

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

**MEETING DATE:** September 14, 2015

**AGENDA TITLE:** Staff briefing and TAB input regarding Phase II Living Laboratory evaluation update, corridor refinements, and upcoming community engagement events.

**PRESENTERS:** Michael Gardner-Sweeney, Interim Director of Public Works for Transportation  
Bill Cowern, Transportation Operations Engineer  
Kathleen Bracke, GO Boulder Manager  
Marni Ratzel, Senior Transportation Planner  
Dave “DK” Kemp, Senior Transportation Planner

**EXECUTIVE SUMMARY**

This memo provides an update on the Living Lab Phase II evaluation, corridor refinements, and upcoming community engagement events for the Folsom Street corridor project.

During the August 25<sup>th</sup> City Council Study Session, council provided feedback to staff to proceed with the option of refining the Folsom Street corridor and/or intersections, particularly in segment between Pearl and Canyon and continuing to evaluate the corridor on a weekly basis, with frequent updates to TAB and Council.

Since the study session, staff has implemented several operational refinements to address community concerns and continues to monitor and evaluate the Folsom Street project on a daily and weekly basis.

Additionally, staff has scheduled several community outreach and listening events in the coming weeks to continue gathering public feedback regarding how the corridor is functioning from a multimodal user perspective.

**TAB ACTION REQUESTED**

Please review and provide feedback regarding the Living Lab Phase II Folsom corridor evaluation results from weeks 1-5 and planned community outreach activities.

## BACKGROUND

At the August 25<sup>th</sup> City Council Study Session, staff presented to City Council a summary of public comments, results of the data collected since the installation of the project, and lessons learned during the public outreach, installation, and data collection processes.

City Council was presented with options with how to proceed with the project ranging from staying the course, to different levels of corridor refinement/modification, through to removing the project. Council provided feedback to staff to go with “Option 2” which includes refinements to the corridor and/or intersections, particularly in the segment between Pearl Street and Canyon Boulevard, and continuing with weekly evaluations and updates to TAB and City Council.

Since the installation of the Folsom Street project, staff has been collecting and reporting data on a weekly basis. The data consists of the following primary evaluation criteria:

- Vehicle weekday volume
- Vehicle speed
- Vehicle travel time (north and southbound evening/PM peak)
- Bicycle weekday volume
- Collisions

Additional data is being collected for secondary evaluation criteria, such as, bicycle demographics, transit ridership, pedestrian crossings, and diverted traffic. This information will be reported when sufficient data has been collected and synthesized (anticipated-October 2015) as part of the three month evaluation of the Living Lab Phase II project.

## STAFF ANALYSIS

Staff has developed an infographic in order to provide an ‘at-a-glance’ perspective of the data collected since the installation of the project. Data from weeks 1-5 is detailed in the latest infographic in **Attachment A**, and in the full after data summary in **Attachment B**.

Vehicle volume, speed, and travel time were not collected during week 4 due to that being the CU “Move-In” week and data collected would not be representative of typical travel patterns. .

Below is brief summation of the week 1-5 data:

- *Vehicle Weekday Volume (measured north of Canyon Boulevard)*  
Vehicle volume has remained relatively constant at 16,500 vehicles per day from week 3 data, although CU is back in session. This represents a reduction in volume of approximately 13% from before data.

- *Vehicle Speed (measured north of Pine Street)*  
The vehicle speed continued to reduce from 39 (mph) in the before condition to 37(mph) in weeks 1-3 to 36 (mph) in week 5. Posted speed is 30 mph.
- *Bicycle Weekday Volume (measured north of Pine Street)*  
The bicycle volume north of Pine Street has increased to 1,471 in week 5. This represents a +68% increase when compared to before data. This substantial increase is largely attributed to CU being back in session.
- *Vehicle Travel Times*  
High, low, and average vehicle travel times increased in week 5 from week 3. The fluctuation in travel time is attributed to CU being back in session. The northbound average vehicle travel time was 10 seconds faster than the projected average travel time. The southbound average vehicle travel time is 22 seconds slower than the projected average travel time.
- *Collisions*  
Since installation, five collisions have occurred – three involving vehicle vs. vehicle and two involving vehicle vs. bicycle. Currently, collisions are averaging 1 per week, compared with 1.6 per week between 2012 and 2014. No serious injuries were reported.

### Corridor Refinements

Based on feedback from City Council at the Aug. 25 study session, the Transportation Division is making several refinements along the Folsom Street corridor, including adjustments to the painted pavement markings, bollard placements, vegetative landscaping, and traffic signal timing. These strategic modifications will clarify and facilitate turning movements at key intersections and driveways that some users have reported to be confusing or challenging. These refinements are scheduled to begin the night of Tuesday, Sept. 8, and are expected to be substantially completed by the end of next week.

#### *Traffic Signal Timing*

After the first two weeks of observations, the city modified the timing of the traffic signal at the intersection of Folsom and Pearl streets during the p.m. peak period (3 to 7 p.m.) to shift several seconds of green lights from Pearl to Folsom streets.

#### *Vegetation Removal*

Following the Aug. 25 City Council Study Session, the city removed overgrown vegetation from the median at the Folsom and Walnut streets pedestrian crossing treatment. The vegetation at this location had blocked visibility for southbound vehicles to see bikes and pedestrians crossing from the east, which required drivers to slow down and hold up traffic behind them whenever approaching this crosswalk because they couldn't be sure if a pedestrian or cyclist was crossing. With the vegetation removed, the sight distance is improved and drivers can now pass through the crosswalk with confidence when no one is crossing the street.

### *Restriping the Center Left-turn Lane*

Additional modifications are scheduled during the night of Tuesday, Sept. 8. These refinements include restriping several of the painted median islands to create more center left-turn space, which will make it easier for vehicles to turn into and out of driveways and alleys along the corridor without blocking the through lanes. The pavement restriping will occur:

- North of the median on the north side of the Folsom Street and Canyon Boulevard intersection;
- South of the median at the Folsom and Walnut streets intersection; and
- On both the northbound and southbound approaches to the Folsom and Pine streets intersection.

### *Bollard Removal*

During the night of Tuesday, Sept. 8, staff will also remove approximately 200 of the bollards from the protected bike lane, which is expected to produce the benefits listed below:

- It will be easier for drivers making right turns into driveways, alleys and streets to do so without blocking traffic in the through lane. It will be easier for drivers to back out of several residential driveways along the corridor.
- There will be more space for drivers to pull aside to the curb to allow emergency response vehicles to safely pass by.
- The bike lane will be less constrained and it will be easier for one cyclist to pass another.
- The sense of clutter along the corridor will be reduced.

### *Traffic Signal Timing*

The city continues to observe the operation of the traffic signals along the corridor during peak travel periods to identify any modifications to the signal timing that would be beneficial. In response to the feedback received to date, staff is also observing signalized intersections that might be affected by diverting traffic, such as Canyon Boulevard and 26th Street.

### *“Right-turn Overlap” Traffic Signal Displays*

At three locations on the Folsom Corridor, staff will be installing “right-turn overlap” signal displays to facilitate right-turning movements. An example of an existing right-turn overlap signal can be found on westbound Pearl Street at Folsom Street, where there is an exclusive right-turn lane. When the green arrow is being displayed for southbound left-turning traffic on Pearl Street, the westbound right-turning traffic can proceed without conflict, so a green arrow is provided for that movement. The Folsom Street Living Lab has created exclusive right-turn lanes on northbound Folsom Street at Canyon Boulevard, on southbound Folsom Street at Canyon Boulevard, and on northbound Folsom Street at Pearl Street, so the existing traffic signal displays can be modified to provide right-turn overlap signals on those three approaches enhancing operations by reducing delay.

### Upcoming community engagement activities

Folsom Street corridor outreach events will continue, including walk, bike and drive audits that are scheduled throughout September and October. Community members are invited to attend a walk, bike, or drive audit along Folsom Street and share observations and stories with city staff and other community members. Participant experiences will be recorded and incorporated into the Living Lab evaluation. Several “pop-up” events also are being scheduled to engage community members at retail locations along the corridor. In addition to gathering feedback, staff will share additional informational materials for both drivers and bicyclists about how to interact with the new corridor treatments at intersection and along the corridor. Topics will include the bike box at Arapahoe; cars crossing over the bike lane to access a right turn lane; options for making room for an emergency vehicle to pass; and plans for winter maintenance.

More detailed schedule of events, technical information, and community feedback to date is available at: [www.boulderlivinglab.net](http://www.boulderlivinglab.net)

### **Key Questions for TAB:**

- 1) Does TAB have input and/or questions regarding the results of week 1-5 evaluation and corridor refinements?
- 2) Does the TAB have input and/or questions upcoming community engagement events?

### **NEXT STEPS**

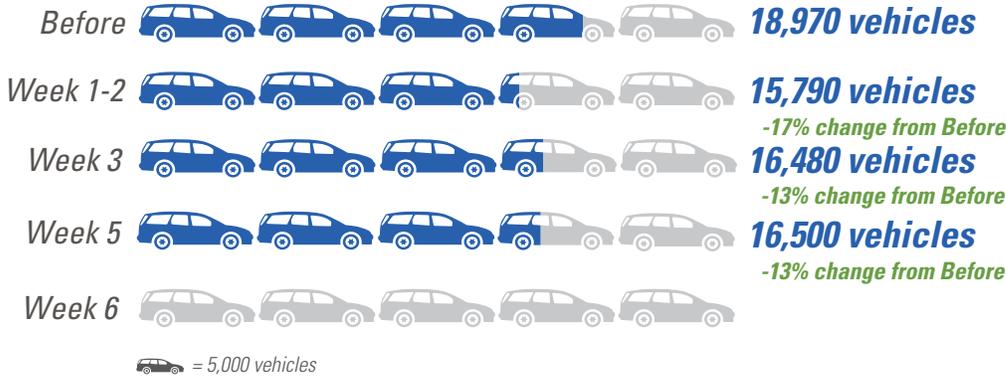
The Transportation Division will continue collecting and reporting data on a weekly basis. Staff will provide an additional update to TAB at the October board meeting prior to presenting an update at the October 20<sup>th</sup> City Council meeting.

### **ATTACHMENTS:**

- Attachment A: Infographic (weeks 1-5)
- Attachment B: Folsom Data Summary (weeks 1-5)



## Auto Weekday Volume



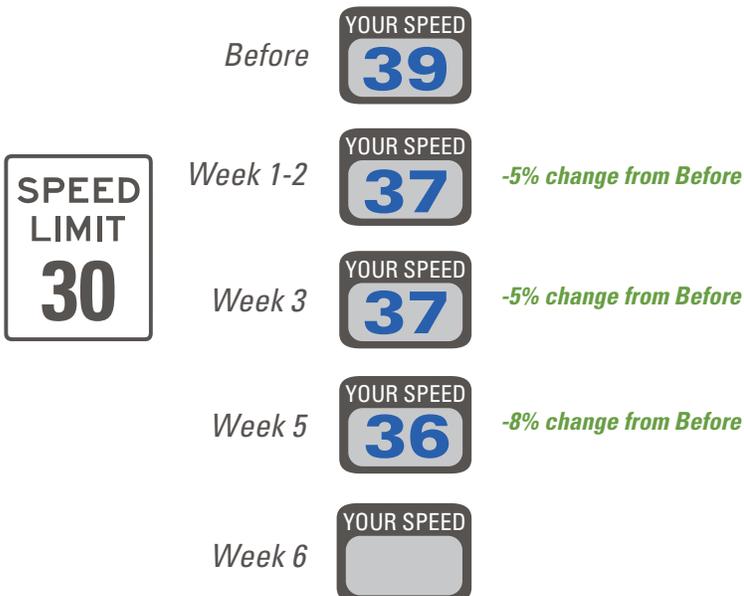
## Bicycle Weekday Volume



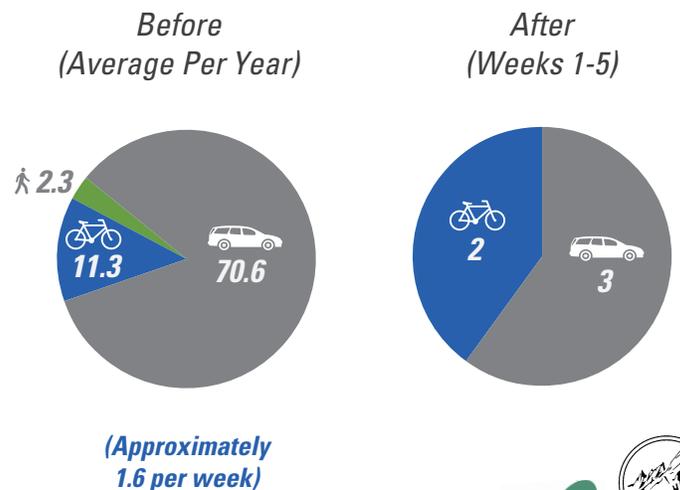
## PM Vehicle Travel Time



## Vehicle Speed



## Collisions



**Notes:**

- **Week 4 data: vehicle volume, vehicle speed, and travel time data were not collected during the CU “Move-In” as traffic patterns during this week do not represent normal conditions.**
- **<sup>1</sup> The northbound modeled PM Vehicle Travel Time is corrected to reflect the projected travel time as reported in the Multimodal Technical Analysis (4/29/2015). Earlier versions of this infographic reported the incorrect travel time of 4 minutes 30 seconds.**
- **<sup>2</sup> Week 3 Bicycle Volume was reported incorrectly as 1,207 in the last version of this infographic and has been updated.**
- **Additional data on demographics, pedestrians, and transit will be added as more data is available to report.**
- **After data collection time frames:**
  - **Week 1-2 is July 27th to August 9th.**
  - **Week 3 is August 10th to August 16th.**
  - **Week 4 is August 17th to August 23rd.**
  - **Week 5 is August 24th to August 30th.**
- **Auto Weekday Volume is measured at Folsom north of Canyon.**
- **Bicycle Weekday Volume is measured at Folsom north of Pine.**
- **Vehicle Travel Time is measured between Arapahoe and Valmont.**
- **Before Collisions are average collision frequency per year (2012-14).**
- **Vehicle Speed is the 85th percentile at Bluff.**



## MEMORANDUM

**To:** David Kemp

**From:** Bill Fox  
Jessica Hernandez

**Date:** September 2, 2015

**Project:** Folsom Street Living Laboratory

**Subject:** Week 4-5 After Data Early Observations

As part of the Folsom Street Living Laboratory, data on vehicle and bicycle volumes, vehicle speed, vehicle travel time, collisions, and bicyclist demographics was collected before the installation of protected bicycle lanes, during weeks 1-5 after the installation, and will continue to be collected as part of the ongoing evaluation process. Fox Tuttle Hernandez was asked to compile the after data available for these primary criteria and summarize early observations through Week 5 after the installation of the protected bicycle lanes on Folsom Street. While the after data from these early weeks is important, it is important to note that it is still considered preliminary, and ongoing data collection and analysis in the coming weeks will continue to inform the evaluation of the project.

Secondary evaluation data is being collected as part of the evaluation process. Details about additional evaluation criteria and the collection time periods for each can be found at [www.BoulderLivingLab.net](http://www.BoulderLivingLab.net).

Before data collection time periods vary by criteria and are noted in the individual tables below. After data collection time frames are:

- Weeks 1-2: July 27<sup>th</sup> to August 9, 2015
- Week 3: August 10<sup>th</sup> to August 16<sup>th</sup>, 2015
- Week 4: August 17<sup>th</sup> to August 23<sup>rd</sup>, 2015
- Week 5: August 24<sup>th</sup> to August 30<sup>th</sup>, 2015

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### Vehicle Volume and Speed

The City has been collecting 24-hour vehicle volume and speed using Miovision cameras at two locations along Folsom Street, north of Bluff and north of Canyon. The data is collected using Miovision technology and is recorded for a 3-day period, and reported as the average of the three days, or average daily traffic (ADT). Note that Boulder Valley School District (BVSD) and Colorado University (CU) schools have been in session during some but not all of the before and after data collection periods (noted in the tables below). For example, before vehicle data north of Bluff was collected in late April, 2015 while both schools were in session. CU and BVSD were not in session during Weeks 1-3.

CU “Move-In” occurred during Week 4 evaluation efforts and most BVSD schools began classes during that week. City and FTH staff determined the vehicle data collection samples would not represent regular (or normal) conditions due to increased visitor traffic during Week 4 when the CU move-in process is on-going, so vehicle volume, speed, and travel time were not collected and/or reported. [Note that traffic studies such as this attempt to document “normal” traffic flow conditions and therefore typically avoid unusual traffic events such as the CU move-in week, or the Thanksgiving or Christmas weeks, etc.] That said, collision data was collected and reported during Week 4 because it relates directly to safety, which may require more immediate attention if issues are noted. As of Week 5 and future data collection efforts, both schools are back in session and all data is being collected and reported.

Vehicle volumes on Folsom north of Bluff and north of Canyon have decreased from “before” volumes. Week 5 volumes north of Bluff increased just under 400 vehicles per day (vpd) from Week 3. Week 5 volumes north of Canyon remained the same as Week 3 volumes at 16,500, a reduction of about 2,500 vpd from June of 2015.

The posted speed on Folsom is 30 mph. Average vehicle speed and 85<sup>th</sup> percentile speed has decreased compared to the before installation speed at both locations along Folsom. North of Bluff, the average vehicle speed has decreased 3 mph from 35 to 32 mph and the 85<sup>th</sup> percentile speed has also decreased 3 mph from 39 to 36 mph. North of Canyon, average and 85<sup>th</sup> percentile speed has decreased 5 mph, from 34 to 29 mph and 29 to 24 mph, respectively.

#### **Folsom Street north of Bluff Street – Posted Speed Limit = 30 mph**

<b>Evaluation Period</b>	<b>Date Collected</b>	<b>ADT-Weekday (vpd)</b>	<b>Average Speed (mph)</b>	<b>85th Percentile Speed (mph)</b>	<b>CU &amp; BVSD In Session</b>
<b>Before</b>	4/27-5/1/15	15,780	35	39	Yes
<b>After-Week 2</b>	8/5-8/7/15	13,790	33	37	No
<b>After-Week 3</b>	8/12-8/14/15	13,930	33	37	No
<b>After-Week 5</b>	8/26-8/28/15	14,310	32	36	Yes

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**Folsom Street north of Canyon Blvd. – Posted Speed Limit = 30 mph**

Evaluation Period	Date Collected	ADT-Weekday (vpd)	Average Speed (mph)	85th Percentile Speed (mph)	CU & BVSD In Session
Before	6/30-7/2/15	18,970	29	34	No
After-Week 2	8/3-8/5/15	15,790	25	30	No
After-Week 3	8/10-8/12/15	16,480	24	29	No
After-Week 5	8/25-8/26/15	16,500	24	29	Yes

ADT = Average Daily Traffic

VPD = Vehicles per Day

MPH = Miles per Hour

**Corridor Travel Time**

The travel time it takes to drive the Folsom corridor end-to-end from Valmont to Arapahoe in the northbound and southbound directions was measured by driving the corridor before and after the installation of the protected bike lanes. The project team used the before travel time measurements to help calibrate the VISSIM modeling software, and then to forecast the expected travel time after the installation. During Weeks 1-2 after the installation, the project team drove the corridor 65 times (34 times during the PM commute/peak hour) and 60 times during Week 3 (23 times during the PM peak hour). As discussed in the previous section, City and FTH staff determined the vehicle data collection samples would not represent regular (or normal) conditions due to increased visitor traffic during Week 4 when the CU move-in process is on-going, so travel time data was not collected or reported. During Week 5, the project team drove the corridor 24 times over two days during the PM peak hour.

During Weeks 1-3, travel times were collected during the AM peak hour (8-9am), midday/early afternoon (noon to 4:30). During Weeks 1-3 and Week 5, travel times were collected during the PM peak hour (4:30-6pm). The travel times recorded during Weeks 1-3 vary throughout the day, with the shortest travel times in the morning and increasing throughout the day. The AM peak hour and midday/early afternoon travel times remained fairly consistent during Weeks 1-3 after installation (see tables below). Starting in Week 5, the travel times were collected for the PM peak only based on the less variable AM and afternoon travel times observed during Weeks 1-3.

The Week 5 average PM peak hour travel time increased about 35 seconds in the northbound direction and about 11 seconds in the southbound direction compared to the Week 3 average travel time (see tables below). There is variation in travel times through the PM peak hour in both directions. The Week 5 variation in travel times in the southbound direction remained at about 2 minutes and 22 seconds. The variation in northbound travel times increased in Week 5 by about a minute to 3 minutes and 36 seconds, with the longest travel time recorded at 6 minutes and 33 seconds.

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Northbound Week 5 average travel time is about 10 seconds shorter than the model forecast average travel time<sup>1</sup>, and the southbound Week 5 average travel time is about 22 seconds longer than the model forecast travel time. These projected increases in travel time represent projected conditions after the traffic patterns have settled down and travelers are familiar with the changes in the corridor. We expect this “learning curve” or “settling period” to take at least a month after the project is fully implemented and CU was back in session. Travel time measurements taken in Weeks 1-5 after implementation have not had the benefit of this “learning curve”, but are being offered as immediate or “early” observations, and they should be considered in this context.

#### Average PM Peak Hour Travel Times (in minutes:seconds)

Evaluation Period	PM Northbound	PM Southbound
Before (Nov. 2014)	3:32	3:20
Modeled	4:47 <sup>1</sup>	4:30
Week 1-2	4:15	5:36
Week 3	4:02	4:41
Week 5	4:37	4:52

#### Northbound PM Peak Hour Travel Time Variability (in minutes:seconds)

Evaluation Period	Average	High	Low	Variability
Before	3:32	4:52	2:46	2:06
Week 1-2	4:15	6:48	2:40	4:08
Week 3	4:02	5:15	2:49	2:26
Week 5	4:37	6:33	2:57	3:36

#### Southbound PM Peak Hour Travel Time Variability (in minutes:seconds)

Evaluation Period	Average	High	Low	Variability
Before	3:20	3:44	2:13	1:31
Week 1-2	5:36	8:14	3:53	4:21
Week 3	4:41	5:58	3:35	2:23
Week 5	4:52	6:15	3:53	2:22

<sup>1</sup> The northbound modeled PM peak travel time is corrected to reflect the projected travel times as reported in the Multimodal Technical Analysis (4-29-15).

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**Northbound Average Morning and Afternoon Travel Times (in minutes:seconds)**

Evaluation Period	AM Peak	Afternoon
Before (Nov. 2014)	2:18	n/a <sup>2</sup>
Modeled	2:45	n/a
Week 1-2	2:32	3:29
Week 3	2:31	3:10

**Southbound Average Morning and Afternoon Travel Times (in minutes:seconds)**

Evaluation Period	AM Peak	Afternoon
Before (Nov. 2014)	3:03	n/a
Modeled	3:01	n/a
Week 1-2	3:23	4:13
Week 3	3:05	4:09

**Collisions**

Collision data for the Folsom corridor from Valmont to Colorado is being compiled from police reports. The totals include all crashes at the intersections and in segments along the corridor. The following summarizes the average collision frequency per year from 2012 to 2014 for vehicle-vehicle, vehicle-bicycle, and vehicle-pedestrian collisions. The collisions reported for Weeks 1-5 are also summarized below by mode.

**Summary of Before Collisions Along Folsom Street from Valmont to Colorado from 2012-2014**

Before Time Period	Vehicle-Vehicle	Vehicle - Bike	Vehicle - Pedestrian	Total
2012-2014	212	34	7	253
Average per Year	70.7	11.3	2.3	84.3

**After Collisions Along Folsom Street from Valmont to Colorado**

After Evaluation Period	Vehicle-Vehicle	Vehicle-Bike	Vehicle-Pedestrian	Total
Week 1-2	1	1	0	2
Week 3	1	0	0	1
Week 4	1	1	0	2
Week 5	0	0	0	0
<b>Total</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>5</b>

<sup>2</sup> Midday and afternoon travel times were not modeled.

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**Bicycle Volume**

Daily bicycle volumes are being collected at three locations along Folsom using permanent 24-hour counters: Boulder Creek, South Street, and Pine Street. BVSD and CU were not in session during the before or after data collection periods. Before and after volumes at Boulder Creek have been collected by a permanent 24-hour counter. The before volumes at South and Pine Street were collected from 6am to 9pm on June 30<sup>th</sup>, 2015 and after volumes are being collected by permanent 24-hour counters installed in late July, 2015. Note that the validation of the counters is currently in progress and volumes may later be adjusted to account for potential variances.

Bicycle volumes at all three locations increased during Weeks 4 and 5 from before conditions and Week 3 volumes. As noted previously, BVSD classes started during Week 4 and CU classes started during Week 5, likely influencing the bicycle volumes.

**Daily Weekday Average Bicycle Volumes Along Folsom Street at Pine Street**

Evaluation Period	Northbound	Southbound	Total
Before	437	440	877
Week 1	620	655	1,275
Week 2	551	625	1,176
Week 3	554	616	1,170
Week 4	603	651	1,254
Week 5	705	766	1,471

**Daily Weekday Average Bicycle Volumes Along Folsom Street at South Street**

Evaluation Period	Northbound	Southbound	Total
Before	388	389	777
Week 1	497	578	1,075
Week 2	512	556	1,068
Week 3	406	500	906
Week 4	570	600	1,169
Week 5	706	791	1,497

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**Daily Weekday Average Bicycle Volumes Along Folsom Street at Boulder Creek**

<b>Evaluation Period</b>	<b>Northbound - Adjusted</b>	<b>Southbound - Adjusted</b>	<b>Total - Adjusted</b>
Before	592	483	1,076
Week 1	683	521	1,204
Week 2	607	497	1,104
Week 3	603	478	1,081
Week 4	782	602	1,384
Week 5	1,060	880	1,940

**Notes:**

- “Before” volumes at Pine and South were collected from 6am – 9pm on June 30<sup>th</sup>, 2015 and converted to daily volumes using the average hourly distribution from the permanent counter data.
- “Before” volumes at Boulder Creek are an average of weekday volumes from the last week of July and first two weeks of August from 2012-14.
- “After” volumes are an average of daily volumes on Tuesday, Wednesday, and Thursday during the corresponding week.
- Volumes from Folsom at Boulder Creek have been adjusted using previously determined adjustment factors. Volumes from Pine and South have not yet been adjusted.

**Bicycle Demographics**

Bicycle demographic data has been observed and recorded along the Folsom corridor before and after the installation of protected bike lanes. The before data was collected on April 28, 2015 for 2 hours. After data was collected on July 29, August 3, August 12-13, and August 25-27 for a total of 12 hours. Observations have been taken during weekday AM, noon, and PM hours. Observers record the total number of male and female bicycle riders on the roadways. In addition, the number of children and adults riding with children is recorded and comprises the “family” category (see table below).

**Bicycle Weekday Demographic Along Folsom Street**

<b>Evaluation Period</b>	<b>Male</b>	<b>Female</b>	<b>Family</b>
Before	72%	28%	4%
Week 1-2	78%	22%	6%
Week 3	67%	33%	5%
Week 5	66%	34%	4%