BLUE SAGE DRIVE TRAFFIC CALMING PILOT PROJECT

FINAL REPORT

January 2022

Littleton
Colorado

Contents

Pilot Project Background

Safety & Speeding Concerns

In 2019 the City of Littleton staff was contacted by residents from the Bow Mar South (BMS) neighborhood regarding concerns about traffic safety. Specifically, residents expressed concerns about perceived vehicular speeding and the potential for cars to collide with pedestrians and cyclists who use the streets throughout the neighborhood due to the absence of sidewalks or bike lanes.

In response, city staff collected speed and volume data throughout the BMS neighborhood. However, despite multiple data collection efforts over 6 months, the results did not suggest to city staff that there was a pervasive problem or pattern of speeding in the neighborhood. In further discussions with the BMS Homeowners Association (HOA) and residents, individuals expressed a concern that even a few vehicles traveling over the speed limit pose a significant danger to those walking and biking in the street. Field observations and additional data collection showed a high number of people using the street to walk and bike compared to similar residential streets in Littleton. With pedestrians and cyclists sharing roadway space with motor vehicles, there are often heightened concerns regarding safety.

Residents suggested potential solutions to address the safety concerns, such as the installation of additional speed humps; adding more speed limit signs; adding signs indicating the presence of children; adding signs clearly identifying pedestrian crossing locations, and signs modifying the use of the gate on Blue Sage Drive. While staff did install additional speed limit signs and a pedestrian sign at a high-volume crossing location, the city suggested testing out some potential options as a pilot project to mitigate conflicts between pedestrians, cyclists and vehicles sharing roadway space.

While residents on many streets throughout the neighborhood share these concerns, Blue Sage Drive was identified regularly and was, therefore, selected for this temporary pilot project. The segment of Blue Sage Drive from the gate north of Tule Lake Drive to the traffic circle at Sumac Lane (see map in Pilot Project Design section) is commonly accessed by the entire neighborhood and is a source of consistent resident safety concerns. As a result, this approximately 1,000-foot segment of Blue Sage Drive was designated by the city to conduct a study of ways to more safely encourage residents to share the roadway by providing a designated space for people to walk and bike, with the anticipation that some of the modifications might also further slow vehicle speed. Additionally, in order to involve the neighborhood and provide transparency throughout the process, city staff prepared before and after surveys to allow residents to participate in the pilot project; to document reactions to the study, and to involve the neighborhood in the decision-making process.

Littleton's Traffic Calming Thresholds

The City of Littleton has been in the process of revamping traffic calming criteria by developing thresholds for what constitutes speeding and safety matters on the roadways in the community where a majority of concerns are prevalent—Local streets (like Blue Sage Drive) and neighborhood connector streets (like Berry Avenue) along which most residents live. These thresholds are intended to help city staff address neighborhood traffic safety consistently from one issue to the next, and help residents understand what thresholds need to be met for the city to pursue physical changes to the roadway versus responding with education and enforcement measures. These thresholds were still being developed during this pilot project, which has enabled the staff to clearly communicate the criteria by which speeding problems should be measured in BMS. These thresholds were developed with the expertise of two licensed

engineers and are consistent with other jurisdictions throughout the front range. These thresholds will be officially adopted as part of the revised Neighborhood Traffic Management Plan. Some common terms utilized for evaluating speeding concerns that are important to know are as follows:

- 85th Percentile Speed (85p): this is the speed by which 85% of drivers are driving at or slower and is considered the general speed people feel comfortable driving. This is also a national and industry standard by which speeds are evaluated.
- Average Speed: this is the average or mean speed of all the vehicles speeds recorded for the data collection period.
- Average Daily Traffic (ADT): the average number of cars per day at the site of measurement.

City staff recognizes the first approach to any potential neighborhood speeding concern is through educating residents and enforcement of the posted speed limit with the assistance of the Littleton Police Department. Below are the city's specific metrics based on data collection by which vehicle speeds may justify consideration for physical changes to the roadway in order to address excessive or prolific speeding:

1. 85p speed is 8 MPH or more over the posted speed limit
2. Average speed is 6 MPH or more over the posted limit
3. Percentage of vehicles speeding
    a. Local streets
        i. 20% of vehicles are driving more than 5 MPH over the speed limit
        ii. 10% of vehicles are driving more than 10 MPH over the speed limit
    b. Neighborhood connector
        i. 30% of vehicles are driving more than 5 MPH over the speed limit
        ii. 15% of vehicles are driving more than 10 MPH over the speed limit

If data collection by the city shows that one the above thresholds is being met, city staff will follow the three E's of traffic safety:

1. Education – Inform residents of the neighborhood about the data collected regarding the neighborhood traffic safety issue, and individual drivers when appropriate.
2. Enforcement – Work with the Littleton Police Department to execute specific speeds or safety enforcement based on the initial data collection findings.
3. Engineering – Through staff expertise, data collection, and/or pilot projects, make changes to the roadway to address the initial safety concerns.

Littleton Traffic and Engineering staff will apply the three E's to resident concerns when they meet the above thresholds. To address a concern staff will start with education and progress to enforcement and engineering only when each step has been unsuccessful at addressing the concern. Engineering will be undertaken as the city's traffic calming budget allows and under the direction and oversight of engineering staff.

Measures of Success

Prior to the installation of the Blue Sage Drive pilot project, city staff developed a series of metrics by which the pilot project would be considered effective. Below is a list of those metrics:

1. 85p Speeds – 85p speeds decrease when compared to pre-pilot data
2. 5+ mph Speeders – the percentage of 5+ mph speeders decrease when compared to pre-pilot data
3. Pedestrian & Cyclist Volume – the volume of pedestrians and cyclist increases when compared to pre-pilot data

4. Community Support – One-Half of the BMS respondents, and two-thirds of residents adjacent to the project area, are in favor of the pilot project

The city considers the last of these four metrics (Community Support) as the most crucial factor in deciding whether or not to move forward with any form of post-pilot changes to the street. Even if the first three metrics are met, without firm community support and buy-in from the HOA, the City of Littleton would not move forward with long-term changes.

Speed Humps

Throughout the pilot project process and in many conversations with BMS residents, the installation of additional speed humps was discussed on several occasions. The City of Littleton Engineering staff has been moving away from the installation of speed humps as a traffic calming device for a number of reasons, including the following:

- Speed humps slow emergency response vehicles
- Speed humps create sound pollution for adjacent properties
- Speed humps cause challenges with plowing and street maintenance
- Speed humps tend to encourage speeding between humps
- In areas with no sidewalks, speed humps impact the space were people bike and walk
- Speed humps tend to increase vehicle volume on nearby streets
- Several jurisdictions have moved away from speed humps as a traffic control device because of the aforementioned issues as well as their ineffectiveness.

Research

In formulating this policy approach on speed humps, city staff researched the policies regarding speed hump use as traffic calming devices from a number of jurisdictions throughout Colorado, primarily in the Denver-Metropolitan Area. City staff found the speed hump policies of eleven jurisdictions posted on the respective websites. Below is summary of those findings:

Littleton (Previous Speed Hump Policy)

- *Only installed on streets with an ADT between 500 and 3,000*
- *30% of traffic must be speeding by 5 mph or more*

Adams County

- *85p speed of 10 mph over the speed limit or more*
- *No more than one speed hump per block*

Aurora

- *Installs speed cushions rather than speed humps*
- *85th Percentile speed of 7 MPH over the limit is the minimum threshold, though other factors are considered such as crash history, proximity to at grade crossings, and nearby schools, and available budget among other factors*

Boulder

- *Still installs speed humps*
- *Criteria not available online*

Jefferson County

- *Still installs speed humps*
- *33% of vehicles on a street must be speeding by 5+ mph*
- *800 vehicle ADT or more on the street in question*

Larimer County

- *Local streets only*
- *Less than 30 mph posted speed limit*
- *Ultimately an Engineering decision*

Mesa County

- *Still uses speed bumps, but…*
- *"Actual tests of experimental designs have demonstrated the physical inability of a speed bump to control all types of lightweight and heavyweight vehicles successfully…"*

Jurisdiction that will not Install speed humps by policy

- *Arapahoe County*
- *City of Arvada*
- *Colorado Springs*
- *Douglas County*
- *City of Englewood*

Data on Existing Speed Humps in Bow Mar South

City staff collected data in BMS at the speed hump on Bell Flower Drive and found that while vehicles leaving the speed hump have speeds 1-3 mph slower than in locations without speed humps, vehicles approaching the speed hump were unphased.

Additionally, data collected near this speed hump seems to suggest that these devices do not address one of the central safety concerns in BMS— the small number of individuals traveling 15+ mph over the speed limit, which pose the greatest risk to pedestrians and cyclists. The max speed recorded at the speed hump on Bell Flower Drive was 43 mph which is in the range of max speeds where no speed humps exist (42 – 47 mph). Table 1 below shows the average and 85p speeds for all of the studies done in BMS prior to the pilot project. The data collected at the speed hump on Bell Flower Drive is highlighted with a **red arrow**. This location had lower average and 85p speeds for vehicles leaving the speed hump, but speeds for vehicles approaching the speed hump seem to be unimpacted.

Leaving Speed Hump

Study Location	NB/EB 85p (mph)
Blue Sage Dr S/O Sumac Ln	31
Blue Sage Dr S/O Sumac Ln	31
Blue Sage Dr S/O Sumac Ln	30
Tule Lake W/O Shasta Cir	28
Tule Lake Crosswalk	28
Tule Lake Crosswalk	27
Sumac Ln & Marigold Ln	27
Tule Lake W/O Bellflower Dr	26
Bellflower Dr N/O Bowles	**23**

Study Location	NB/EB Average Speed (mph)
Tule Lake W/O Shasta Cir	24
Tule Lake Crosswalk	24
Blue Sage Dr S/O Sumac Ln	24
Tule Lake Crosswalk	23
Blue Sage Dr S/O Sumac Ln	23
Blue Sage Dr S/O Sumac Ln	23
Tule Lake W/O Bellflower Dr	22
Sumac Ln & Marigold Ln	21
Bellflower Dr N/O Bowles	**20**

Approaching Speed Hump

Study Location	SB/WB 85p (mph)
Tule Lake Crosswalk	29
Bellflower Dr N/O Bowles	**28**
Tule Lake Crosswalk	28
Tule Lake W/O Bellflower Dr	28
Tule Lake W/O Shasta Cir	28
Blue Sage Dr S/O Sumac Ln	25
Blue Sage Dr S/O Sumac Ln	25
Blue Sage Dr S/O Sumac Ln	25
Sumac Ln & Marigold Ln	25

Study Location	SB/WB Average Speed (mph)
Tule Lake W/O Shasta Cir	24
Tule Lake Crosswalk	24
Tule Lake Crosswalk	24
Tule Lake W/O Bellflower Dr	23
Bellflower Dr N/O Bowles	**23**
Blue Sage Dr S/O Sumac Ln	22
Blue Sage Dr S/O Sumac Ln	22
Blue Sage Dr S/O Sumac Ln	21
Sumac Ln & Marigold Ln	21

City staff conducted several speed and volume studies in the neighborhood, three of which were on Blue Sage Drive. The results (see table below) did not suggest to city engineering staff that there was a pervasive problem or pattern of speeding in the neighborhood. For reference, the posted speed limit is 25 mph.

Table 2: Pre-Pilot Data Summary

Study Date	Study Location *(see Pilot Design Map)*	Pilot Phase	NB 85p (mph)	SB 85p (mph)	NB Average Speed (mph)	SB Average Speed (mph)	% over 5+ MPH	Max Speed	ADT
May-2019	Data Collection Location 1	Pre-Pilot	31	25	23	22	10.3%	47	720
Sep-2019	Location 1	Pre-Pilot	30	25	23	21	9.1%	42	547
Mar-2020	Location 1	Pre-Pilot	31	25	24	22	12.3%	47	527
-	**Location 1**	**Pre-Pilot Average**	**30.7**	**25**	**23.3**	**21.7**	**10.6%**	**45.3**	**598**

*Notes: **NB** – Northbound; **SB** – Southbound; **85p** – 85th percentile speed, common metric to evaluate speeding patterns and measures the speed people feel comfortable driving; **Avg Speed** – the average (mean) of all the vehicle speeds recorded for the data collection period; **ADT** – Average Daily Traffic, or the average numbers of cars per day at the place of measuring.*

Data Driven Approach

In reviewing data collected before the pilot project, staff did not see a speeding problem. However, field observation and bike and pedestrian data collection showed a high number of people using the street to walk and bike compared to other residential streets in Littleton. With pedestrians and cyclists sharing the same space as motor vehicles, there was some concern over potential user conflicts. This pilot project was created in an attempt to improve bike and pedestrian safety on the street (a city-wide priority) by creating separate facilities and see if, at the same time, such changes might also further calm traffic (a BMS priority).

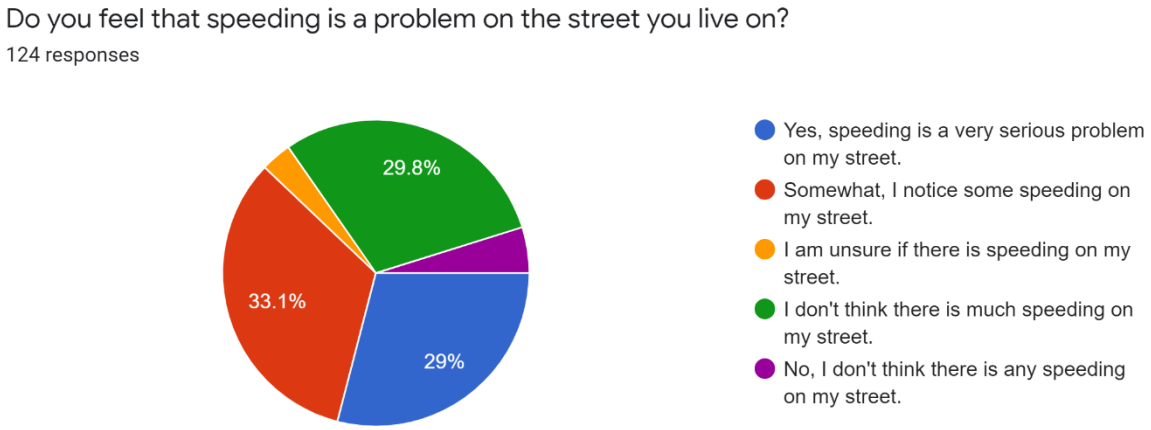
Pre-Pilot Engagement

Prior to initiating the pilot project, the city conducted pre-pilot resident engagement with the neighborhood. Originally this pilot project was scheduled to take place during the early spring and summer months of 2020 so that the pilot could remain in place for 90 days. Prior to deploying the pilot project, the city wanted to have in-person public engagement with BMS residents. However, in response to the COVID-19 pandemic, the city suspended in-person meetings for an indefinite amount of time.
City staff delayed the pilot project for a few months in hopes of still having in-person public meetings later in the year. When it became clear that in-person gatherings would be canceled for the foreseeable future, City staff developed a virtual public engagement to (1) explain the reason for the project, (2) review the data collected by the City, (3) present some potential pilot project alternatives, and (4) gather resident feedback.

The pre-pilot resident engagement included a 20-minute presentation along with a 22-question survey about potential pilot options and a number of neighborhood traffic safety concerns. Below are some of the high-level takeaways. Complete survey results are available in the Pre-Pilot Survey Data.

Perceptions of Speeding

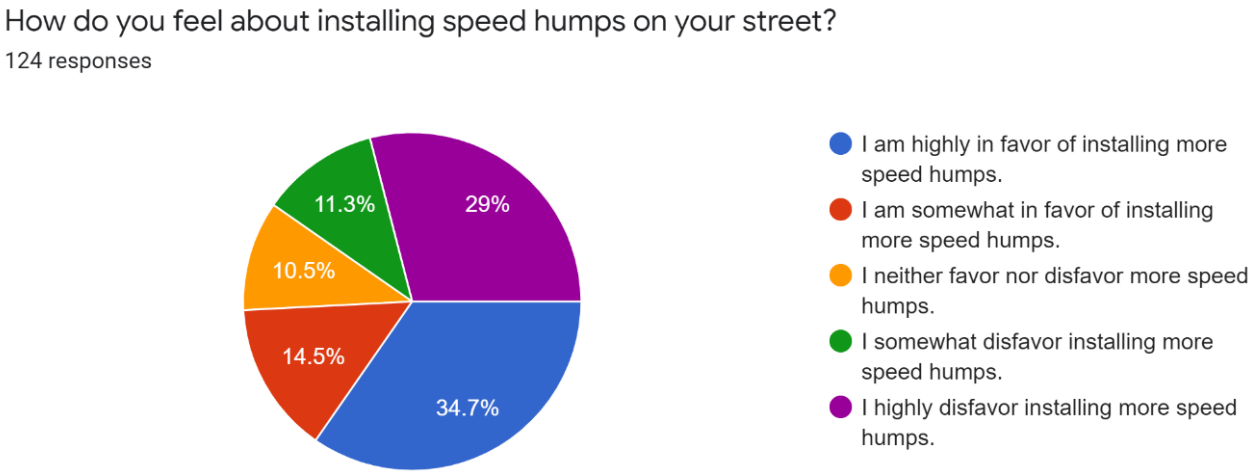
In the pre-pilot survey, one of the questions asked about speeding on the street that respondents live. The opinions were split fairly evenly between three response options provided— (1) speeding seems to be a major issue, (2) that there seems to be some speeding, and (3) there doesn't seem to be much speeding.



There are many factors that can influence a person's perception of speeding but, generally speaking, there is not a majority of respondents with a singular opinion. This suggests to City Staff that there is not consensus on this issue in the neighborhood.

Opinions on Traffic Calming

In addition to asking BMS residents about speeding, the survey also asked for respondents' opinions on installing additional speed humps which was one of the requests Staff heard from the HOA. The largest portion of respondents (34.7%) said they were highly in favor of installing more speed humps. However, the second largest portion of respondents (29%) said they highly disfavor additional speed humps.

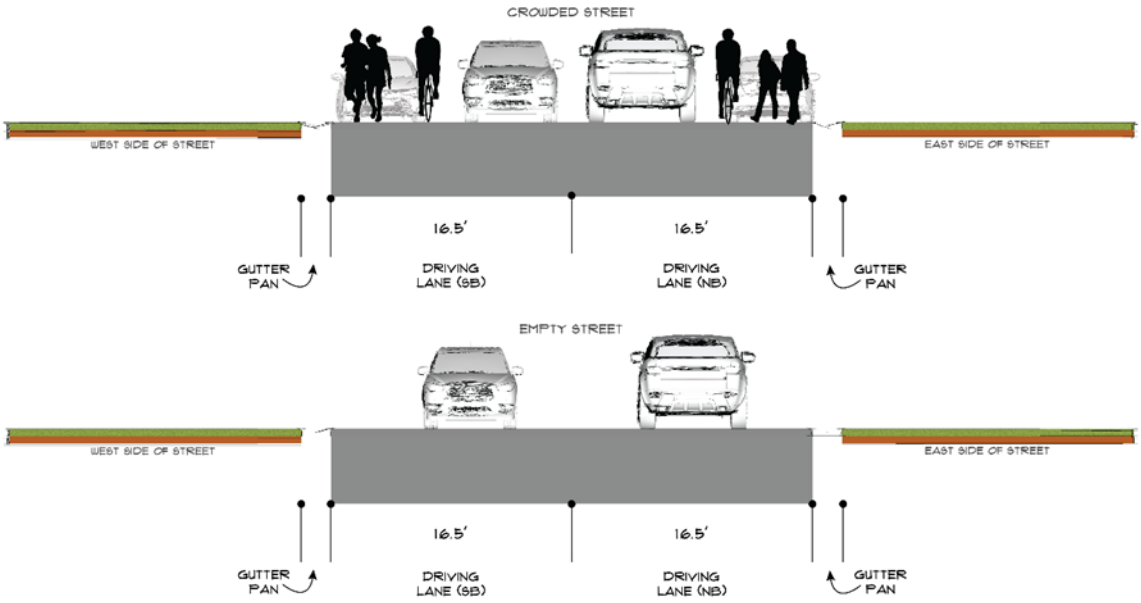


Similar to respondents' opinions of speeding, the initial survey showed a mix of opinions on the installation of additional speed humps in BMS.

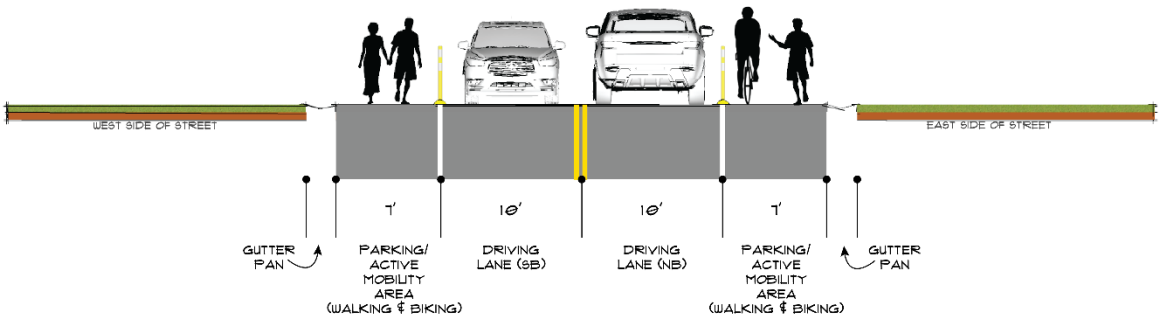
Potential Pilot Project Options

The initial public engagement survey asked about potential pilot project options on Blue Sage Drive and how respondents felt about each. City Staff created four potential options (shown below) of modified treatment of the roadway for a temporary pilot project that provided a dedicated space for bikes and pedestrians, as well as narrower drive lanes to encourage drivers to slow down.

BLUE SAGE DR - EXISTING CONDITION



BLUE SAGE DR - OPTION 1



PROS

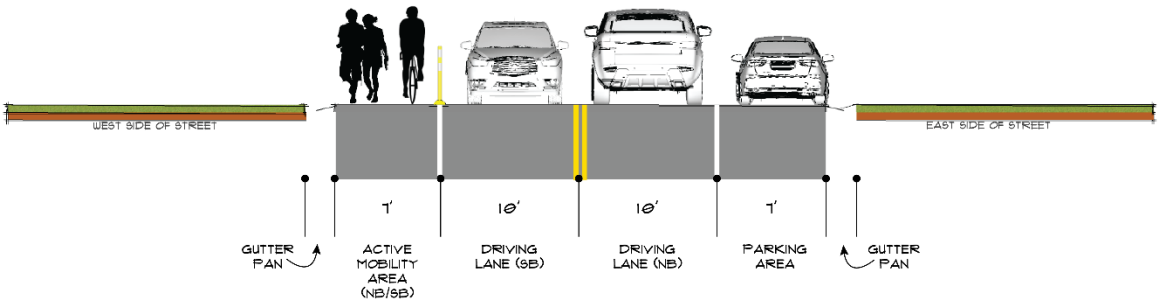
+ NARROW DRIVE LANES THAT TEND TO SLOW DRIVERS

+ DEDICATED AREA FOR PEOPLE TO WALK & BIKE

CONS

+ ON-STREET PARKING WILL NEED TO BE RESTRICTED OR REMOVED

BLUE SAGE DR - OPTION 2



PROS

+ NARROW DRIVE LANES THAT TEND TO SLOW DRIVERS

+ SMALL DEDICATED AREA FOR PEOPLE TO WALK & BIKE

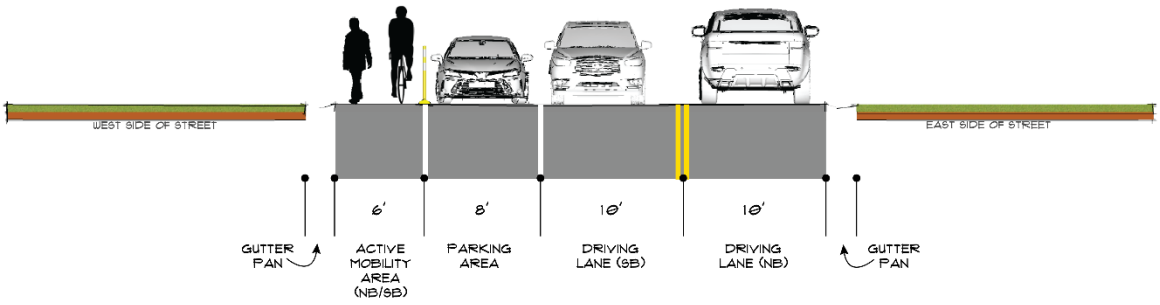
CONS

+ ON-STREET PARKING WILL NEED TO BE REMOVED FROM THE WEST SIDE OF STREET

+ WALKING & BIKING AREA IS BI-DIRECTIONAL AND SMALLER THAN RECOMMENDED

+ PEOPLE MAY NEED TO CROSS STREET TO WALK OR BIKE

BLUE SAGE DR - OPTION 3



PROS

+ NARROW DRIVE LANES THAT TEND TO SLOW DRIVERS

+ SMALL DEDICATED AREA FOR PEOPLE TO WALK & BIKE

+ ACTIVE MOBILITY AREA IS BUFFERED FROM MOVING TRAFFIC

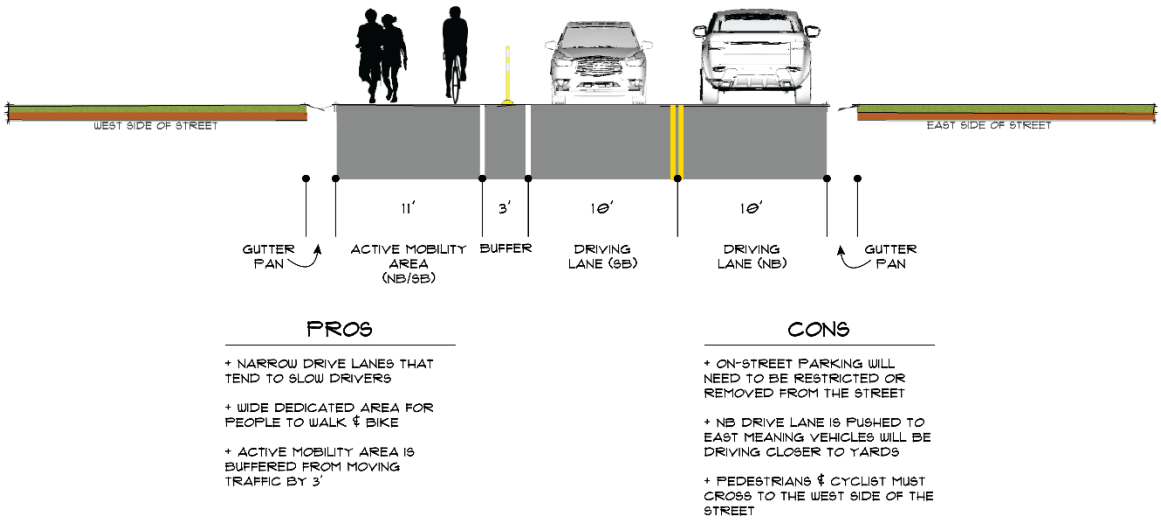
CONS

+ ON-STREET PARKING WILL NEED TO BE REMOVED FROM THE EAST SIDE OF STREET

+ WALKING & BIKING AREA IS BI-DIRECTIONAL AND SMALLER THAN RECOMMENDED

+ NB DRIVE LANE IS PUSHED TO EAST MEANING VEHICLES WILL BE DRIVING CLOSER TO YARDS

+ PEDESTRIANS & CYCLIST MUST CROSS TO THE WEST SIDE OF THE STREET



In the survey, respondents were asked to rate each option from 1 to 5, with 5 being the most favorable rating. The table below shows an aggregate score for each of the potential options.

Table 3: *Options Scoring*

	Mean Score	Median Score
Option 1	2.31	2
Option 2	1.75	1
Option 3	1.53	1
Option 4	1.73	1

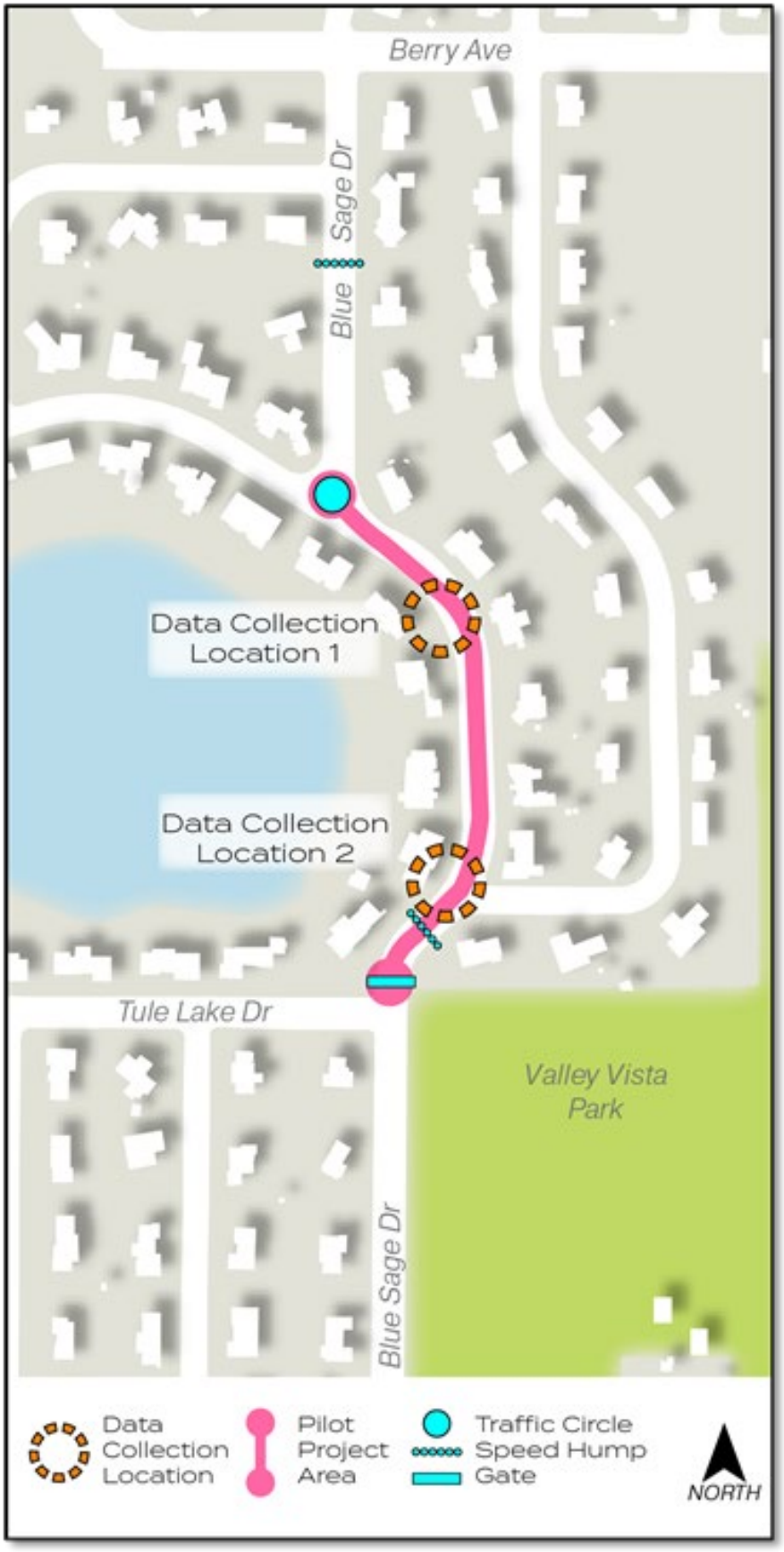
None of the potential options were very popular with respondents, but one option rated higher than the others—Option 1—which has a 7' mobility area on each side of the roadway (for bikes and pedestrians) and 10' travel lanes for cars.

Pilot Project Implementation

Pilot Project Design

The section of Blue Sage Drive from the gate (just north of Tule Lake Drive) to the traffic circle (Sumac Lane intersection) was chosen for implementation of the pilot project because this section was mentioned in residents' concerns as a commonly used roadway segment in the neighborhood. This was also the location where data had been collected prior to the pilot project. Below is a pilot project map.

Map 1: Pilot Project Design



Map 1: Pilot Design

Prior to the pilot project the City of Littleton collected data only at Location 1 (see map to the left). During the pilot project the City collected data at both location 1 and location 2 to see how the two locations compared.

Pilot Project Materials

Because pilot projects are intended to be a temporary installation to measure the impacts of a new traffic condition, the City of Littleton uses low cost and reusable materials for these efforts. For the Blue Sage Drive Pilot project, the City of Littleton considered the following pilot materials:

1. **C-Curb** – Half ellipse shaped traffic separator that diverts vehicles back toward travel lanes. Typically installed with flex posts. Also called Tuff Curb and Temporary Curb.
   ***Cost**: $120 each*

2. **Flex Posts** – typically used with C-curb, flex posts provide a clear visual signal to drivers that a space is not meant for moving vehicles.
   ***Cost**: $40 each*

3. **Short-Term Striping** –Low-cost paint that fades in about 9 – 12 months.
   ***Cost**: $.03/linear foot*

4. **Markers** – Small plastic pieces that are adhered to the street and highlight lane lines using highly reflective surfaces.
   Cost: $1.64 each

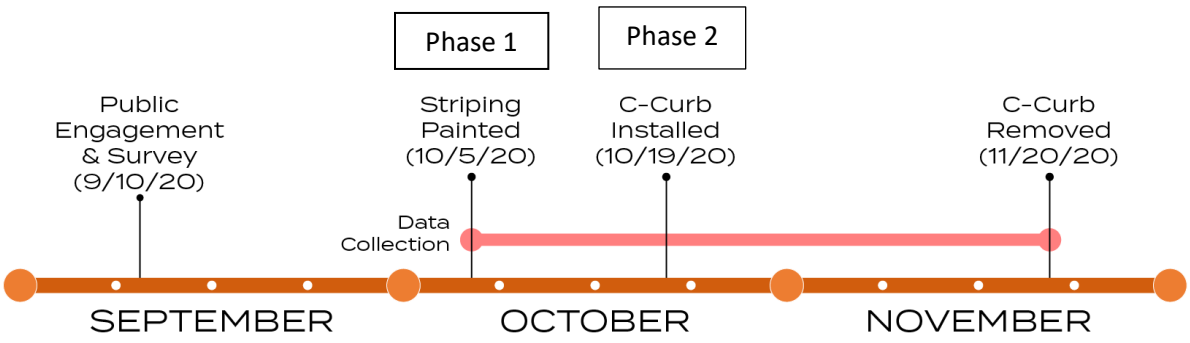
5. **Bots' Dots** – Low profile circle or square shaped bumps that are adhered to the street and rumble tires when driven on.
   ***Cost**: $2.85 each*

Due to material availability and the potential for snow fall during this pilot project, the City of Littleton decided to use C-Curb, flex posts, and short-term striping for the Blue Sage Pilot Project.

Pilot Project Timeline

As mentioned above, City Staff desired to keep the pilot project installation in place for at least 90 days but, with the delays stemming from COVID-19, that timeline was truncated to avoid winter weather as much as possible. The pilot installation was split into two phases—striping only (Phase 1) and striping with c-curb (Phase 2)—with the intent of seeing how each roadway treatment impacted travel behavior differently. Below is the pilot project timeline:

Chart 1: *Pilot Project Timeline*



Data Collection

For the pilot project, two data collection locations were chosen on this segment of Blue Sage Drive (see previous map). The first data collection location was chosen because it was the same location used to collect data before the pilot project and would allow an apples-to-apples comparison of vehicle speeds before and during the pilot project.

The second data collection point was at the existing speed hump on Blue Sage Drive. Though data was not collected at this location prior to the pilot project, city staff decided this additional data point would also be useful to evaluate the impacts of speed humps in the neighborhood. This additional collection location would allow staff and residents to see how speeds vary between the two data collection points.
Both before and throughout the pilot project, the City of Littleton collected data on pedestrian volumes, bike volumes, and vehicle volumes and speeds to determine the impacts this pilot project had on all forms of transportation.

The City of Littleton used motion activated cameras to determine how many pedestrians and cyclists used Blue Sage Drive before and during the pilot project. Below is a summary table of the data that was collected—the complete data is available on the project page on the City of Littleton website.

Table 4: Multimodal Count Data

Blue Sage Dr Bike and Pedestrian Counts by Day of Week										
	Base Counts 9/14 to 9/22		Striping Counts (Phase 1) 10/9 to 10/19		C-Curb Counts*+ (Phase 2) 10/20 to 11/19		% Change Phase 1 from Base		% Change Phase 2 from Base	
Day of Week	Bikes	Peds	Bikes	Peds	Bikes	Peds	Bikes	Peds	Bikes	Peds
Monday	3	10	0	18	8	32	-100%	80%	150%	215%
Tuesday	0	11	2	7	2	52	-	-36%	-	368%
Wednesday	0	8	2	4	6	41	-	-50%	-	417%
Thursday	11	29	1	4	5	26	-91%	-86%	-55%	-12%
Friday	1	2	0	15	7	45	-100%	650%	550%	2150%
Saturday	12	29	2	17	18	50	-83%	-41%	46%	72%
Sunday	5	19	0	9	7	31	-100%	-53%	30%	61%
Min	0.0	2	0	4	2	25	-	-	-	-
Max	12.0	29	2	18	18	52	-	-	-	-
Median	3	11	1	9	6	41	-	-	-	-
Average	4.6	15.4	1.0	10.6	7.3	39.3	-78%	-31%	629%	272%

**Data collected covered two weeks; numbers are averaged by day of the week.*
+ Counts exclude pedestrians in costumes or large groups on 10/31/2020 after 6pm

The data collected by the city shows a drop in counts from the base data to Phase one of the project, but a sharp increase in counts from the base data to Phase two of the project. Though the city expects to see increases in counts as pedestrian and bike facilities improve, these counts only capture snapshots of data. Before any conclusions can be drawn about this project's impacts on bike and pedestrian volumes, future counts performed in similar weather conditions should be conducted and compared to the base data. Because the motion activated cameras snap a picture when motion is detected, and counts are recorded manually, these numbers could be artificially low, but are not likely to be artificially high. Drawing any strong conclusions from this data is difficult, but at the very least the pilot project does not appear to have deterred people from walking or biking on Blue Sage Drive.

The City of Littleton also collected vehicle speed and volume data before and during the pilot project. This data was collected at two locations along Blue Sage Drive, both at the previous location approximately midway along the pilot segment and also just south of Morning Glory Lane near the existing speed hump. Below are the summarized results of this data. The complete data is available on the project page on the City of Littleton website.

Table 5: Phase 1 Data Summary

Study Date	Study Location	Pilot Phase	NB 85p (mph)	SB 85p (mph)	NB Average (mph)	SB Average (mph)	% Over 5+ MPH	Max Speed	ADT
Oct-2020	Location 1	Striping Alone / Phase 1 (week 1)	29	25	23	21	7.1%	41	527
Oct-2020	Location 1	Phase 1 (week 2)	30	25	23	22	9.8%	45	494
Oct-2020	Location 1	Phase 1 Overall	30	25	23	22	8.2%	45	504

Table 6: Phase 2 Data Summary

Study Date	Study Location	Pilot Phase	NB 85p (mph)	SB 85p (mph)	NB Average (mph)	SB Average (mph)	% Over 5+ MPH	Max Speed	ADT
Oct-2020	Location 1	C-Curb / Phase 2 (week 1)	31	23	24	20	10.7%	45	464
Oct-2020	Location 1	Phase 2 (week 2)	30	23	23	20	9.3%	44	513
Nov-2020	Location 1	Phase 2 (week 3)	30	23	23	20	9.3%	42	442
Nov-2020	Location 1	Phase 2 (week 4)	30	23	23	20	9.3%	46	411
Nov-2020	Location 1	Phase 2 Overall	30	23	23	20	9.5%	46	446

Table 7: All Phases Data Near Speed Hump

Study Date	Study Location	Pilot Phase	NB 85p (mph)	SB 85p (mph)	NB Average (mph)	SB Average (mph)	% Over 5+ MPH	Max Speed	ADT
Oct/ Nov-2020	Data Collection Location 2	Speed Hump (All Phases Overall)	27	24	21	20	3.5%	44	495

Though the pilot project impacts to traffic speeds were not dramatic, there was a slight decrease in the northbound 85th percentile (85p) speeds and average speed in both directions. There was also a minor decrease in the percentage of cars going more than 5 mph over the speed limit. The striping alone phase on Blue Sage Drive appears to have had the largest calming impact during the pilot project. While the northbound speed measurements were recorded to be lower at the southern count location adjacent to the speed hump, those vehicles increased their speed as they proceeded north on Blue Sage Drive and reached the northern most data collection point. In addition, the highest vehicle speeds recorded near the speed humps are not significantly lower than the speeds recorded further north on Blue Sage Drive (44 mph compared to 46 mph) and are in the same range of max speeds recorded prior to the pilot project (42-47 mph). This reinforces that while most vehicles slow down for speed humps, they speed back up in just a few hundred feet, and those determined to speed will still do so even over speed humps.

Overall, the data does not show that the pilot project had a large impact on vehicle speeds, and justification for permanent changes to the roadway similar to those studied in this pilot project are not supported by the data that was collected.

Post-Pilot Installation Survey

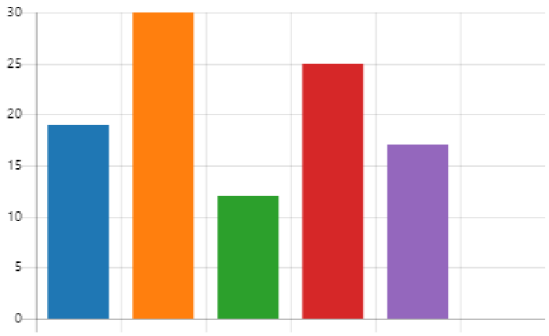
In the post-pilot project installation survey, the questions formulated by City Staff were aimed at evaluating residents' perceptions of the pilot project's effectiveness and cohesion with the neighborhood aesthetics. In addition, some questions regarding speeding, speed humps, and age demographics were added at the request of the BMS HOA. For this survey there were fewer respondents (103 post-project versus 124 pre-project) and 85% said they had completed the first survey in September of 2020. Below is a sampling of the survey questions and results. The complete survey can be found on the project page on the City of Littleton website.

Opinions of Striping and C-Curb

Phase 1 of the pilot project (striping alone on Blue Sage Drive) was the more popular of the two phases with 48% of respondents (49 of 103) saying they viewed the striping positively, 12% saying they viewed the striping neither positively or negatively, and 41% saying they viewed the striping negatively.

8. If you did notice the striping, was your reaction generally positive or negative?

Very positive	19
Somewhat positive	30
Neither positive or negative	12
Somewhat negative	25
Very negative	17
I did not notice the striping on Blue Sage Dr	0



Additionally, 59% of respondents felt that striping on Blue Sage Drive was an appropriate long-term application either alone or as part of other traffic calming measures.

10. Do you think striping on Blue Sage Dr is an appropriate long term application in the Bow Mar South Neighborhood?

Yes, it is an appropriate long term solution	35
Yes, striping is appropriate but as part of other measures	26
No, striping is not an appropriate long term solution in any application	42

Of the two phases, striping also had the most positive impact on the perception of safety on Blue Sage Drive with 49% saying the street felt safer with striping, 40% saying the striping had no impact, and 12% saying the striping made the street feel less safe.

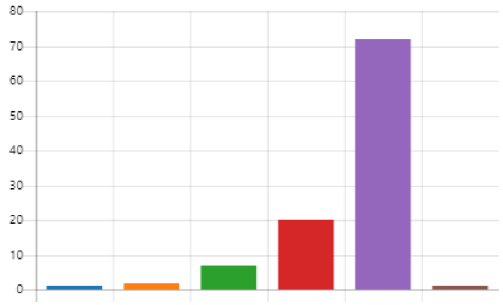
29. When there was new striping alone on Blue Sage Drive (Oct 5th - Oct 18th) did it change your perception of safety on the street?

It seemed much safer	9
It seemed somewhat safer	41
It seemed neither safer nor less safe	41
It seemed somewhat less safe	7
It seemed much less safe	5

Though opinions were generally accepting or neutral toward the striping in Phase 1, respondents were clear that they did not like the addition of C-Curb on Blue Sage Drive that came along with Phase 2. Only 3% of respondents viewed the C-Curb positively, while 90% viewed the C-Curb negatively.

12. If you did notice the c-curb, was your reaction generally positive or negative?

Very positive	1
Somewhat positive	2
Neither positive or negative	7
Somewhat negative	20
Very negative	72
I did not notice the c-curb	1



Negative opinions toward the C-Curb in Phase 2 continued with 92% of respondents indicating they did not think C-Curb was an appropriate long-term solution, and with 41% indicating that C-Curb made the Blue Sage Drive feel less safe than before.

14. Do you think c-curb on Blue Sage Dr is an appropriate long term application in the Bow Mar South Neighborhood?

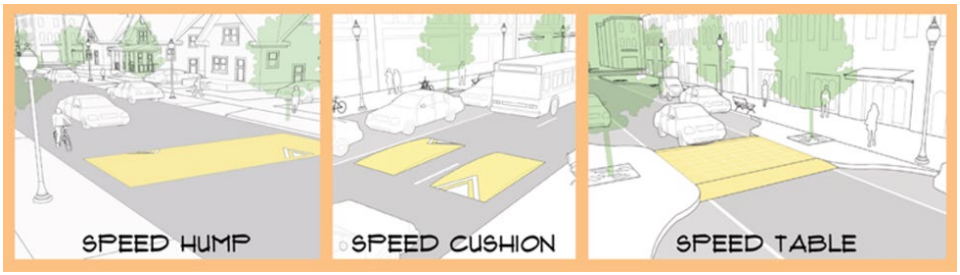
Yes, c-curb is an appropriate long term solution	1
Yes, c-curb is appropriate but as part of other measures	7
No, c-curb is not an appropriate long term solution in any application	95

30. When there was both striping and c-curb on Blue Sage Drive (Oct 19 - Nov 19) did it change your perception of safety on the street?

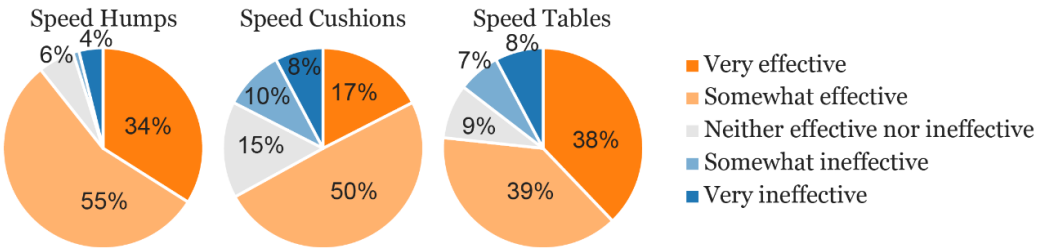
It seemed much safer	10
It seemed somewhat safer	26
It seemed neither safer nor less safe	25
It seemed somewhat less safe	23
It seemed much less safe	19

Opinions of Speed Humps and Similar Devices

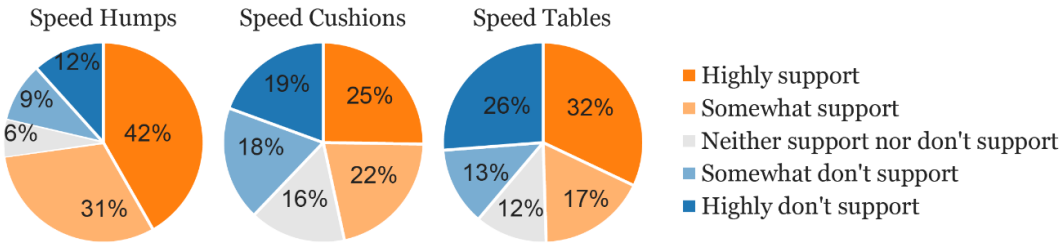
At the request of the BMS HOA, City Staff included questions regarding the installation of additional traffic calming devices, including speed cushions and speed tables, which are similar in nature to speed humps. See example photos below of each device:



31. Do you consider speed humps, speed cushions, or speed tables to be effective in reducing traffic speed?



32. Would you support speed humps, speed cusions, or speed tables being installed in Bow Mar South?

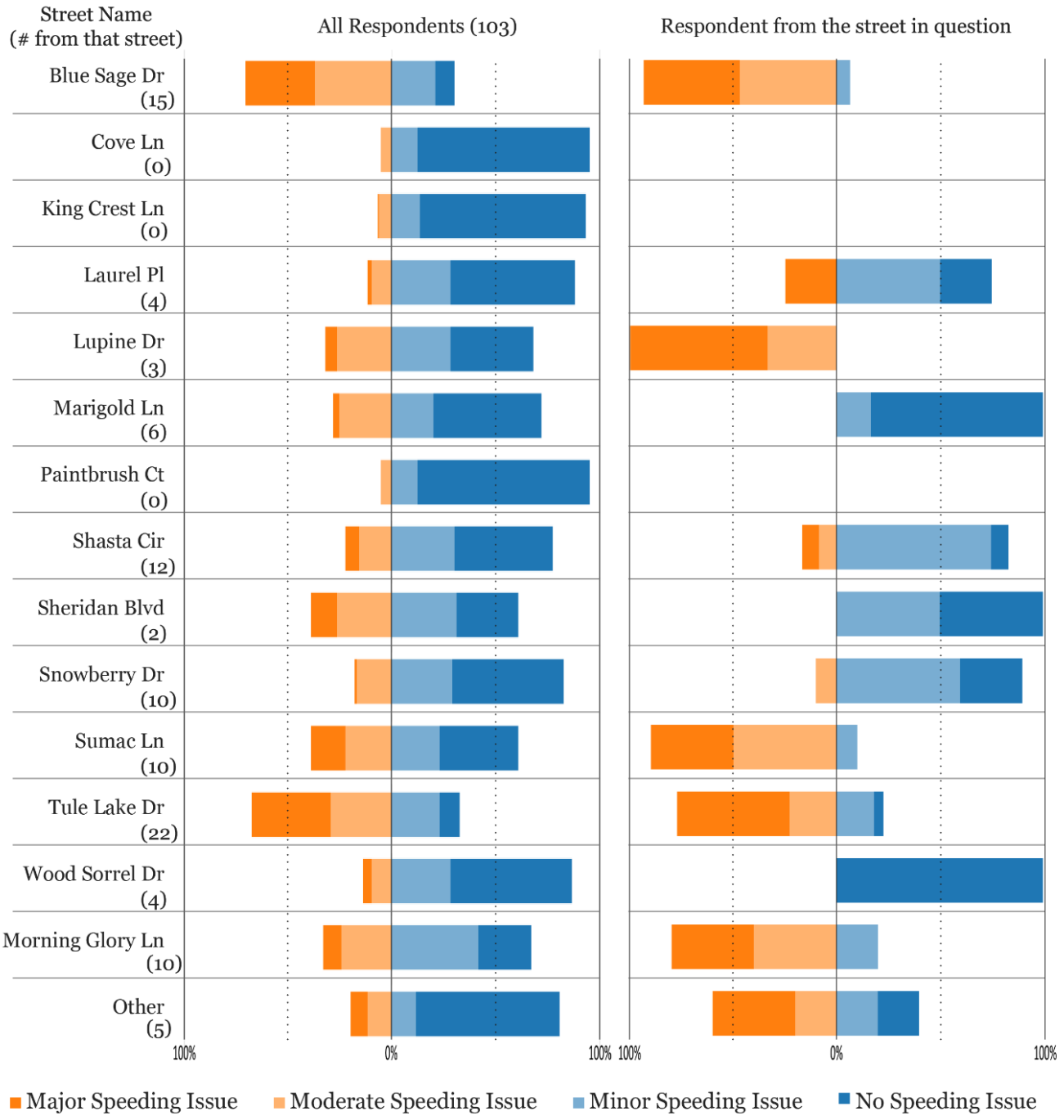


In this post-project survey, opinions on installing more speed humps were more favorable than in the pre-project survey with 73% of respondents saying they supported the installation of speed humps in BMS versus 35% from the pre-project survey (see Opinions on Traffic Calming). Without tracking individuals from one survey to the next stating if the opinions about speed humps have improved is difficult, or if fewer people who view speed humps negatively participated in this survey.

Perceptions of Speeding

Another series of questions prompted by the HOA were regarding speeding on streets in BMS. The below series of questions asks about which streets people feel there is a speeding problem.

33. Which streets in Bow Mar South do yo think have issues with speeding and safety and might benefit from traffic calming measures?



Overall, majority of respondents believed only two roadways in BMS had a major or moderate speeding issue—Tule Lake Drive and Blue Sage Drive—both of which have been mentioned repeatedly in correspondence between City Staff and BMS residents. Interestingly, the perception of a major or moderate speeding problem increased among residents living on any of the streets in the neighborhood seen as primary access or connection roads (i.e., to traffic signals on Bowles Avenue, to the lake area, or between the north and south areas) but decreased for residents living on limited access streets (i.e., non-signalized Bowles Avenue access, cul de sacs) in question.

Pilot Project Conclusions

Speeding Thresholds Not Met

In reviewing all the data collected both before and during the pilot project installation, city staff does not see evidence of a speeding problem, especially one that would justify physical changes (manipulation or construction) to the roadway. This finding would preclude the installation of speed bumps but would also preclude any changes that mimicked the effect of C-Curb. This does not mean that no actions are available to the BMS neighborhood – just that the data does not support consideration of physical modifications to the roadways at this time.

Pilot Project Metrics

In drawing conclusions about the pilot project, City Staff looked back to the pilot project metrics outlined in the pre-pilot presentation (see Measures of Success).

85p Speeds – 85p speeds decrease when compared to pre-pilot data
In comparing the data collected prior to the pilot project, to the data collected during the pilot project, both phases of the pilot project did correlate with a small decrease in 85p speeds on Blue Sage Drive. The pre-pilot data showed an 85p range of 30-31 mph in the northbound direction and 25 mph in the southbound direction. During Phase one of the pilot installation (striping only), northbound 85p ranged between 29-30, while southbound 85p remained the same at 25 mph. In phase two of the pilot project (striping and c-curb), northbound 85p was the same as the pre-pilot ranging from 30-31 mph. Southbound 85p speeds in phase two were the lowest of any data collection periods at 23 mph.

5+ mph Speeders – the percentage of 5+ mph speeders decrease when compared to pre-pilot data
In pre-pilot data collection, the percentage of drivers exceeding 5+ mph over the posted speed limit ranged from 9.1% to 12.3%. During Phase one of the pilot project this percentage ranged from 7.1% to 9.8% and in Phase two ranged from 9.3% to 10.7%. Phase one (striping alone) correlated with the greatest decrease in this number, about 2.5%, while Phase two (striping and c-curb) correlated with only about a 1% change.

Pedestrian & Cyclist Volume – the volume of pedestrians and cyclist increases when compare to pre-pilot data
In comparing the pre-pilot and in-pilot bike and pedestrian data, there is a clear increase in the number of recorded walkers and bikers. Overall, there was a 272% increase in the number of pedestrians recorded on Blue Sage Drive, and 629% increase in cyclists during Phase 2 of the project (see Data Collection).

Though city staff would love to attribute the increase in bike and pedestrian traffic to the increased sense of safety during Phase two of the pilot, such drastic changes suggest there may have been an issue with the pre-pilot data collection and potentially during the Phase one data collection. Before any definitive conclusions can be drawn regarding the pilot project's impacts on bike and pedestrian traffic, further investigation would need to be conducted to verify these findings.

Community Support - One-half of the BMS respondents, and two-thirds of residents adjacent to the project area, are in favor of the project
To gauge community support, the post-pilot survey asked residents how they felt about each phase of the pilot project and if each phase should be part of a long-term solution. Respondents generally had a positive or neutral view of the striping in Phase one, but generally had a negative view of the C-Curb in

Phase 2 (see Opinions of Striping and C-Curb). Residents that live in the project area along Blue Sage Drive had similar views regarding each phase of the project:

- Of residents living in the project area, 40% had a very positive view of striping alone, and 20% had a somewhat positive view of the striping alone.
- Of residents living the project area, 40% feel striping is an appropriate long-term solution on Blue Sage Drive, and 27% feel striping is appropriate as part of other traffic calming measures. The C-Curb was not a popular application with residents.

Variation Between Collection Points

Throughout the pilot project data was collected at two locations along Blue Sage Drive, the first data collection point (point 1) was just south of the traffic circle, and second data collection point (point 2) was just north of the speed hump near Morning Glory Lane. In comparing the data collected at the two locations along Blue Sage Drive, there was a significant difference in the percentage of vehicles driving 5+ mph over the speed limit, with 3.5% at the southern point 2 near the speed hump compared to 9.5% at the northern point 1. There was also a 2-3 mph drop in southbound vehicle speeds at the southern location compared to the northern point. This is consistent with the data collected by the speed hump on Bell Flower Drive, where vehicle speeds departing the speed hump are lower, while vehicle speeds approaching the speed hump seem unphased. The radar data collection units used by the City record approaching vehicle speeds when they are about 50-100 feet away from the unit, and about 100-150 feet away when they are departing the unit. The two collection points are about 700 feet apart and, while the speed hump slows departing vehicles for the first 100-150 feet, these traffic calming effects are gone by the time these vehicles reach the second data collection point. Additionally, data collected at the speed hump shows this calming device does not deter some drivers from going 40+ mph on Blue Sage Drive, which fails to address one of the primary concerns about traffic safety on the roadway.

Next Steps

As outlined above, vehicle speed data collected both before and during the pilot project does not meet the speeding thresholds to justify physical changes to the roadway. That being said, the City of Littleton has a number of strategies to help remind drivers to slow down and be aware of bikes and pedestrians on Blue Sage Drive and throughout the neighborhood.

Striping Option

In reviewing the data collected regarding vehicle speeds and opinions of survey respondents, expanding striping on Blue Sage Drive is an option that City Staff would consider as a low-cost alternative for helping with traffic calming. However, the metric set by the City for community support (1/2 of all respondents being in support, and 2/3 of residents living in the project area being in support) was not met. If further striping on Blue Sage Drive, or other streets in BMS, is desired by the community, then further discussions would need to be held with residents and the HOA Board.

The City of Littleton also has a number of educational strategies to remind drivers of the need to drive slowly and safely throughout the neighborhood. These tools include:

- A postcard campaign with engaging graphics and statistics on why driving safe in the neighborhood is so important.
- Letters on City of Littleton letterhead reminding all residents to slow down.

- Yard signs reminding people driving in BMS to slow down and be alert for pedestrians and cyclists.
- Regular reminders in HOA correspondence (i.e., letters, newsletters, emails, on a website) reminding residents to drive safely and respect their neighbors.
- Additionally, the City of Littleton has portable speed radar signs that warn drivers when they are exceeding the speed limit. One of these signs can be placed on Blue Sage Drive temporarily, and there is a possibility one could be placed permanently if desired by the community.

Targeted Enforcement

Another strategy to address a small number of vehicles speeding in neighborhoods is targeted enforcement. If the data collected shows a particular time of day that most speeding is occurring, this can be provided to the Police Department for focused enforcement. If this is a strategy desired by residents, Engineering Staff can take a more in-depth look at the speed data and work with the Police Department to determine a 2-3-hour window to enforce speeding as their limited time and resources allow.

Further Discussion

Finally, the City of Littleton is willing to continue discussing how the existing options could be refined and/or investigating new ideas on how to address the residents' and City Staff concerns simultaneously.

FAQ's & Staff Responses

Why was this pilot project necessary?

+ The initial concerns from BMS residents and HOA members were about vehicle speeds in the neighborhood, and Blue Sage Drive was often brought up as a specific example. The data collected and reviewed by city staff did not suggest there was a speeding problem; however, staff recognized a high volume of bikes and pedestrians on Blue Sage Drive without dedicated bike lanes or sidewalks. The pilot project was seen as an approach to evaluate if creating a dedicated space for bikes and pedestrians separate from the vehicle travel lanes would help create a safer environment for vulnerable roadway users while also having the added benefit of slowing vehicle traffic.

What were all the pilot project options, and why did the City choose the option they did?

+ See the Potential Pilot Options section for all of the options that were considered by City Staff. City Staff chose Option 1 for the pilot project for two reasons: (1) though none of the options were overwhelmingly popular among respondents of the first survey, Option 1 was rated as the most favorable, and (2) Option 1 balanced the use of the street better than other options, did not require pedestrians to cross the street to access the mobility area, and did not place moving vehicles closer to yards on one side of the street.

Who was allowed to provide input on the surveys?

+ The BMS HOA advertised the pre-pilot survey to the neighborhood by sending out an email notification to residents. Concurrently, city staff mailed a letter to all BMS homes with

information about the project and survey. The pre-pilot survey was made available to residents through a dedicated webpage in September 2020, resulting in 124 responses. Similarly, in December of 2020 city staff opened the post-pilot survey, continuing to work with the HOA who sent an email notification to residents in addition to a letter from city staff. The second survey was open for residents to complete from December 28, 2020 through January 17, 2021, resulting in 103 responses.

Can the Blue Sage Drive gate be closed permanently, and only BMS residents be provided access?

+ Blue Sage Drive is a publicly funded and maintained roadway and, therefore, residents of BMS cannot be provided special access different from any other Littleton resident or non-resident. This would be similar to having a publicly funded park that only a small group of residents are allowed to use. If restricting access to Blue Sage Drive is a serious consideration of residents and the HOA, the public right-of-way would need to be purchased and privately maintained by the HOA.

Why is the City spending money on these types of pilot projects?

+ The City of Littleton wants to take an innovative and data-driven approach to addressing transportation all over the City. Collecting data and conducting low-cost pilot projects that aim to improve safety by using new, but industry-recognized techniques, is one way to accomplish this. This project accounted for about $120 in additional costs to the City for paint, but the C-Curb is a reusable traffic calming device that the City already had on hand and will be used for future projects in other locations. The City has $25,000 budgeted annually toward studying neighborhood traffic calming concerns and implementing corrective measures when determined necessary.

Complete Data Collection Records

All data collection for this project can be downloaded from the City of Littleton website (https://www.littletongov.org/city-services/city-departments/public-works/transportation-management/blue-sage-pilot-project) or by clicking the available links below.

Pre-Pilot Traffic Data

A.1 – May 2019 Traffic
A.2 – Sep 2019 Traffic
A.3 – Mar 2020 Traffic

Pre-Pilot Survey Data

B.1—Complete Pre-Pilot Survey Results

During Pilot Data Collection

C.1 – Striping: Week 1
C.2 – Striping: Week 2
C.3 – C-Curb: Week 1
C.4 – C-Curb: Week 2
C.5 – C-Curb: Week 3

C.6 – C-Curb: Week 4
C.7—Striping: All Weeks
C.8—C-Curb: All Weeks
C.9—Speed-Hump: All Phases

Post-Pilot Survey Data

D.1—Complete Post-Pilot Survey Results

All Phase Bike & Pedestrian Data

E.1– Bike and Ped Count Data for All Phases