shared paths, which is their preference.



### Theo – Non-Peak Commuter

Non-peak commuters are those that do not fall into the above peak commuting groups. This type of commuter might arrive at DEN in the evening and depart in the early hours, before 4AM.

Theo is an airplane marshaller and lives along East Colfax in Aurora with his partner. They have one car that they share. His partner is a nurse at the Children's Hospital on the Anschutz Medical campus nearby and gets a ride with friends. Theo's 6PM to 2AM shifts, as well as having the farther commute, means he takes the car to work most nights. His commute to the employee lot takes him about a half hour.



Theo lives in census tract 78.01, which is more likely to have households with only own one vehicle and/or take the train or bus to work.

While he drives everyday now, Theo relies on his partner's car which is really old, and he wishes he could take transit to work. They dream about taking road trips once they save up enough money, but worry that with all this driving, the car is getting too much mileage on it. While Theo could take the A-Line to his work at the start of his shift, a lack of transit options in the early mornings means that he would be stranded at the end of his shift.

# Short Term Recommendations

## Programmatic

### 1

#### Non-Cash Incentives

Non-Cash incentives are benefits, rewards or other non-cash incentives used to encourage alternative transit methods. Some rewards include rewarding PTO, preferential shift bidding, and extended or extra break time. A related incentive program is the creation of “points” that are earned during alternative transit use, once enough points are earned, the employee can select a reward from a small library of options such as gift cards or physical items. As added value, these programs can also be teamed with recognition programs to incentivize teamwork or excellent service.

These incentive methods require a logging and accounting method such as an app and/or individual employees who verify and track hours. This allows for an automated system while reducing potential abuse.

#### In Practice: City of Austin’s Leave Time Travel Incentive (Kassirer, 2021)

This method has been implemented in the City of Austin where city employees can accrue additional PTO by using alternative transportation modes. Employees used the “RideAmigos” app to track each alternative transit trip. After 50 alternative trips, employees earned 4 extra PTO hours. This incentive led to a 12 percent drop in employees who drove alone.

At the tech company Twilio, employees earn a set number of points called “hoots” that can be spent on a library of items. Twilio uses this library to encourage teamwork and recognition by attaching a set number of points for each recognition. This method can be modified to encourage alternative transit in the same way.

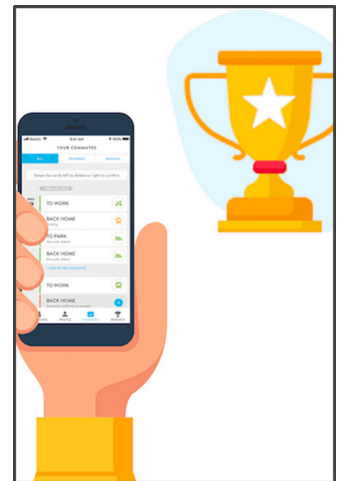


Image Source: RideAmigos

### ★

#### Recommendations for DEN:

For Denver International Airport to implement a non-cash incentive method, an app will need to be created or modified to track hours. In addition, an agreed upon ratio of trips to PTO hours needs to be established. If DEN wants to create a library of reward options, several companies exist specifically to help DEN implement a modified reward and recognition system that is client focused to DEN.

# Short Term Recommendations

## Programmatic

### 2

#### Onboarding

Sometimes employees simply need to know what options are available to them. Each employee, when they start their work at or with Denver International Airport (DEN), takes part in onboarding. This process creates a unified moment all employees can receive information about alternative transportation methods.

Information such as how to obtain and use a bus pass while also outlining all the methods that can be used to reach DEN, such as train, bus, carpooling, and bikes can be part of the onboarding. This method can be used in conjunction with other recommendations such as added PTO for alternative transit, explain how to log hours and find carpools.

In Practice: Dane County, Wisconsin (Dane County, 2020)

This method was used in Dane County, Wisconsin to inform their employees of such benefits. In addition, an employee transportation coordinator position was created to help inform employees of their options while also assisting with connecting employees to options that work for them. This position also assisted with creating supplemental materials and updating new transit methods.



Image Source: Boulder Transportation Connections

### ★

#### Recommendations for DEN:

For DEN to accomplish this method, onboarding materials that are specific to DEN's alternative transit methods will need to be created. Onboarding materials can even be specific to each employer, likelihood of working overtime, if the employee is provided an EcoPass, and more. In addition, an employee who can teach each item will need to be trained or hired.

# Short Term Recommendations

## Programmatic

### 3

#### Flexible Parking Passes

As new modes of travel are encouraged to DEN, employees may find that they require less days of parking at the airport. Currently, employers pay a full monthly pass, regardless of the employee's use of other modes of commuting. This means that employers could be overpaying for parking for employees that do not need it. A flexible parking pass can provide cost-saving solutions for employers who have employees that only need a few days a month or do not need a parking pass at all.

In Practice: An Assessment of the Expected Impacts of City-Level Parking Cash-Out and Commuter Benefits Ordinances (Abou-Zeid et al., 2023)

A study by the FHWA estimated that, with a cash-out model, the City of Philadelphia would see a 13% reduction in vehicle miles traveled (FHWA, 2023). This study also noted that flexible parking passes are likely to be revenue neutral, but that employers can save on payroll taxes when providing up to \$300 per person in employer-paid commuter benefits. When paired, commuter benefits and flexible parking models can help shift commuters away from single occupancy vehicles.

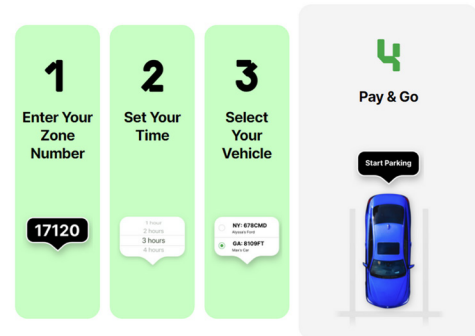


Image Source: Park Mobile

### ★

#### Recommendations for DEN:

Flexible parking pass models are just that; flexible. There are a variety of models of flexible parking passes that should be explored for implementation at DEN. Options for DEN could include:

- Pay-As-You-Go Permits: Employers can pay as their employees utilize the parking.
- Pre-Paid Permits in Combination with an EcoPass: Employees with an EcoPass choose a certain number of parking sessions or hours in advance, paid for by employers.
  - For example, an employee with an EcoPass primarily taking the train to work could elect to have four 24-hour parking sessions for the month.
- Monthly Parking Cash-Out: Employers that offer a free/subsidized parking provide employees the option to "cash-out" the parking value monthly.

# Short Term Recommendations

## Infrastructure and Technology

### 4

#### Secure Bicycle Parking

Bicycling is a clean, efficient method of transportation that can greatly supplement ridership by expanding transit sheds. Bicycles and transit can be a harmonious combination, but many commuters bringing their bicycles on trains can limit valuable space that could be used by other commuters. On most RTD buses, there is only room for two bicycles at a time. To ensure maximum efficiency and to increase the likelihood of bicycle use, proper infrastructure must be put in place. Secure bicycle parking is necessary to ensure bicyclists feel safe leaving their bicycles at transit centers.

In Practice: Bike-n-Ride Shelters (Boulder County, n.d.)

Many options are available for secure bicycle parking. Modular bike lockers can be installed at low cost, with different options for access, including key, RFID, or some combination of these locking options. Access can be paid for via subscription or on a per-use basis. These fees may be subsidized by employers to incentivize bike/transit use and discourage single occupancy vehicle commuting. For security purposes, there are bicycle lockers with transparent sides. Modular lockers can be paired with shelters, bicycle repair stations, and wayfinding. Ideally, secure bicycle parking will be as close to the transit platform as possible. But it can also be installed at park-and-ride facilities, or on transit property near platforms.



Another secure bike parking option is bike-and-ride shelters. These shelters are built in steel cages or with plexiglass walls for transparency, while also shielding parked bicycles from the elements. They can be accessed via RFID badge. Users must bring their own locks to secure their bicycles inside the shelter. These shelters may be monitored by security personnel and/or surveillance cameras to add an extra layer of security. These shelters can be paired with lighting and wayfinding to supplement



Image Source: Boulder County

## Short Term Recommendations

# Infrastructure and Technology

ridership and provide a resource for less seasoned users. Boulder County has 7 of their own bike-n-ride shelters as well as 2 shelters managed by Commuting Solutions. Boulder County utilizes access cards that allow users entrance into all 9 shelters in the county.



### Recommendations for DEN:

Install secure bicycle lockers and/or bike-and-ride shelters and specified transit locations. The project team has identified 9 locations that would be ideal for additional bike parking based on census data and survey data provided by DEN. Secure bicycle parking at these locations would expand transit sheds and give employees an additional option for non-SOV transportation to work. These locations include:

- Union Station
- 38th and Blake Station
- 40th and Airport Station
- 61st and Peña Station
- Colfax Station (R-Line)
- Aurora Metro Center Station
- Buckley Road and Mississippi Avenue
- 9 Mile Station
- Denver Airport Station

DEN could use non-cash incentives to encourage bicycle/transit use, or reach out to DEN employers to subsidize bicycle parking access as a supplement to transit passes. These options can be subscription based or pay-per-use.



# Short Term Recommendations

## Infrastructure and Technology

5

### Wayfinding

Wayfinding is a means for people to identify where to go when using public transportation and cycling as their commute option. Wayfinding provides clarity across transit networks and serves to inform travelers at every level of familiarity with the area. Wayfinding should be implemented at transit locations to supplement bicycle parking, and along bicycle and pedestrian routes to transit locations. Ideal wayfinding systems should include the following:

- Consistent signage across network
- Common sign style and color across network
- Predictable sign placement
- Prominent and easy to read signs
- Decision signs at junctions of routes with 1+ destinations
- Confirmation signs placed after a turning movement or intersection
- Turn signs to let travelers know when they must turn

Additionally, there are opportunities for private-public partnerships through art to improve user sense experiences.

In Practice: Transit Street Design Guide (National Association of City Transportation Officials, 2016)

The National Association of City Transportation Officials (NACTO) provides guidance for passenger information and wayfinding at and near transit stops. The benefits of good wayfinding are that it's easier for passengers to understand their travel options, it's easier to find bus stops and know when/where to transfer, passengers better understand key destinations, transit can better serve passengers with visual disabilities, it makes passengers more informed, the transit network may run quicker, and real-time arrival information reduces uncertainty for passengers. NACTO deems it critical for each stop to include the following elements:

- Use recognizable system logos or standard transit stop markers that are consistent with agency branding
- Place wayfinding in predictable and progressive locations
- Signage complies with accessibility requirements
- Provide alternatives to visual display boards such as audible announcements that can be heard over station/street noise or braille



Image Source: People for Bikes

## Short Term Recommendations

# Infrastructure and Technology

- Stop name or identifier
- Route identification
- Network and route map
- Schedule and route information
- Clear indication of stop location and position
- At intersections, ensure signs are visible from all street corners
- Real-time arrival displays with mobile app integration

In Washington D.C., there are stops with audible bus arrival announcements that can be activated by a push button. Some stops in Chicago have real-time arrival boards.

While some stops in the RTD network have elements of good wayfinding, many stops are lacking the infrastructure for good wayfinding.



Image Source: National Association of City Transportation Officials



### Recommendations for DEN:

Provide wayfinding signs and lighting at and around specified transit locations. Ideal locations for wayfinding are listed here and are the same as the specified locations for secure bicycle parking:

- Union Station
- 38th and Blake Station
- 40th and Airport Station
- 61st and Peña Station
- Colfax Station (R-Line)
- Aurora Metro Center Station
- Buckley Road and Mississippi Avenue
- 9 Mile Station
- Denver Airport Station

Wayfinding signs should provide information about nearby bikeways and transit centers and give distance and/or travel time estimates. Wayfinding signs should also include directions to nearby points of interest. By supplementing transit locations with wayfinding and lighting, the experience of travelers and commuters will be greatly enhanced. DEN should also investigate private-public partnerships through art to further enhance the user experience through aesthetics.

# Long Term Recommendations

## Programmatic

### 6

#### Casual Carpool

Casual carpooling entails spontaneous ridesharing without prior arrangements between drivers and passengers. The process is uncomplicated, with casual carpool participants usually gathering in a predetermined public space with ample parking, conveniently located near an HOV facility. This organic and dynamic ridesharing approach proves remarkably straightforward and efficient for commuting. It minimizes infrastructure requirements, taps into an untapped resource (vacant car seats), and involves minimal organizational oversight.

In the morning rush, passengers form a line while drivers arrive to pick them up, usually to comply with HOV lane eligibility criteria. The first person in line announces the destination of drivers until securing a ride. Carpoolers retain the right to decline any driver or rider. Riders have the option to wait for the next available car, while drivers can pick up the next passenger in line. Typically, there is a set of informal but well-followed rules:

- Only the driver should initiate a conversation. There is no pressure to socialize with others like there may be in a traditional carpool. Riders can remain anonymous if they wish.
- Riders should not consume food and drink.
- Drivers should not play loud music.
- Cars should have functioning seat belts, which everyone should use.
- Drivers should drive cautiously and avoid using their phones.

Casual carpooling extends to evening commute hours, but due to varying schedules, individuals generally do not share rides with the same driver in the morning and evening. Many participants opt to both drive and ride, with their individual schedules dictating when they choose to take on the role of the driver on any given day.

No specialized technology is needed, but casual carpoolers can leverage apps, online sites, message boards or Google Maps to arrange rides ahead of time if they prefer. Most casual carpoolers find out through word-of-mouth from friends, neighbors, or co-workers. They can also find out through new employee orientation at work.

Casual carpooling is most prominent among regular commuters and young professionals. Participation is chiefly driven by the convenience, time efficiency, and financial advantages resulting from waived express or toll lane fees due to HOV requirements, along with the avoidance of parking fees. Monetary transactions are absent, and carpoolers usually make no enduring commitments. Environmental benefits serve as an incidental positive outcome. Enrollees enjoy a non-stop journey to their destination, sidestepping the multiple stops associated with transit. Nonetheless, transit

# Long Term Recommendations

## Programmatic

and ridesharing function harmoniously as transportation modes, with carpoolers often considering transit as a supplementary option. Transit providers might perceive casual carpoolers as occasional customers rather than direct competitors.



In Practice: In Washington, D.C.'s Secret Carpool Cabal, It's a Daily Slug Fest (Scherr, 2023)

There seems to be a crucial “tipping point” that renders dynamic ridesharing appealing to commuters. Achieving this tipping point proves challenging in typical circumstances, as evidenced by its existence in only three U.S. cities: Houston, San Francisco, and Washington, DC. Certain factors enhance the likelihood of successful casual carpooling in these locations:



Image Source: Car and Driver

- One notable commonality in these three locations is the requirement for three or more occupants in HOV lanes, differing from many U.S. lanes allowing two or more occupants. This heightened occupancy standard significantly contributes to the formation of casual carpools.
- A vehicle with three occupants is perceived as safer than one with two, underscoring why casual carpooling thrives on HOV3+ lanes. Fellow carpoolers identify unsafe drivers, disseminating this information through word-of-mouth within the community.
- Availability of large park-and-ride lots, easily accessible to HOV lanes, is an ideal scenario.
- Proximity to transit serves as a backup option for those unable to secure a carpool match.
- Substantial travel demand at both trip origin and destination is essential for successful casual carpooling.
- The allure of participation is heightened when parking at the destination is expensive or limited.
- Participants benefit from sharing similar work situations and schedules, fostering trust. For instance, in Washington, federal workers' identification badges contribute to increased trust, a factor that could similarly apply to DEN employees.

# Long Term Recommendations

## Programmatic

While active promotion of casual carpooling by employers might be restrained by potential liability concerns, a more passive endorsement could involve strategically locating and coordinating park-and-ride HOV facilities conducive to this mode of transportation. Public agencies in participating cities are dedicated to maintaining participant control over casual carpooling, recognizing the necessity of supporting infrastructure like staging areas and signage. Their role is informational, not directly providing transportation services. Given the voluntary nature of participation and driver selection, organizations seemingly do not assume explicit duties toward participants. If an employer merely encourages, without mandating, employees to adopt alternative transportation modes, such as carpooling, it is likely that the employer can be shielded from liability concerns.



Image Source: Yelp



### Recommendations for DEN:

Identifying potential pilot sites involves selecting areas with a concentrated presence of employees from Denver International Airport (DEN), such as Green Valley Ranch and Reunion. These locations boast close proximity to transit services, E-470, and Peña Boulevard. To facilitate coordination, designated points can be established at park-and-ride lots or transit stops. Additionally, for weekday carpooling, lightly utilized lots during Monday through Friday, such as those near churches, can be suitable. On weekends, school lots can be effectively utilized for coordinating carpooling activities.

# Long Term Recommendations

## Programmatic

### 7

#### Circulators and Microtransit

This section explores circulators and microtransit. Both forms of transit are often utilized in lower-density areas with suburban development patterns that are currently typical in areas near the airport. Circulators are a short-distance, circular, fixed-route transit mode that takes riders around a specific area with major destinations. Such a service may include streetcars, rubber-tire trolleys, or electric buses.<sup>1</sup> A neighborhood circulator typically provides service to low-density suburban communities. It connects popular local destinations (schools, grocery stores, and shopping centers) and rail transit. Microtransit consists of IT-enabled multi-passenger transportation services that serve passengers using dynamically generated routes and may expect passengers to make their way to and from common pick-up or drop-off points. Vehicles can range from large SUVs to vans to shuttle buses. Because they provide transit-like service but on a smaller, more flexible scale, these new services have been referred to as microtransit. These services can be operated by a transit agency or local government (e.g. Montbello Connector) or by a private company (e.g. Via). [TCRP Research Report 188]

For many cities, investing millions of dollars to build a conventional rail or bus network may not seem feasible, and the results may be too far off to meet their immediate needs. Capital-light and quick-to-launch services, like on-demand microtransit, can be an appealing alternative. That said, these options do require a public investment. Circulators generally require a \$30-40 subsidy per trip while microtransit can range from \$15-43 subsidy per trip. For context, RTD urban buses are subsidized at approximately \$5 per trip, suburban buses at approximately \$7 per trip, and rail at approximately \$8 per trip.

In Practice: Denver Connector Microtransit Program (City and County of Denver, n.d.), Welcome to the Aurora Highlands TDM page (Aurora Highlands — NETC Transportation, n.d.)

Currently the City and County of Denver operates two microtransit services. One covers the Globeville, Elyria-Swansea neighborhoods with connections to two A-line stations (38th & Blake, and 40th & Colorado). The other service covers Montbello and Green Valley Ranch, with a connection to the Peoria A-line station.



Image Source: City and County of Denver



## Long Term Recommendations

# Programmatic

An additional example of microtransit service is The Aero. The Aero is a free, on-demand shuttle, providing service between Aurora Highlands and the 40th and Gateway Station area. Users can request on-demand or scheduled rides through their rider app. This is a grant-funded service provided by the Northeast TMA and operated by VIA. RTD is contributing funds from a special subregional program. The hope is that the service will be self-sustaining in 3-4 years.

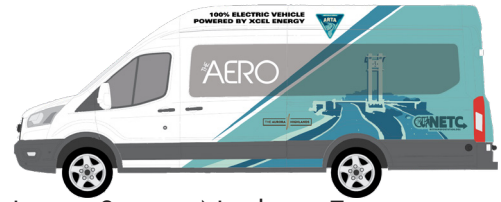


Image Source: Northeast Transportation Connections



### Recommendations for DEN:

We recommend that DEN help facilitate and encourage the implementation of more microtransit or circulator services to build upon the existing ones. The area bounded by Alameda, Illif, Havana, and Tower Road could be an area worth targeting for a circulator or microtransit service. The eastern portion of this geography includes a concentrated area of DEN employees, and the western section includes two of the top census tracts with concentrations of DEN employees (801 and 77.04). Furthermore, RTD's R-line runs through the middle of this area with several stations and connects to the A-line at Peoria Station. There are also connections to the 169L and AT/ATA buses providing direct service to DEN.

## Long Term Recommendations

### Programmatic

## 8

## Windows of Opportunity with the New ConRAC Facility

In October of 2023, Denver International Airport (DEN) announced the location for a consolidated rental car facility (ConRAC). The ConRAC will house the major rental car businesses and facilities that operate out of the airport and serve the region. DEN aims to have the ConRAC provide over 16,000 parking spaces for rental businesses. Additionally, new rail-based mass transportation services will be created to directly serve the airport and the ConRAC, eliminating the need for rental company specific shuttles to and from the terminal.

The location of the ConRAC has been determined to be the current airside employee parking lot located along 78th Avenue, north of Peña Blvd and east of Jackson Gap. The air-side parking lot serves as a vehicle parking and security gate space for those employees that work directly with airlines, such as ground crews, pilots, and flight attendants. By using this location for the development of the ConRAC, air-side employee travel patterns and behaviors will be disrupted by acquisition and construction, creating a window of opportunity for DEN to encourage employees to consider alternate modes of transportation to work at the airport.

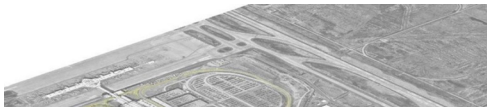


Image Source: Denver International Airport



In Practice: Changes in Transport Behavior During the COVID-19 Crisis (Sung & Monschauer, 2020)

An event perceived as a crisis can present windows of opportunity to change mobility patterns. Supporting policies are needed to promote sustainable behaviors and avoid negative consequences. Some major examples of crises that changed transportation behaviors include Covid-19, SARS in 2003, and the London bombing terrorist attack in 2005 where multiple bombs exploded in 3 underground trains and 1 bus, killing 56 and injuring 700.



# Long Term Recommendations

## Programmatic

While the building of the new ConRAC facility may not be a crisis to the same scale as a pandemic or a terrorist attack, it will significantly disrupt the driving patterns of employees getting to work at the airport.



### Recommendations for DEN:

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In order to take full advantage of the window of opportunity presented by the implementation of the ConRAC, DEN should work to complete an investigation and study on how airside employees will be impacted by a disruption in travel patterns, and how that impact intersects with the logistics of needing security protocols for airside employees.

Because of the opportunity that the ConRAC provides in changing travel patterns and habits for employees, DEN should increase education and outreach to these affected employees about the different options of transportation that exist in getting to the airport; for example, increased promotion of RTD services and lower fares in 2024 that employees can use.

Based off other recommendations found in this report, DEN could also use some of the other recommendations and direct them to airside employees to encourage use of alternate modes of transportation.

# Long Term Recommendations

## Infrastructure and Technology

### 9

#### First Mile/Last Mile Gap Analysis

'First Mile, Last Mile' (FMLM) is a concept used to refer to the additional trips that a person must make when utilizing public transit. For example, a DEN employee taking the A-Line to work must first reach the station from their home, and vice-versa on the return. If the station is within a 'comfortable distance', or the distance a user is comfortable and willing to cover to reach a station, a commuter could be more inclined to choose an alternative mode of transit to single occupancy vehicle (Nafakh, 2018).

There are a variety of strategies to address FMLM issues in a commute, such as improving walking and bicycling routes with better infrastructure and wayfinding or providing circulators or shuttles to people in certain neighborhoods around a station. However, before understanding what strategies can be implemented, it is critical to identify priority areas and perform a gaps analysis around bus and rail transit stops.

#### In Practice: Walk & Roll Palm Desert (Engage Palm Desert, n.d.)

A gaps analysis Palm Desert, CA aimed to identify the gaps in their walking and bicycling network. It is important that study areas for both pedestrians and bicycles to be identified. Each study area should be paired with an implementation plan for eliminating the gaps identified. The pedestrian area is likely to be much smaller than the bicycle study area, particularly with the ability of e-bikes to allow for much further travel. An area of about a half-mile for pedestrians and 2-3 miles for bicycles is recommended (Dill and Rose, 2012).

In their gaps analysis, they identified the following:

- Physical Gaps: i.e., missing sidewalks, sudden stops in a bike lane.
- Level of Traffic Street (LTS) or Another **Comparable Comfortability Measure Gaps.**
- Safety Gaps: Presence of high collision segments or large intersections.

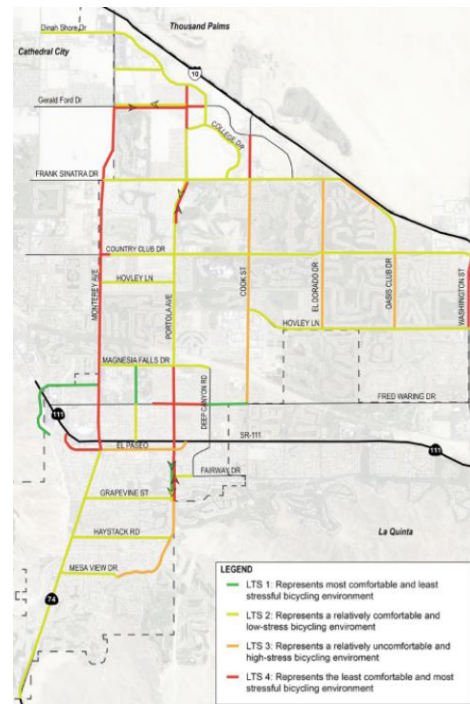


Image Source: Engage Palm Desert

# Long Term Recommendations

## Infrastructure and Technology

- Wayfinding Gaps: Lack of signage guiding bicyclists and pedestrians to the station/stop from various points in the study area.

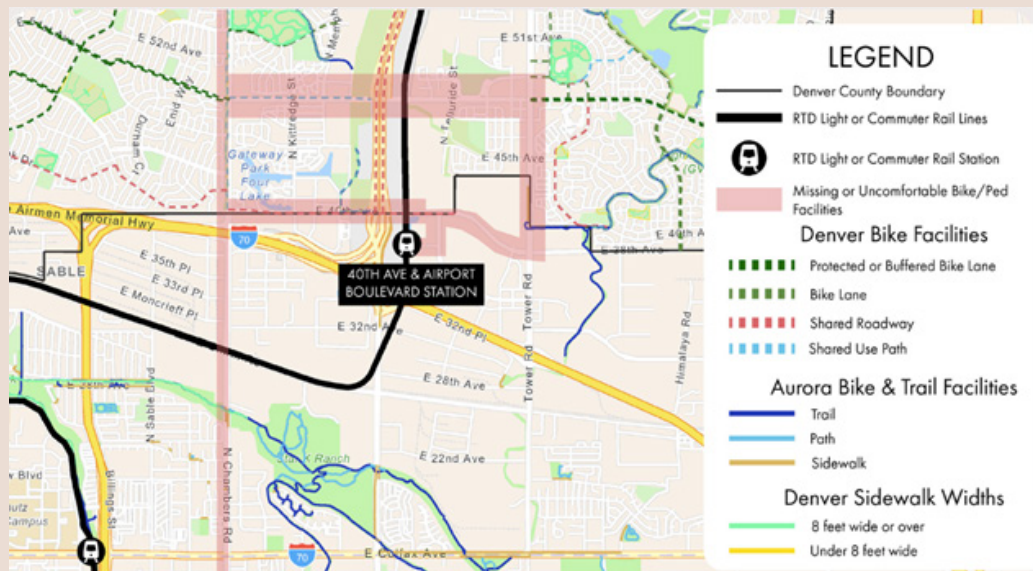
As a direct result of the gaps analysis study, their city council approved the Walk and Roll Palm Desert Implementation Plan in 2023. The implementation plan includes the addition of over 28 miles of sidewalks and bikeways to the city.



### Recommendations for DEN:

The Market Identification study analyzed and identified several census tracts for DEN's consideration for future transit efforts. These areas are likely the best place to start for a gaps analysis intended to influence mode shifts.

Below is an example of a gap analysis at the 40th Avenue and Airport Boulevard A-Line Station that could work for DEN. This analysis considers the presence of bicycle facilities and sidewalks, but should be expanded to other social and infrastructure considerations, as recommended above.



Example Gaps Analysis at the 40th and Airport A-Line Station

The DEN team will need to conduct additional gaps analyses to better understand where to make first mile/last mile improvements. In areas identified as gaps, pedestrian and bicycle infrastructure will need to be improved.

# Long Term Recommendations

## Infrastructure and Technology

10

### HOV Lanes

High-occupancy vehicle (HOV) lanes have been a prominent policy instrument since the 1970s to alleviate traffic congestion by providing dedicated traffic lanes for multi-occupant vehicles. Despite their widespread adoption, the effectiveness of HOV lanes remains a subject of controversy among researchers, policymakers, and the public.

Many HOV lanes in the United States have encountered congestion, prompting considerations for raising occupancy requirements. However, this approach may face objections. Addressing the challenge of persuading casual carpool drivers to accommodate more passengers than required for HOV lane access or toll discounts is crucial. Strategies such as financial incentives or personalized encouragement could play a pivotal role in optimizing HOV lane usage.

HOV lanes stand out for their ability to carry more people than unrestricted lanes, making them not only highly efficient but also beneficial for transportation-related air quality mitigation. The positive correlation between HOV lanes and air quality improvement underscores the significance of this transportation strategy in addressing environmental concerns.

HOV lanes have stimulated the emergence of new forms of casual carpools. This phenomenon involves spontaneous carpooling among individuals who may not be acquainted. By bringing new users to carpooling platforms, HOV lanes play a crucial role in mitigating limited adoption problem in the marketplace. Early challenges, where new drivers create offers but struggle to find compatible riders, are gradually overcome as HOV lanes attract both new drivers and riders, fostering successful carpooling matches.



In Practice: The Impact of High-Occupancy Vehicle Lanes on Carpooling (Cohen et al., 2022)

While challenges exist, studies indicate a positive impact of HOV lanes on carpooling intent. The introduction of 3 HOV lanes in 2019 in Israel has demonstrated this positive impact. The introduction of these HOV lanes lead to an increase in the number of carpool offers sent by drivers through Waze. Carpooling increased on 2 out of the 3 new HOV lanes that were introduced. Moreover, the design of HOV lanes, such as



# Long Term Recommendations

## Infrastructure and Technology

round-trip HOV options, appears to have a beneficial impact on carpooling adoption.

Colorado already has multiple HOV/express lanes across the state, including some in the Denver metro such as on I-25 and U.S. 36. To use the lanes as a carpooler, drivers are supposed to have a Switchable HOV Transponder device and at least 3 individuals in the car to use the Colorado Express Lanes. When a driver has 3 or more total people in their car, including themselves, they can slide the tab on the transponder to the red "HOV" mode and use specified Colorado Express Lanes for free. Drivers are only supposed to enter and exit Colorado Express Lanes through dashed lines only, as weaving in and out of these lanes over a double white line results in a fine.

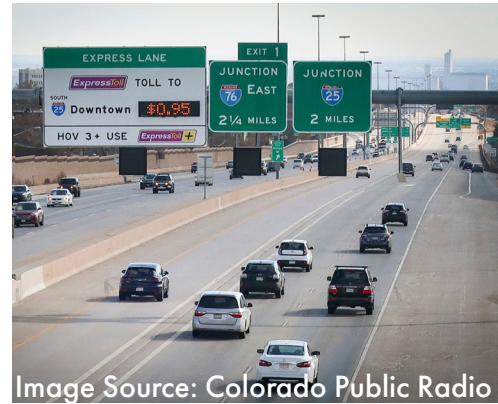


Image Source: Colorado Public Radio



### Recommendations for DEN:

As the Peña Boulevard redevelopment project moves forward, an HOV-3 lane would serve a pivotal role in shaping casual carpooling dynamics, addressing the limited adoption problem in carpooling platforms, and influencing carpooling intent. However, consideration of design elements and potential unintended consequences such as liability and safety remain crucial to maximize the positive effects of HOV lanes on transportation efficiency and sustainability. If there is an expansion to the number of lanes on Peña Boulevard, it is recommended that these lanes are for HOV travel with three or more passengers only.



# Long Term Recommendations

## Infrastructure and Technology

11

### Additional/Expanded Transit

Transit is the most efficient, safe, and equitable way to move many people to a single location, making it critical to meeting Denver Airport's projected demand growth. Currently, only 12% of surveyed DEN employees ride the train and 5% commute by bus.

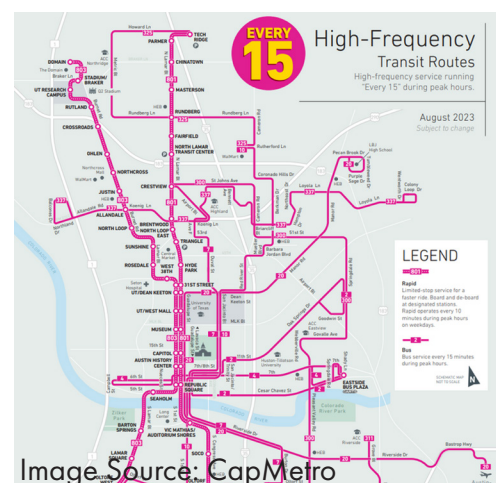
According to the survey of DEN employees, bus commuters tend to be lower-income and prioritize low stress and affordability. This suggests the importance of maintaining and improving bus services to ensure convenience and comfort for these employees. Additionally, offering further discounts or subsidies for bus passes may incentivize more people to opt for bus travel, especially considering a significant portion of the top employee home census tracts are within walksheds of existing bus stops.

Train commuters value affordability and low stress according to the survey of DEN employees. Investing in train station accessibility, parking facilities, and reliable train services can enhance their commuting experience. Subsidizing train passes or providing shuttle services for the first and last miles can also attract more employees to choose trains.

In Practice: Modeling airport employees commuting mode choice (Tsamboulas et al., 2012), Will Ground Access Woes and Federal Revenue Restrictions Choke U.S. Airports? (Foley et al., 2016)

Our primary goal is to increase transit frequency to the airport. Competitive travel times can attract a significant share of employees to use transit rather than SOVs. For example, CapMetro in Austin, TX implemented a high-frequency route network in 2015 with 15-minute headways. They saw ridership increase up to 37% in the first year.

Additionally, the FAA has permitted airports in San Francisco, the Twin Cities, Portland, and New York to use funds towards transit infrastructure. A legal expert, after examining each case, argued that the federal restrictions in place are overly stringent and recommended their relaxation. According to the FAA, airport revenue may be utilized for an airport's share in a ground access



# Long Term Recommendations

## Infrastructure and Technology

project if it either constitutes an integral component of an airport capital project or is directly and substantially related to the air transportation of passengers or property, under the ownership or operation of the sponsor. (The Airport Compliance Manual, 2009)



### Recommendations for DEN:

Our team recommends a few different strategies for providing additional/expanded transit service to help employees get to DEN. These include the following, with further explanations below:

- Increase frequency and span of bus service to airport.
- Increase frequency and span of A and R Line trains.
- Add new service to SE Aurora / E-470 express.
- Explore using FAA funds for A-line improvements and other transit investments.
- Pursue better connections from bus to rail, especially bus routes 169 and 45.
- Add an AT/ATA stop at Colfax & I-225 to capture 15/15L and future Colfax BRT riders.
- Adopt formal transit mode share goals informed by GHG targets.

There are several buses that provide direct service to the airport, but none of them provide frequent service. While it would be ideal to increase frequency across all bus lines serving the airport, capital and labor constraints make that difficult. Judging from the data around employee origins, it appears Route 169/169L would be worth focusing attention on. The 169 provides service from Arapahoe Station to the 40th and Airport Blvd Station - at which point passengers can transfer to the A-line. The 169L provides express service from the Smokey Hill and Pleasant Run bus stop in southwest Aurora to DEN. However, service span and frequency are very limited. The 169L arrives at DEN every hour (4:44AM-7:44AM) and at 12:54PM. It departs DEN every hour (1:40PM-3:40PM) and at 5:10PM and 10:10PM. We recommend that DEN work with RTD and other stakeholders to increase bus service, starting with the 169/169L routes. A full list of bus routes that go to DEN and their frequencies can be found in Appendix A, with most of the information courtesy of Greater Denver Transit.

For transit to be a viable option for DEN employees, many will need to transfer at a rail station. However, there are some tight transfers on key routes that present challenges. For example, Route 45 serving Montbello and Green Valley Ranch runs every 30 minutes. The eastbound 45 arrives at the 40th & Airport Blvd Station at 21 and 51 minutes after the hour in the afternoon and 24 and 54 minutes after the hour in the evening. Meanwhile, the eastbound A-line arrives at the station at 22 and 52 minutes after the hour. Another example of a tight transfer is Route 169 which arrives at

## Long Term Recommendations

# Infrastructure and Technology

the 40th & Airport Blvd Station 38 minutes after the hour. The A-line arrives at 40th & Airport Blvd Station at 37 minutes after the hour making for a tight transfer, especially if the bus is running late. The R-line connection to the A-line at Peoria Station presents another tight transfer with the R-line arriving at 29 and 59 minutes after the hour and the eastbound A-line arriving at 1 and 31 minutes after the hour. We recommend that DEN work with RTD and other stakeholders to adjust transit service times to make transfers easier for employees to get to and from DEN.

Adding a stop at Colfax Ave and I-225 to the AT/ATA Express bus serving the Denver Tech Center could increase options for transit riders. This route already has limited stops, so adding one more stop should not significantly impact service. Additionally, the bus sometimes stops at this exit to utilize a nearby bus shop. This stop would capture riders from the popular 15/15L Routes and Colfax BRT riders when that route is operational. We recommend that DEN work with RTD and other stakeholders to increase the number of employees that could take transit to DEN.

The airport is served directly by the A-line commuter train and indirectly by the R-line light rail. Both services run at less-than-ideal frequencies and spans. Currently, the A-line (Union Station to DEN) arrives at DEN every 15 minutes during peak (4:52AM-7:07PM) and every 30 minutes off-peak, with a span from 3:37 AM–1:07 AM (21.5 hours); it runs an extra 30 minutes on Fridays and Saturdays. The A-line departs DEN every 15 minutes during peak (5:12 AM–7:27 PM) and every 30 minutes off-peak, with a span from 4:12AM-1:27AM (21.5 hours); it runs an extra 30 minutes on Fridays and Saturdays. The R-Line (Lincoln Station to Peoria Station) arrives at Peoria Station every 30 minutes from 3:51 AM–11:05 PM, with a span of 19 hours. From Peoria Station, the A-line takes 21 minutes to arrive at DEN. We recommend that DEN work with RTD and other stakeholders to improve the frequency and span of both the A-line and R-line to improve service to DEN. Relatedly, we recommend that DEN encourage RTD, the City of Aurora, and other stakeholders to address bottlenecks along the R-line through Aurora, particularly near Town Center at Aurora.

DEN has ascertained that up to 73% of the funding for the proposed expansion of Peña Boulevard, stretching from Interstate 70 to E-470, could be covered by the Federal Aviation Administration (FAA). (DRCOG, 2022) However, DEN has not yet pursued discussions with the FAA regarding the allocation of funds towards enhancements of the A-line in this specific segment. (Minor, 2023) In the past, DEN has allocated airport revenues for certain A-line infrastructure developments. This practice aligns with trends observed in other American cities, where airports have utilized their financial resources to support specific transit improvements. Notably, DEN has previously financed portions of A-line infrastructure, including the construction of the 61st and Peña Station as well as the Airport Station. In 2010, the FAA endorsed

## Long Term Recommendations

# Infrastructure and Technology

a comprehensive legal agreement between the City of Denver and RTD. The FAA's stance also implied that the airport could generally be expected to fund enhancements to the airport terminal and the construction of the airport rail station. Implementing such a strategy would require meticulous compliance with intricate federal laws and policies. It would necessitate collaboration between DEN and RTD to formulate an improvement plan, subsequently seeking FAA's endorsement. An example of a project that could benefit from FAA funds is the enhancement of a 3.6-mile segment lacking double track between the 61st / Peña Station on the A-line. This upgrade would facilitate a 10-minute frequency on the A-line. (Greater Denver Transit, 2023)

There is currently a gap in service southeast of the airport along the E-470 Express corridor. Providing service to this rapidly developing area could benefit both DEN employees and passengers. We recommend that DEN work with RTD and other stakeholders to study possible transit solutions for that area.

Lastly, we recommend that DEN adopt transit mode share goals that are informed by greenhouse gas emission reduction targets. DEN has stated its commitment to supporting the City and County of Denver's target to reduce GHG emissions 65% by 2030 and a 2040 net zero emissions goal. There is precedent for these GHG emission reductions since several airports including ORD, DFW, JFK, SFO, and SEA have a 20% target for transit mode share by 2030.

# Asset Creation

## The New Commute

The recommendations in this report will require major time and financial investments as well as concurrent implementation to properly address employee commuting concerns and to shift travel modes away from single occupancy vehicles. When phased and marketed thoughtfully, these interventions can make a real difference in the commuting decisions of DEN employees.

To illustrate how these recommendations can make a real difference in someone's commute decisions, let's revisit our three commuters; Belinda the flight attendant, Rob the barista, and Theo the airplane marshaller. Included is an explanation of their new commute and the recommendations from this report that influenced them to change their commuting patterns.

### PEAK EASTBOUND COMMUTER



**BELINDA**

### PEAK WESTBOUND COMMUTER



**ROB**

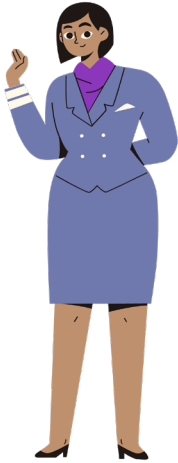
### NON- PEAK COMMUTER



**THEO**

# Asset Creation

## The New Commute



### Belinda – Peak Eastbound Commuter

Peak Eastbound Commuters arrive at DEN between 7AM and 3PM.

Belinda was notified by her employer that alongside the newly finished 3+ HOV lane expansion of Peña Boulevard, DEN had created an app a few months back that tracks and rewards employees with points when they commute using in a mode other than in a car by themselves. There is also a competition for the Top 10 Eco-Commute Companies, based on how many employees of that company choose non-SOV commutes. Belinda's work has chosen to opt-in to this program and announced that they will reward employees with PTO based on how many points they earn. The DEN app also features information to help employees figure out a new mode of travel. For instance, on the carpooling page, the app gives locations where casual carpooling will be facilitated by DEN in the coming months, as well as a feature that connects you directly with other DEN employees in your area. Both options require that users present their DEN badge before getting in the car.

Belinda is excited to try carpooling and is encouraged to coordinate it now that she knows she will have a faster commute and will earn extra PTO. Additionally, Belinda is competitive and is excited to make her company the #1 eco-commuters. Due to her variable schedule, she decides to try casual carpooling. DEN has identified a parking lot at 6th Ave and Potomac Ave, right before she would get on I-225 on her normal commute, as a casual carpool spot. Belinda arrives at the casual carpool lot and calls out that she needs at least 2 people. Two people, who show her their DEN badges, hop into the car, and they all listen to Belinda's great playlists in the HOV lane, arriving a little early for work.



Recommendations that would help Belinda and those who carpool with her:

- HOV Lane
- Casual Carpooling
- Windows of Opportunity
- Flexible Parking Passes
- Non-Cash Incentives

# Asset Creation

## The New Commute

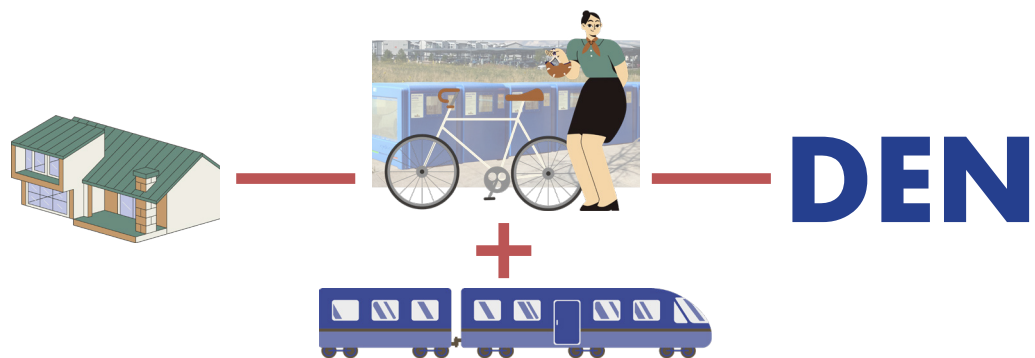


### Rob – Peak Westbound Commuter

Peak Westbound Commuters depart DEN between 4AM and 12PM.

All recipients of the DEN EcoPass got a notification that there would be a new project to improve and secure the bicycle facilities at the airport and at key transit points. It also said that based on an analysis of difficulties in getting to transit stops, a few road segments had been identified for bicycling and signage improvements. The project schedule in the announcement told Rob that while bike path improvements from their neighborhood to the A-Line station would take about 6 months, there would be new bicycle lockers at the 40th and Airport Blvd. station at the end of the month. They also let employees know that there is an app where they can log their non-SOV commutes and earn points to redeem for gift cards; the app also includes a bike route feature.

Rob decided that the new bike lockers were enough to encourage them to map out a route that they would be comfortable with. They used the DEN employee commute app to find a route that would get them safely to the station. Now, Rob rides their bike along this route and pays a few dollars to lock up their bike at the station. Rob then catches the A-Line to get to DEN. If they know they are going to go somewhere downtown after work, they will take their bike with them on the train, and lock it up at the new, secure facility at DEN. Rob feels comfortable leaving their bike in the new facilities at DEN because they require an employee badge and are in a well-lit area. When they leave work, they grab their bike and can go downtown and do any activities they like. Additionally, with the points they earn from the app, Rob is working towards a gift card to the Denver Botanic Gardens so they can get a pass and visit.



Recommendations that would help Rob:

- Secure Bicycle Parking
- Gaps Analysis
- Wayfinding
- Non-Cash Incentives



# Asset Creation

## The New Commute

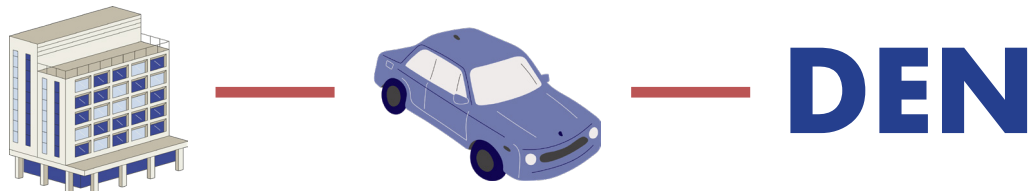


### Theo – Non-Peak Commuter

Non-peak commuters are those that do not fall into the above peak commuting groups. This type of commuter might arrive at DEN in the evening and depart in the early hours, before 4AM.

Theo's work has taken advantage of a flexible parking pass program with DEN and offers all employees the option to elect to have an EcoPass and flexible parking pass instead of a monthly parking pass. Theo's employer has also opted to reward employees that use transit to get to work with additional PTO that is tracked through a new DEN employee commute app. After downloading the new DEN employee commute app, Theo is notified that the AT/ATA line is adding a stop near his house and extending their service hours.

Theo lets his employer know that he would prefer to have the EcoPass with a flex parking option now that there is a way for him to take transit home from work. He likes that he could have parking a few days a month in case he ever needs to drive. However, Theo is excited to mostly utilize the AT/ATA line and other forms of transit to get to work and back. He additionally can take advantage of the DEN app to earn PTO for his commute, all while lessening the wear and tear on his partner's car. While on his commute, Theo now spends his time researching the best road trips that he can take with his partner, using his extra PTO.



Interventions that help Theo:

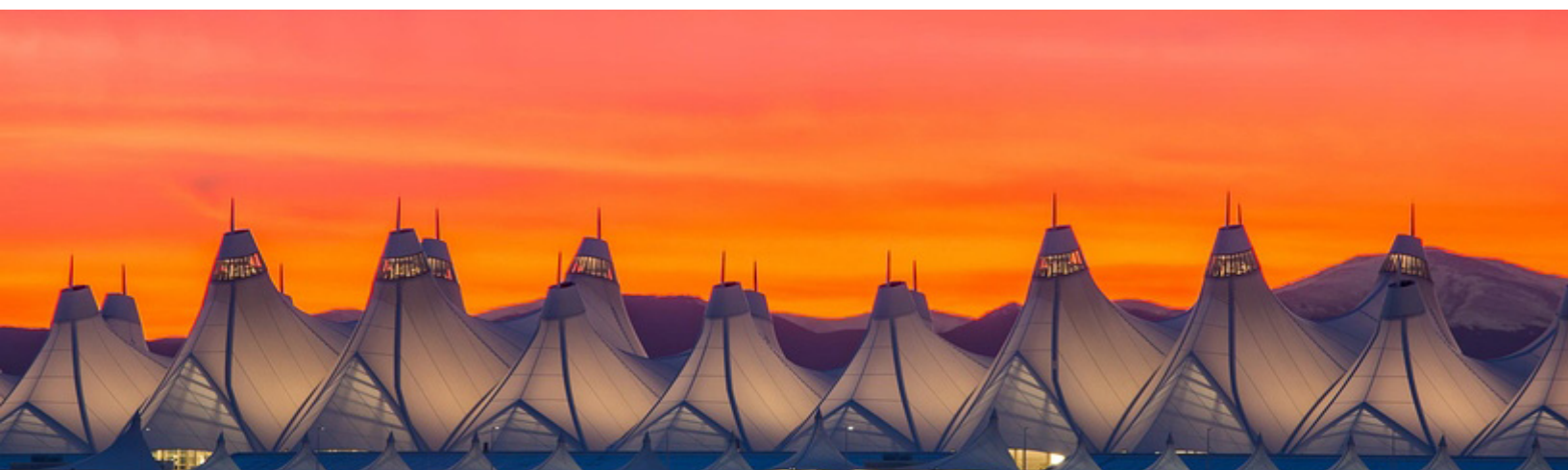
- Flexible Parking
- EcoPass Subsidies
- Additional or Adjusted Transit
- Non-Cash Incentives

# Conclusion

While it is important to understand best practices that peer airports have successfully implemented to reduce employee SOV trips, and to identify cohorts/markets for specific programs and interventions, it is equally important not to lose individual people in the analysis. Expanding opportunities for DEN employees to more freely choose how they get to work has direct, meaningful impact on their lives, as can be seen by the potential new commute of Belinda, Rob, and Theo.

Specifically, we recommend that DEN and other stakeholders explore adopting non-cash incentives, improving onboarding education about transportation options, flexible parking passes, secure bicycle parking, wayfinding signs, casual carpool programs, circulators and microtransit, taking advantage of windows of opportunity such as the new ConRAC facility, implementing a first mile / last mile gaps analysis, creating HOV lanes on Peña Boulevard, and expanding additional transit options for bus and train commuters. Meaningful implementation can be achieved through additional research into DEN employees' commuting wants relative to where they live.

A combination of these interventions has transformative potential to enhance the lives of DEN employees. We strongly recommend DEN, RTD, DRCOG, and other partners invest in these interventions to pave the way for a new commute in which speed, reliability, and flexibility are strengths of a variety of modes beyond driving alone.



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