ATTACHMENT E

CITY OF BOULDER

Department of Public Works Transportation Division
P.O. Box 791
1739 Broadway
Boulder, Colorado 80306
(303) 441-3266

Inter-Office Memorandum

TO: **Bill Cowern, Transportation Operations Engineer**

FROM: **Shannon Young, Transportation Engineer**

DATE: **May 19, 2015**

SUBJECT: **Safety Analysis for Phase II Living Laboratory Projects**

As part of the evaluation process of the complete streets Phase II Living Laboratory, the potential safety benefits of rightsizing projects were considered. Crash data from each proposed corridor was compiled and reviewed to determine existing crash trends which may be mitigated by the implementation of the proposed projects. The purpose of this memo is to summarize the findings of this evaluation.

Expected Crash Reduction
The Highway Safety Manual (HSM) provides information about the effects on crash frequency of various safety treatments, geometric design characteristics, and operational characteristics. The effects are quantified in the form of crash modification factors (CMF) which are based on published transportation safety research. CMFs can be applied to historic crash data in order to estimate the expected crash frequency after a treatment is installed.

The HSM presents a CMF for removing through lanes or "road diets" which is applicable to the Living Laboratory Phase II rightsizing projects. Based on the CMF, the potential crash effect of a four to three lane conversions on an urban arterial is a 29% reduction in crashes for all crash types and all severities.

Crash Types Susceptible to Mitigation
While an overall decrease in the frequency of crashes is expected, the implementation of a rightsizing project has the potential to decrease the frequency of certain crash types and increase others. The inclusion of various right-turn treatments in the Living Labs projects could provide additional benefits to bicycle-related crash frequency. The following crash types could be mitigated by the implementation of the rightsizing projects.

Left-Turn Rear End: The addition of a two-way left-turn lane or left-turn lanes at intersections would provide space for vehicles waiting to turn left onto a side street and reduce the chances of being rear-ended.

Sideswipe-Same Direction: By repurposing a lane in each direction, there would only be one through lane in each direction and vehicles would no longer be switching lanes or traveling side-by-side.

Sideswipe-Opposite Direction: A two-way left-turn lane would provide additional space between opposing lanes of traffic, reducing the chances of a sideswipe between vehicles traveling in opposite directions.

Left-Turns from Side Streets: At unsignalized intersections, the two-way left-turn lane would provide space for vehicles to make a two-stage left-turn, and thus, they would only need to cross one lane of traffic at a time.

Pedestrian Crossing: The reduced crossing distance and reduced number of vehicle lanes results in safer crossing opportunities for pedestrians at unsignalized locations.

Right Hook: The installation of specialized right-turn treatments at signalized intersections should reduce collisions between bicyclists and right-turning vehicles.

Conversely, the potential increased congestion associated with the installation of a rightsizing project could result in an increase in rear-end collisions. However, a decrease in speeds along the corridors due to rightsizing may result in additional safety benefits and decreased crash frequency of other crash types.

Crashes by Corridor

In order to better understand the potential safety benefits of the proposed rightsizing projects, historic crash data from each candidate corridor was reviewed to determine how many crashes susceptible to mitigation have been occurring. Crash data from the past three years (2012-2014) at intersections and on segments along the corridors was used for the analysis. The crash types considered susceptible to correction vary from corridor to corridor, as the proposed facilities are different depending on the corridor and segment.

Iris Avenue

Along Iris Avenue, west of Broadway to Folsom Street, 59 crashes have occurred during the last three years. Existing crash trends which may be lessened by a four to three lane conversion include rear ends due to vehicles waiting to turn left at 16th Street and 17th Street, right angle crashes from vehicles turning left from side streets along the corridor, and right hook crashes at Folsom Street. Of the 59 crashes along the corridor, about 12 (20%) of them could be considered potentially correctable by a rightsizing project.

Folsom Street

A total of 242 crashes occurred at the intersections and on segments along Folsom Street between and including Valmont Road and Arapahoe Avenue. Potentially mitigatable crashes along Folsom Street include left-turn rear ends at Pine Street and South Street, right hook crashes at Valmont Road, Pearl Street, and Arapahoe Avenue, and sideswipes due to lane changes along the corridor. Depending on the limits chosen for the rightsizing project, the number of

potentially correctable crashes ranges from 7 to 9 and 7% to 10% of total crashes.

55th Street

From Pearl Parkway/Valmont Road to north of Arapahoe Avenue, 55th Street experienced 71 crashes within the past three years. Of the 71 total crashes, 11 (15%) were considered correctable. Most of the crashes which could be mitigated by a rightsizing project on 55th Street were right angle crashes involving eastbound vehicles turning left from Western Avenue or the driveway access north of Arapahoe Avenue. A four to three lane conversion on 55th Street would reduce the number lanes to navigate across at each location and would provide a two-way left-turn lane at the driveway access north of Arapahoe Avenue.

63rd Street

A total of 47 crashes were reported at the intersections on 63rd Street from Lookout Road to Gunbarrel Avenue/Nautilus Drive during the past three years. Twenty-three of these crashes occurred at Lookout Road and are not likely to be mitigated by the proposed rightsizing project. Since 63rd Street has a raised median and limited intersections, the potential reduction in crash frequency is lower than the other corridors. The only existing crash trend which may be corrected is right angle crashes at Longbow Drive involving eastbound left-turns. These crashes represent 6% of the total crashes on the corridor.

Conclusion

Some of the existing crash trends on Iris Avenue, Folsom Street, 55th Street, and 63rd Street could be mitigated by the implementation of the Phase II Living Laboratory rightsizing projects. Since the historic crashes and proposed facilities are different on each corridor, the potential safety benefits also vary. The frequency of crash types considered correctable by the proposed projects ranges from 6% to 20% on the candidate corridors. Actual crash reductions may be higher or lower than these projections as a result of increased congestion, decreased speeds, or changes in traffic volumes.

Appendix:
Crash Summaries by Corridor

Appendix

Crash Summaries by Corridor

Iris Avenue

Intersection/Segment	Total Crashes				Correctable Crashes	
	2012	2013	2014	Total		
Iris Ave and 13th St	3	0	1	4	2	50%
Iris Ave and 14th St	1	1	0	2	0	0%
Iris Ave and 15th St	1	1	1	3	1	33%
Iris Ave and 16th St	2	5	4	11	4	36%
Iris Ave and Iris Ct	0	1	1	2	0	0%
Iris Ave and 17th St	1	0	0	1	1	100%
Iris Ave and 19th St	4	2	1	7	0	0%
Iris Ave and 22nd St	1	0	0	1	0	0%
Iris Ave and Hermosa Dr	0	0	2	2	1	50%
Iris Ave and 25th St	1	0	1	2	0	0%
Iris Ave and Folsom St	4	12	8	24	3	13%
Total	**18**	**22**	**19**	**59**	**12**	**20%**

Folsom Street

Intersection/Segment	Total Crashes				Correctable Crashes	
	2012	2013	2014	Total		
Folsom St and Valmont Rd	6	5	6	17	2	12%
Folsom St and Bluff St	1	0	3	4	0	0%
Folsom St and Mapleton Ave	0	0	1	1	0	0%
Folsom St and Pine St	9	8	4	21	2	10%
Folsom St and Spruce St	5	5	0	10	0	0%
Folsom St and Pearl St	11	7	8	26	3	12%
Folsom St and Walnut St	1	3	1	5	0	0%
Subtotal	**33**	**28**	**23**	**84**	**7**	**8%**
Folsom St and South St	1	2	0	3	1	33%
Folsom St from South St to Canyon Blvd	3	1	0	4	1	25%
Subtotal	**37**	**31**	**23**	**91**	**9**	**10%**
Folsom St and Canyon Blvd	16	28	25	69	0	0%
Folsom St from Canyon Blvd to Goss St	1	2	0	3	1	33%
Folsom St and Goss St	5	0	0	5	1	20%
Folsom St and Grove St	2	2	2	6	0	0%
Folsom St and Arapahoe Ave	24	21	23	68	5	7%
Total	**85**	**84**	**73**	**242**	**16**	**7%**

55th Street

Intersection/Segment	Total Crashes				Correctable Crashes	
	2012	2013	2014	Total		
55th St and Pearl Pkwy/Valmont Rd	20	13	9	42	0	0%
55th St and Flatirion Ln	1	2	1	4	1	25%
55th St and Mine Way	0	1	0	1	1	100%
55th St and Central Ave	4	4	0	8	0	0%
55th St and Western Ave	4	3	1	8	5	63%
55th St from Western to Arapahoe	2	5	1	8	4	50%
Total	31	28	12	71	11	15%

63rd Street

Intersection/Segment	Total Crashes				Correctable Crashes	
	2012	2013	2014	Total		
63rd St and Lookout Rd	11	4	8	23	0	0%
63rd St and Spine Rd	6	7	5	18	0	0%
63rd St and Longbow Dr	2	0	1	3	0	0%
63rd St and Gunbarrel Ave/Nautilus Dr	2	0	1	3	3	100%
Total	**21**	**11**	**15**	**47**	**3**	**6%**