THE POWERHOUSE AT UNION STATION ● 401 S. 18TH ST., STE. 400 ● SAINT LOUIS, MISSOURI 63103-2296

▪ TECHNICAL MEMORANDUM ▪

TO: Lane Harness
FROM: Ramin Ashrafzadeh, PE
SUBJECT: US 61 Safety Evaluation
DATE: December 1, 2023
H&S JOB NO.: 2329000

In accordance with your request, Horner & Shifrin (H&S) has completed a safety evaluation of the crash reports for US 61 at the intersections of I-55 Southbound and Northbound Exit Ramps, and River Cement Road, south of the cities of Festus and Crystal City in Jefferson County Missouri.

Scope and Report Purpose

The safety evaluation is intended to review the crash reports from 2013 to present and provide potential improvements that can create a safer corridor.

Figure 1: Project Location

Figure 2: US 61/I-55 Southbound looking east

Figure 3: US 61/I-55 Southbound looking south

Figure 4: US 61/I-55 Northbound looking east

Figure 5: US 61/I-55 Northbound looking north

Figure 6: US 61/River Cement Rd. looking east

Figure 7: US 61/ River Cement Rd. looking south

Existing Conditions

US 61 is classified as a Major Collector with 2755 AADT (2022) west of I-55 and 6255 AADT (2022) east of I-55. The speed limit of US 61 is 45 MPH. Interstate 55 has a diamond interchange at US 61 (Exit 170). The intersection of US 61 and the I-55 Southbound Exit Ramps is signalized. The intersections of US 61 and I-55 Northbound Exit Ramps; and US 61 and River Cement Road; are traffic controlled with stop signs, with US 61 having uninterrupted flow.

Crash Data

Below is a summary of crash data from 2013-2023 at each intersection. See Appendix B for all crash reports.

- US 61/Interstate 55 Southbound Intersection - 9 Total Crashes
  - 4 included injuries
  - 5 included property damage only
  - 5 included driver error when utilizing the traffic signal
  - 2 were weather related
- US 61/Interstate 55 Northbound Intersection - 11 Total Crashes
  - 4 included injuries
  - 7 included property damage only
  - 5 were attributed to I-55 Exit Ramp not seeing US 61 traffic
  - 7 angle crashes
- US 61/River Cement Road Intersection - 7 Total Crashes
  - 2 included injuries
  - 5 included property damage only
  - 6 were front to rear on US 61 Southbound

Per discussions with Jefferson County, multiple fatal crashes have occurred in this area; however, these crashes occurred prior to 2013. While these fatal crashes are outside of the evaluation period, the crashes have been broadly discussed during the evaluation due to community concerns. In addition, US 61 runs east and west in this section. It is our understanding; this alignment creates driver issues with sun blindness.

Sight Distance Analysis

Sight distance calculations are based on aerial measurements and a site visit. AASHTO's Greenbook requires a stopping sight distance of 360' for 45 MPH.

The US 61 and I-55 Southbound Exit Ramp intersection has not been evaluated for sight distance due to having an existing traffic signal.

The US 61 and I-55 Northbound Exit Ramp intersection provides a stopping sight distance of approximately 180' looking west and greater than 500' looking east.

The US 61 and River Cement Road intersection provides a stopping sight distance of greater than 600' looking west and approximately than 400' looking east. While the sight distance looking east exceeds the minimum AASHTO requirements, the existing crest curve creates an apparent loss in sight distance due to the roadway surface dropping below the sight line. This apparent loss in sight distance creates driver discomfort.

Potential Countermeasures

The following countermeasures were identified:

- Construct roundabouts. Roundabouts are included in the Federal Highway Administration's "Proven Safety Countermeasures" (see Appendix A) and provide up to 82% reduction in fatal and injury crashes.
- Install traffic signals at unsignalized intersections. Traffic signals can reduce the effects of poor sight distance as intersection sight distance can be analyzed as a stop condition.
- Construct dedicated turn lanes. Dedicated turn lanes are included in the Federal Highway Administration's "Proven Safety Countermeasures" (see Appendix A) and provide up to 48% reduction in total crashes.
- Install backplates with retroreflective borders. Backplates with retroreflective borders are included in the Federal Highway Administration's "Proven Safety Countermeasures" (see Appendix A) and provide 15% reduction in total crashes.
- Install enhanced signing and pavement markings. These are included in the Federal Highway Administration's "Proven Safety Countermeasures" (see Appendix A) and provide up to 27% reduction in injury crashes.

Summary and Next Steps

H&S has completed the safety evaluation and has the following recommendations (see Figure 8):

1. Construct a dedicated left turn lane on US 61 for traffic turning on River Cement Road. This countermeasure is currently planned for construction in 2024.
2. Consider installation of a traffic signal at US 61/I-55 Northbound Exit Ramps Intersection. While the traffic counts and crash data, at the isolated intersection, are not sufficient to justify signalization, both northbound and southbound exit ramps should be considered a single intersection per MUTCD Section 4C.01 paragraph 12: "For signal warrant analysis, a location with a wide median, even if the median width is greater than 30 feet, should be considered as one intersection." As the southbound exit ramps meet warrants for signalization, the northbound ramps meet warrants for signalization.
3. Consider installation of backplates with retroreflective borders on all traffic signals.
4. Consider doubled-up oversized advance intersection warning signs with flashing beacons along US 61.

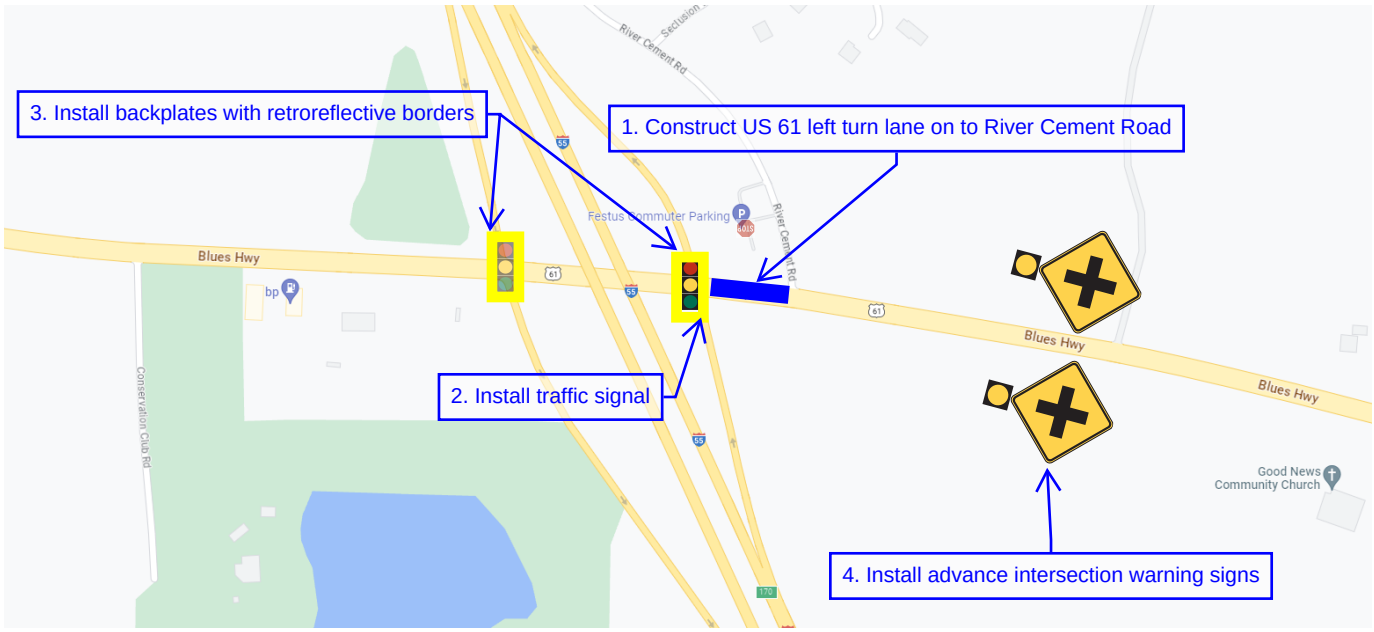

Figure 8: Recommendations

Appendix A

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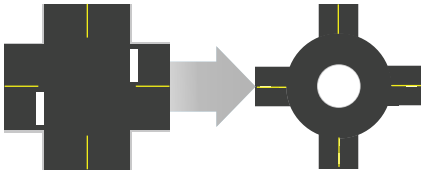
Proven Safety Countermeasures

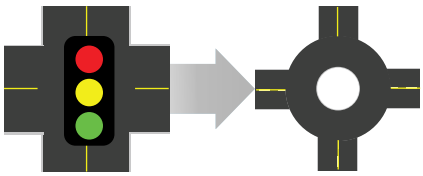
Safety Benefits:

Two-Way Stop-Controlled Intersection to a Roundabout



82%
reduction in fatal and injury crashes.[1]

Signalized Intersection to a Roundabout



78%
reduction in fatal and injury crashes.[1]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://highways.dot.gov/safety/proven-safety-countermeasures and https://highways.dot.gov/safety/intersection-safety/intersection-types/roundabouts.

FHWA-SA-21-042

Roundabouts

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

Roundabouts are not only a safer type of intersection; they are also efficient in terms of keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.

Illustration of a multilane roundabout. Source: FHWA

Example of a single-lane roundabout. Source: FHWA

1 (CMF ID: 211,226) AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).

ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

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Dedicated Left- and Right-Turn Lanes at Intersections

Auxiliary turn lanes—either for left turns or right turns—provide physical separation between turning traffic that is slowing or stopped and adjacent through traffic at approaches to intersections. Turn lanes can be designed to provide for deceleration prior to a turn, as well as for storage of vehicles that are stopped and waiting for the opportunity to complete a turn.

Safety Benefits:

Left-Turn Lanes

28-48%

reduction in total crashes.[1]

Positive Offset Left-Turn Lanes

36%

reduction in fatal and injury crashes.[2]

Right-Turn Lanes

14-26%

reduction in total crashes.[1]

Left- and right-turn lanes at a two-way stop-controlled intersection. Source: City of Greeley, CO

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://highways.dot.gov/safety/proven-safety-countermeasures and https://www.fhwa.dot.gov/publications/research/safety/02103/02103techbrief.pdf.

FHWA-SA-21-041

While turn lanes provide measurable safety and operational benefits at many types of intersections, they are particularly helpful at two-way stop-controlled intersections. Crashes occurring at these intersections are often related to turning maneuvers. Since the major route traffic is free flowing and typically travels at higher speeds, crashes that do occur are often severe. The main crash types include collisions of vehicles turning left across opposing through traffic and rear-end collisions of vehicles turning left or right with other vehicles following closely behind. Turn lanes reduce the potential for these types of crashes.

Installing left-turn lanes and/or right-turn lanes should be considered for the major road approaches for improving safety at both three- and four-leg intersections with stop control on the minor road, where significant turning volumes exist, or where there is a history of turn-related crashes. Pedestrian and bicyclist safety and convenience should also be considered when adding turn lanes at an intersection. Specifically, offset left- and right-turn lanes will lengthen crossing distances for pedestrians.

Offset Turn Lanes

Providing offset of left- and right-turn lanes to increase visibility can provide added safety benefits, and is preferable in many situations, particularly at locations with higher speeds, or where free-flow or permissive movements are possible.

At turn lanes with zero or negative offset, turning vehicles can block sightlines. For left-turn lanes, this usually involves opposing left-turning vehicles occupying the turn lanes at the same time. For right-turn lanes, this typically involves right-turning vehicles from the major road and vehicles entering the intersection from the minor road. In both scenarios, adding positive offset to turn lanes enhances the sight distance to approaching vehicles that conflict with the turning movement. Offset turn lanes should be considered when there is a high frequency of these types of conflicts in order to reduce the likelihood of a severe crash.

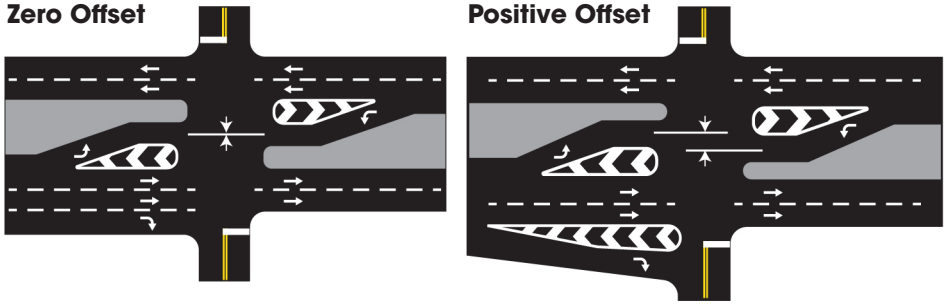

Illustration comparing zero offset to positive offset of left- and right-turn lanes. Source: FHWA

1 (CMF ID: 260, 268, 285, 289) Harwood et al. Safety Effectiveness of Intersection Left- and Right-Turn Lanes. FHWA-HRD-02-089, (2002).
2 (CMF ID: 6096) Persaud et al. Safety Evaluation of Offset Improvements for Left-Turn Lanes. FHWA-HRT-09-035, (2009).

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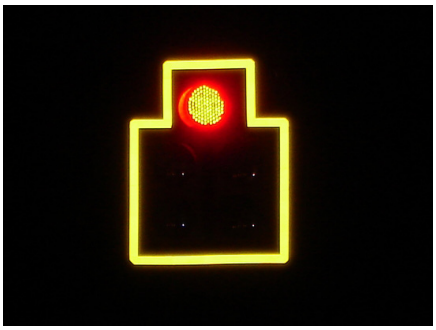
Backplates with Retroreflective Borders

Backplates added to a traffic signal head improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. The improved visibility of a signal head with a backplate is made even more conspicuous by framing it with a 1- to 3-inch yellow retroreflective border. Signal heads that have backplates equipped with retroreflective borders are more visible and conspicuous in both daytime and nighttime conditions.

Safety Benefits:

15%
reduction in total crashes.[1]

This treatment is recognized as a human factors enhancement of traffic signal visibility, conspicuity, and orientation for both older and color vision deficient drivers. This countermeasure is also advantageous during periods of power outages when the signals would otherwise be dark, providing a visible cue for motorists to stop at the intersection ahead.



Retroreflective borders are highly visible during the night. Source: South Carolina DOT

Considerations

Transportation agencies should consider backplates with retroreflective borders as part of their efforts to systematically improve safety performance at signalized intersections. Adding a retroreflective border to an existing signal backplate is a very low-cost safety treatment. This can be done by either adding retroreflective tape to an existing backplate or purchasing a new backplate with a retroreflective border already incorporated. The most efficient means of implementing this proven safety countermeasure is to adopt it as a standard treatment for signalized intersections across a jurisdiction or State.

Implementation challenges include minimizing installation time, accessing existing signal heads, and structural limitations due to added wind load in instances where an entire backplate is added. Agencies should consider the design of the existing signal support structure to determine if the design is sufficient to support the added wind load.

Signal backplate framed with a retroreflective border. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://rosap.ntl.bts.gov/view/dot/42807.

1 Sayed, T., Leur, P., and Pump, J., "Safety Impact of Increased Traffic Signal Backboards Conspicuity." 2005 TRB 84th Annual Meeting: Compendium of Papers CD-ROM, Vol. TRB#05-16, Washington, D.C., (2005).

FHWA-SA-21-039

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Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.

Safety Benefits:

10%
reduction of fatal and injury crashes at all locations/types/areas.

15%
reduction of nighttime crashes at all locations/types/areas.

27%
reduction of fatal and injury crashes at rural intersections.

19%
reduction of fatal and injury crashes at 2-lane by 2-lane intersections.

Average Benefit-Cost Ratio

12:1

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://highways.dot.gov/safety/proven-safety-countermeasures and https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa18047.pdf.

FHWA-SA-21-031

There are several benefits to systemically applying multiple low-cost countermeasures at stop-controlled intersections, including,

- Resources are maximized because the treatments are low cost.
- A high number of intersections can receive treatment.
- Improvements are highly cost-effective, with an average benefit-cost ratio of 12:1, even assuming a conservative 3-year service life.

Example of countermeasures on the through approach.
Source: South Carolina DOT

Example of countermeasures on the stop approach.
Source: South Carolina DOT

The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

On the Through Approach

- Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
- Retroreflective sheeting on sign posts.
- Enhanced pavement markings that delineate through lane edge lines.

On the Stop Approach

- Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
- Doubled-up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of vegetation, parking, or obstructions that limit sight distance.
- Double arrow warning sign at stem of T-intersections.

Source: (CMF ID: 8867, 8870, 8874, 8893) T. Le et al. "Safety Effects of Low-Cost Systemic Safety Improvements at Signalized and Stop-Controlled Intersections," 96th Annual Meeting of the Transportation Research Board, Paper Number 17-05379, January 2017.

Appendix B
(Crash Reports)