

MEMORANDUM

Project: CO 119 Safety & Mobility
To: Adnana Murtic, PE, CDOT
From: Nate Algoe, PE, et al, Muller Engineering Company
Date: February 16, 2022
Subject: NB Airport Rd Intersections Alternative Memo

Project Background

In 2019, through a joint effort between Boulder County and the Regional Transportation District (RTD), a Multimodal Planning and Environmental Linkages Study (PEL) was completed for the CO 119 corridor between Boulder and Longmont. That PEL established goals for the corridor, including addressing travel demand, providing efficient Bus Rapid Transit (BRT) service between Boulder and Longmont, as well as multiple alternatives recommended for future study to improve safety and mobility along the entire corridor.

In 2020, the High-Performance Transportation Enterprise (HPTE) initiated a Traffic Study (“Traffic Study”) to analyze the alternatives from the PEL. The Traffic Study, completed in November 2021, included the analysis of a no-build alternative, a bus queue bypass alternative, and a tolled express lane (TEL) alternative, among others. The purpose of the Traffic Study was to carry an alternative forward for design and construction of roadway and transit elements by CDOT and RTD in the CO 119 Safety and Mobility Project. There is a separate, concurrent project underway by Boulder County to study, design, and construct a center median bikeway between Boulder and Longmont.

Airport Road Intersection Alternative

The selected alternative from the Traffic Study includes bus queue bypass lanes at signalized intersections, as well as other “baseline” improvements that were included in all alternatives. For the purposes of this memo, the northeast direction of CO 119 will be referred to as northbound CO 119, and the southwest direction of CO 119 will be referred to as southbound CO 119. The baseline improvements include, in part, the full reconstruction of the CO 119 and CO 52 intersection to create a split intersection, as well as the introduction of a new traffic signal at the northbound CO 119 and Airport Road intersection. In the selected alternative from the Traffic Study, bus queue bypasses are included at the existing southbound CO 119 and Airport signalized intersection, as well as at the proposed northbound CO 119 and Airport signalized intersection. The area of the project around CO 119 and Airport Road is shown in **Figure 1**.





Figure 1. Intersection of CO 119 & Airport Rd/ Ogallala Rd

In December 2021, Boulder County brought forward a concept to the CO 119 Mobility and Safety Project Leadership Team that would eliminate the need to signalize the northbound CO 119 and Airport Road intersection, while potentially offering vehicular, transit, and bike and pedestrian operational and safety benefits, when compared to the option to signalize the northbound CO 119 and Airport Road intersection.

This alternative, shown in **Figure 2**, includes converting Airport Road between northbound CO 119 and southbound CO 119 to one-way northbound. The one-way northbound Airport Road movement would include two through-lanes, and a bus queue bypass lane for the future BRT Orange Line. The Orange line turns left from northbound CO 119 to northbound airport. Southbound Airport Road becomes a right-turn only at southbound CO 119, and the movement across southbound CO 119 to and from Ogallala Road would be prohibited. If the alternative carries forward, the movement northbound from Ogallala Road and the associated left turn to southbound CO 119 will be analyzed to confirm if the movements should be restricted.

The inferred benefits cited to consider this alternative treatment at Airport Road are safety and operational improvements for all modes at the southbound CO 119 and Airport Road intersection, as well as rendering as unnecessary the need for signalization and a queue bypass lane at the northbound CO 119 and Airport Road intersection.

The following memo summarizes a comparison between the proposed one-way treatment of Airport Road and the signalization of northbound CO 119 and Airport Road from the Traffic Study. The memo includes an analysis of vehicular operations and safety, an assessment of differences in multimodal safety and

operations, as well as considerations for road users and capital improvement costs. The purpose is to provide information to confirm (or not) that the inferred benefits are valid.

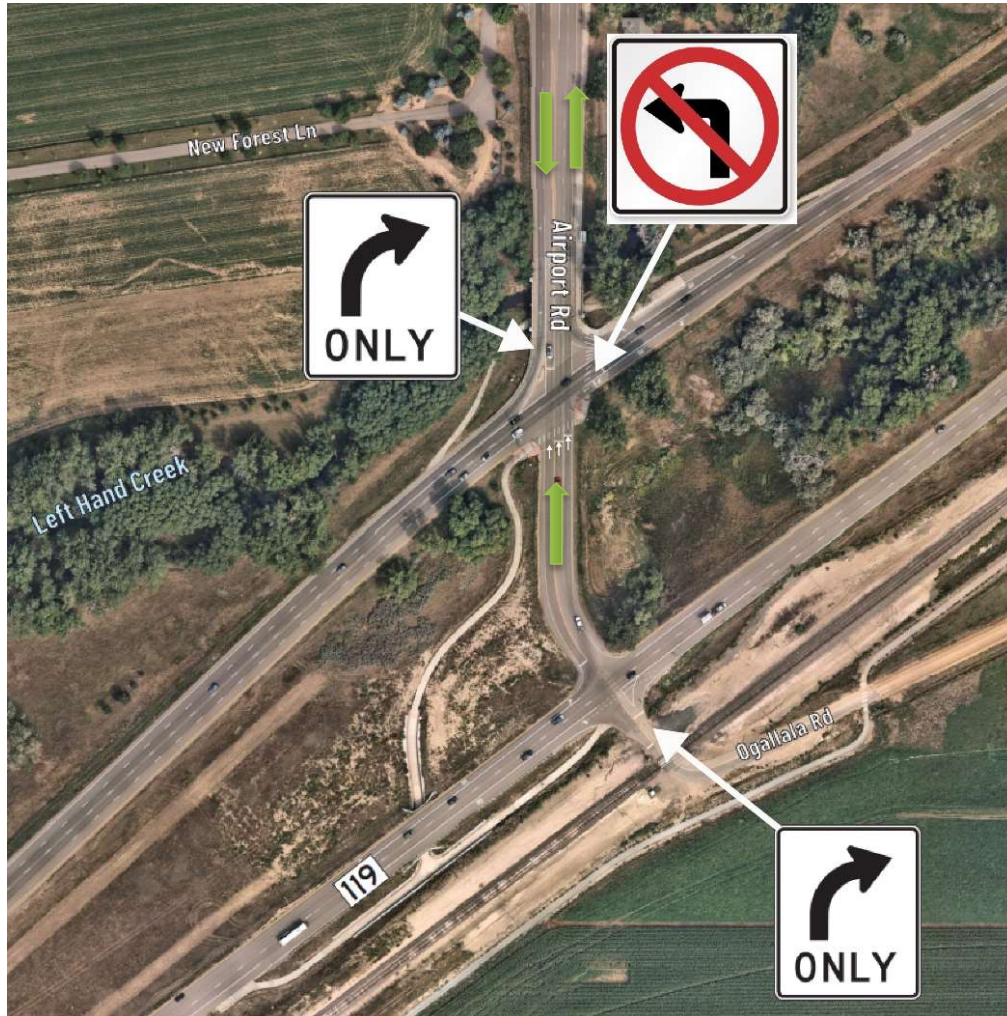


Figure 2. Alternative Airport Intersection Treatment (Airport Rd One Way Northbound)

Operations Analysis

Building upon the traffic analysis performed as part of the previous CDOT/HPTE project (discussed in detail in the CO 119 Traffic Analysis Technical Report dated December 10, 2021), the traffic analysis for maintaining an unsignalized intersection northbound at Airport Road was performed using VISSIM micro-simulation software. VISSIM was chosen for the previous corridor analysis because it allows for accurate general traffic, transit, and tolled express lane operations within an entire network. This is also useful for analysis of closely spaced intersections where queues impact adjacent intersections, such as those in the existing condition along CO 119, as well as tolled express lane operations. Because the Baseline 2045 and Queue Bypass 2045 VISSIM models were already developed in VISSIM, the analysis for the unsignalized intersection northbound at Airport Road was able to be efficiently performed using the previous networks that were built.

The results provided in this memo only show impacts to the intersections of CO 119 and Airport Road; given the minimal traffic volumes that needed to be rerouted in each of the peak periods, minimal impacts were seen at adjacent intersections. To understand the impact of the unsignalized vs. signalized intersection at NB CO 119 / Airport Road, the Baseline 2045 and Queue Bypass 2045 VISSIM models were updated to remove this signal and make the turning movement restrictions previously noted in this memo.

Measures of effectiveness were pulled from the models including general traffic and transit delay; general traffic and transit level of service (LOS); maximum queue lengths by turning movement; and average queue lengths by turning movement. The detailed results for the Baseline 2045 (Signalized with Unsignalized NB Airport) and Queue Bypass 2045 (Signalized with Unsignalized NB Airport) VISSIM models are provided in Appendix A and Appendix B, respectively. A summary of turning movement volumes, peak hour delay and LOS for the two CO 119 / Airport Road intersections are provided in **Table 1** and **Table 2**.

As shown, the suggested adjustments to the Airport Road intersections along CO 119 improve overall traffic operations due to the removal of traffic movements that were previously performing poorly (LOS E and F in some cases). In all scenarios both intersections in the unsignalized NB intersection condition perform at a LOS A in the AM peak hour, and improvements are also seen in the PM peak hour, especially for the NB intersection. While longer travel times are anticipated for the vehicles that need to reroute due to the turn restrictions at these intersections, these vehicles are anticipated to be minimal in the peak hours compared to the over 3,000 vehicles total using these intersections in the peak hours (as shown in the following tables).

Table 1. 2045 Baseline VISSIM Models Comparison

		2045 Baseline (NB Airport Signalized)						2045 Baseline (NB Airport Unsignalized)					
		AM Peak-Hour			PM Peak-Hour			AM Peak-Hour			PM Peak-Hour		
	Intersection / Movement	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS
SB CO 119 / Airport Road	SB Left-Turn (CO 119)	0	0	A	7	13	B	N/A	N/A	N/A	N/A	N/A	N/A
	SB Through (CO 119)	1,822	8	A	999	21	C	1,822	7	A	1,006	19	B
	SB Right-Turn (CO 119)	20	1	A	41	13	B	20	1	A	41	9	A
	EB Through (Airport Rd)	40	57	E	34	37	D	N/A	N/A	N/A	N/A	N/A	N/A
	EB Right-Turn (Airport Rd)	753	2	A	336	1	A	793	2	A	370	1	A
	WB Left-Turn (Airport Rd)	13	8	A	7	41	D	N/A	N/A	N/A	N/A	N/A	N/A
	WB Through (Airport Rd)	260	69	E	751	43	D	273	58	E	758	50	D
	Intersection Total	2,908	12	B	2,175	25	C	2,908	9	A	2,175	26	C
NB CO 119 / Airport Road	NB Left-Turn (CO 119)	230	13	B	733	26	C	230	7	A	733	12	B
	NB Through (CO 119)	793	13	B	2,080	29	C	793	4	A	2,080	9	A
	NB Right-Turn (CO 119)	2	6	A	8	6	A	2	5	A	8	4	A
	EB Left-Turn (Airport Rd)	15	1	A	14	36	D	N/A	N/A	N/A	N/A	N/A	N/A
	EB Through (Airport Rd)	25	5	A	27	78	E	N/A	N/A	N/A	N/A	N/A	N/A
	WB Through (Airport Rd)	43	54	D	25	38	D	N/A	N/A	N/A	N/A	N/A	N/A
	WB Right-Turn (Airport Rd)	5	7	A	4	2	A	48	7	A	29	6	A
	Intersection Total	1,113	15	B	2,891	28	C	1,073	5	A	2,850	10	B

Table 2. 2045 Queue Bypass VISSIM Models Comparison

		2045 Queue Bypass (NB Airport Rd Signalized)						2045 Queue Bypass (NB Airport Unsignalized)					
		AM Peak-Hour			PM Peak-Hour			AM Peak-Hour			PM Peak-Hour		
	Intersection /Movement	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS	Veh.	Delay (sec.)	LOS
SB CO 119 / Airport Road	SB Left-Turn (CO 119)	0	0	A	7	10	A	N/A	N/A	N/A	N/A	N/A	N/A
	SB Through (CO 119)	1,822	8	A	999	21	C	1,822	7	A	1,006	19	B
	SB Right-Turn (CO 119)	20	2	A	41	12	B	20	2	A	41	9	A
	EB Through (Airport Rd)	40	57	E	34	36	D	N/A	N/A	N/A	N/A	N/A	N/A
	EB Right-Turn (Airport Rd)	753	8	A	336	21	C	793	2	A	370	1	A
	WB Left-Turn (Airport Rd)	13	11	B	7	41	D	N/A	N/A	N/A	N/A	N/A	N/A
	WB Through (Airport Rd)	260	55	D	751	45	D	273	44	D	758	48	D
	Intersection Total	2,908	11	B	2,175	27	C	2,908	8	A	2,175	25	C
NB CO 119 / Airport Road	NB Left-Turn (CO 119)	230	12	B	733	15	B	230	4	A	733	9	A
	NB Through (CO 119)	793	14	B	2,080	22	C	793	3	A	2,080	8	A
	NB Right-Turn (CO 119)	2	4	A	8	6	A	2	4	A	8	4	A
	EB Left-Turn (Airport Rd)	15	4	A	14	93	F	N/A	N/A	N/A	N/A	N/A	N/A
	EB Through (Airport Rd)	25	3	A	27	79	E	N/A	N/A	N/A	N/A	N/A	N/A
	WB Through (Airport Rd)	43	55	E	25	37	D	N/A	N/A	N/A	N/A	N/A	N/A
	WB Right-Turn (Airport Rd)	5	6	A	4	2	A	48	7	A	29	6	A
	Intersection Total	1,113	15	B	2,891	21	C	1,073	3	A	2,850	8	A

Safety Analysis

The Safety Assessment Report (Apex, 2021) examined the crash history over the five-year study period (2015 – 2019). At the Southbound CO 119 signalized intersection, close to half of the crashes observed involved the southbound through movement from Airport Road in some capacity; therefore, removing this conflicting movement is expected to have a significant safety benefit. At the Northbound CO 119 unsignalized intersection there was a pattern of *broadside* type crashes involving Airport Road traffic turning onto northbound CO 119. In the short term, the traffic involved in these collisions would be diverted to 83rd Street to the south as an out-of-direction U-Turn movement, or to Fordham Street to the north via Pike Road or Clover Basin Drive. In the longer term these movements would be expected to

divert to more direct routes. At either location, the left-turn onto northbound CO 119 would occur under very similar traffic conditions and as such this improvement would not necessarily be eliminating these crashes as much as relocating them. Though it would be reasonable to expect that the suggested improvement would have a positive safety impact due to an overall reduction in conflict points with northbound CO 119 traffic. It is important to point out that while the proposed signal at NB CO 119 and Airport Road had the potential to reduce the frequency of *broadside* type crashes, it would have substantially increased the potential for high-speed *rear end* type crashes by introducing stop conditions where none currently exist.

Multimodal Operations and Safety

Pedestrians

Pedestrian activity at the Airport Road intersection may include pedestrians traveling to bus stops, pedestrians crossing CO 119 between Airport Road and Ogallala Road and in the future, pedestrians accessing the median bikeway.

For pedestrians needing to cross northbound CO 119, grade separated access is provided via an underpass located 300 feet to the south of the intersection, which provides an alternative to crossing directly at the northbound CO 119 intersection. The proposed concept (to keep the northbound CO 119 unsignalized) will have no impact on this crossing.

For crossing southbound CO 119, pedestrians must cross both CO 119 and Airport Road. The Airport Road pedestrian crossing operates in parallel with high-speed southbound traffic including left turn movements conflicting with the pedestrian crossing. Removing the southbound CO 119 left turn movement will eliminate a key point of conflict for pedestrians. Removing southbound traffic from the Airport Road section between northbound and southbound CO 119 may also allow the pedestrian crossing width to be reduced, limiting pedestrian exposure to vehicular traffic. Due to these factors, the proposed concept would be expected to provide safer crossing for pedestrians.

Bicyclists

The Airport Road intersection with CO 119 is one of the more challenging locations within the CO 119 corridor for bicyclists to access the proposed median Bikeway. Airport Road is a designated bicycle route serving numerous residential neighborhoods in western Longmont. It is one of the higher volume bicycle routes in Longmont according to Strava™ Heatmap data. To access the proposed median Bikeway from Airport Road, bicyclists must navigate a high-speed intersection with high volumes of vehicular turning traffic, specifically vehicles turning right at a high rate of speed from southbound Airport Road to southbound CO 119. Additionally, the bikeway is proposed to continue east of Airport Road in the median of CO 119, so bicyclists must cross both directions of Airport Road traffic to continue along the bikeway between points east and west of Airport Road.

Boulder County's Bikeway design team has evaluated options to install an underpass beneath Airport Road or under southbound CO 119 to minimize conflicts with vehicular traffic. Because of the numerous bicycle routings through the intersection and resulting points of conflict between turning vehicles and bicyclists, neither of the two underpass options can fully address the safety concerns for bicyclists at this intersection. An underpass will be designed but currently there is no funding to construct it and at-grade bicycle and pedestrian enhancements are needed.

The proposed option of reconfiguring the travel lanes on Airport Road within the median of CO 119 so that all traffic is one way in the northbound direction would offer notable safety improvements for bicyclists navigating the Airport Road intersection. These include:

- Removal of southbound Airport Road through traffic and southbound CO 119 to southbound Airport Road left-turning traffic from the intersection, thereby reducing the number of vehicle-bicycle conflict points
- Reduced crossing width for bicyclists crossing CO 119
- Provision for signalized crosswalks across all four legs of the intersection
- A potential raised crosswalk for southbound Airport Road bicyclists crossing the channelized high-volume southbound Airport Road to southbound CO 119 vehicular right turn movement (similar to the existing raised crosswalk across the eastbound to southbound right turn at US 36 and 28th Street in Boulder)

While the proposed lane configuration changes of Airport Road do not fully address all bicycle safety concerns at this intersection, the proposed modifications would provide a more controlled crossing condition than what exists today while reducing the number of conflict points between bicycles and vehicles. Additionally, the City of Longmont has indicated a desire to construct a future underpass beneath southbound CO 119, which would further enhance bicycle safety by eliminating the need for most bicyclists to cross CO 119. A future underpass beneath southbound CO 119 would not preclude the Airport Road one way option.

Transit

The proposed one-way configuration and removal of the signalized intersection will improve future BRT transit operations at the CO 119 and Airport Road intersections. Removal of the proposed northbound CO 119 traffic signal will eliminate the need for a northbound CO 119 transit queue bypass lane at this intersection. When the BRT system is fully implemented, the Orange Line will turn north from northbound CO 119 to northbound Airport. The existing pavement on Airport Road will allow enough space to include a bus bypass lane for northbound Airport crossing southbound CO 119 at the traffic signal. No other significant differences in transit operations are expected between the two alternatives.

Additional Considerations

Roadway User Impacts

The changes proposed in this alternative will require residents to the north and south of the intersection to use alternate routes to travel across CO 119. Southbound Airport Road and southbound CO 119 motorists wishing to cross to Ogallala will need to detour 1.4 miles to N 83rd Street and U-turn (or find an alternate route). Motorists wishing to travel from Ogallala Road to southbound CO 119 will need to detour 1.7 miles to S Fordham Street and U-turn (or find an alternate route). See **Figure 3** for a map of local detours. These detours are expected to be short term, before motorists modify their travel patterns to use more direct routes.

Due to these changes, stakeholders will need to generate consensus around the configuration. Public input will be gathered and considered during the preliminary design process. If the change is carried forward a concerted public education and outreach effort should be enacted. If this alternative carries forward, the detour assumptions will be included in forthcoming CO 119 unsignalized intersection safety and operations analysis. Examples of considerations that will be reviewed are safety and operations at

Fordham Street and 83rd Street, additional weaving across northbound and southbound CO 119 traffic, and the potential for safety and operational improvements like a southbound acceleration lane at Fordham Street.

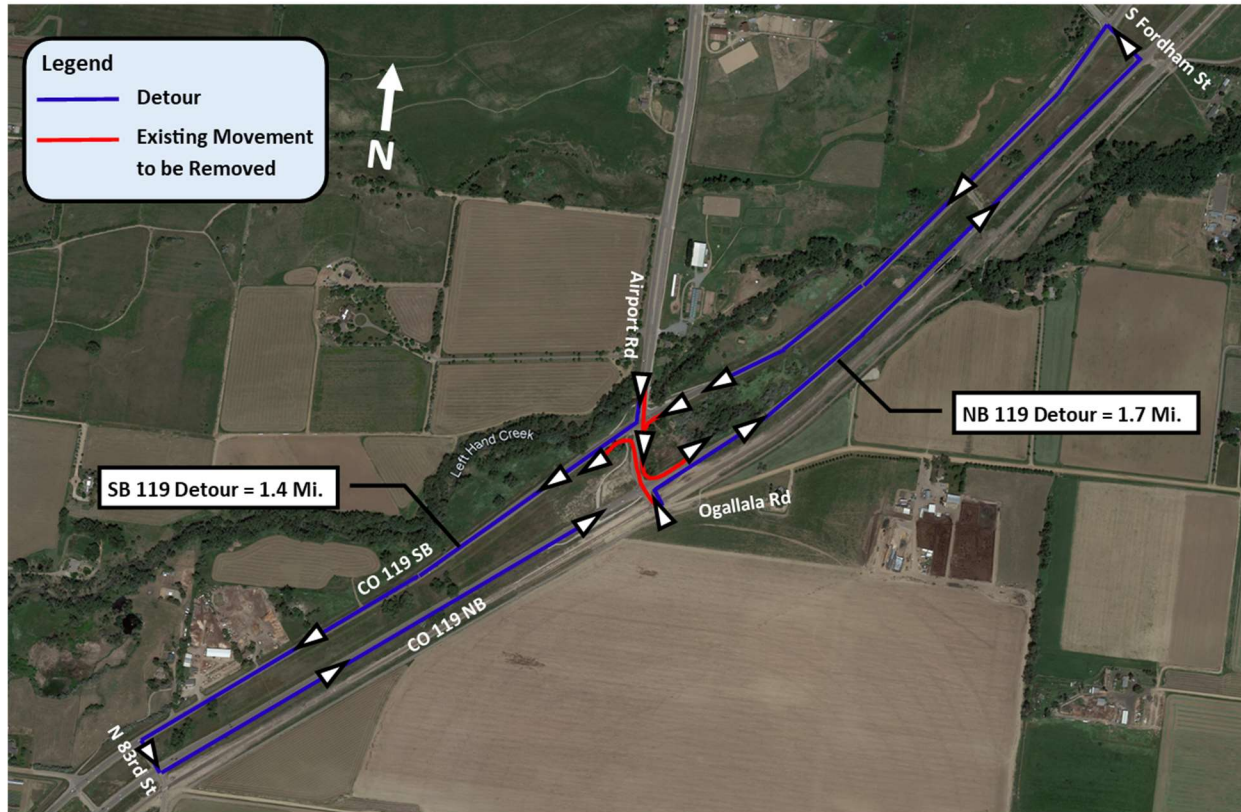


Figure 3. SB CO 119 Left Turn Detour

Table 3 illustrates the peak hour volumes from the 2045 Baseline (NB Airport Signalized) model that would use the detour route described above or find an alternate route.

Table 3 Detour Traffic Volume

Movement	Detour Distance	AM Peak-Hour Volume (2045 Baseline)	PM Peak-Hour Volume (2045 Baseline)
NB Ogallala Through/Left	1.7 Mi.	43	25
SB Airport Through/Left	1.4 Mi.	40	34
SB 119 Left	1.4 mi	0	7

Impacts of improvements at CO 119 and Hover Road and other planned development in the area will be assessed during the preliminary design phase of the project.

Cost Benefits

The proposed intersection changes lead to a cost savings as compared to the signalization of northbound CO 119 at Airport. With the northbound CO 119 signal removed in the new concept design, there would no longer be a need for a northbound CO 119 queue bypass lane, resulting in roughly a \$3,300,000 reduction in project costs. Some of the existing turn lane can be used as a queue bypass lane, resulting in \$300,000 in reduction in project costs. Additional savings would be incurred from the removal of this queue bypass lane due to there no longer being an impact to the existing bike/ped box culvert 300 feet upstream of the intersection. The elimination of a signal at northbound CO 119 would reduce project costs by an additional \$600,000. There will be additional cost associated with the new design concept for signing and striping changes north and south of southbound CO 119, a new longer signal mast arm, and raised island reconfigurations. There will also be additional cost for signing and potentially marking for the new alternate routes. In total, the approximate reduction in project costs related to this alternative is \$3,650,000.

Note that it is assumed that a second left turn lane at NB CO119/Airport will be added regardless of the design chosen, so this cost is not included in the summary shown in Table 4.

Table 4. Estimation of Cost Savings

Improvements Needed	Cost* Associated with Previous Design Concept	Cost* Associated with New Design Concept
SB Queue Bypass Lane	\$700,000**	\$400,000***
NB Queue Bypass Lane****	\$3,300,000	N/A
Modifications to Existing Box Culvert	\$200,000	N/A
NB CO 119 Signal Equipment	\$600,000	N/A
SB CO 119 Intersection Modifications	N/A	\$700,000
Alternate Route Signing and Marking	N/A	\$50,000
Total	\$4,800,000	\$1,150,000

* All costs shown are an approximation in 2021 dollars

** The SB queue bypass lane cost for the previous design concept includes 600 feet of added pavement upstream of the intersection, and zero feet of added pavement downstream of the intersection. The existing SB acceleration length is sufficient.

*** The SB queue bypass lane cost for the new design concept includes 400 feet of added pavement upstream of the intersection, and zero feet of added pavement downstream of the intersection. The existing left turn lane and taper need to be lengthened to accommodate the new queue bypass lane.

**** The NB queue bypass lane includes 1,500 feet of added pavement upstream of the intersection, and 1,200 feet of added pavement downstream of the intersection

Summary

The expected benefits of this concept are as follows:

- Elimination of poorly operating vehicular movements, leading to overall improvement in traffic operations
- A positive safety impact due to an overall reduction in conflict points with northbound CO 119 traffic, and removal of the potential for an increase in rear-end crashes due to adding a traffic signal at a high-speed facility.
- For pedestrians, a reduction in conflict points at the southbound CO 119 and Airport Road intersection
- For bicyclists, a more controlled crossing condition at the southbound CO 119 and Airport Road intersection than what exists today, while reducing the number of conflict points between bicycles and vehicles
- For transit, providing space for a future BRT Orange line queue bypass lane across the existing signalized southbound CO 119 and Airport Road intersection, and eliminating the need for queue bypass lane at the northbound CO 119 intersection.
- A reduction in construction scope and cost

Expected challenges to this concept are as follows:

- Residents of southeastern Longmont likely use the Ogallala Road movement onto southbound CO 119 to get to Boulder.
- Residents of western Longmont trying to access 95th Street or US 287 would not be able to use Ogallala Road without detouring to 83rd Street.

Items to analyze in more detail during preliminary design include:

- Analyze the effects, if any, of weaving from detouring movements
- Review the basis for restricting the through movement from Ogallala Road across CO 119. If this movement is restricted, determine the best way to restrict this movement
- Restrictions of left turn from northbound Airport Road to southbound CO 119
- Impacts of improvements at CO 119 and Hover Road and other planned development in the area, and those impacts on assumed alternate routes, will be assessed during the preliminary design phase of the project.
- Public outreach will be completed during the design phase of the project
- If this alternative carries forward, the detour assumptions will be included in forthcoming CO 119 unsignalized intersection safety and operations analysis.

APPENDIX A

APPENDIX B