

**CITY OF BOULDER
TRANSPORTATION ADVISORY BOARD
AGENDA ITEM**

MEETING DATE: May 8, 2015

AGENDA TITLE: Staff briefing and TAB input regarding the TMP measurable objectives update and the Transportation Metrics program, including results from Boulder Valley Employee Survey

PRESENTERS: Michael Gardner-Sweeney, Acting Director of Public Works for Transportation
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I. EXECUTIVE SUMMARY

Since the adoption of the first Transportation Master Plan (TMP) in 1989, the city has collected transportation data for all modes to understand travel in the community and to monitor the results of the TMP policy direction. This data is collected through a variety of count programs and surveys and evaluated comprehensively as part of the Transportation Metrics program. As part of this program, a number of technical annual reports were produced between the 1996 TMP and the 2003 TMP. More recently, the 2012 *Transportation Report on Progress* has presented this information in a more user friendly way. The *Transportation Report on Progress* is being produced every other year with the next report scheduled for release in 4th quarter 2015.

This memo provides a summary of recent data collected through a number of the Transportation Metrics program efforts. These results show that the roadway system continues to perform well and progress in mode shift away from the single occupant vehicle by Boulder residents. At the same time, the single occupant vehicle mode share for non resident employees shows little change and remains a challenge. Summary highlights are provided for the following

- Intersection level of service
- Travel time survey
- Bicycle count program
- Downtown bicycle parking counts
- Boulder Valley Employee Survey
- Downtown Employee Survey

Staff also continues to develop and refine the Measurable Objectives of the 2014 TMP, including the three new objectives:

- Safety – goal of “Vision Zero”
- Vehicle Miles Traveled per capita for residents and non-resident employees
- Neighborhood accessibility – 15 minute walkable neighborhoods

II. BACKGROUND

The performance of the city’s multimodal street system is evaluated using several different measures including traffic volumes, peak hour intersection level of service, and travel time data collected on arterial roadways as well as measures regarding bicycle, pedestrian, and transit. Bike counts are collected at 25 on- and off-street locations and an annual bike parking survey is done for the Downtown area. The Boulder Valley Employee Survey is one of two primary surveys of travel behavior conducted since 1990.

Vehicle Counts

Traffic volume data is collected by three yearly count programs: the Arterial Count Program, Boulder Valley Count Program, and Turning Movement Count Program. The Arterial Count Program has been used since 1982 to capture average daily traffic (ADT) volumes on a selection of arterial roadway sections throughout the City. The Boulder Valley Count Program has been in place since 1993 and captures all traffic entering and exiting the City. Data from this program is used to calculate trends in overall traffic volumes within the City and track progress towards the Transportation Master Plan goals. The turning movement count program captures peak hour intersection volumes for each specific turning movement at all signalized intersections in the city. Data is collected for each intersection every three years during the morning, noon, and evening peak hours. Peak hour turning movement volumes are a key inputs used to determine intersection level of service.

Intersection Level of Service

Level of service is an operational analysis method that assigns a qualitative measure (level of service A through F) based on quantitative results such as average vehicle delay. Since the capacity and performance of arterial roadways are controlled by the signalized intersections, an operational analysis of these intersections is used to evaluate the City’s transportation system. Thus, a level of service (LOS) analysis is conducted every three years for all signalized intersections within the City. This analysis models the City’s transportation network, including intersection geometries and peak hour turning movement volumes to determine the average vehicle delay per movement, approach, and intersection according to the Highway Capacity Manual (HCM) methodology. Based on the delay, a LOS is assigned for each intersection and each vehicular movement.

Drive Time Study

In addition to traffic volumes and level of service, travel times are also considered when evaluating the City’s transportation system. Travel time studies are conducted every three years for six major east-west corridors and north-south corridors. These corridors are Arapahoe Avenue, Broadway, Balsam/Edgewood/Valmont Road, 28th Street, Peal Street, and Foothills

Parkway. The travel time studies measure the time it takes to travel each corridor across the City during the peak traffic hours (morning, noon, and evening). Each corridor is driven repeatedly during peak periods to give a statistically significant measure of travel time on the arterials over time.

Bike Counts

Downtown Bike Parking

Since 2007 bicycle parking data has been collected and analyzed for downtown Boulder. Data is collected by a team of volunteers and staff on four different times on four different days intended to reflect times of high bike demand. All bikes on the 41 blocks of the downtown are counted, including those in alleys and accessible garages, as well as the type of parking involved. Bike parking is classified as on-rack, on-other and free standing. These results are then analyzed to assess the bike parking demand, rack supply and issues with rack placement.

Automated Bike Counts



Following the 1996 TMP, the city began installing a set of automated bike count stations. Including several stations operated by the Colorado Department of Transportation, there are currently 25 bike count locations in the Boulder Valley, include three on-street stations and 22 counters on bike path locations. The most recent addition to the count program was the installation of the EcoCounter real time display on the 13th Street bike lane. This station both provides highly sensitive bike detection and a running daily total of bike activity on 13th Street as part of the Broadway bike route. While these count stations do not capture all bike activity, researchers have stated that this is the most comprehensive set of bike data in the country.

Surveys

The primary surveys conducted as part of the Transportation Metrics program are the resident travel diary and the employee surveys. For both the Boulder Valley Employee and Downtown Boulder Employee surveys, participants are volunteers from companies that agreed to participate in the study. These volunteers are asked to complete a survey form distributed through their employer or have the option to complete the survey online. As the surveys utilize a number of identical questions, a report that compares the results between the surveys for the common questions is available on the city's [Transportation Use Measurements](#) webpage. For 2014, comparable surveys were conducted for University of Colorado (CU) faculty and staff,

Boulder Valley School District faculty and staff, and City of Boulder employees. Results for all five groups are included in the comparison report.

Boulder Valley Employee Survey

Boulder Valley Employee Survey for transportation (*BVES*) was first conducted in 1991 and was repeated every odd-numbered year through 2001, then repeated again in 2005, 2008, 2011 and 2014. The survey was not conducted in 2003 due to budget constraints and the update to the Transportation Master Plan. In 2014, 1,150 businesses were randomly selected to participate in the survey, and 2,060 employees from 374 companies completed the survey forms. The data are weighted to account for the differential response rates of organizations and employees to more accurately represent employees of the Boulder Valley. This results in a 95 percent confidence interval (margin of error) around the results of approximately plus-or-minus two percent per year. Thus, for a difference to be statistically significant between years there must be a difference of at least four percent.

Downtown Boulder Employee Transportation Survey

The *Downtown Boulder Employee Transportation Survey* (*DBETS*) was first conducted in 1993 and also repeated every odd-numbered year through 2001, then repeated again in 2005, 2008 and 2011. In 2014, 350 businesses were randomly selected to participate in the survey, and 472 employees from 83 companies completed the survey forms either on-line or on paper forms. This sample size and weighting to better represent the types of companies in the Downtown provides a 95 percent confidence interval (margin of error) of approximately plus-or-minus five percent. Thus, for a difference to be statistically significant between years there must be a shift of at least 10 percent. For the first time in 2014, a printed two page short form was available to try and better capture responses from service workers.

III. ANALYSIS

Vehicle Counts

The results of the roadway system evaluation indicate that traffic conditions and operational performance have remained relatively stable over the past 10 years. Traffic volumes on the City's arterial roadways have generally decreased over time despite the growth in population and employment. The LOS evaluation and travel time studies show similar patterns, as vehicle delay and travel times have not increased in recent years.

Traffic Volumes

An analysis of 10-year traffic count volumes from the Arterial Count Program shows that, on average, traffic volumes on the City's arterial roadways have been decreasing by approximately 1.1% annually. During this time, the City's population has grown by approximately 0.3% annually and employment has increased by approximately 0.4% each year. Additional population and jobs result in additional trip making potential. However, these added trips have not resulted in increased traffic volume on our arterial roadways. These trends are illustrated in **Figure 1**. More detailed information on the City's Count Programs can be found on the City's website at the following address: http://gisweb.ci.boulder.co.us/agswebsites/pds/pds_traffic/.

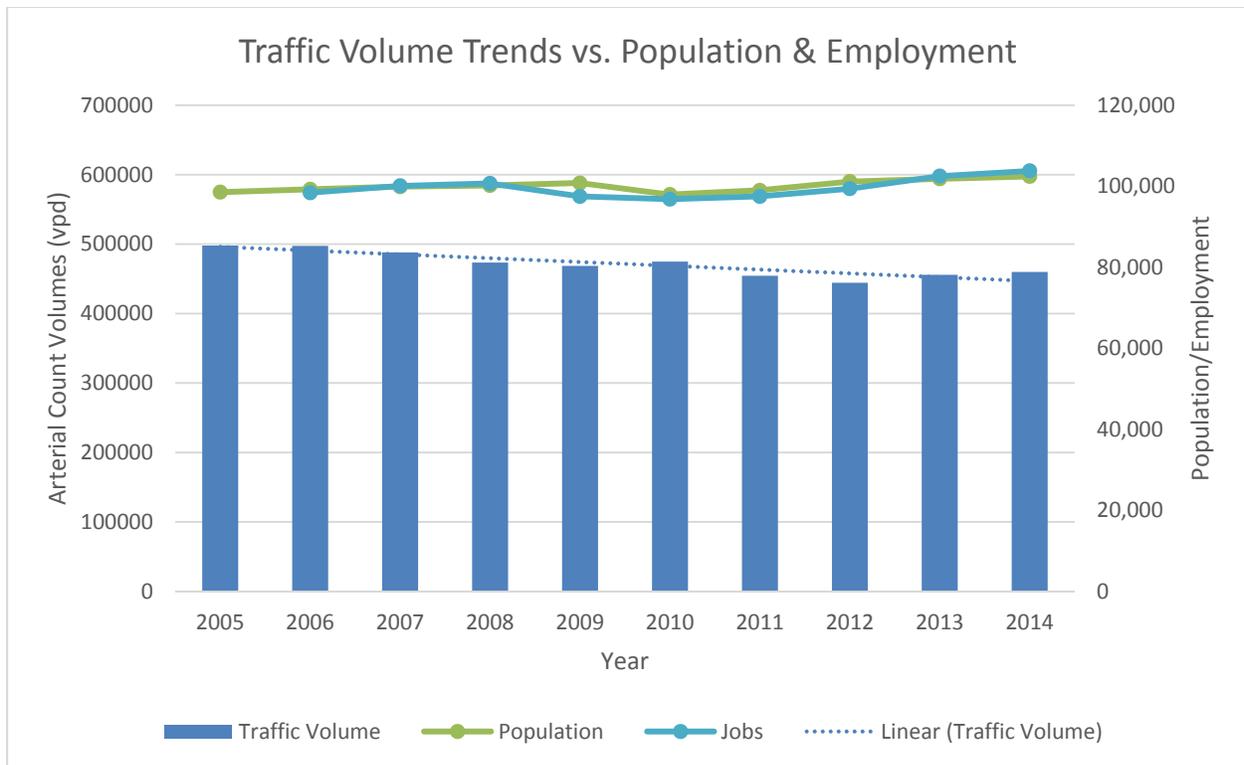


Figure 1. Trends in Boulder Traffic Volumes, Population, and Employment

Level of Service

An update of vehicle LOS at all signalized intersections based on intersection traffic volumes from 2012-2014 was completed in 2015. The vehicle LOS at signalized intersections has not degraded, even as the City grows in population and employment. The number of intersections with an overall vehicle LOS of E or F during any peak hour is tracked and the percentage of intersections at overall LOS E or F has remained around 19-21% during the last several LOS updates but dropped to 11% in the 2015 report. The results of the recent LOS analyses are summarized in **Table 1**. This reflects the decrease in traffic volumes during the three previous years. In response to concerns raised during the TMP update, the 2015 LOS update also began tracking the percentage of traffic in each peak period that experiences a movement of LOS E or F. This new metric is shown in **Table 2** and is a baseline metric that staff will be tracking with all future LOS updates.

Year	Total # Signalized Intersections	# at LOS E or F in Any Peak Hour	% of Total
2007	132	25	19%
2009	133	25	19%
2011	133	28	21%
2015	138	15	11%

Table 1. Summary of Level of Service Results

Peak Hour	Total Entering Volume	# of Entering Vehicles Experiencing LOS E or F	% of Entering Vehicles Experiencing LOS E or F
AM	275,116.00	18,128.00	7%
Noon	275,391.00	9,783.00	4%
PM	351,425.00	33,520.00	10%

Table 2. Vehicles Experiencing LOS E or F

Travel Times

Travel time studies were completed for Broadway, 28th Street, and Foothills Parkway in 2012 and for Arapahoe Avenue, Valmont Road, and Broadway in 2014. Changes in corridor travel times can be caused by a variety of factors including intersection improvements, modifications to traffic signal timing, construction projects, and fluctuations in traffic volumes. Thus, increased traffic congestion would likely adversely affect travel times. The latest travel time studies provided results consistent with past studies, revealing no significant changes to the time it takes to traverse these corridors.

The results of the travel time runs can be compared to the theoretical minimum travel time based on the speed limit of each corridor. As shown in **Figure 2**, travel times have remained relatively steady over the past 10 years. The sharp decrease in travel times on 28th Street between 2006 and 2008 was most likely a result of improvements at the Iris Avenue intersection.

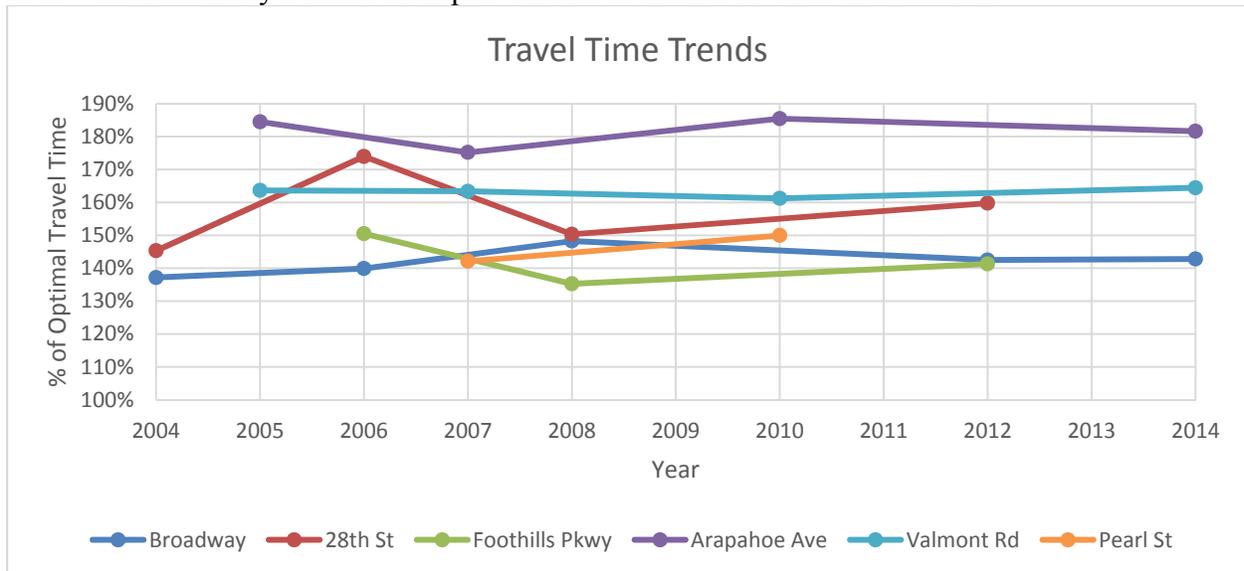


Figure 2. Travel Time Trends on Major Corridors

Bike Counts

Downtown Bike Parking

During the period of the Downtown bike parking counts, bike parking has gone up significantly between 2007 and 2014. This increase has largely been accommodated through almost an 80 percent increase in bike parking racks. However, the increase in bikes downtown has flattened since 2009, potentially reflecting a lack of available racks or poor placement of the existing racks. The Downtown bike parking analysis has identified blocks where existing racks do not meet demand and blocks where rack placement seems to limit use of those racks.

Automated Bike Counts

The city's automated bike count data has been the subject of several academic research projects, including an effort to predict annual bike ridership from limited data and a study of weather factors affecting bike ridership. This research has shown that bike ridership is strongly affected by weather, particularly temperature and precipitation. Bike ridership follows a consistent pattern of peaking during the warm summer months and reaching minimums in mid-winter. Precipitation will then significantly reduce bike usage at any time of the year.

Over the period of automated bike counts, there has not been a significant increase in bike counts. This is not consistent with the increase in resident bike mode share shown in the Boulder Valley Employee Survey, where bike mode share has increased from 13 percent in 2001 to 18 percent in 2014. This might reflect the location of the count stations, which might be counting older parts of the bike system while recent improvements have made other routes or corridors more attractive. A notable example would be the completion of the 30th Street corridor which does not have any count stations.

Surveys

With the 1989 TMP call for a better understanding of travel in the Boulder Valley, two primary surveys were created to measure travel: the travel diary survey to measure how Boulder residents travel and the *Boulder Valley Employee Survey (BVES)* to measure travel by both resident and non-resident employees in the Boulder Valley. As more than half of Boulder employees commute in from outside the Boulder Valley, trips by non-residents are a large share of the travel puzzle.

Boulder Valley Employee Survey

The 2015 BVES show continued progress in reducing the single-occupancy vehicle (SOV) mode share of the work commute. As shown in **Figure 3** below, from 1991 to 2014, SOV mode share for Boulder Valley employees commute trips declined from 73 percent to 67.8 percent.

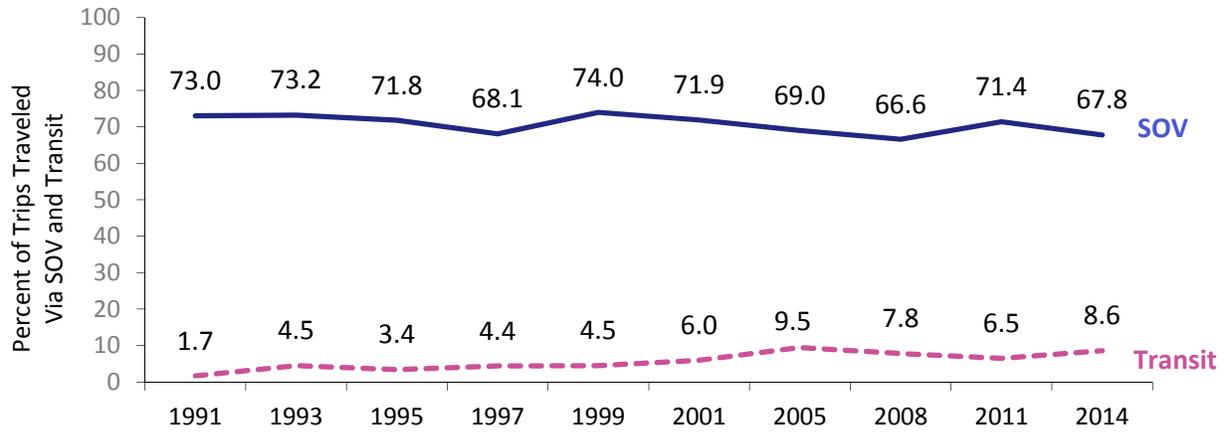


Figure 3. Work Trip Mode share of Boulder Valley Employees

While the SOV work trip mode share of non-resident employees has remained relatively constant, the SOV commute mode share for Boulder residents has shown a significant reduction from 65 percent to 47 percent. This reduction is shown in **Figure 4**, and a comparison of the two figures show that

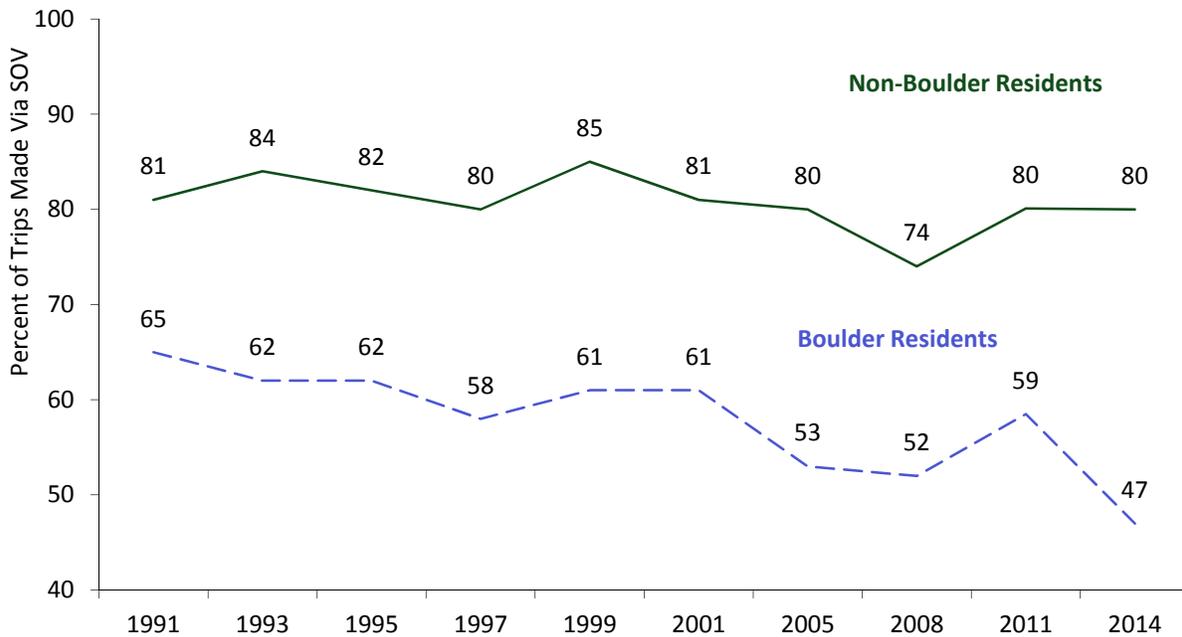


Figure 4. Work Trip Mode share of Resident and Non-Resident Boulder Valley Employees

the mode change in Boulder Valley employees is almost entirely driven by Boulder resident mode change. The 2014 BVES also shows that Eco Pass procession continues to increase for Boulder Valley employees, with 42 percent of all employees having an Eco Pass for an increase of 6 percent from 2011. Car sharing has continued to drop and is less than half of its previous high, reflecting national trends. And the distance of the work commute continues to increase, with 20.2 percent of employees traveling more than 20 miles to work, up from 12.4 percent in 1991. The proportion of the employees who ever telework has increased significantly, rising from about 28 percent in 2011 to 38 percent in 2014 for all respondents and from about 42 percent to 48 percent for online respondents for the same year.

Downtown Boulder Employee Transportation Survey

For the Downtown, the low point for the drive-alone mode share was 34 percent in 2008, reflecting high gasoline prices. SOV mode share for the day of the survey was 43 percent in 2014, unchanged from 2011. These changes in SOV commuting are reflected in an overall change in transit commute mode share as shown in **Figure 5**, which peaked in 2008 at 34 percent and was 23 percent in 2014. Mode shares for a “typical” week were very similar to those for the day of the survey.

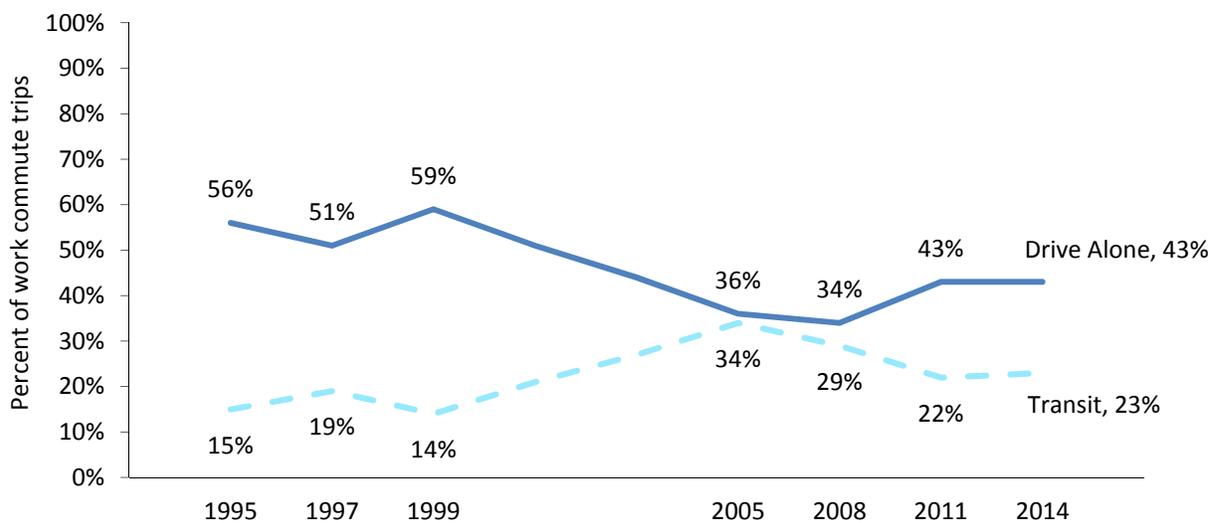


Figure 5. Work Trip SOV and Transit Mode Share of Downtown Employees

Eco Pass procession reached a new high, with 84 percent of Downtown employees having an Eco Pass. Telecommuting also increased significantly, with about 16% of all online respondents in 2014 reported telecommuting once a week or more, nearly double the 8% who reported doing so in 2011. Both Boulder B-Cycle and eGo CarShare memberships increased, with eGo CarShare memberships doubling from 2 percent to 4 percent.

TMP Measurable Objectives

The 2014 TMP modified the plan’s existing measurable objectives by expanding the number from six to nine and continues the Transportation Metrics program of reporting the results of our efforts to the community. Relative to the TMP measurable objectives, the recent LOS report shows a significant improvement and that the system is well under the “no more than 20 percent congested” TMP objective. And continued reduction in the resident SOV mode share for the

work commute will contribute to meeting the TMP objective of a “20 percent SOV mode share” for all trips and a “20 percent reduction in resident per-capita VMT. The lack of SOV mode share reduction for non resident employees confirms the identified challenge of effecting mode shift in these trips. As part of this program, both the *Safe Streets Boulder* and *Transportation Report on Progress* are scheduled to be updated in 2015 and will provide a comprehensive report to the community of progress in these areas.

The three new objectives relate to increasing safety, increasing the share of residents living in complete “15 minute” walkable neighborhoods, and reducing resident and non-resident per capita VMT.

Safety

While the first *Safe Streets Boulder* report was produced in 2012, safety was not a TMP objective until the 2014 TMP. The Vision Zero strategy adopted as a TMP objective has been adopted by a number of cities across the world and was recently promoted by the US Department of Transportation in the Mayors’ Challenge for Safer People, Safer Streets. The city is participating in this challenge and staff has begun the process of updating and expanding our accident analysis to include accidents for all modes. The proposed metrics for the TMP safety objective are:

- Total crashes, fatalities, and serious injuries
- Total bike crashes, fatalities, and serious injuries
- Total pedestrian crashes, fatalities, and serious injuries

In order to work towards achieving our TMP safety goal, the *Safe Streets Boulder Report* will review and analyze bike, pedestrian, and motor vehicle crashes. The report will provide a more detailed look into crash trends and how they can be mitigated and will evaluate:

- Injury severities
- Crashes vs. mode share and/or miles traveled
- Locations of crashes (intersection, driveway access, parking lot, crosswalk, etc.)
- Citations and driver actions
- Demographics of persons involved in crashes
- Crashes by time of day, day of week, and month of year
- Crash types
- High crash locations

15 Minute Neighborhoods

The 15 minute neighborhood access tool developed as part of the TMP process is being developed into a Web based tool that will be useful to a broader set of city staff and potentially the public. Staff and consultants have been working with the city’s Information Technology (IT) department to address security and compatibility concerns. A scope of work has been defined and approved by IT and development work should be completed by the end of July.

Per Capita Vehicle Miles of Traffic

Developing an objective for VMT per capita provides residents and employees with a goal that resonates on a more personal level and allows a connection between their day-to-day travel choices and overall community goals. To achieve a 20 percent reduction in VMT from current levels, daily VMT needs to be reduced to 7.3 miles for residents for all trips and to 11.4 miles (one-way work trip) for non resident employees.

According to the 2012 Modal Shift Report the average VMT per capita for Boulder residents is 11.2 miles. According to the 2011 Boulder Valley Employee Survey, the average VMT per capita for work trips (one-way) by non-resident employees is 15.3 miles, an increase from the 14.4 miles reported as part of the TMP.

VI. NEXT STEPS

The city's major transportation surveys are now being conducted every three years as both a cost saving measure and due to the relatively consistency of the data. The city will be conducting the travel diary survey of Boulder residents this fall. In addition to conducting the paper travel diary as in the past, staff has contracted for development of a smart phone app that will be piloted as part of the travel diary survey. The *Safe Streets Boulder* and *Transportation Report on Progress* will also be revised and produced in the fourth quarter of this year.

The second six month TMP implementation check-in study session with council is scheduled for Aug. 26, 2015. The TAB will be reviewing materials for this study session at the Boards upcoming meetings. For more information and updates regarding the 2014 Transportation Master Plan, please visit: www.bouldertmp.net

ATTACHMENTS

- A. Boulder Valley Employee Survey Executive Summary

EXECUTIVE SUMMARY

The Boulder Valley Employee Survey has been conducted for the Transportation Division nine times previous to the 2014 implementation; every two or three years between 1991 and 2011. Employees were targeted for inclusion in the study through a two-stage selection process; first a group of employers was randomly chosen, and then employees from within the selected organization were invited to participate in the survey. All companies in Boulder Valley, considered to be the zip codes of 80301 through 80310, were eligible for the study. A total of 1,150 employers were selected for the study, 350 from the downtown area, and 800 from the rest of Boulder Valley. These selected organizations were mailed a letter explaining the importance of the study, and were contacted over the next few weeks to invite participation. Most employers emailed an online survey invitation to their employees. For some organizations like restaurants, retail stores and hotels, research staff worked with a contact person at the organization to drop off hard copy surveys which the employer would distribute and collect, to be later picked up by research staff. A total of 2,060 surveys were collected from employees in 374 organizations. The company response rate was 24% in the downtown area and 44% in the rest of Boulder Valley. The employee response rate was 34% in the downtown area and 31% in the rest of Boulder Valley. The data were weighted to account for the differential response rates of organizations and employees to more accurately represented employees of the Boulder Valley. With a sample size of over 1,000, the margin of error around the results is approximately $\pm 2\%$ per year.

Survey Highlights

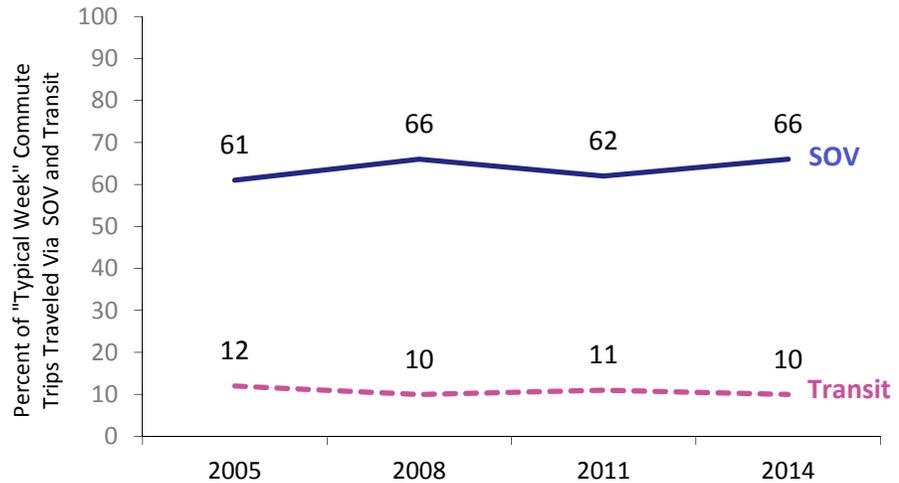
About two-thirds of work commute trips made during a “typical” week are made by driving alone.

One of the main purposes of the Employee Transportation Survey is to determine the “modal share” of trips made to and from the place of employment by those who work in Boulder Valley; that is, the proportion of work commute trips made via each method of transportation. Several questions on the survey relate to the work commute modal share.

One question asked how many days various modes of transportation were used for the commute to work during a typical week. Driving alone was the most common form of transportation used during a typical week, used for 66% of trips. Driving with another person was used for 6% of trips. Riding the bus and biking were each used for 7% of trips. Multi-mode travel (e.g., car then bus, bike then bus, etc.) was used for 3% of trips in a typical week. Walking to work accounted for 5% of trips. Working from home replaced about 4% of trips, while a compressed work week replaced another 2% of trips. Less than 1% of trips were by other modes.

Little change has been observed in the modal share of work commute trips in a typical week since the question was first asked in 2005.

Modal shift examines how the use of various modes changes over time. There has been little change in the reported modal share of work commute trips in a typical week since the question was first asked in 2005, with the proportion of single-occupancy vehicle (SOV) trips ranging from 61% to 66%.

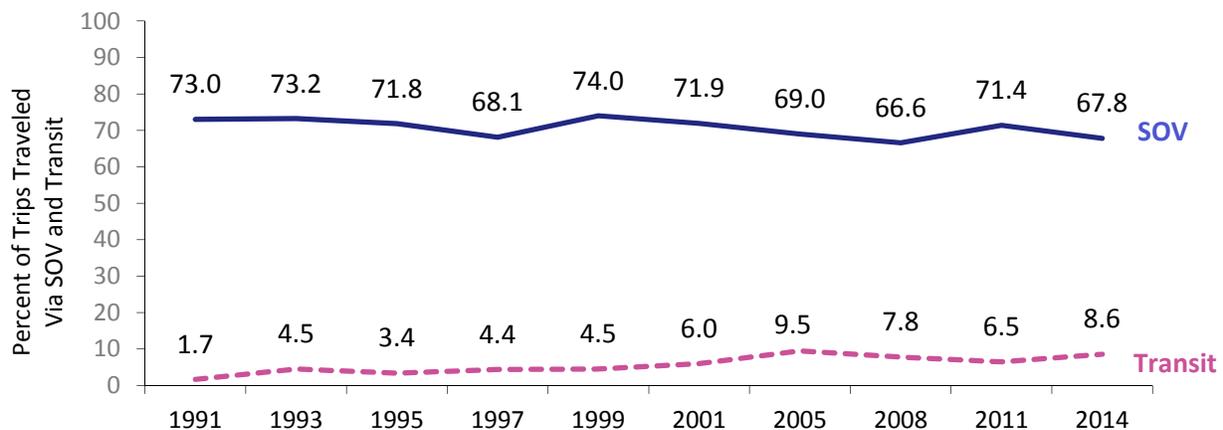


When asked how they traveled to work on the day they completed the survey, about two-thirds of respondents had commuted by driving alone.

In 2014, 68% of work commute trips on the day the survey was completed were made by driving alone. Using transit and bicycling were the next most common forms of commuting to work, representing 9% and 8% of trips, respectively. About 5% of respondents had shared a ride with at least one other person, and 4% walked to work. Approximately 3% telecommuted on the day they completed the questionnaire and 2% used multiple modes.

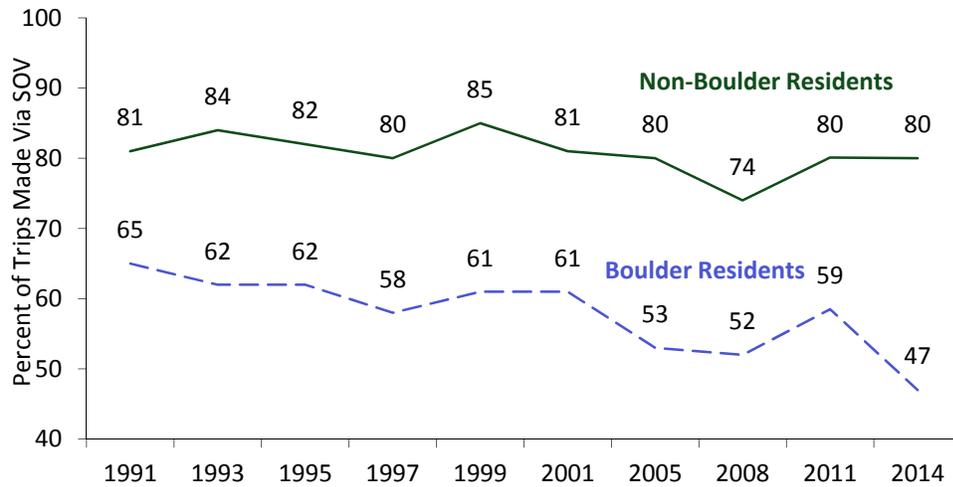
Since the survey was first conducted in 1991, the proportion of those who work in Boulder Valley and commute to work using a single-occupancy vehicle (SOV) has remained fairly constant, ranging from a low of 67% in 2008 to a high of 74% in 1999.

Transit use reached a peak of nearly 10% in 2005 from a low of 1.7% the first time the survey was administered in 1991. In 2014, transit was nearly as high as the peak with 9% of respondents reporting the rode a bus to work on the day the completed the survey.



Those who live outside Boulder were more likely drive alone for the work commute than were those who live in Boulder.

About 38% of respondents reported the live in the city of Boulder, and the remaining 62% lived outside of Boulder. When the modal shift over time is examined by place of residence, a trend of decreasing use of the single occupancy vehicle (SOV) was seen over time among those who lived in Boulder between 1999 and 2008. In 2011, however, rates increased and were similar to those of years prior to 2005. Then, in 2014 a large decrease was seen, to 47%, a level five percentage points below that observed in 2008, continuing the overall downward trend. For those



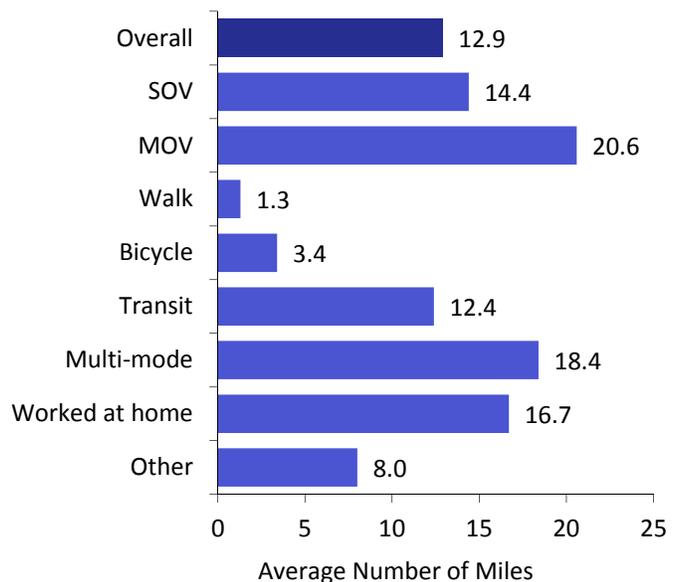
who lived outside of Boulder, where the prevalence of driving alone for the work commute was greater, SOV share decreased between 1999 and 2008. As with Boulder residents, SOV share increased in 2011, but then leveled off in 2014, to remain at 80%.

Those who walked or bicycled for their work commute lived much closer to work, on average, than did those who used vehicles, either private or transit, for their work commute.

The average distance of an employee’s work commute was 12.9 miles in 2014, while the average duration was 27.7 minutes.

The average walk commute distance was 1.3 miles, while the average bicycle commute was 3.4 miles.

The distance of the work commute increased gradually from 1991 to 2001, and then has remained relative stable. Average duration of the work commute has been generally increasing over time, with a larger jump from 23.2 minutes in 2011 to 27.7 minutes in 2014.

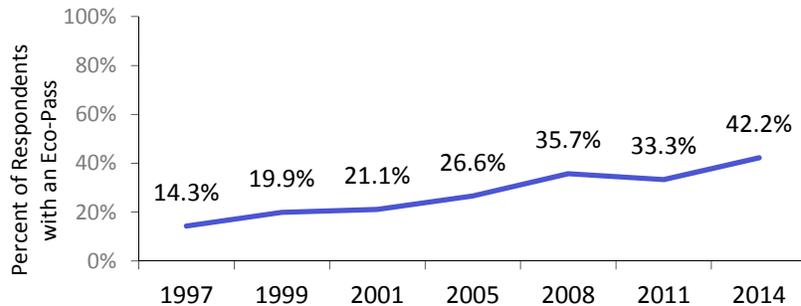


About 6% of the private motor vehicles used for the work commute were hybrid gas/electric vehicles.

About 8 in 10 respondents reported a motor vehicle was available to them for their work commute. For the first time in 2014, these respondents were asked about the characteristics of the type of vehicle available for the work commute. Of those with a vehicle available for the work commute, 6% were hybrid (gas/electric) vehicles. Nine percent of these vehicles were a partial zero emissions vehicle. Very few (0.2%) were electric vehicles, and only a couple of respondents (0.1%) used a Level 2 EV charger at work.

Eco-Pass holdership continued to climb.

In 2014, four in 10 respondents reported they had an Eco-Pass. Eco-Pass possession increased steadily from 1997 to 2008, leveled off from 2008 to 2011, and then increased again in 2014.



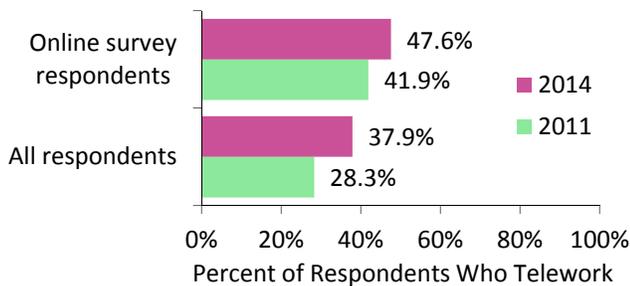
When asked if they ever ride a bus to work, about a third of those completing the employee transportation survey said they did so.

This was similar to results from previous years. About one in five respondents reported riding a bus for **non-commute trips** during a typical week. This represents a slight decrease from 2011, but is similar to what had been observed in 2008 and 2005. The average number of trips per respondent made during a typical week for non-commute trips on the bus was 0.6 trips per week. Among those who typically made at least one trip, the average number of non-commute bus trips per week was 3.0.

As observed in previous years, Eco-Pass possession was associated with use of transit for work and non-work trips. Almost 1 in 5 of employees with an Eco-Pass rode a bus for the work commute on the survey day compared to just 4% of those without an Eco-Pass. This was similar to levels reported since 2008, although the proportion of those riding with an Eco-Pass was slightly lower, and the proportion riding without an Eco-Pass was slightly higher.

The proportion of employees who ever telework for their job continued to increase.

The percentage of respondents who telework at least some of the time increased from 2005 to 2008 and remained stable between 2008 and 2011, with another increase in 2014. As this



question was only asked of those who completed the web version of the survey in 2014, the increase compared to 2011 was examined by mode in which the respondent completed the survey. Even when comparing only those who completed the online version of the survey in 2011 and 2014, an 8% increase was seen in the proportion those ever able to telework.