

(Draft) Shared E-Scooter Evaluation Report 2022

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E-scooter Evaluation Report

I. Executive Summary

Mobility as a service, or shared micromobility, is a growing industry offering people a fun and sustainable means of travel through cities for both transportation and recreation purposes. Today's shared micromobility programs typically consist of two types of vehicles- electric-assist bikes (e-bikes) and electric scooters (e-scooters). These vehicles are equipped with electric motors that make it easier and more convenient to move from origins to desired destinations.

Shared micromobility programs are helping cities across the world by providing a means of transportation to help offset the impacts of motor vehicles on our transportation system including the traffic congestion and the reduction of harmful greenhouse gas emissions. The City of Boulder shares this goal as we strive toward providing transportation choices while in an environmentally responsible manner.

In August 2021, the City of Boulder introduced a new pilot program to test the efficacy of shared e-scooters for a period of one year in a limited-service area east of 28th street. Throughout the pilot period, staff and community stakeholders have monitored and worked together to optimize the program. During the pilot period from August 17, 2021, through August 31, 2022, users took 115,000 e-scooter trips resulting in 117,700 miles traveled.

This report details the results of the pilot program based on predetermined evaluation criteria and input gleaned from community members and stakeholders. This report also documents the efforts undertaken by the city and its e-scooter provider, Lime, to work toward a safe and successful program. Staff's evaluation, based on utilization statistics and public input, offers a range of results and considerations for the future formalization of this component of Boulder's Shared Micromobility program. While the e-scooter pilot program has introduced a new form of mobility and has demonstrated a mode shift from single occupancy vehicles, as well as a reduction of greenhouse gases, the program has also encountered challenges dealing primarily with the parking or storage of the devices within the pilot area and the impact on sidewalk and multi-use path users, particularly those with disabilities.

This report explores several aspects of the program including overall utilization, user demographics and behavior, safety, sustainability, racial equity, and parking. It documents what is working well and what areas need improvement as the program moves into the formalization phase in the spring of 2023.

Summary of Key Findings

The summary of key findings follows the order of the evaluation criteria as described in the evaluation report.

Utilization

- E-scooter utilization is prevalent throughout the entire pilot program area. The 30th Street corridor sees the highest volume of shared e-scooter travel representing an average of 25 daily trips along the corridor over the course of the pilot program period.
- Trip start data indicates high e-scooter activity in four distinct areas of East Boulder:
    - Northeast Boulder- comprises high density residential neighborhoods, including five traditionally undeserved communities
    - Central Boulder – 29th Street Mall shopping center (most common destination of all zones)
    - CU Boulder's East Campus (experiences frequent travel between East Campus and Williams Village)
    - CU Boulder's Williams Village (experiences frequent travel between Williams Village and edge of Main Campus along the east pilot boundary of 28th Street)
- By the numbers:

Measures – August 2021—August 2022	**Lime E-Scooters**
Number of trips	115,000
Total distance traveled (miles)	117,700
Average trips per device per day	1.5
Average trip duration (minutes)	11
Average trip distance (miles)	1
Approximate greenhouse gas savings (pounds)	26,058
Number of reported severe crashes	4

User Demographic and Trip Purpose

- Lime has registered 40,000 unique users in the City of Boulder market
- 88% of Lime's customers live, work, or go to school in the City of Boulder
- 85% of trips originated in the city right-of-way. The remaining 15% originated on a CU Boulder property
- 61% of Lime's customers live in households earning less than the median income level
- The average age of their customer is 31 years old and 25% of Lime riders are 36 or older
- 37% of people use e-scooters for fun and recreation
- 34% of people use e-scooters for shopping and running errands

Mode Shift Analysis

- Nearly half (47%) of the respondents to the city's questionnaire reported that they would have taken a car if an e-scooter wasn't available for their trip
    - Nearly 30% would have walked
    - 13% would have biked
    - 3.5% would have taken the bus

Environmental and Material Sustainability: Greenhouse Gas Savings and E-scooter Lifespan

- 26,058 pounds of CO2 were saved within the span of the pilot program timeframe. This is equivalent to consuming 1,330 gallons of gasoline or the carbon sequestration rate of 13 acres of U.S. forests in one year.
- It is estimated e-scooters have a lifespan of five years
- 13 out of 300 e-scooter were decommissioned and recycled during the pilot program timeframe due to vandalism beyond repair or the e-scooter was submerged in water for a long period
- Lime's e-scooters are 96% recyclable
- The Life Cycle Assessment of Lime's e-scooter found an estimated greenhouse gas impact of 46.5grams of CO2 emissions (seven times less than a typical motor vehicle).

Safety: Equipment, Technology, Reported Crashes, Travel Preferences, Parking Considerations

- The durability of e-scooters has improved greatly over the past three years, including thicker steer tubes, larger wheel diameter, longer wheelbase, front and rear brakes, and front suspension
- New user safety programs through the mobile app have been developed to improve safety, for example, "Training Ride" and a sobriety test
- Boulder's crash rate is .01% and a total of 17 share e-scooter crashes were reported to the city and/or Lime during the pilot program
    - Four moderate to severe injury crashes were reported in which the victim was transported to the hospital via ambulance. Two of those crashes occurred in the city right-of-way, the other two crashes occurred on CU Boulder property. One of the crashes involved a motor vehicle
    - The remaining 13 crashes were reported with minor injuries to the victims
- 147 out of 343 respondents to the city's questionnaire reported a preference to travel on sidewalks due to feeling unsafe in the street or in conventional bike lanes due to motor vehicle speeds and volume
- Improperly parked or fallen shared e-scooters present a significant mobility issue for people with disabilities

- Mandatory, designated shared e-scooter parking has been proven to mitigate many issues associated with blocking sidewalks and multi-use paths where this has been implemented during the pilot on CU Boulder property.

Safety Education Outreach

- The Shared Micromobility Program webpage offers information on the program and methods for community members to report issues directly to staff and to the shared micromobility vendors, including vendor and staff contacts and a link to the city's Inquire Boulder reporting platform. Outreach through City of Boulder social media is frequently conducted to provide information pertaining to parking the devices responsibly, customer safety, including the use of helmets.

Addressing Racial Equity

- Community members living in or near traditionally underserved communities have access to shared e-scooters due to requirements set forth in Lime's operating agreement.
- 15% of total fleet must be allocated to these locations at all times
- 9, 370 trips originated in the racial equity area, which generated over 12,180 e-scooter miles traveled.
- Lime's affordability program (Lime Access) has experienced low participation

Transportation and Parks Maintenance Impacts

- Transportation Maintenance staff have occasionally needed to remove individual e-scooters from right-of-way to perform their duties, such as, to remove snow from sidewalks and/or multi-use paths.
- No negative impacts to Parks and Recreation Department maintenance practices have been reported.

II. Background

The City of Boulder's Shared Micromobility program was developed following the direction of City Council on September 15, 2020. City Council adopted Ordinance 8423, allowing the operation and regulation of shared electric scooters, but excluding use on open space land.

Council requested that a dockless shared e-scooter program be restricted to East Boulder (east of 28th Street) for the first year of operations to evaluate the efficacy of the program and to ensure it was a good fit for Boulder before expanding city-wide. *(Appendix A)*

The shared e-scooter ordinance (Title 4- Chapter 34) is included in the Boulder Revised Code (BRC) and provides the general requirements for e-scooter operations, such as, licensing and fees, operator responsibilities, e-scooter standards, and the parking of e-scooters.



Figure 1- Deployed e-scooters on 30th Street

At the October 27, 2020 City Council Study Session, staff presented the initial structure of a new shared micromobility program, including a recommendation to proceed with a Request for Proposal (RFP) process to select a vendor(s) to provide shared micromobility services for the Boulder community. The November 17 Study Session Summary summarizes the subsequent steps taken to form a group of community stakeholders to developed a scope of work and conduct a competitive search through a request for proposal (RFP) process to select a vendor(s) to provide both shared e-bike and e-scooter services for the Boulder community.

Community stakeholder organizations were convened to develop the RFP scope of work including, members of the Transportation Advisory Board, CU Boulder, Boulder County, Boulder Chamber, Community Cycles, Shared Paths Boulder, Boulder Housing Partners, Boulder County's Mobility for All program, Boulder Transportation Connections and Commuting Solutions.

As part of the development of the RFP, a specific goal and several objectives were identified for the city's Shared Micromobility Program to help guide the program and track progress.

The City of Boulder's goal for the Shared Micromobility Program is to:

Provide community members safe, equitable and sustainable forms of transportation to improve quality of life, provide connections to transit and key destinations; and replace motor vehicle trips to reduce traffic congestion and transportation-related greenhouse gas emissions.

To work toward achieving this goal, the following objectives and corresponding performance measures were identified:

SMP Objectives	Baseline	2023 Performance Measure
1) Build upon the success of Boulder's previous bike share program	2020 – 110,000 trips	440,000 trips
2) Expand the quantity of available shared e-bikes and e-scooters by 2023	2020 – 300 bikes	500-700 devices (e-bikes and e-scooters) in service
3) Demonstrates on-going safety improvements for users of shared devices	Establish baseline number of severe crash reports in 2021-2022	Compare number of severe crashes in 2023 to 2022 – 0 is the goal.
4) Provides an equitable program that is easily accessible and affordable for traditionally underserved community members.	Establish baseline use in 2021-2022	Compare use in 2023 to 2022
5) Expand city-wide accessibility to shared micromobility devices	2020 – 45 B-Cycle docking stations	Compare 2023 accessibility (areas of Boulder served) to 2020

As a result of the RFP process, Neutron Holdings, Inc. DBA Lime was selected, and a service agreement comprised of the RFP scope of work and requirements contained within the shared e-scooter ordinance was signed between the City of Boulder and Lime in August 2021. The agreement can be renewed annually for four subsequent years following the first year of operations. CU Boulder established a separate operating agreement with Lime around the same time.

Lime is a transportation company based in San Francisco, California. It runs electric scooters, electric bikes, normal pedal bikes, electric mopeds, and car sharing systems in various cities around the world.

The pilot program was initiated August 17, 2021, and an initial 200 shared e-scooters were deployed in a limited-service area east of 28th Street. The service area map can be found in appendix A.

Operator License and Fees

The initial fee for a vendor's license is $3,300 and $1,800 annually thereafter. The vendor also pays a $0.15 per trip fee. Funds generated are used by the city to support the program, such as, expenses related to administrative needs, safety signing and striping, equity programs, safety education outreach, and micromobility-related infrastructure. During the pilot period

timeframe (August 17, 2021 – August 31, 2022), $20,550 in fees have been assessed by the City of Boulder.

Differentiating "Docked" and "Dockless"

There are two primary types of shared micromobility operating systems: Docked and dockless. The docked system, which utilizes "docking stations," consists of devices that can be borrowed or rented from an automated docking station using a smartphone app or RFID card and can be returned only to another docking station belonging to the same system.



Figure 2 – Boulder BCycle Docking Station

The dockless system does not require a docking station. With dockless systems, devices are free-floating and can be parked anywhere within a defined service area. Dockless devices are typically located and unlocked using a smartphone app and do not require a kiosk to rent the device.

In Boulder, B-Cycle is an example of a docked system (figure 2) and Lime e-scooters is an example of a dockless system (figure 3). Both docked and dockless systems present benefits and tradeoffs; however, both systems work best in areas with a high density of people and with a high density of available devices or stations offering the respective devices:

- Docked system:
  - Benefits - Provides predictability in terms of where devices can be rented and returned. Docked systems are organized and are not as susceptible to devices being knocked over, nor do docked devices block the public right-of-way.
  - Tradeoffs – Does not provide point to point transportation. An initial trip must be planned to retrieve the docked device, and occasionally, there may be no available docks at a station to return the device leaving the customer to find an alternative docking station and further from their destination. Point to point transportation is not as convenient.



Figure 3 – Lime E-scooters Deployed at the 29th Street Mall

- Dockless system:
  - Benefits: Allows the customer to locate and rent a device nearest their location. Provides customer the convenience to ride the

device to their precise destination and park virtually anywhere.

- Tradeoffs: Devices are sometimes parked in a manner which blocks the public right-of-way and can impede the passage of pedestrians, cyclists, and people with disabilities.

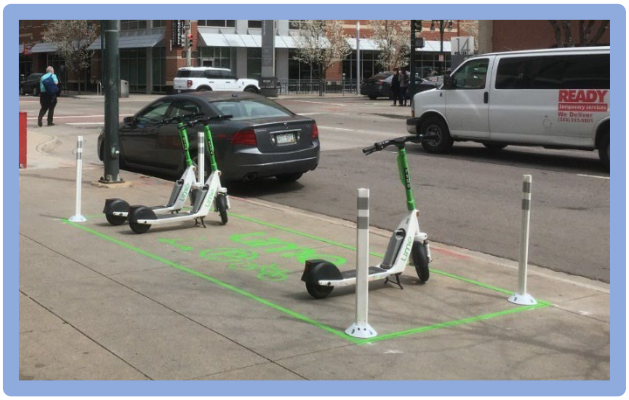


Figure 4 – Example of a Lime designated parking area

A dockless system can incorporate a hybrid approach and include specific geofenced zones, or corrals, where devices must be parked within a specific designated area. In this case, the devices may still be susceptible to being knocked over or moved by a third party unless the device is physically tethered to a fixed object (figure 4).

Shared micromobility services typically consist of a mobile app that allows riders to locate, unlock, and pay for a vehicle. Operations include deployment of devices to specific locations daily within the service area, charging of device batteries, and routine maintenance inspection to ensure it is mechanically sound. These operational aspects are carried out by the vendor and its company employees, which is how Lime operates in Boulder.

To utilize a shared e-scooter, Lime users are required to play a flat fee ($1.00) to unlock the device and an additional pay-per-minute charge ($0.29 per minute) is incurred while the device is in operation. The trip is officially ended by the user using the mobile app.

Geofencing

Geofencing is an implemented means of regulating where and at what speed shared e-scooters can travel in Boulder. Geofence technology can be described as a "a virtual geographic boundary," defined by Global Position System (GPS) technology. GPS technology enables software to trigger a response when an e-scooter enters or leaves a particular area.

The geographic boundary for the shared e-scooter pilot program is in East Boulder east of 28th Street, south of Jay Road and north of South Boulder Road (figure 5). Smaller boundaries within the larger service area can be created to restrict e-scooter access.

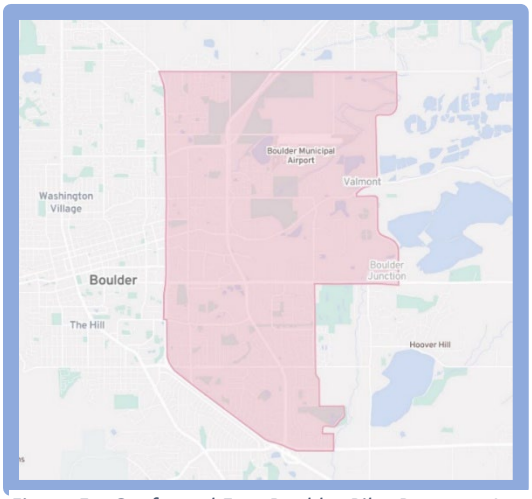


Figure 5 – Geofenced East Boulder Pilot Program Area

Geofencing can also control where a shared e-scooter can be parked by applying mandatory, designated parking areas or zones. All shared e-scooters operating in Boulder are equipped with a speed governor that ensures the device will not travel more than 15 mph. The speed of a device can also

be programmed at reduced speeds at specified areas, such as, areas with high pedestrian volume.

Demand-Based Cap

A demand-based cap is a fleet control formula that governs how many shared e-scooters are deployed in the service area. This function is included in Lime's operating agreement and helps to control the appropriate number of devices in the Boulder market. The City of Boulder seeks a utilization rate of two trips per day per device. If this rate can be achieved consistently for two weeks, Lime may increase its e-scooter fleet size by 20%. If this rate is not achieved in four weeks following the increase, Lime must retract 10% of its e-scooters. Since the initial deployment of 200 e-scooters, Lime has increased the fleet twice and now operates a total of 300 e-scooters in Boulder.

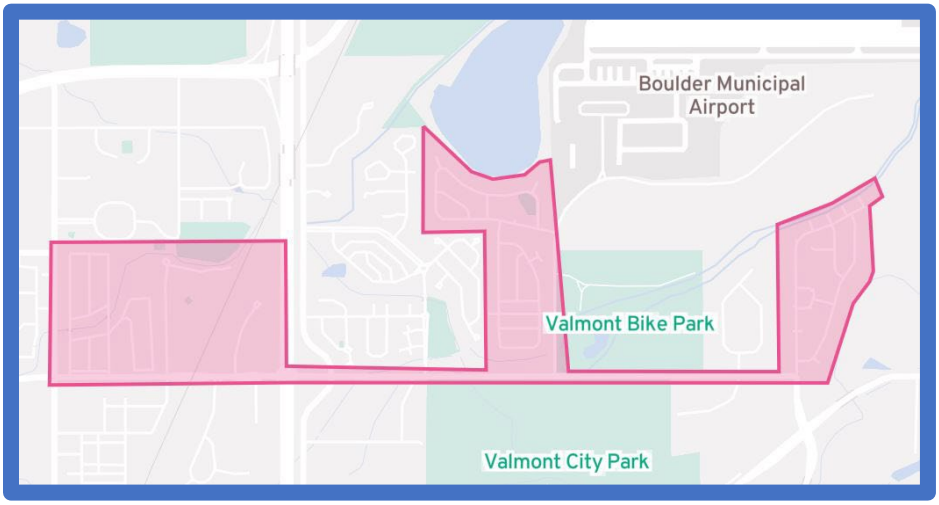


Figure 6 – Racial Equity Zone in Pilot Program Area

This formula does not factor utilization in Boulder's equity-focused zones (figure 6). Nationally, shared e-scooter utilization has been disproportionately low in known equity-focused areas despite the offering of affordability programs. If areas with lower utilization rates were included in the overall demand-based cap, this could have a significant impact on the larger program resulting inadequate supply of e-scooters to meet demand in the more active utilization areas. Lime is required to consistently deploy a minimum of 15% of its fleet to serve traditionally underserved neighborhoods in the pilot service area. Boulder's equity-focused zones, neighborhood boundaries, affordability program, and utilization rates are further discussed later in this report.

Deployment Zones

Over 40 deployment zones are identified in the pilot service areas. These zones were coordinated with city staff to ensure shared e-scooter access was available at strategic locations with higher levels of activity and user potential. These locations include several neighborhoods, transit stops, parks, CU Boulder, city facilities, and shopping centers.

Evaluation criteria

Prior to the start of the e-scooter pilot program, several evaluation criteria were selected to study the program. The criteria were identified to track use patterns, demographics, safety, sustainability, and community input:

Utilization

Overall shared e-scooter utilization is tracked through a software program called Ride Report that displays aggregated data. This third-party platform enables staff to manage the program remotely and determine in real time, and at selected timeframe, what routes e-scooters are traveling, where trips are starting and ending, and how many e-scooters are available in the Boulder market.

Ride Report also created an open data portal for the public viewing of Boulder's data, as well as the micromobility data from other cities to draw comparisons. The open data portal is updated on a quarterly basis.

As previously mentioned, all shared e-scooters are equipped with a GPS device, which sends each e-scooter's location information to a cloud server at regular intervals. Through a software program called Mobility Data Specification (MDS), aggregate data is converted to a format that allows both Lime and City of Boulder staff to manage the program and routinely monitor the activity of all e-scooters in the East Boulder service area. Specifically, the Ride Report program helps staff track the utilization statistics overall and in specified locations. This data can also be tracked in real time, or in specified timeframes.

User Demographics and Trip Purpose

This criterion focuses on who uses shared e-scooters (age, gender, and income level) and for what reasons people choose to use shared e-scooters.

Mode Shift Analysis

Understanding how the use of shared e-scooters shift people's transportation modes is of great interest, particularly shifted motor vehicle and active transportation trips, as this illuminates how e-scooter trips contribute to Boulder's climate and mobility goals through reduction of greenhouse gas emissions.

Environmental and Material Sustainability: Greenhouse Gas Savings & Lifespan

As the City of Boulder strives to reduce single occupancy vehicle (SOV) trips, it's important to understand whether shared e-scooters are contributing to a reduction of SOV trips and ultimately the reduction of greenhouse gas emissions. The lifespan of a shared e-scooter is also a sustainability consideration.

Safety

User safety is an important metric for the program. Safety criteria considered in this evaluation include:

- *Equipment* – Examines materials and fabrication affecting the durability of e-scooter design and impacts to user safety

- *Technology* – Examines technology to improve travel safety either through geofencing technology or interface with mobile application
- *Reported Crashes* – Examines the number of and types of e-scooter crashes that occurred during the pilot program
- *Travel Preferences* – Explores e-scooters user's facility preferences and impact to theirs and others safety
- *Parking Considerations* – Explores the impacts of e-scooter parking behaviors and impact on other sidewalk and multi-use path users.

Community Member and Stakeholder Input

Staff has garnered input from community members through a city-wide questionnaire (over 1000 responses), Inquire Boulder reports, and e-mail and phone correspondence. Lime has also administered a customer questionnaire (175 responses) and reported its findings to city staff *(Appendices B & C)*. Over October and November 2022, staff has presented the preliminary findings and outcomes of the evaluation process to community stakeholders including the following organizations:

- Downtown Boulder Partnership
- Downtown Management Commission
- University Hill Commercial Area Management Commission
- Boulder Junction Access District
- Center for People with Disabilities
- CU Boulder – Pathway Safety Committee
- Boulder Chamber
- Parks and Recreation Advisory Board
- Transportation Advisory Board (November)
- City Council (December)

Community feedback has been interwoven into the report and its findings are reflective of public sentiment and utilization statistics.

Safety Education and Communications Outreach

How have the City of Boulder and community partners provided shared e-scooter safety education outreach?

Addressing Racial Equity

How has the shared e-scooter program impacted traditionally underserved neighborhoods and what is the efficacy of Lime's affordability program?

Transportation and Parks Maintenance Impacts

How have the shared e-scooter program's deployment zones and parked devices affected Parks and Transportation Maintenance efforts?

III. Results and Findings of E-scooter Pilot

A. Overall Trip Utilization

The geographic boundary for the shared e-scooter pilot program is in East Boulder east of 28th Street, south of Jay Road and north of South Boulder Road. Over the course of the pilot program, shared e-scooters have been ridden on nearly every street and multi-use path in the service area.

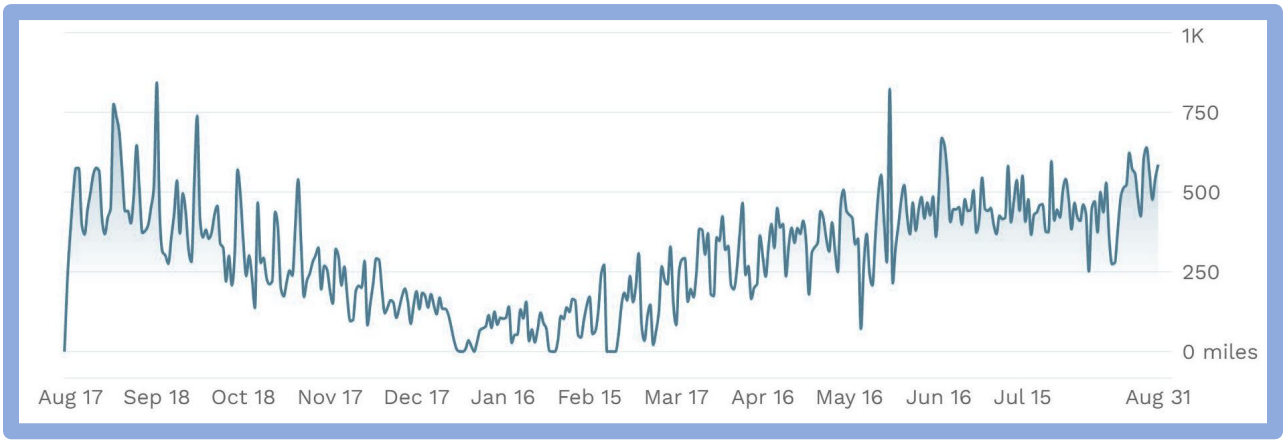


Figure 7 - Lime E-scooter Utilization Rates (August 2021-August 2022)

Figure 7 shows the number of trips taken over the pilot study period. These utilization rates are considerably lower during the colder, winter months and higher use is commensurate with nicer weather and CU's Boulder's semester school schedule.

Utilization begins to grow in March, plateaus in summer and spikes again when CU Boulder students return to Boulder.

By the numbers
As shown in Figure 8, since the beginning of the program, over 115,000 shared e-scooter trips have been logged resulting in 117,700 miles traveled.

Shared e-scooters are used for relatively short trips in Boulder and average one mile per trip per day. Shared e-scooter use in Boulder is consistent with national data.

Utilization rates are relatively high and on the average of 1.5 trips per device per day across the year. Although e-scooters are used throughout the entire week, e-scooter riders are most active during the weekends.

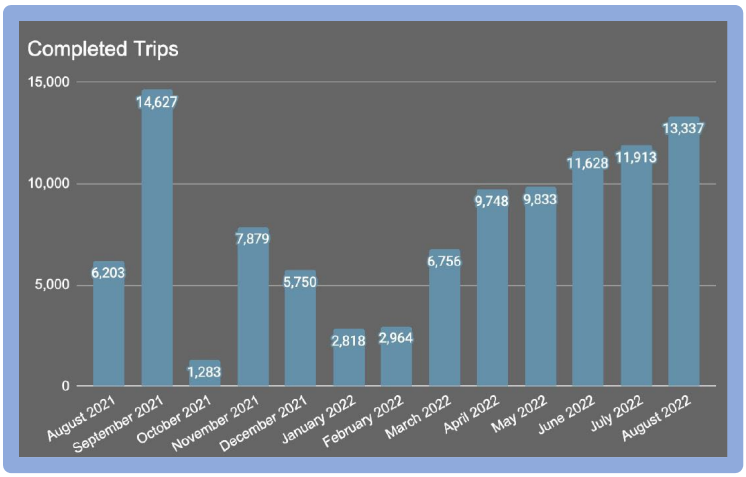


Figure 8 – Completed Trips by Month

The weekend spike may reflect different trip purposes that occur on weekends versus weekdays, such as recreational and shopping trips. Shared e-scooter activity is highest between the hours of 12:00 p.m. – 8:00 p.m.

Shared e-scooters travel through much of the East Boulder service area, particularly along several key arterial street and off-street connections. 30th Street has surfaced as the corridor with the highest concentration of daily trips followed by Valmont and Baseline Roads. The Boulder Creek, Goose Creek, and Skunk Creek paths multi-use paths are also heavily utilized.

Much of the activity is centered on four distinct zones:

- Northeast Boulder (high density housing and traditionally undeserved neighborhoods)
- Central Boulder (29th Street Mall, Boulder Junction)
- CU Boulder's East Boulder Campus
- CU Boulder's Williams Village area

Most trips take place within these zones but there is also considerable travel between these zones. The 29th Street Mall is a common destination, and travel between CU Boulder's campuses is frequent. The heat maps in figures 10 and 11 provide a visual representation of routes most traveled, and the origin of trip starts in the East Boulder pilot area.

Location: East Boulder (Pilot Area)	Lime E-scooters
Number of devices currently deployed	300
Number of trips	115,000
Total distance traveled (miles)	117,700
Average trips per device per day	1.5
Average trip duration (minutes)	11
Average trip distance (miles)	1

Figure 9 – Utilization - By the Numbers

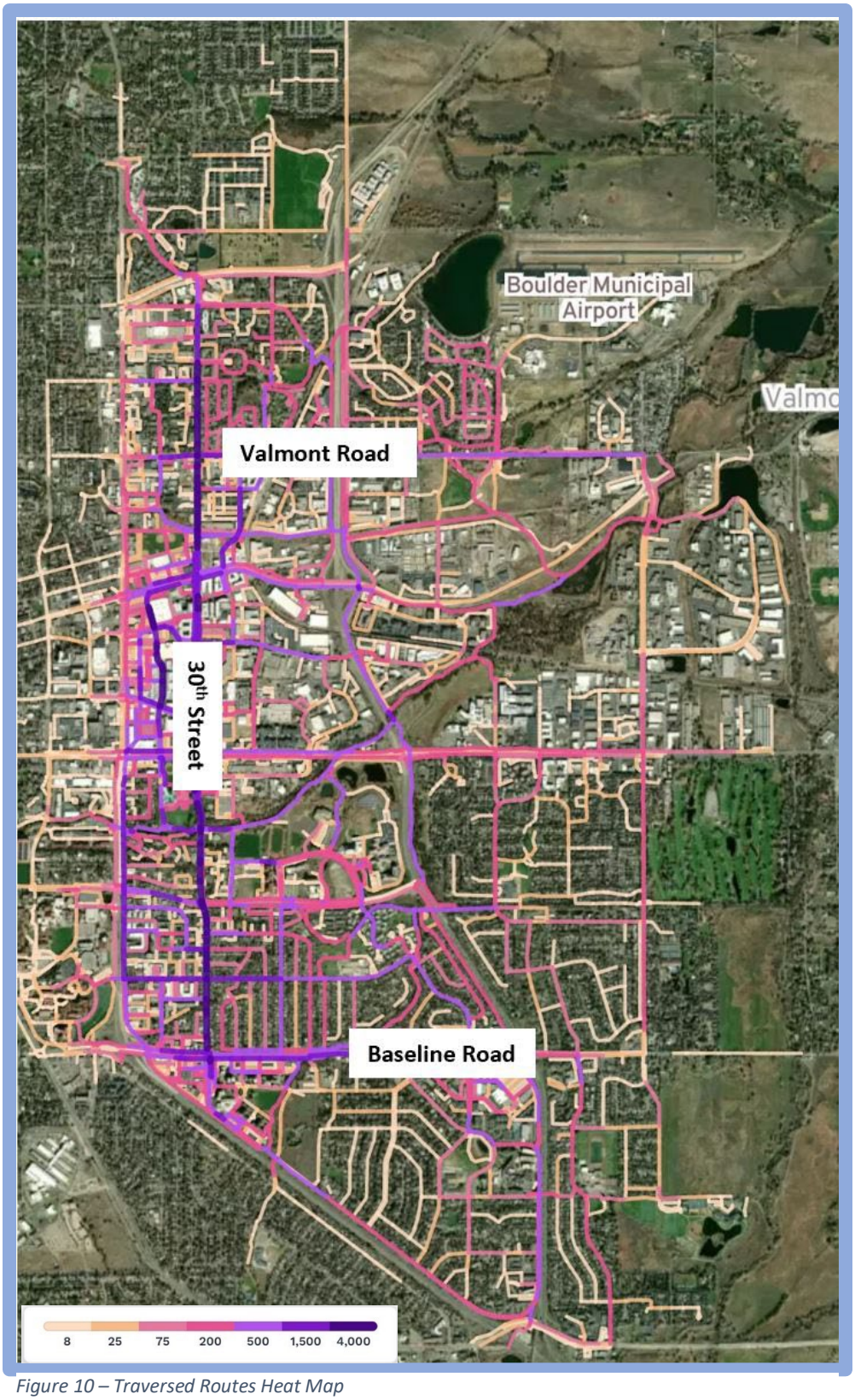


Figure 10 – Traversed Routes Heat Map

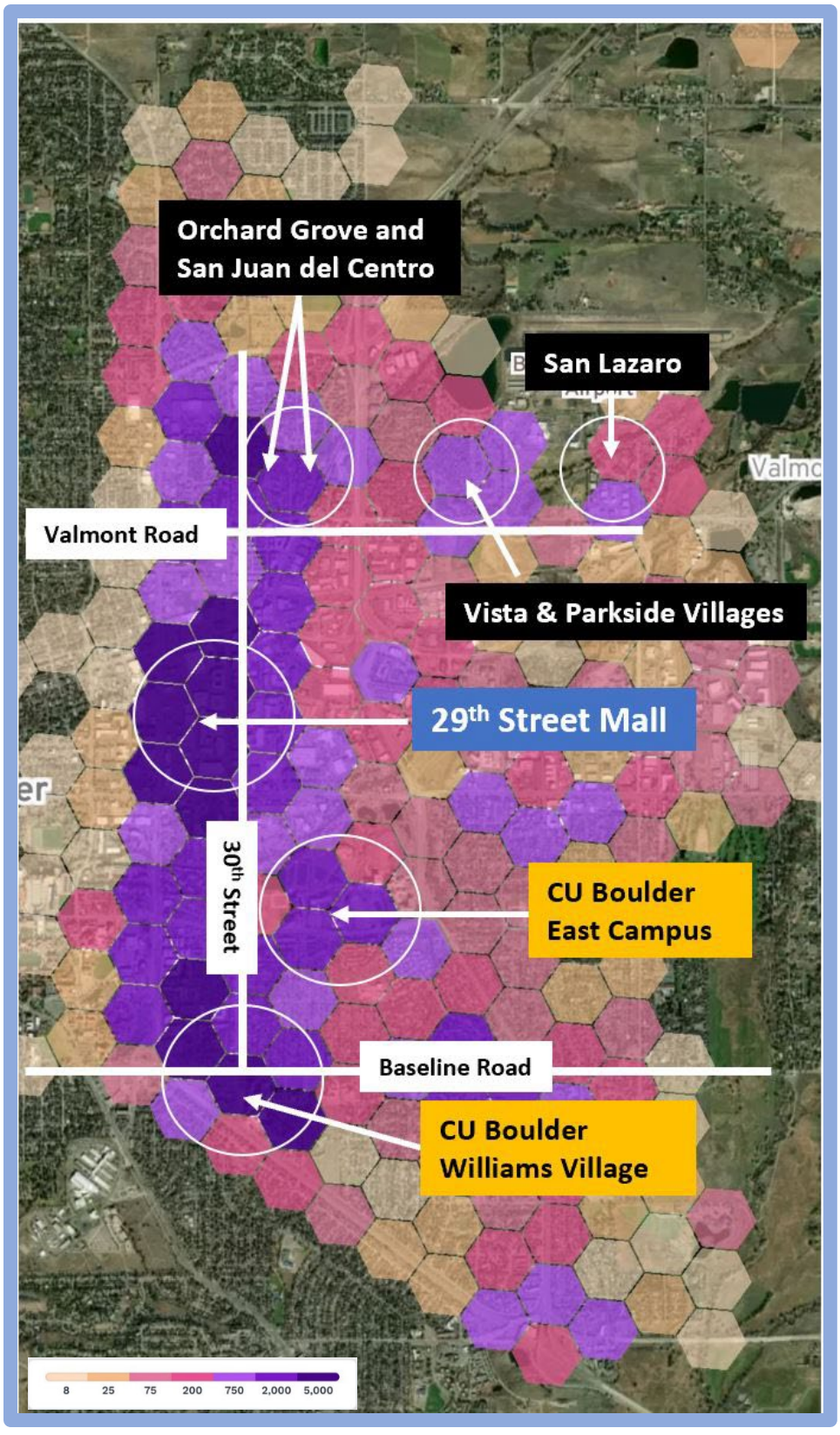


Figure 11 – Trip Starts Heat Map & Key Act

B. E-scooter User Demographics and Use

Since the start of the pilot program Lime has registered over 40,000 unique users (Figure 12). People use shared e-scooters for a variety of means, whether it be for fun and recreation, to go to work and school, connect with transit or to run errands. Approximately 85% of total shared e-scooter trips originated in the City of Boulder right-of-way and the remaining 15% of total trips originated on a CU Boulder property, such as East Campus or Williams Village.

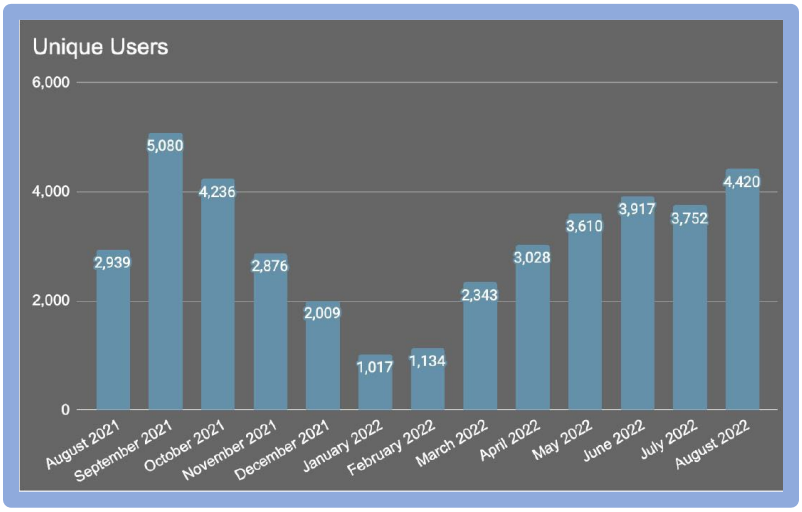


Figure 12 – Lime's Registered Unique User by Month

Information gleaned from two separate user questionnaires provides insight into user characteristics, travel patterns and preferences. The City of Boulder launched a questionnaire in September 2022 through its Be Heard Boulder public engagement platform and received 1,022 responses. Lime also distributed a questionnaire to its customers in September 2022 and collected 175 responses. It's important to note that neither of the questionnaires are statistically valid; however, when combined, the information from these two questionnaires provides a snapshot into user demographics and behaviors.

Based on internal user data, Lime reports that 88% of its customers live, work, or go to school in the City of Boulder, while 61% of its customers live in households earning less than the median income level. The average age of their customer is 31 years old and 25% of Lime riders are 36 or older.

This data is consistent with the national trend in terms of high shared e-scooters use among younger generations, although is inconsistent in terms of income level, as more users in Boulder are reporting their income below the median income level. National data suggests that users' income level is at both ends of the spectrum: below and higher than the median income level. This could be due to the relatively high use of the program by college-age community members.

"Lime has over 40,000 registered unique users in the Boulder market"

Early national research suggested that men and women used e-scooters approximately evenly (4% and 3% of the general population, respectively) and that women were slightly more likely to

have a positive view of e-scooters than men did. However, later surveys consistently found that men were more likely to ride e-scooters, take more trips, and respond to surveys. City of Boulder's September 2022 questionnaire did not request the gender identity of e-scooter users in its demographic questions.

Of the 1,022 responses to the City of Boulder's questionnaire, 904 of the respondents live in Boulder, 536 respondents also work in Boulder and 144 respondents attend school in Boulder.

343 of the respondents reported using a shared e-scooter in Boulder. When asked for what purpose they used an e-scooter, the following response by percentage were listed:

- 37% for fun and recreation
- 34% for shopping and running errands
- 11.4% to get to work
- 10.6% to get to college campus
- 7% to connect with public transit

Lime's questionnaire shows somewhat similar results. Its customers reported the following trip purposes (Figure 13):

- 30% to get to work or school
- 20% for shopping and running errands
- 23% to connect with public transit
- 16% to attend a social event, to dining or for entertainment

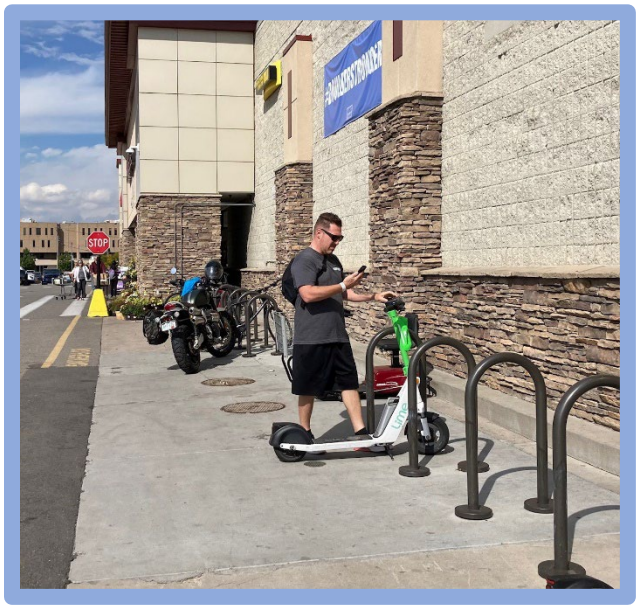


Figure 13 – Renting an E-scooter at King Soopers on 30th Street

The City of Boulder asked respondents where they choose to ride a shared e-scooter, the following locations were reported. The respondents were given the opportunity to check all that apply:

- In a bike lane (206 respondents)
- On a residential or local street (163 respondents)
- On sidewalks (147 respondents)
- On multi-use paths (196 respondents)

C. Mode Shift Analysis

From a transportation planning perspective, understanding mode shift is an important aspect. The city's Transportation Master Plan sets mode share goals and identifies actions to reach its goals.

One of the city's mode share goals is to reduce car dependency by reducing SOV trips both within the city and from a regional perspective, to and from the city. This means shifting trips from 50% of resident trips taken by motor vehicle to 20% by 2030; and reducing non-resident

motor vehicle trips from 85% to 60% by 2030. To accomplish this goal, the city must increase sustainable transportation trips by 80% by 2030, which includes, walking, biking e-micromobility, transit and carpool. These goals roll up to the City of Boulder's overall climate goals of carbon neutrality by 2035.

The implementation of the city's Shared Micromobility Program is one of the action items the city takes to shift trips from motor vehicles to other forms of transportation that have a lesser impact on traffic congestion and the environment. It is believed that shared e-scooters as part of the city's Shared Micromobility Program (both shared e-bikes and e-scooters combined) may be instrumental in significantly contributing to a shift from the dependence of motor vehicles.

To better understand this potential impact, we ask the question, "if a shared e-scooter wasn't available, how would have someone made their trip instead?" The results of both the City of Boulder and Lime questionnaires demonstrate people's mode shift away from motor vehicles and on to shared e-scooters.

Lime reports that 26% of its customers used a shared e-scooter rather than a motor vehicle (personally owned, taxi, or ride hailing service). 75% of its customers also reported that shared micromobility decreased their reliance on cars and 71% felt that micromobility reduced traffic.

The City of Boulder's questionnaire shows similar results when asked if an e-scooter wasn't available, how would they have made their trip. Responses included:

- 34.8% would have driven a car
- 29.5% would have walked
- 12.9% would have ridden a bicycle
- 12.3% would have used ride hailing
- 7% wouldn't have taken the trip
- 3.5% would have taken the bus

This data suggests that nearly half (47.1%) of respondents would have taken a motor vehicle (private or ride hail) if an e-scooter wasn't available.

"Nearly half of respondents would have taken a motor vehicle (private or ride hail) if an e-scooter wasn't available"

The data also suggests, however, that shared e-scooter use is also impacting forms of active transportation, like walking, biking, and taking the bus. Approximately 46% of active travel trips may have shifted to shared e-scooter. Still, e-scooter trips may also facilitate first- and last-mile connections with transit trips, a level of analysis that was not sought in the city's questionnaire.

Staff recognizes the health and environmental benefits of active travel, and that e-scooters may compete with other forms of environmentally responsible forms of transportation. That said,

people desire transportation choices and with choices comes an overall increase in the use of these sustainable transportation options.

Compared to other cities in North America, Boulder's responses to both questionnaires are similar in terms of mode shift. As shown in Figure 14, cities with shared e-scooter programs estimate that anywhere from a third to a half of e-scooter trips replace car trips, and over half replace trips made by other low carbon modes.

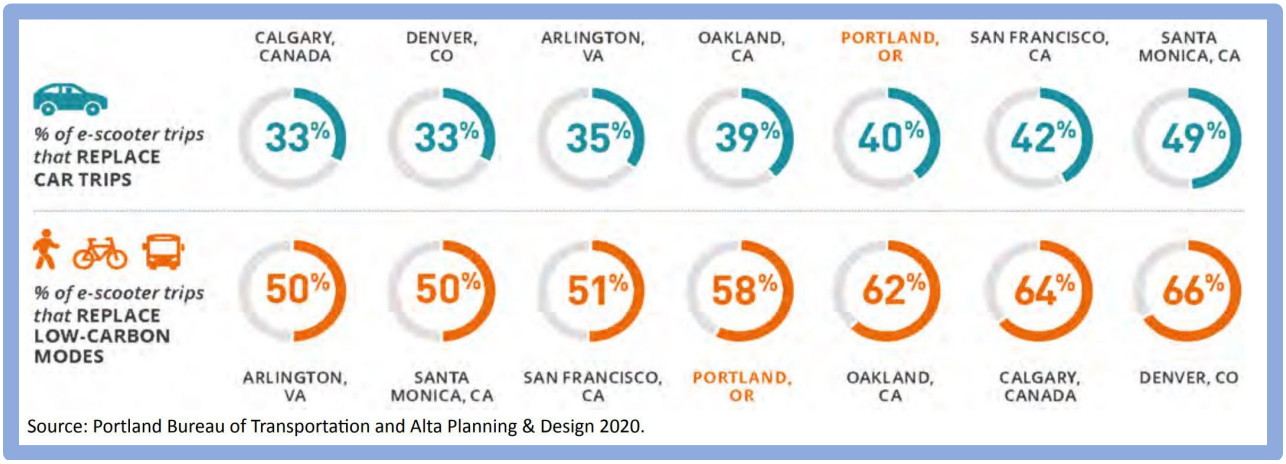


Figure 14 – City Comparison of Replaced Vehicle and Active Mode Trips – Source: Portland Bureau of Transportation 2020

D. Environmental and Material Sustainability: Greenhouse Gas Savings and E-scooter Lifespan

To determine a shared e-scooter's effect of mode shift from motor vehicles and resulting greenhouse gas savings, Lime has taken a more conservative approach and estimates that 25% of motor vehicle trips are displaced by shared e-scooters.

In 2019, Lime conducted a statistically significant global mode shift survey to understand their customer's travel patterns, particularly their "shift" away from other modes to Lime's fleet of shared e-scooters and bicycles (*Appendix D).* From that survey data, Fehr & Peers, transportation consulting firm, wrote a report characterizing the mode shift of Lime customers (globally), and the implications for greenhouse gas emissions, air quality, traffic congestion, and car parking demand.: Lime Global Utilization Survey summarizes these findings.

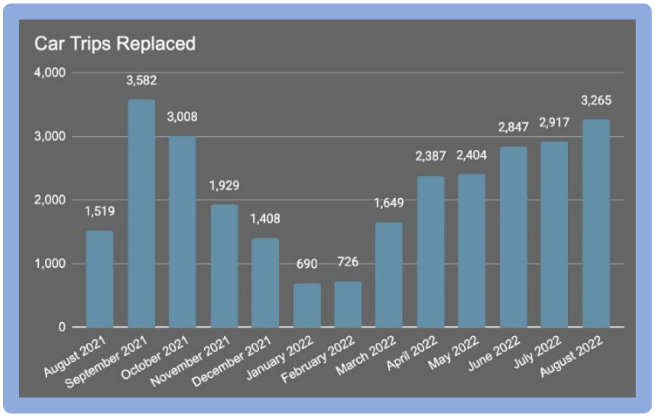


Figure 15 – Estimated Car Trips Replaced by Lime E-scooter in Boulder

In the study, they used stratified random sampling, by market and by rider segment (1 ride vs 2 rides vs 3 or more rides in the last 30 days). They aimed for a sample size of 400 respondents in

each market, but in some small markets this was infeasible and in other instances the rider response rate was lower than anticipated. Overall, Lime received responses from over 18,000 riders, providing information for over 36,000 rides.

Lime's survey resulted in the estimation that 25% of Lime e-scooter trips displaced motor vehicle trips (privately owned or ride hail services). Assuming this 25% mode shift reported by Lime (figure 15), and applying the City of Boulder's methodology for calculating greenhouse gas saving

*"**26,058 pounds** of CO2 is equivalent to consuming **1,330 gallons** of gasoline"*

During the pilot period, shared e-scooters generated 115,000 trips and 117,000 miles traveled. If 25% of those trips displace vehicle trips, then 28,750 vehicle trips were displaced during the pilot period. The average e-scooter trip length is 1.017 miles. 28,750 vehicle trips equate to 29,250 motor vehicle miles saved.

The United States Environmental Protection Agency averages 404 grams of Carbon Dioxide emitted per mile driven in North America.

Hence, 29,250 miles X 404 grams = 11,815,939 million grams or 11.8 metric tons, or 26,058 pounds of CO2 saved within the span of the pilot program timeframe.

In terms of material sustainability, Lime claims that the Gen 4 e-scooter model, which comprises Boulder's fleet, has a lifespan of five years in terms of normal day-to-day operations. This lifespan does not factor in deliberate mishandling of, or vandalism to its device. Lime's shared e-scooters are designed using modular parts that can be individually replaced which helps to extend the overall life of each device. The e-scooters are 96% recyclable and Lime claims a nearly 100% landfill diversion.

Between August 17, 2021, and August 31, 2022 (pilot program period), Lime recorded 13 total decommissioned e-scooters in the Boulder market. Most of these decommissioned e-scooters were collected after being vandalized beyond repair or submerged in water.

The 2021 Life Cycle Assessment of the Lime Gen 4 shared e-scooter found an estimated greenhouse gas impact of 46.4g of CO2 emissions per passenger kilometer, which is seven times less than a typical motor vehicle (figure 16). "Anthesis," a global sustainability consultancy, conducted the life cycle analysis for the Lime's Gen 4 device.

The rebalancing of shared e-scooters to ensure access to e-scooters is consistent at identified deployment zones is another environmental factor to consider. Before the advent of swappable battery technology, e-scooters were collected by motor vehicles and brought back to warehouses for recharging. The batteries in earlier e-scooter models were encased within the base or frame of each e-scooter and were not easily accessible.



Figure 16 – Lime's Life Cycle Analysis of Gen 4 E-scooter

Lime's Gen 4 model shared e-scooters are equipped with swappable batteries (figure 17), which has led to a nearly 70% decrease in vehicle miles traveled. Battery replacement trips can be accomplished in a more efficient manner leading to less back and forth for the vehicles.

The rebalancing of e-scooters to specified deployment locations and to retrieve of abandoned, mis-parked, or idle e-scooters is still conducted with a motor vehicle. To address this, Lime claims to be working on the transition to a zero emissions operations fleet.



Figure 17 – Lime's Swappable Battery

It's important to note, that both the recharging of batteries and rebalancing of devices is comparable to BCycle's current bikeshare operations. The rebalancing of the shared e-scooters and current use of a motor vehicle is not factored into greenhouse gas saving estimation for Boulder.

E. Safety Analysis: (Equipment, Technology, Reported Crashes, Travel Preferences & Parking Considerations)

When shared e-scooters arrived on scene in 2017, there was great concern for user safety. Early data showed users being injured and killed considerably more often than people using shared bikes. Between 2018-2019, after just a few years into initial U.S. operations, over 25 people lost their lives while riding a shared e-scooter. In comparison, four people had been killed in the previous ten years on shared bike operations.

In 2018, several shared e-scooter companies expressed interest to operate in Boulder. At the time, e-scooters, both shared and privately owned, were illegal to operate on city streets, sidewalks, and multi-use paths. Characterized as "disruptive technology," the City of Boulder sought to avoid the illegal deployment of e-scooters in the public right-of-way, which was occurring in numerous other cities throughout the U.S., including the City of Denver. This business practice on the part of shard e-scooter companies (deployment without permission or city partnership) caught many cities off guard and set off a chain reaction of cities developing regulations reactively, instead of proactively.

The City of Boulder avoided this problem by alerting the business license office to flag companies seeking a business license to "rent out" e-scooters within the city limits. The City of Boulder never had to deny a business license. Instead, the City of Boulder asked the companies how they would comply with local laws, considering they were illegal to operate at the time, if invited to partner with the city and be allowed to operate. Companies did not respond to staff's requests for more information and without a license to operate, it was an effective tool that restrained companies from illegally deploying shared e-scooters due to the significant daily fine associated with operating a business without a license.

Concerned primarily with creating a safe program for community members, the City of Boulder took deliberate steps to develop a regulatory framework and conduct community engagement on the matter before allowing providers to operate.

While taking the necessary time to prepare for potential shared e-scooter operations, the shared micromobility industry also evolved itself, particularly in the realm of e-scooter equipment, governing technology, and user familiarity.

Durability

It was the "durability" of early shared e-scooter model that first came under question. Most of the vehicles were not equipped with front and rear brakes, nor lights. Wires were exposed and the severing or breaking of the steer tube was commonplace. The wheels were small in diameter and could not safely handle street abnormalities nor variable terrain.

The overall wheelbase was short, and the device was very low to the ground, which lessened the device's stability making it more susceptible to mishaps.

In the beginning, these devices were designed more as "toys," rather than sturdy, transportation devices. The average lifespan of a shared e-scooters was thirty days in a market and the poor design and fabrication of the devices were leading to numerous crashes and injured users across North American cities.



Figure 18 – Lime's Gen 4 E-scooter Specifications

Since then, the durability of the device has been greatly improved. Most devices are more robust and are fabricated using higher quality materials. E-scooters now come equipped with a thicker steer tube, front and rear brakes and lights, and the wheel size has increased considerably in diameter from 4 inches to 9 inches. With the addition of both pneumatic and fork suspension, the devices hold up better and are easier to handle when negotiating city transportation infrastructure. The e-scooters deployed by Lime in the City of Boulder reflect these advancements (figure 18).

Technology

The technology governing the device, including the mobile application, has also evolved with the goal to improve safety. An operational consideration for Boulder's program was to control device speed at a maximum of 15mph, the same maximum speed as BCycle's e-bike. To help prevent first time crashes, or at least, lessen the severity of injury if a crash occurs for new users, staff requested that Lime put in place a new safety program, called "Training Ride," which automatically limits the device speed to 8 mph for a customer's first ride on a shared e-scooter.

Lime provides other mobile application safety features. Its safety quiz (figure 19) requires riders to successfully answer a series of questions before they can operate a vehicle. The questions test riders on their knowledge of the basic principles and requirements of safely operating a Lime vehicle. These requirements are based on requirements set forth in the City of Boulder shared e-scooter ordinance.

Lime can also verify a user's identity, their age, and the validity of their driver's license to avoid use of the Lime platform by unauthorized persons. Lime's ID scan technology is designed by Microblink and certified by the National Institute of Standards and Technology. It operates with

a 90% first-time success rate, a <1% false rejection rate, and has no demographic bias within facial recognition and matching. The age requirement to ride a Lime shared e-scooter is 18 years of age.

To prevent individuals from using Lime vehicles when under the influence of alcohol, Lime has implemented a sobriety test, administered during late evening hours, that requires riders to complete a series of tests to determine if they can safely operate an e-scooter.

Lime users who fail the test 3 times are blocked from operating a vehicle for at least two hours. This feature helps to ensure safety for riders and pedestrians.

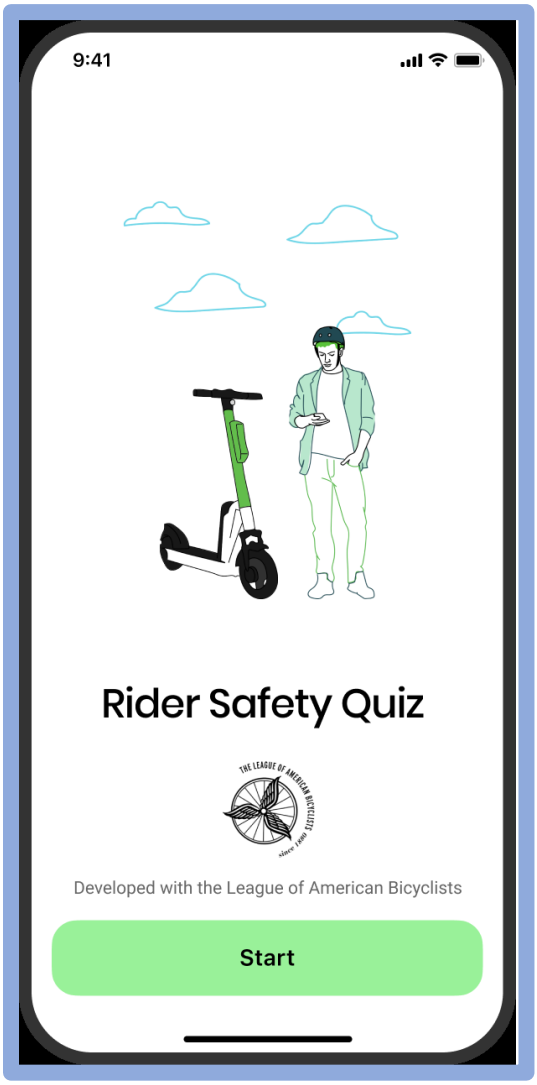


Figure 19 – Lime's Safety Quiz

Reported Crashes

Since the inception of the program, the City of Boulder and the University of Colorado Boulder has experienced a total of four shared e-scooter crashes resulting in moderate to severe injury.

Two of those crashes occurred on CU's campus and two of those in City of Boulder right-of-way. In all four cases, the victim was transported to the hospital.

Out of the four crashes, one of the crashes included a motor vehicle. The e-scooter rider was suspected of operating the device while under the influence and the driver was not issued a citation. The other three crashes occurred on a sidewalk, or other off-street facility.

In addition to the four crashes above, 13 other crashes were reported to Lime. The injuries in these crashes were considered "minor" and there are no City of Boulder or CU Boulder police reports to augment understanding of the cases.

Staff recognize that it's likely that some crashes go unreported. Unfortunately, Boulder Community Health does not document the causes of injuries by micromobility vehicle type, and further, does not discern whether injuries occurred while riding a shared or private device.

The table below shows a summary of the crashes in which the victim was transported to a hospital.

Date	Location	Nearest Intersection	Cause of Crash	Injury Type
8/23/2021	CU Campus	Discovery Drive & Colorado Avenue	Lost control of device – facility not specified	Pain in left ankle and knee
9/23/2021	CU Campus	Williams Village	Lost control of device – facility not specified	Lacerations to face, wrist pain
3/5/2022	City	30th Street & Valmont Road	Lost control of device on sidewalk	Severe head Injury
4/8/2022	City	Foothills Parkway & Colorado Avenue	Entered roadway against direction of travel and struck by motor vehicle	Severe head Injury

From a national perspective, recent research shows that males are more likely to ride e-scooters than females and that e-scooters are popular among riders under 40 years old. Injury demographics appear consistent with the ridership data.

Staff relies on police reports and customer reports submitted to Lime to obtain crash data. Police reports contain officer narratives and witness reports to help staff better understand the nature of each crash. Boulder's current reported e-scooter crash rate is .01% and is below initial national crash rates identified in the first two years of shared e-scooter operations across the U.S.



There are several contributing factors that have helped to keep crashes relatively low, including device durability, improved technology, previous user familiarity with shared e-scooter programs, Boulder's high quality and extensive transportation infrastructure, safety education outreach, and an overall greater awareness of drivers in Boulder who watch for vulnerable users, including e-scooter riders. This greater awareness can be attributed to Dr. Peter Jacobsen's "safety in numbers" theory that hypothesizes that vulnerable users are safer in an environment when there are more of them, which has a result on other road users expecting to see them more frequently. That said, severe e-scooter crashes have occurred and through the lens of Vision Zero, even one severe crash is too many. There's still work to do to help people understand how these devices can be ridden in a safe manner.

The interaction with motor vehicles continues to be of great concern, as it is for all vulnerable users, such as, pedestrians, people using assistive devices such as wheelchairs, and bicyclists. In Boulder, vulnerable users are overrepresented in terms of being severely injured in a crash and thus, this aspect remains paramount in our goal to eliminate crashes that result in severe injury or death.

Crashes often happen because of human behavior. The speed of a vehicle comes into play in terms of the severity of an injury when crashes occur; however, the speed of the vehicle can be controlled by its user. Staff, however, also recognize that transportation facility design can influence vehicle speed. Following a safe systems approach, staff continues to improve Boulder's transportation infrastructure to make micromobility a safe, comfortable, and attractive form of transportation.

The Core Arterial Network initiative is a recent example of focusing improvements on an interconnected network of streets to build separated facilities for vulnerable users while mitigating crashes between all road users. The continued build out of Boulder's protected bicycle lane network and pedestrian infrastructure will lead to more people safely using micromobility, more often and in more places.

Travel Preferences

Understanding where people choose to ride e-scooters is an integral element to analyzing safety both real and perceived. The City of Boulder asked the question where people typically ride an e-scooter with the option of providing multiple answers. People reported the following facilities:

- In the bike lane (206 respondents)
- On residential streets (163 respondents)
- On sidewalks (147 respondents)
- On multi-use path (196 respondents)

While operating an e-scooter in bike lanes, on residential streets and on multi-use paths is legal per the City of Boulder's Boulder Revised Code, riding an e-scooter on a sidewalk is illegal, unless there is not a bike lane in the adjacent roadway. An example of this scenario exists along Broadway north of Spruce Street.

If respondents selected "sidewalks" as a facility by which they typically travel, the questionnaire included a follow-up question to understand the reason(s).

Most of the feedback pertains to people not feeling safe in the bike lanes, or on streets due to motor vehicle traffic. People feel exposed in the street and are concerned about distracted drivers and being struck by a motor vehicle. Other reasons cited is the convenience factor of traveling bi-directional on the same side of the street to access destinations and that some streets did not have safe bike facilities in the adjacent street.

The primary reason for prohibiting e-scooter use on sidewalks is to mitigate potential conflicts between people walking and using wheelchairs with people riding e-scooters. To date, there have been no reported crashes between these user groups; however, when asked in the city's questionnaire on a scale of 1-4, with 4 being the most concern and 1 being the least concern, 337 people reported that people riding e-scooters on the sidewalk are a safety risk to people walking (figure 20).

From a national research perspective, pedestrian and e-scooter collisions represented just 12% of e-scooter crashes in San Francisco's pilot program. In Portland, an even smaller portion (1.7%) of emergency department visits associated with e-scooters were caused by a collision with a pedestrian.

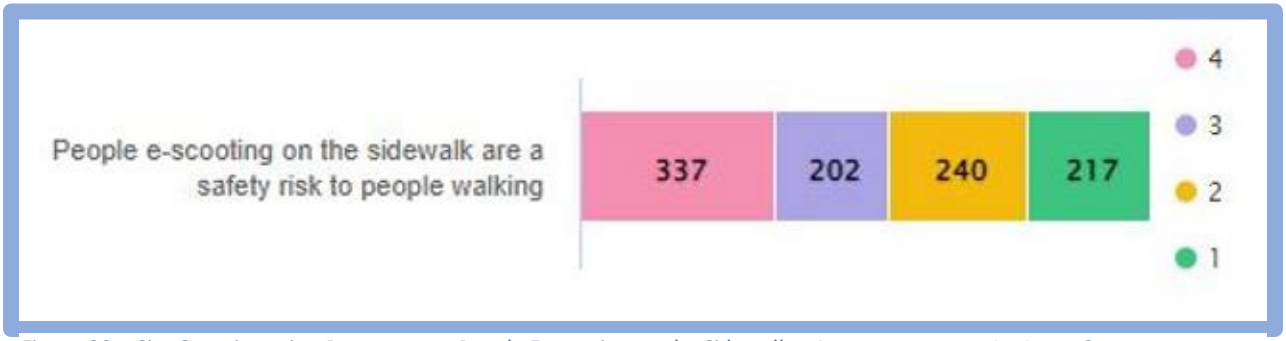


Figure 20 – City Questionnaire: Responses to People E-scooting on the Sidewalk – 4 = most concern, 1 = Least Concern

This information begs the question of whether the City of Boulder's sidewalk restrictions are prudent. Currently, both traditional and electric-assist bikes are allowed to use the sidewalk unless the sidewalk is a designated dismount zone. In Boulder, the data to date suggests that riding e-scooters on a sidewalk is more of a perceived safety issue rather than an actual crash issue. Perceived risk should not be ignored; however, as perceived risk is a deterrent for people who would normally use sidewalks and multi-use paths, but do not because of safety concerns.

Nationally speaking, sidewalk restrictions for e-scooters differ among cities. Some cities allow sidewalk riding anywhere "when done in a prudent manner," some allow it when there is no separated or protected bike lane and when motor vehicle travel speeds are high, and many disallow it altogether.

Various mechanisms have been implemented to attempt to reduce illegal sidewalk riding. Many e-scooter operators, including Lime, are developing GPS technology that detects and alerts riders on a scooter's digital display if sidewalk riding is occurring, but the technology is not currently sensitive enough to reliably distinguish between sidewalk and in-street usage. Overall, sidewalk riding restrictions have proven difficult to enforce, including in the City of Boulder.

Helmet Use

Early national e-scooter crash data from 2019 revealed that 30% of injuries resulted in head trauma and that one in three users were likely to crash on their first ride.

Helmets can protect e-scooter riders from head injury, but usage is consistently low across national studies, and anecdotally, in Boulder as well. Lime offers free helmets to its customers upon request and provides free helmets at safety events. Typically, the lack of advanced planning for many scooter trips does not allow for helmet use.

To date, two reported crashes have occurred in the city which have resulted in head injuries. There are currently no regulations in Boulder that require users to wear a helmet; however, Lime, city and CU Boulder staff encourage it though safety education messaging.

Regulations requiring e-scooter riders to wear a helmet may disincentivize potential trips and would also be very difficult to enforce.

Parking Considerations

The parking of shared e-scooters has surfaced as a fundamental issue during the pilot program. The dockless model lends itself to parking problems as the e-scooters can be parked anywhere unless designated parking areas are mandated within the service area.

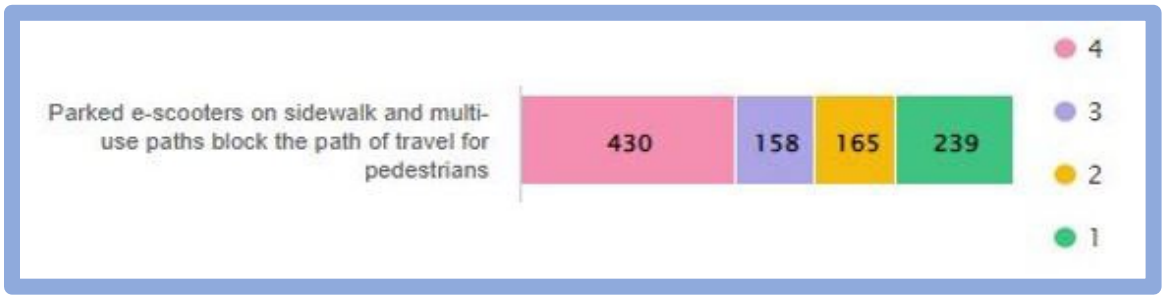


Figure 21 – City Questionnaire: Responses to Parked E-Scooters on the Sidewalk – 4 = most concern, 1 = Least Concern

The blocking of sidewalks, crosswalk ramps, and multi-use paths is a major concern for many community members and staff has received numerous complains through Inquire Boulder reports and was identified as a top concern in the City of Boulder's questionnaire, as noted in figure 21.

While no crashes have been reported involving improperly parked e-scooters, they have caused significant mobility challenges for other sidewalk and multi-use path users. Of particular concern is the impact to people with mobility and visual disabilities who are in some cases limited in their ability to safely negotiate around a parked e-scooter or may be unable to physically move a parked e-scooter to continue along their path of travel. In some cases, people may be forced to take an alternative route which can be a major inconvenience for people with disabilities.

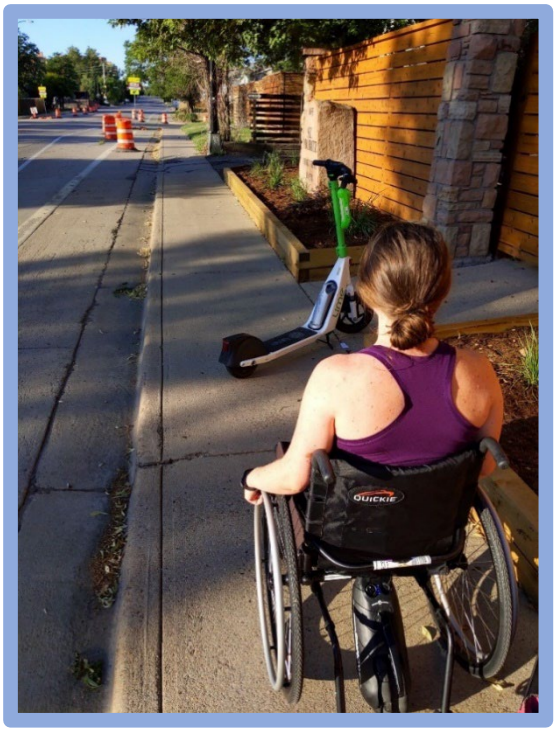


Figure 22 – E-scooter Blocking Path Wheelchair User in Boulder

Improperly parked shared e-scooters create a situation where people with disabilities, including those in wheelchairs, or who are low-vision or blind, are being denied their right to travel freely and safely on public walkways due to physical barriers (figure 22).

The City of Boulder's shared e-scooter ordinance contains provisions prohibiting the parking of shared e-scooters in such a manner that they impede the path of travel for other sidewalk and multi-use path users (figure 23); however, these situations are hard to enforce due to a lack of enforcement resources, although there is a provision in the ordinance to assess a fine on both the vendor (Lime) and the customer responsible for an improperly parked shared e-scooter.



Figure 23 – E-scooters Parked on Sidewalk at Street Corner in Boulder

The ordinance also contains a provision for the vendor (Lime) to respond to a report of an abandoned, damaged, or improperly parked e-scooter within two hours between the hours of 6:00 a.m. – 10:00 p.m.

Improperly parked e-scooters are reported to both Lime and city staff and each e-scooter is equipped with a unique identification number and a service telephone phone number for both English and Spanish speakers. Community members have also reported abandoned e-scooters and being discarded in less-than-ideal locations, for example on people's private property, like gardens and driveways. Improperly parked e-scooters can appear as clutter or abandoned. Unfortunately, e-scooters are sometimes purposefully knocked over or

thrown into riparian areas, such as irrigation ditches and creeks. These issues are most prominent when e-scooters are parked in obscure, less frequented areas of the city. Often these e-scooters end up being the subject of vandalism.

Throughout the pilot program, Lime has demonstrated consistently responsive customer service to community members and staff representing the City of Boulder and CU Boulder. Lime

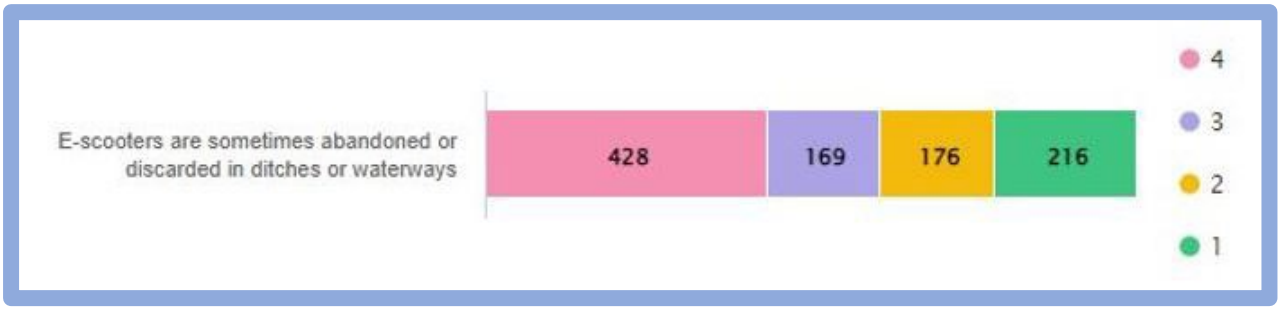


Figure 24 – City Questionnaire – E-scooter are sometimes abandoned – 4 = Most Concern, 1 = Least Concern

usually responds to reported e-scooters under the two-hour requirement and has never left a reported improperly parked e-scooter sit for longer than two hours.

Lime has consistently followed up with the person or agency who filed the complaint to let them know the issue has been dealt with, thereby closing the circle of communication. Lime recognizes the challenges of improperly parked e-scooters and is receptive to adopting parking protocols that will mitigate these issues. As it currently stands with operating a shared dockless system, not all improperly parked e-scooters are reported and it's possible that an abandoned, vandalized or improperly parked e-scooter may be non-reported for a considerable amount of time.



Figure 25 – Geofenced and Marked Designated E-scooter Parking Area at CU Boulder

CU Boulder has taken a different approach to managing shared e-scooter parking. Mandatory, designated parking areas on CU's East Boulder campus and at Williams Village residential halls has successfully mitigated most of the problems associated with improperly parked e-scooters. When implementing a designated parking zone, the user of the shared e-scooter is unable to end a ride unless the e-scooter is physically within a designated parking zone. This is accomplished through geofencing technology and is communicated to the user through the mobile application. The geofenced mandatory parking zones (figures 25 & 26), otherwise known as corrals or "Lime Groves," are also physically demarcated with paint and posts to make the areas visible to e-scooter users.

This City of Boulder and Lime have begun to experiment with this e-scooter parking approach in the Park East Square neighborhood. This neighborhood is located just south of CU Boulder's campus and is comprised of many college age students who use the program daily. The city and Lime and have installed its first on-street designated parking zone on Monroe Ct. (figure 27). Three other designated parking zones have been established in the neighborhood.



Figure 26 – Example of Designated E-scooter Parking Area at CU Boulder

This e-scooter parking approach came at the request of the Park East Square Homeowner's Association, and to date, the results are encouraging. Dockless mobility has its benefit to the user in terms of convenience. The user does not have to find a specific location to park the device and they may park as close as they'd like to their destination.



Figure 27 – New Designated E-scooter Parking Area in City ROW at Park East Square

This convenience factor, however, comes with significant tradeoffs to other people who walk, ride and roll. Most importantly, it negatively affects those people with a physical disability and resulting mobility challenges.

F. Safety Education Outreach

The city did not evaluate the effectiveness of safety education outreach during the pilot program; however, the City of Boulder and CU Boulder took a proactive approach at the start of the program to provide safety education and e-scooter program information with the goal of influencing the safe operations of e-scooters.

The City of Boulder published an informative press release and corresponding webpage providing instructions for how to use the program safely. Over the course of the year, the City of Boulder and CU Boulder have routinely published additional safety education though its communication channels and particularly through social media (figure 28). Social media typically yields a high interaction rate among community members.

The safety education efforts focused on four primary topics:

- Wearing a helmet
- Follow all traffic rules
- Always yield to pedestrians
- Use the bell to pass
- Ride predictably and defensively
- Be 18 years or older
- Ride solo and sober



Figure 28 – An Example of City of Boulder E-scooter Safety Messaging Social Media Graphic

Prior to the start of the city's Shared Micromobility Program, the city conducted a community engagement process to determine where micromobility devices should be operated in the public right of way. City council subsequently adopted modifications to the Boulder Revised Code allowing their use on specific facilities. The "Which Wheels Go Where?" information materials (figure 29) are consistently broadcasted through the city communication channels to improve user safety. Lime also provides safety education to its users through it mobile application and this method may be the most effective way to reach e-scooter riders. Every month, Lime sends in-app messages to remind riders of the rules of the road in their city, how to safely operate a Lime vehicle, and how to ensure safety for pedestrians.

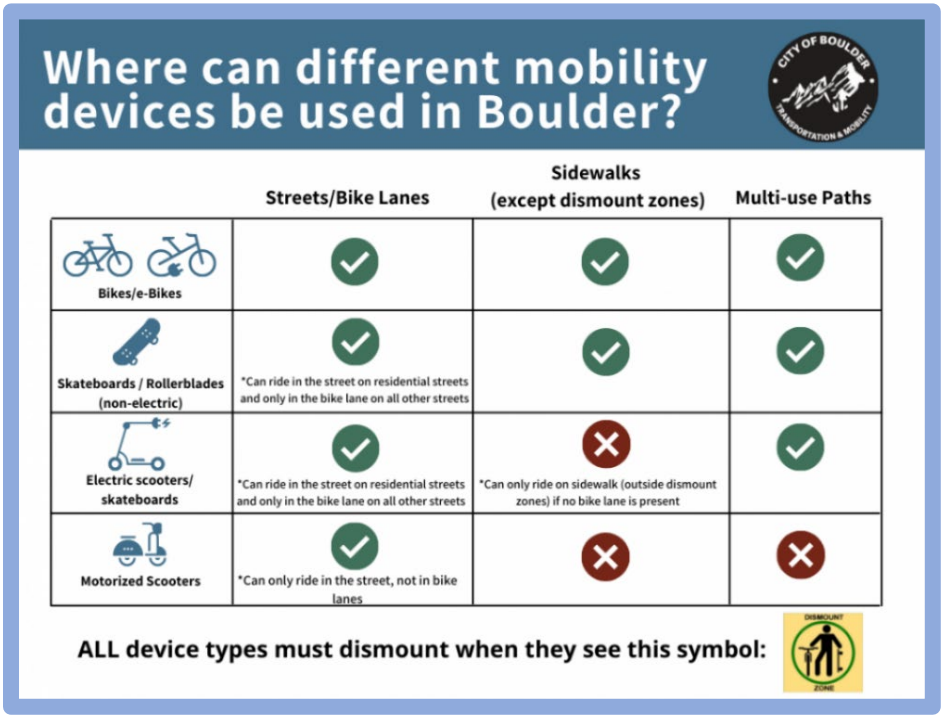


Figure 29 – Which Wheels Go Where? Micromobility Chart

G. Addressing Racial Equity

Staff and community partners ensured racial equity was considered in the city's Shared Micromobility Program at the outset, including during the development of the scope of work for the Request for Proposals process. The Shared Micromobility Program has the objective to:

"Provide its services in an equitable manner by developing and promoting a program that is easily accessible and affordable for traditionally underserved community members."

The City of Boulder and Lime are committed to ensuring residents living within these opportunity areas have access to shared micromobility. There are five distinct neighborhoods identified within the pilot program service area, including Orchard Grove, San Juan del Centro, Vista Village, Parkside Village, and San Lazaro.



Figure 30 – Map of Traditionally Underserved Communities in Pilot Program Area

During the pilot program, 9, 370 trips originated in the racial equity area (figure 31), which generated over 12,180 e-scooter miles traveled.

Lime offers an affordability program, called Lime Access, for people with lower income eligibility or who do not have a credit card or a mobile phone to access the devices. To qualify for Lime Access, a user must be a recipient of any sort of public assistance from any government entity and must provide proof of this assistance. The cost to riders on Lime Access is $0.50 to unlock vehicles and then $0.07 per minute after that. This is a 50% discount from regular pricing. Lime and the City of Boulder continue to promote the Lime Access affordability program to community members, but participation in the program has been low, likely due to the requirement of providing documentation.

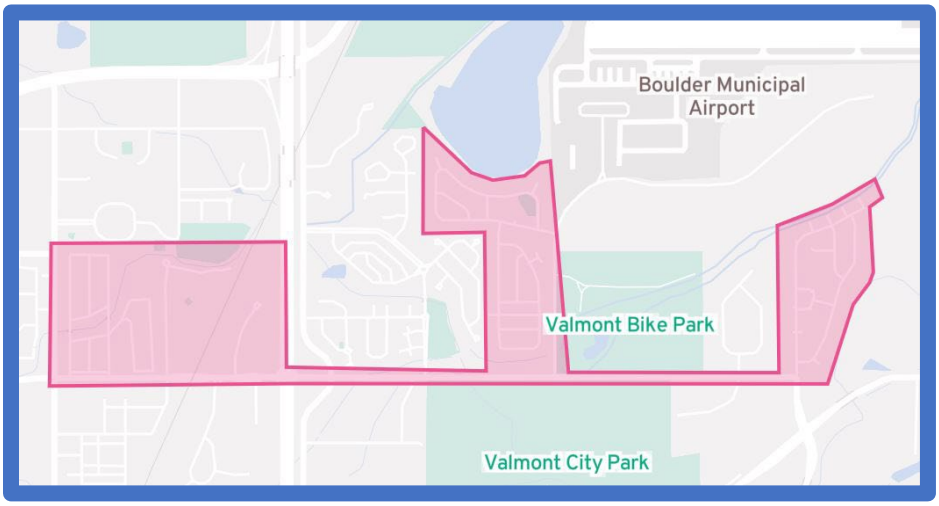


Figure 31 – Racial Equity Boundary Used to Track Utilization

Per the requirement in the operating agreement, Lime has coordinated with staff to ensure access to shared e-scooters is available either on or within proximity to these traditionally underserved neighborhoods. I

Most trips starting in this service area also ended within the area, as well as the 29th Street Mall shopping area between Pearl Street and Arapahoe Avenue. The average trip duration was 9.5 minutes, and the average trip length was .95 miles. The average number of trips per device per day was .8.

H. Transportation and Parks Maintenance

Coordination with Transportation and Parks Maintenance personnel has been on-going throughout the pilot program. An inclement weather policy was established to proactively guide the approach to impending weather events and management of parked e-scooters. For weather events predicted to accumulate more than 4 inches of snow, and dependent upon the forecasted subsequent days following the event, Lime and city staff consider whether the fleet of shared e-scooters should be moved from the city right-of-way so not to impede Transportation and Parks maintenance efforts. During the pilot period, shared e-scooters were moved from the public right-of-way one time.



Figure 32 – An Example of a Geofenced Boundary of Pleasant View Fields

Lime takes preventative measures to rebalance e-scooters and remove parked e-scooters that may impede snow removal practices on sidewalks and multi-use paths. While these efforts do help to mitigate conflicts with transportation maintenance practices, there have been instances where maintenance staff have had to move or relocate e-scooters from their path of travel.

In terms of impacts to parks, there have not been any concerns or events that have negatively impacted City of Boulder parks or open space areas. The shared e-scooters are equipped with a GPS unit that can regulate where the e-scooters are operated. In advance of the start of the program, staff identified areas where shared e-

scooters should not be operated, such as, the lawn at Scott Carpenter Park, Howard Heuston Park, Valmont Bike Park, and Pleasant View fields (figure 31). Moving forward, this "geofencing" technology can be used to designate parking areas and include additional areas where e-scooters should not be operated.

VII. Proposed Next Steps

In summary, the pilot program has mostly demonstrated a niche for shared e-scooters in the Boulder community; however, there are some operational challenges associated with dockless mobility that need to be addressed to ensure a safe environment for all community members.

Staff has developed initial concepts to explore as we consider changes that improve utilization and program sustainability while reducing risk and conflicts with other users of Boulder's transportation infrastructure.

Staff is in the process of seeking feedback from stakeholders, the Transportation Advisory Board and City Council on these preliminary ideas, as well as other ideas that will optimize the program. Following the final phase of input, staff will finalize all proposed next steps and perform identified modifications to the program in spring 2023.

Possible next steps for program formalization in 2023 will relate to operational components of the program, including, but not limited to:

<u>Service Area Expansion</u>

- Expand service west of 28th Street making access to shared e-scooters city-wide
    - Employ geofencing to prohibit scooters in sensitive areas such as Pearl Street Mall. Specific areas will be defined in early 2023 based on feedback from TAB, Council and other stakeholders
    - Continue coordination with CU Boulder to determine appropriate expansion efforts on CU properties

<u>Mandatory, Designated Parking Zones</u>

- Explore transition of the shared e-scooter model from primarily a dockless system to a hybrid docked system by developing criteria to identify candidate areas for designated parking zones city-wide. Designated parking zones should consist of a combination of on-street and off-street parking facilities
    - Begin transition in current service area east of 28th Street
    - Coordinate with HOA's and neighbors to determine appropriate designated parking area locations
    - Continue to allow dockless capability at major shopping centers and in Boulder Junction

    - Create mandatory e-scooter parking zones on the periphery of downtown Boulder and University Hill
        - Geofence restricted riding areas that mirror the current dismount zones for both areas
        - Investigate options to allow north-south travel on streets through downtown (7th – 19th Streets)

Safety

- Continue tracking shared e-scooter related crashes and continue coordination with Boulder Police Department and CU Boulder Police Department regarding the reporting of crash details and possible crash trends
- Eliminate impacts to people with disabilities due to improperly parked e-scooters on sidewalks and multi-use paths
- Partner with shared micromobility venders and CU Boulder to create a culture of safety and courtesy on Boulder's multi-use path system through signing, marking, and corresponding safety education efforts
- Continue City of Boulder and CU Boulder safety education messaging through special events and social media campaigns
- Reinforce and encourage helmet use including the distribution of free helmets to registered shared e-scooter riders
- Revisit restrictions for riding shared e-scooters on sidewalks along specific corridors without high pedestrian volumes until on-street, protected facilities can be established

Transportation Demand Management

- Explore opportunities to extend TDM benefits to include a micromobility membership program to employees of general improvement districts (Downtown Boulder, University Hill, and Boulder Junction)
    - In the Downtown and University Hill, explore expanding TDM benefits to include both Lime and BCycle memberships to employees
    - In Boulder Junction, explore expanding TDM Access District to include Lime memberships to employees and residents. Boulder Junction's TDM Access District currently provides BCycle memberships to all residents and employees.
    - Allow access to shared e-scooters past current hours of operation (6:00am-11:00 p.m.) for people who work in the service industry or whose work shifts extend beyond current hours of operation
- Explore the concept of a "mobility card" that houses micromobility access, transit access, and other transportation options for users in one location
- Explore Lime student membership program for CU Boulder and Naropa University
- As workers continue to return to Boulder's employment centers on East Walnut, East Airport Road and Flatirons Business Park, coordinate with Lime, BCycle, the Boulder Chamber/Boulder Transportation Connections to promote and encourage corporate micromobility membership programs for employees

- Improve first and final mile mobility options and coordination between transit agencies and Lime

Racial Equity (Accessibility and Affordability)

- Continue to encourage the use of shared micromobility and optimize accessibility for community members living in traditionally underserved neighborhoods
- Identify and remove barriers to Lime's affordability programs
- Plan and implement focus group meetings to vet program perceptions, opportunities, and constraints
- On-going coordination with the City of Boulder Community Connectors-in-Residence program to optimize the program to fit the needs of community members
- Explore feasibility and test installation of e-scooter electrical charging infrastructure in which docked e-scooters can be charged in the field, thereby minimizing provider trips to replace batteries

Program Support

- Create an expenditure plan for collected license and per trip fees to bolster the shared micromobility program in 2023 and beyond. Potential expenditure categories include:
    - expenses related to the signing, striping, and marking of roadways
    - educational and promotional outreach
    - equity programs
    - staff time