

TABLE 5. COUNTERMEASURE SUMMARY

Countermeasures	CMF	Context (Urban/Rural)
Raised Medians	0.29	Both
Change Driveway Width	0.25	Both
Rectangular Rapid Flashing Beacons (RRFB)	0.31	Both
Pedestrian Refuge Islands	0.44	Urban
Midblock Crossings	0.45	Urban
Roadway Reconfiguration	0.53	Urban
Sidewalks	0.598	Both
Corridor Lighting	0.68	Both
Crosswalk Visibility Enhancements	0.732	Both
Rumble Strips	0.745	Rural
High-Contrast Lane Markings	0.75	Both
Flashing Yellow Arrow	0.97	Both
Retroreflective Backplates	0.85	Both
Appropriate Speed Limits	0.856	Both
Corridor Access Management	0.93	Both
Speed Feedback Signs	0.95	Both
Wider Edge Lines	0.97	Both
Curb Extensions	–	Urban



CHAPTER 4: COUNTERMEASURES

This chapter outlines systemic recommendations are organized by safety emphasis areas and provide a countermeasure toolbox to make Citywide improvements. Furthermore, this chapter details the five (5) study corridors identified by the HIN, City staff and SSC, along with their respective targeted recommendations and countermeasures. Informed by the countermeasure toolbox, targeted recommendations at study corridors provide detailed and crafter recommendations for specific areas of the City of Tahlequah that have varying crash history, road geometry, intersection control, and land use context.

SYSTEMIC COUNTERMEASURE TOOLBOX

A countermeasure toolbox is a comprehensive collection of strategies and interventions designed to address specific traffic safety issues and challenges. It provides transportation professional with a range of options and resources to effectively mitigate risks, improve safety, and enhance the overall performance of roadways and transportation systems.

The following details systemic countermeasures that can be implemented in all areas of the City to improve safety, not limited to the recommendations and study corridors. The summary of all Tahlequah countermeasures is found in **Table 5**. Tahlequah’s systemic countermeasure toolbox is provided with each categorized by safety emphasis area in **Table 6**. Priority should be given to roads along the HIN and in areas of disadvantages populations to lessen severity among crashes.

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This chapter outlines systemic recommendations are organized by safety emphasis areas and provide a countermeasure toolbox to make Citywide improvements.

TABLE 6. SAFETY EMPHASIS AREAS COUNTERMEASURES TOOLBOX

Safety Emphasis Areas	CMF	Lane Departures	Impaired Driving	Occupant Protection	Unsafe Speeds	Intersections	CMV Crashes and Work Zones	Motorcycle Crashes and ATVs	Vulnerable Road Users
Raised Median	0.29	●	●	●	●				●
Corridor Access Management	0.93			●		●		●	●
Change Driveway Width	0.25			●		●			●
Retroreflective Backplates	0.85					●			
Flashing Yellow Arrow	0.97					●			
Lane Designation Markings and Signs	0.75		●			●	●		
Wide Edge Lines	0.63	●	●						
High Contrast Lane Markings	0.75	●	●						
Rumble Strips	0.36	●	●	●			●		
Curb Extensions	N/A				●			●	●
Speed Feedback Signs	0.95			●	●		●	●	●
Appropriate Speed Limits				●	●		●	●	●
Rectangular Rapid Flashing Beacon	0.31								●
Pedestrian Refuge Islands	0.44								●
Midblock Crossings	0.45								●
Corridor Lighting	0.73	●	●	●				●	
Crosswalk Visibility Enhancements	0.73								●

RAISED MEDIAN

A raised median is a physical barrier or divider that separates opposing lanes of traffic on a roadway. It is most used in urban and suburban areas to enhance safety and traffic flow by preventing vehicles from crossing over into opposing lanes or making certain left-turn movements. Installing a raised median has a CMF of 0.29 for all crash types and severities. **Figure 10** provides an example of a raised median.

FIGURE 10. RAISED MEDIAN

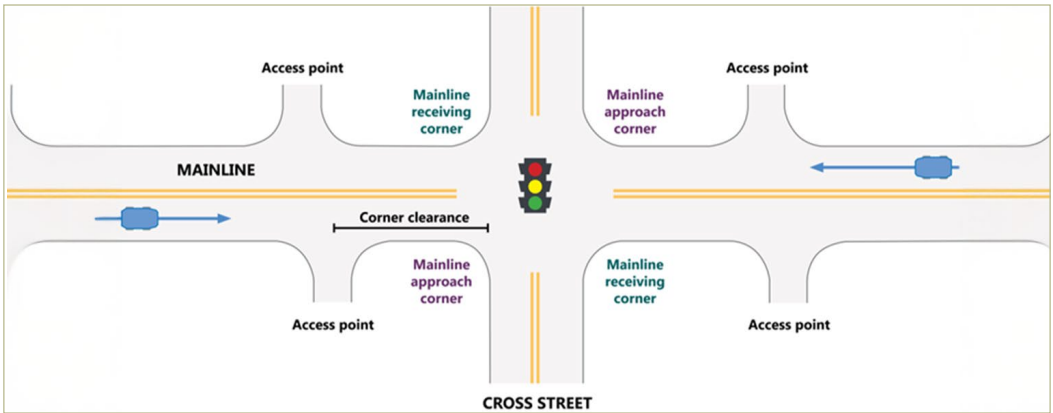


Source: Adobe Stock

CORRIDOR ACCESS MANAGEMENT

Access management pertains to the planning, implementation, and regulation of entry and exit locations along a road, encompassing intersections with other roads and driveways serving nearby properties. Thoughtful management of access along a corridor can improve safety for all transportation modes, promote walking and cycling, and alleviate traffic congestion and delays. Closure or relocation of driveways from functional area of intersection has a CMF of 0.93 for all crash types and severities. **Figure 11** provides an example of corridor access management elements and example.

FIGURE 11. CORRIDOR ACCESS MANAGEMENT



Source: FHWA

RETROREFLECTIVE BACKPLATES

A retroreflective backplate is a backplate made by framing a signal head with a 1-to-3-inch yellow retroreflective border. They improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. They are also more visible and conspicuous in both daytime and nighttime conditions. Installing retroreflective backplates has a CMF of 0.85 for all crash types and severities. **Figure 12** provides an example of a retroreflective backplate installed on a signal head.

FIGURE 12. RETROREFLECTIVE BACKPLATE



Source: FHWA

FLASHING YELLOW ARROW

A flashing yellow arrow (FYA) indicates that drivers are permitted to turn left but should yield to pedestrians and oncoming traffic during a permissive circular green. This countermeasure is a national standard adopted by the FHWA meant to increase intersection safety. The addition of an FYA is meant to decrease the number of left-turn crashes, especially those that involve a crash between vehicles turning left and those going straight. Installing an FYA has a CMF of 0.975. **Figure 13** shows an example of an FYA installed at an intersection.

FIGURE 13. FLASHING YELLOW ARROW



Source: mntransportationresearch.org

WIDE EDGE LINES

Edge lines are the pavement markings at the edge of travel lanes and are designed to help drivers clearly identify the road alignment ahead. Edge lines are considered “wider” when the marking width is increased from the minimum normal line width of 4 inches to the maximum normal width of 6 inches. Wider edge lines enhance the visibility of travel lane boundaries compared to traditional edge lines. This has a CMF of 0.635 for all crash types and for K, A, B, or C crash severities. **Figure 14** provides an example of a wide edge line.

FIGURE 14. WIDE EDGE LINE

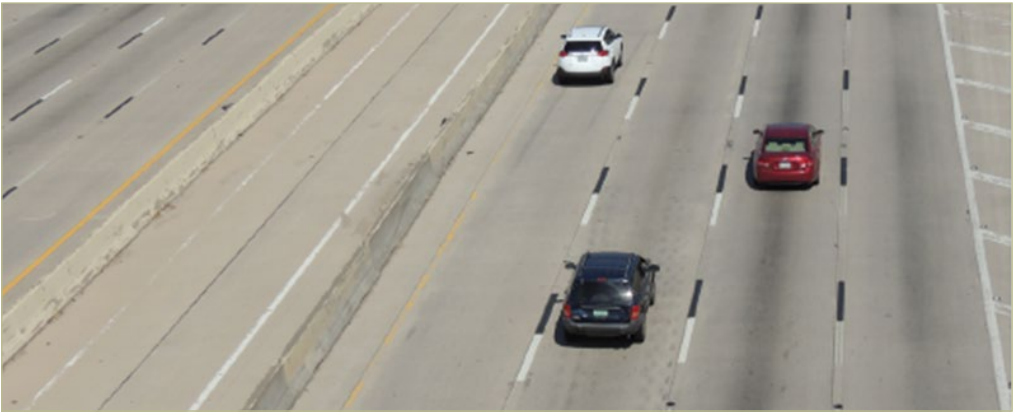


Source: FHWA, Texas Transportation Institute

HIGH-CONTRAST LANE MARKINGS

High contrast lane markings are road markings designed to be easily distinguishable from the surrounding pavement, typically by contrasting colors or materials. These markings are intended to improve visibility and clarity for drivers, especially in challenging conditions such as low light, inclement weather, or areas with poor visibility. High contrast lane markings can reduce lane departure, intersection, distracted driving, and impaired driving related crashes. Installing high contrast lane markings has a CMF of 0.75. **Figure 15** provides an example of high contrast lane markings.

FIGURE 15. HIGH CONTRAST LANE MARKINGS



Source: FHWA

RUMBLE STRIPS

Rumble Strips are a method of improving traffic safety by alerting drivers in the case that they leave the traveled way. In the instance that a driver strays from the travel lane rumble strips will produce a noise and vibration that will alert drivers prompting them to correct the error. Longitudinal, center line, edge line, and shoulder rumble strips are effective low-cost safety countermeasures. Longitudinal rumble strips can result in a 44-64% reduction in head-on fatal and injury crashes on two-lane rural roads. Installing rumble strips have a CMF of 0.36. **Figure 16** shows an example of longitudinal rumble strips.

FIGURE 16. RUMBLE STRIPS



Source: Adobe Stock

CURB EXTENSIONS

Curb Extensions visually and physically narrow the roadway, creating a safer and shorter crossing for pedestrians while increasing the available space for pedestrians or other amenities. Curb Extensions help with speed reductions and increased safety. There is currently not CMF for Curb Extensions. **Figure 17** provides an example of curb extensions.

FIGURE 17. CURB EXTENSIONS



Source: FHWA

IMPLEMENT SYSTEMIC SIGNING AND MARKING IMPROVEMENTS AT STOP-CONTROLLED INTERSECTIONS

Deploying a variety of low-cost countermeasures at a number of stop-controlled intersection within a jurisdiction can increase overall intersection safety in that location. Countermeasure that could applied to stop-controlled intersections are properly placed stop bars, doubled-up oversized stop signs, doubled up oversized advance “stop ahead” signs, and removal of vegetation. These countermeasures increase driver awareness to the upcoming intersection and any potential conflicts. Implementing signing and marking improvements at stop-controlled intersections through a systemic approach has a CMF of 0.734. **Figure 18** provides an example of some low-cost countermeasures that could be utilized.

FIGURE 18. EXAMPLE OF COUNTERMEASURES AT A STOP CONTROLLED INTERSECTION



Source: FHWA

RECTANGULAR RAPID FLASHING BEACON (RRFB)

A RRFB is a pedestrian activated safety device installed at crosswalks to enhance visibility and alert drivers to the presence of pedestrians. A RRFB consists of two, rectangular-shaped yellow indicators, each with a light emitting diode (LED)-array-based light source. When activated these the RRFB emits a rapid, alternating pattern of flashing lights to alert drivers to pedestrians crossing the street. RRFBs are a low maintenance improvement that should be deployed at targeted locations. According to FHWA, RRFBs can result in motorist yielding rates as high as 98 percent at marked crosswalks with varied speed limits, crossing distances, and number of travel lanes. Installation of an RRFB has a CMF of 0.31 for all crash types and severities. **Figure 19** provides an example of an RRFB.

FIGURE 19. RRFB



Source: Adobe Stock

PEDESTRIAN REFUGE ISLANDS

Pedestrian Refuge Islands is a dedicated pedestrian “island” in the middle of an intersection that provides a safe place for vulnerable road users to stop when crossing a large and busy intersection. Pedestrian Refuge Islands increase pedestrian safety by shortening pedestrian exposure when crossing an intersection. This safety countermeasure is most useful at intersections with high traffic volumes. Pedestrian Refuge Islands contribute to a 56% reduction in pedestrian crashes and have a CMF value of 0.44. **Figure 20** shows an example of a pedestrian refuge island.

FIGURE 20. PEDESTRIAN REFUGE ISLAND



Source: Adobe Stock

MIDBLOCK CROSSINGS

Designated pedestrian crossings away from an intersection. Inexpensive method to increase pedestrian safety through clear visual cues to pedestrians and drivers of a crossing, particularly in the case of increased distance between pedestrian crossing points. Increases vulnerable road user safety through alerting drivers to pedestrian crossings and encourage pedestrians to use dedicated crossing points. These treatments should be implemented at key locations where there are large expanses between pedestrian crossings at intersections. Installing Midblock Crossings has a CMF of 0.45. **Figure 21** provides an example of a midblock crossing.

FIGURE 21. MIDBLOCK CROSSINGS



Source: Adobe Stock

APPROPRIATE SPEED LIMITS

Utilization of appropriate speed limits increases roadway safety through implementing speed limits that take into account factors such as school/work zones, visibility, elevation changes, curves, congestion, and vulnerable road users. Through implementing appropriate speed limits into street design, it increases roadway safety for all users. Speeding increases fatality of all collisions, this low-cost method of speed control reduces danger of speed related collisions. A driver traveling at 30 miles per hour who hits a pedestrian has a 45 percent chance of killing or seriously injuring them. At 20 miles per hour, that percentage drops to 5 percent.

FIGURE 22. APPROPRIATE SPEED LIMITS

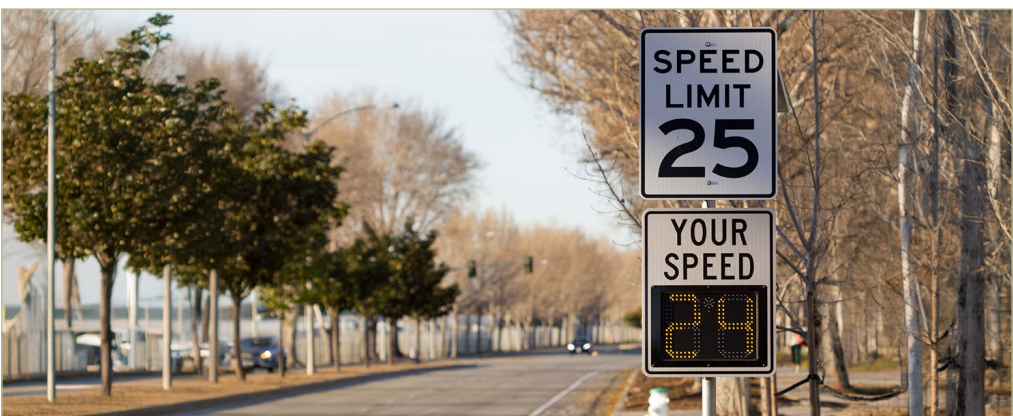


Source: Adobe Stock

SPEED FEEDBACK SIGNS

Traffic control device using a system of speed measurement and feedback sign to alert and warn drivers if exceeding the speed limit. Feedback signs typically consist of a display panel, often featuring LED or digital readouts, which visually indicate the speed of approaching vehicles or a warning message. Primary purpose of speed feedback signs is to increase roadway safety by alerting drivers of their speed, encouraging driver awareness, and promoting safer driving behaviors. These speed feedback signs are typically implemented in school zones, work zones, residential areas, and other areas in which speeding is an increased safety hazard. Installing Speed Feedback Signs has a CMF of 0.95. **Figure 23** shows an example of a speed feedback sign.

FIGURE 23. SPEED FEEDBACK SIGNS



Source: Adobe Stock

CORRIDOR LIGHTING

The number of fatal crashes occurring during daylight is roughly equal to those occurring in darkness. However, the nighttime fatality rate is three times higher than the daytime rate, despite only 25% of vehicle miles traveled (VMT) occurring at night. At higher speeds, vehicles may be unable to stop in time when a hazard or roadway change becomes visible within headlight range.

Enhancing roadway lighting significantly improves visibility and safety. Research-based recommendations for horizontal and vertical illuminance levels ensure lighting meets or exceeds minimum acceptable standards, benefiting all roadway users. Additionally, adequate lighting enhances personal security for non-vehicle users traveling along or across roadways. Depending on community needs, lighting improvements can take the form of intersection or corridor lighting. Increased lighting has been shown to reduce pedestrian nighttime crashes by up to 42%. Corridor lighting improvements have a CMF value of 0.73; an example of a well-lit roadway corridor is seen in **Figure 24**.

FIGURE 24. CORRIDOR LIGHTING



Source: Adobe Stock

CROSSWALK VISIBILITY ENHANCEMENTS

Crosswalk Visibility Enhancements may include lighting, high-visibility crosswalks, and signing and pavement markings. These enhancements improve pedestrian safety by improving visibility and better alerting drivers of pedestrian presence. These low-cost improvements can be deployed on a large scale and encourage active transportation. Crosswalk Visibility Enhancements have a CMF of 0.732. Examples of visibility enhancements to a crosswalk is found in **Figure 25**.

FIGURE 25. CROSSWALK VISIBILITY ENHANCEMENTS



Source: FHWA

CHANGE DRIVEWAY WIDTH

Changing the width of existing driveways can have a significant impact on decreasing crashes near the driveway location. Through this countermeasure, driveways with large widths will not have to be fully closed but rather shortened to enhance intersection safety. Although this countermeasure reduced the degree of access a driveway has, it should be considered when limited sight distance does not allow adequate time to judge traffic, there is proximity to busy intersections, or there is a need to reduce conflicting turning movements. Reducing driveway widths in Tahlequah could have a CMF of 0.25 for all crash severities.

FIGURE 26. DRIVEWAY IN NEED OF CHANGE



Source: Kimley-Horn

TARGETED RECOMMENDATIONS

To select projects and recommendations that would improve safety in Tahlequah, in-field observations were made to understand existing conditions and crash locations. The following sections summarizes the crash history and highlights corridor-level recommendations for each of the five selected study corridors.

STUDY CORRIDORS AND INTERSECTIONS

Five road segments on the High-Injury Network were selected as priority corridors to make targeted recommendations that improve safety on the City’s most unsafe corridors today. The highest priority study corridors were selected with input from City staff and the SSC. The criteria for study corridor selection were based on the following inputs:

- Equity
 - Disadvantaged Areas (USDOT ETC Explorer)
 - Transportation Disadvantaged Areas (USDOT ETC Explorer)
- Engagement
 - Social Pinpoint Map Survey Comments
 - SSC Study Area Comments (from Meeting 2)
 - SSC Priority Selection (from Meeting 3)
- Feasibility
 - Current City Projects
 - Current ODOT Projects

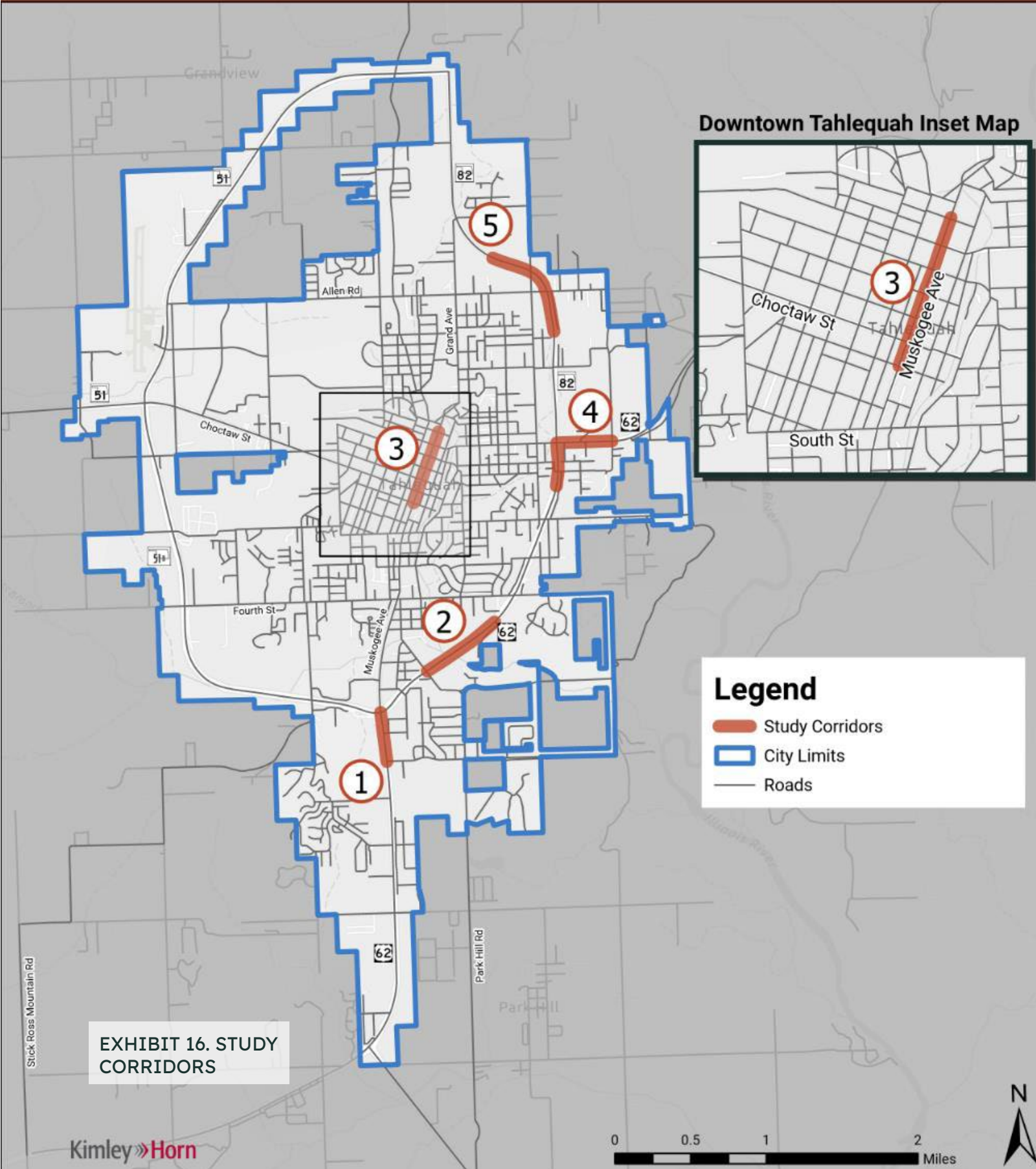
In coordination with the City of Tahlequah Staff and the SSC, the five study corridors for targeted recommendations are outlined in **Table 7**. The study corridors, seen in **Exhibit 16**, add up to 2.98 miles of roadway, capturing 18% of the total KAB crashes within their limits. Each are spread between various locations of Tahlequah and are located near multiple land use contexts.

TABLE 7. STUDY CORRIDORS

Corridor		Limits		Length	Crashes			Total KABS	AADT
		From	To		K	A	B		
1	S Muskogee Ave	E Ballentine Rd	Bypass	0.33	0	1	4	62	20,800
2	Bypass	S Park Hill Rd	7th Street	0.55	1	2	5	42	17,500
3	S Muskogee Ave	W Chickasaw St	Goingsnake St	0.61	0	0	1	27	7,400
4	Bypass/US-82	E Boone St	E Downing St	0.78	2	3	4	85	16,000
5	SH-82	Near E Allen Rd		0.71	0	1	2	25	9,500
Totals				2.98	3	7	16	240	–



Study Corridors



1 CORRIDOR 1: S MUSKOGEE AVENUE, FROM E. BALLENTINE ROAD TO BYPASS

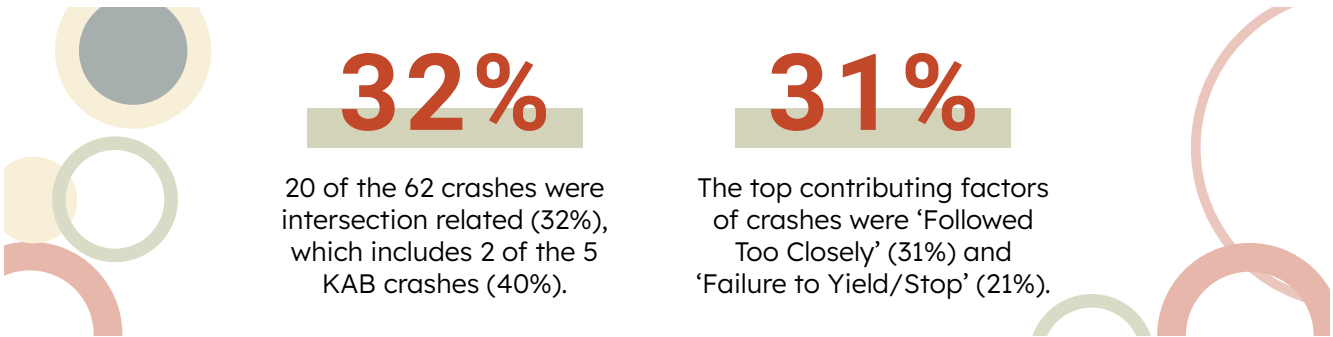


Context

The S Muskogee Avenue corridor (Corridor 1) is a section of Muskogee Ave, also known as US-62, from E Ballentine Road to the US-62/SH-82 Bypass that is 0.33 miles in length. Corridor 1 is located south of Downtown Tahlequah and is surrounded by primarily commercial land uses. This section of Muskogee Avenue is primarily a 5-lane undivided roadway with a center two-way left-turn lane. The volume of this road is approximately 20,800 vehicles per day. The posted speed limit of this corridor is 45 MPH. This corridor has two signalized intersections, one at the Bypass and one at Rayne Street, which acts as an entrance point to Walmart and Reasor’s.

Crash History

There were 64 total crashes on this section of S Muskogee Road between 2017-2021. Of these crashes, 5 were KABs. Key takeaways for crash trends along Corridor 1 were the following:



Corridor Recommendations

It is recommended to install countermeasures along Corridor 1 that would both increase driver awareness and address both intersection and access management concerns. These countermeasures include installing corridor-wide high-contrast lane markings, a raised center median, improved lighting, transverse rumble strips, and steep hill warning signage. Raised medians will draw drivers’ attention to the way, help decrease speeds and improve access management along the corridor. High contrast lane markings enhance the visibility of the travel lanes throughout the corridor. This, paired with improved corridor lighting, will allow drivers to easily see in low-light conditions and see where travel lanes begin and end. Installation of transverse rumble strips and ‘Steep Hill Ahead’ signage will alert drivers about the steep hill south of Rayne Street; increasing driver awareness of these conditions is important so drivers are cognizant of speed and potential sight issues.

To enhance the safety of vulnerable road users, it is recommended to install sidewalks and ensure these sidewalks are adequately lit. There is an ODOT Transportation Alternative Project proposed to install a multi-use trail on the west side of the corridor that will address some vulnerable road user concern; it is recommended to connect this proposed trail to the east side of the corridor, as well as constructing sidewalks to connect to priority destinations, such as Walmart, Chick fil A, and Reasor’s.

Improved access management along this corridor is important, especially due to high traffic volumes and congestion seen here. Reduction of the number of driveway openings and creation of shared driveways between Rayne Street and Ballentine Road is recommended. Also, a designated ‘Entrance Only’ and ‘Exit Only’ driveway for Chick fil A is recommended.

Intersection Recommendations

For Corridor 1, the only signalized intersection that have safety recommendation is S Muskogee Avenue and Rayne Street. Currently, the intersection of S Muskogee Avenue and the US-62/SH-82 Bypass is under construction for pedestrian and capacity improvements.

Rayne Street

- Add positive offset left-turn lanes for Northbound and Southbound traffic.
- Realign the east-west movement of intersection along Rayne Street.
- Add pedestrian crossing and pedestrian signals.
- Install new retroreflective backplates.

TABLE 8. COUNTERMEASURE CRASH MODIFICATION FACTORS FOR CORRIDOR 1

ID	Location	Recommendation	CMF ID	Countermeasure	CMF
1.1	Corridor	• Install a Raised Median	7792	• Install a raised median	0.76
1.2	Corridor	• Install High Contrast Pavement Markings	11280	• Install contrast pavement markings	0.84
1.3	Corridor	• Install Sidewalk	11246	• Install sidewalk	0.6
1.4	Corridor	• Driveway Consolidation	442	• Closure and/or consolidation of driveway access	0.93
1.5	Corridor	• Transverse Rumble Strips	138	• Install transverse rumble strips to alert drivers of steep hill	0.66
1.6	Corridor	• Install Signage	N/A	• Install steep hill ahead signage	N/A
1.7	Corridor	• Illumination	581	• Install lighting	0.73
1.A.1	Rayne St	• Reflective Backplates	1410	• Add 3-inch yellow retroreflective sheeting to signal backplates	0.85
1.A.2	Rayne St	• Road Alignment	N/A	• Adjust intersection road alignment	N/A
1.A.3	Rayne St	• Pedestrian Signals	8967	• Implement signing and visibility improvements at signalized intersection	0.732
1.A.4	Rayne St	• Positive Left Turn Offset	277	• Introduce a positive offset left turn lane for the NB/SB lanes	0.8

CORRIDOR 1: S MUSKOGEE AVE

From E. Ballentine Rd. to Bypass

CORRIDOR WIDE

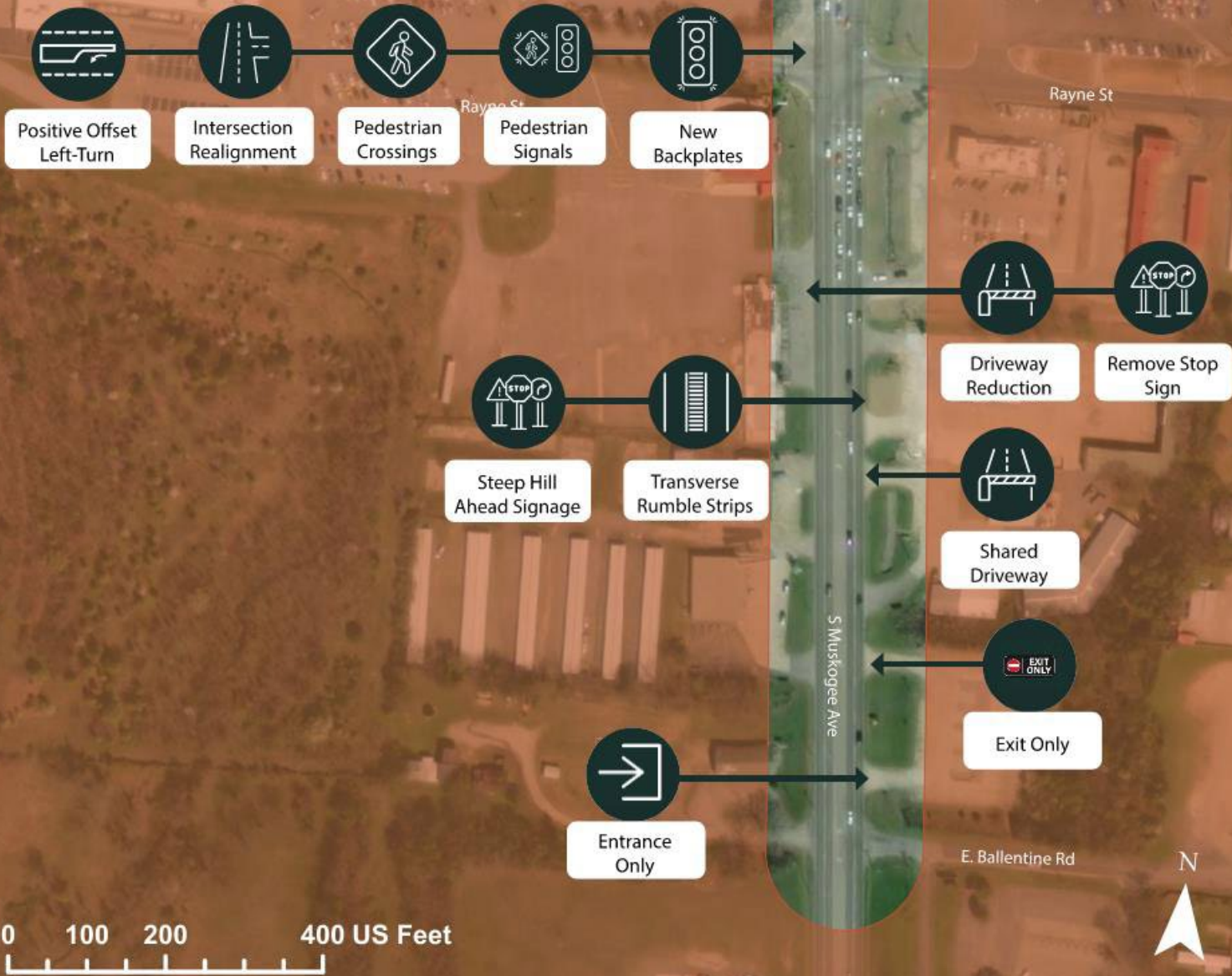
High-Contrast Lane Markings

Center Median

Improved Lighting

Sidewalk

EXHIBIT 17. CORRIDOR 1 RECOMMENDATIONS



2 CORRIDOR 2: BYPASS FROM S PARK HILL ROAD TO 7TH STREET

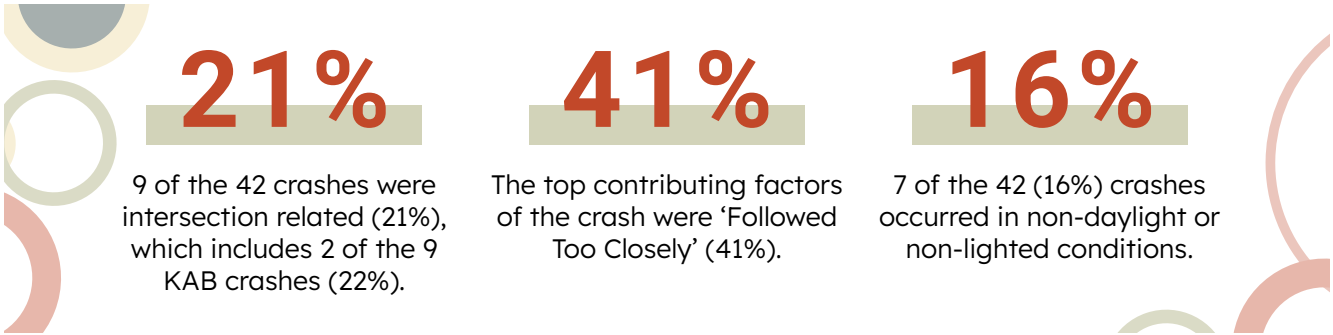


Context

The US-62/SH-82 Bypass corridor (Corridor 2) is a section of the Bypass from S Park Hill Road to 7th Street that is 0.55 miles in length. Corridor 2 is located southeast of Downtown Tahlequah and is surrounded by primarily industrial and agricultural land uses. This section of the Bypass is a 4-lane divided roadway. The volume of this road is approximately 17,500 vehicles per day. The speed limit varies on this corridor, with the southern half posted at 45 MPH and the norther half posted at 55 MPH. This corridor has one signalized intersection at S Park Hill Road.

Crash History

There were 42 total crashes on this section of the Bypass between 2017-2021. Of these crashes, 8 were KABs. Key takeaways for crash trends along Corridor 2 were the following:



Corridor Recommendations

It is recommended to install countermeasures along Corridor 2 that would increase driver awareness. These countermeasures include installing high contrast lane markings, wider edge lane lines and shoulder rumble strips. Wider edge lines and high contrast lane markings enhance the visibility of the travel lanes throughout the corridor. Installation of shoulder rumble strips along the edge line of the roadway will alert drivers if they begin to depart the roadway.

To further enhance the safety along this corridor, it is recommended to install adequate roadway lighting and manage speeds along this section of the roadway. Adequate roadway lighting will help mitigate crashes that occur in dark conditions. Management of the speed limit along this corridor to safe and adequate speeds is recommended to reduce the severity of crashes; installation of speed feedback signs is a mitigation technique to reduce speeds.

Intersection Recommendations

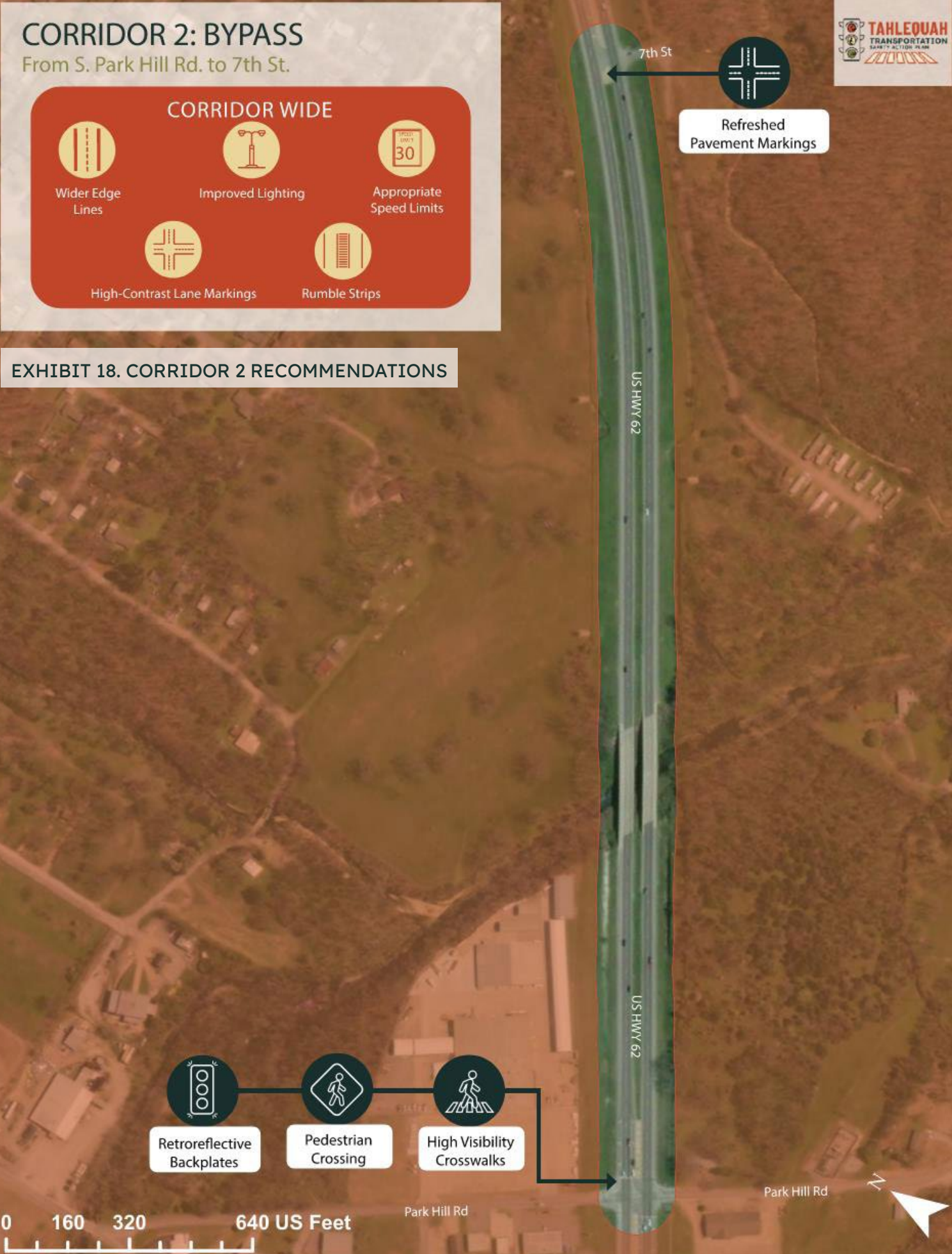
For Corridor 2, the only signalized intersection is the Bypass and S Park Hill Road. The non-signalize T-intersection of 7th Street also have minor recommendations.

Park Hill Road

- Install new retroreflective signal backplates.
- Install high visibility crosswalks.
- Add pedestrian crossing and pedestrian signals.
- Refresh pavement markings.

TABLE 9. COUNTERMEASURE CRASH MODIFICATION FACTORS FOR CORRIDOR 2

ID	Location	Recommendation	CMF ID	Countermeasure	CMF
2.1	Corridor	• Install High Contrast Pavement Markings	11280	• Install high contrast pavement markings	0.84
2.2	Corridor	• Install Shoulder Rumble Strips	10449	• Install shoulder rumble strips	0.68
2.3	Corridor	• Illumination	581	• Install lighting	0.73
2.4	Corridor	• Install Wide Edge Lines	4737	• Install wider edge lines (4 in to 6 in)	0.64
2.5	Corridor	• Speed Management	6885	• Install dynamic speed feedback sign	0.95
2.A.1	Park Hill Rd	• Reflective Backplates	1410	• Add 3-inch yellow retroreflective sheeting to signal backplates	0.85
2.A.2	Park Hill Rd	• Pedestrian Signals	8697	• Implement signing and visibility improvement at signalize intersection	0.732
2.A.3	Park Hill Rd	• Crosswalk	4123	• Install high-visibility crosswalk	0.6
2.B.1	7th St	• Refresh Pavement Markings	N/A	• Refresh existing pavement markings	N/A



3 CORRIDOR 3: S MUSKOGEE AVE FROM W CHICKASAW STREET TO GOINGSNAKE STREET

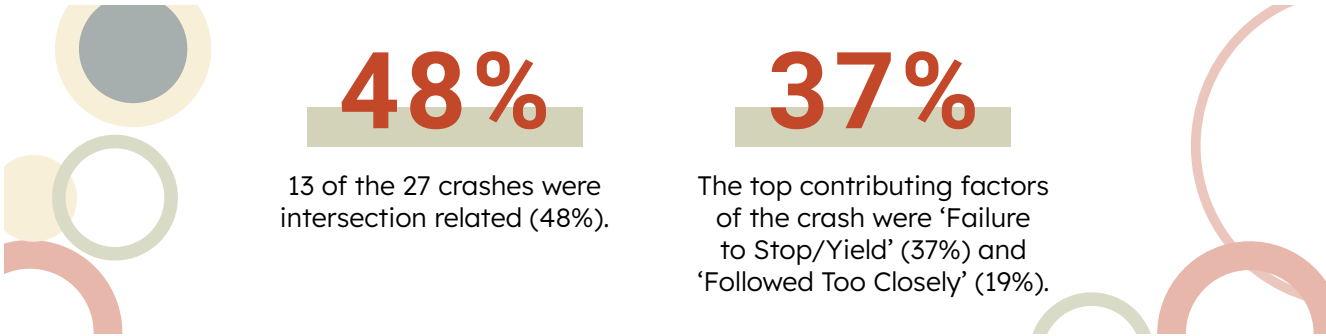


Context

The S Muskogee Avenue corridor (Corridor 3) is a section of Muskogee from W Chickasaw Street to Goingsnake Street that is 0.61 miles in length. Corridor 3 is in Downtown Tahlequah and is surrounded by primarily commercial and residential land uses. This section of Muskogee Avenue is primarily a 2-lane undivided roadway with parallel parking on each side of the road. The volume of this roadway is approximately 7,400 vehicles per day. The posted speed limit of this corridor is 25 MPH. This corridor has seven signalized intersections. This corridor also experiences heavy pedestrian traffic due to its high concentration of businesses and proximity to Northeastern State University.

Crash History

There were 27 crashes along this section of S Muskogee Road between 2017-2021. Of these crashes, 1 was a KAB. Key takeaways for crash trends along Corridor 3 were the following:



Corridor Recommendations

It is recommended to install countermeasures along Corridor 3 that will increase pedestrian safety. These countermeasures include implementing ADA enhancements to all sidewalks, installing bulb outs at intersections, implementing pedestrian enhancements at all signalized intersections, reducing driveways, and improving lighting. Providing adequate pedestrian facilities will provide pedestrians of all abilities greater and safer access along this corridor. Implementing corridor-wide bulb out installation at intersections will provide pedestrians more visibility to vehicles and a shorter distance to cross the street. Further enhancement of intersection to include pedestrian signals will provide designated movements across the intersections, something that is currently lacking today. Driveway reduction along the corridor will provide better guidance to drivers and allow pedestrians to safely cross these openings. Corridor-wide lighting improvements will impact the visibility of both pedestrians and drivers, especially in low-light conditions.

Other corridor recommendations include the upgrade of all traffic signals and installation of high visibility markings. Current traffic signals along this corridor are positioned in the center of the intersection at a difficult to see height, compounded with the size of many traffic signal heads not in compliance with current guidelines. Installation of compliant and better visible traffic signals will impact intersection related crashes. Additionally, installation of high visibility markings at intersection and along the corridor will enhance the visibility of the travel lanes and provide better guidance for drivers.

Intersection Recommendations

For Corridor 3, all signalized intersections are recommended to be upgraded in the previous corridor recommendations. Other, targeted, improvements are as follows.

Spring Street

- Reconfigure driveway and parking lot.
- Introduce RRFB pedestrian crossing.

E Downing Street

- Update pavement markings to clearly delineate lanes.

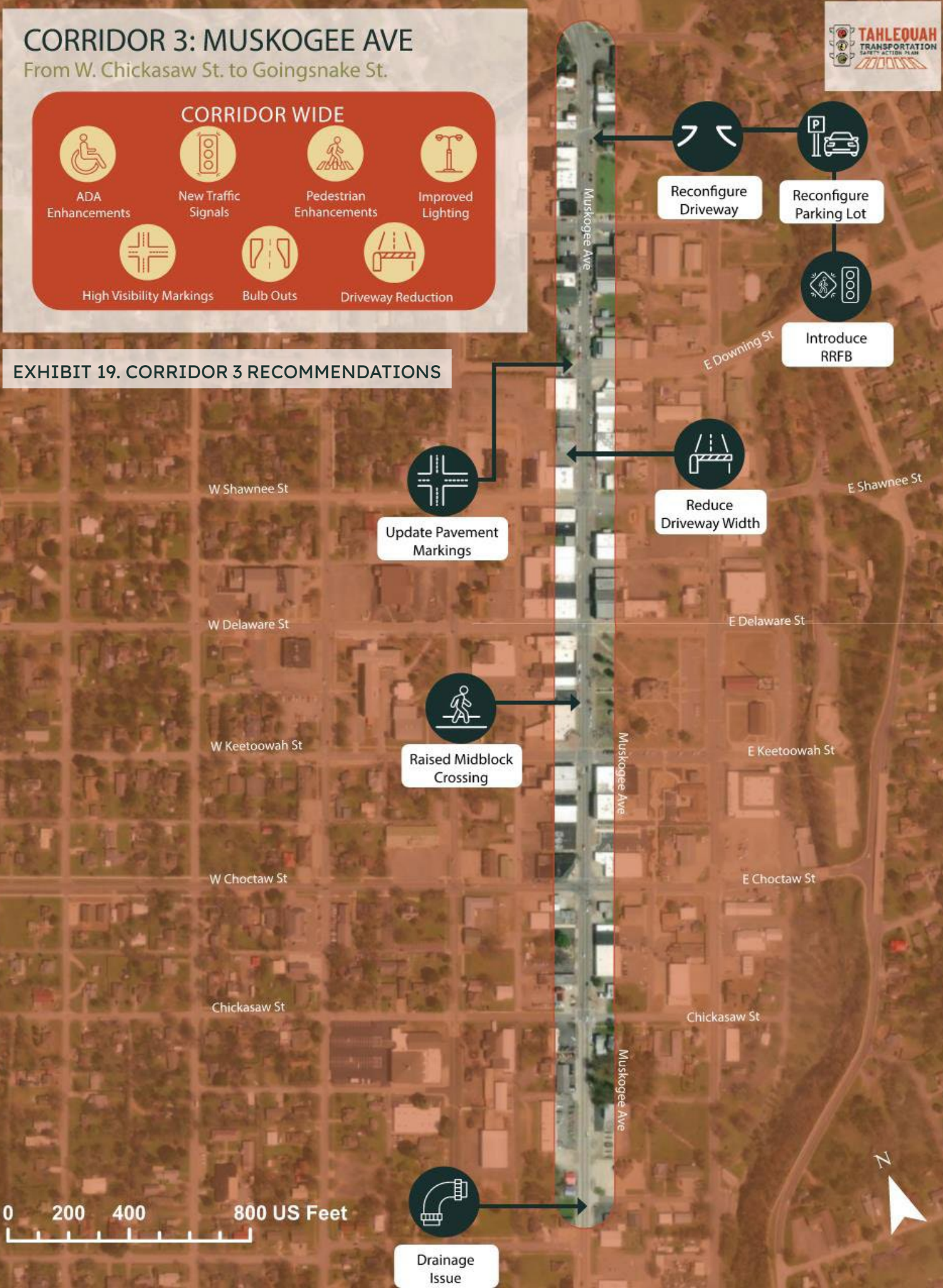
Midblock at the Cherokee National History Museum

- Construct a raised midblock crossing with RRFB.

TABLE 10. COUNTERMEASURE CRASH MODIFICATION FACTORS FOR CORRIDOR 3

ID	Location	Recommendation	CMF ID	Countermeasure	CMF
3.1	Corridor	• Retroreflective Backplates	1410	• Add 3-inch yellow retroreflective sheeting to signal backplate	0.85
3.2	Corridor	• Illumination	581	• Install upgraded lighting.	0.73
3.3	Corridor	• Pedestrian Signals	8967	• Implement systemic signing and visibility improvements at signalized intersections	0.68
3.4	Corridor	• Upgrade Signalized Intersection	N/A	• Upgrade signalized intersection to meet current guideline standards	N/A
3.5	Corridor	• ADA Pedestrian Improvements	N/A	• Implement ADA enhancements to all pedestrian facilities	N/A
3.6	Corridor	• Driveway Consolidation	442	• Closure or relocation of driveways from functional area of intersection	0.93
3.7	Corridor	• Pedestrian Bump Outs	9120	• Median treatment for ped/bike safety	0.86
3.8	Corridor	• High-Visibility Crosswalks	4123	• Install high-visibility crosswalk	0.6

3.A.1	Spring St	• RRFB Installation	11168	• Install Rectangular Rapid Flashing Beacon (RRFB)	0.3
3.B.1	E Downing St	• Update Pavement Markings	N/A	• Update existing pavement markings to delineate lanes	N/A
3.C.1	Cherokee National History Museum	• Midblock Crossing	11181	• Presence of a pedestrian crosswalk at midblock locations	0.82



4 CORRIDOR 4: BYPASS/US-62 FROM E BOONE STREET TO E DOWNING STREET

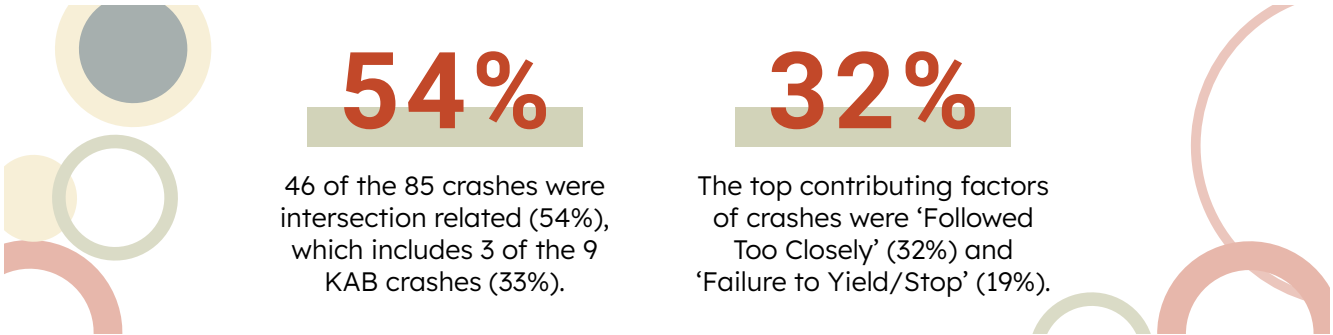


Context

The US-62/SH-82 Bypass and US-62 corridor (Corridor 4) is a section of these roadway from E Boone Street to E Downing Street that is 0.78 miles in length. Corridor 4 is located east of Downtown Tahlequah and is surrounded by primarily commercial and residential land uses. The volume of this road is approximately 16,000 vehicles per day. This section of the Bypass included in this corridor is a four-lane divided roadway, and the section of US-62 is a four-lane undivided roadway. The posted speed limit along the Bypass is 35 MPH and 45 MPH, while the posted speed limit along US-62 is 35 MPH. This corridor is a primary mover of traffic around Tahlequah and has important access to medical facilities, including the Northeastern Health System and Cherokee Nation W.W. Hastings Hospital.

Crash History

There were 85 total crashes on the section of the Bypass/US-62 between 2017-2021. Of these crashes, 9 were KABs. Key takeaways for crash trends along Corridor 4 were the following:



Corridor Recommendations

It is recommended to install countermeasures along Corridor 4 that would increase driver awareness and slow down speeds along the corridor. These improvements include installing high contrast lane markings, new shoulder rumble strips and wider edge lines. These improvements will increase the visibility of travel lanes throughout the corridor and alert drivers if they begin to depart the roadway.

Other corridor countermeasures to slow down speeds along this corridor include installing elevated medians at targeted location along US-62 and assigning appropriate speed limits along the corridor. Installation of elevated median along US-62, from the Bypass to Harris Circle will draw drivers' attention to roadway to reduce speeds and control access both in and out of driveways. Allowing for strategic left-turn cuts in the center median will allow for adequate access and decrease conflict points between exiting vehicles. Appropriate speed limits along this corridor are necessary to decrease the amount of unsafe speed related crashes.

Intersection Recommendations

For intersections on Corridor 4, it is recommended that dangerous driver maneuvers are eliminated, access management techniques are deployed, pedestrian access is improved, and signalized intersections are upgraded to include safety features.

Bypass & E Boone Street

- Add positive offset left-turn lanes for Northbound and Southbound traffic.
- Prohibit EB/WB left turning movements.
- Install improved lighting.

Bypass & US-62

- Install high visibility crosswalks.
- Extend center median.
- Upgrade pedestrian refuge island.
- Install turning tracks for left-turn movements.

US-62 & Plaza Drive

- Driveway consolidation at the Sonic Drive-In.
- Right-in, right-out at southbound Plaza Drive.

US-62 & Harris Circle

- Reconfigure Harris Circle to one entrance/exit roadway.

US-62 & Bliss Avenue

- Install flashing yellow arrow left-turn signal heads.
- Install new retroreflective signal backplates.
- Install high visibility crosswalks.
- Add pedestrian crossing and pedestrian signals at missing approaches.
- Consolidate driveways at the business on the northwest corner of the intersection.

US-62 & E Downing Street

- Consolidate driveways at the gas station west of the intersection.
- Adjust road alignment of Old River Road and E Downing Street.
- Install a traffic signal or alternative intersection treatment at this intersection.

TABLE 11. COUNTERMEASURE CRASH MODIFICATION FACTORS FOR CORRIDOR 4

ID	Location	Recommendation	CMF ID	Countermeasure	CMF
4.1	Corridor	• Install a Raised Median	2219	• Install a raised median	0.29
4.2	Corridor	• Install High Contrast Pavement Markings	11280	• Install contrast pavement markings	0.84
4.3	Corridor	• Install Shoulder Rumble Strips	10449	• Install shoulder rumble strips	0.68
4.4	Corridor	• Install Wide Edge Lines	4737	• Install wider edge lines (4 in to 6 in)	0.64
4.5	Corridor	• Speed Management	11290	• Lower posted speed limit	0.95
4.A.1	E Boone St	• Positive Left Turn Offset	277	• Introduce a positive offset left turn lane for the NB/SB lanes	0.8
4.A.2	E Boone St	• Turn Prohibitions/Permissions	390	• Prohibit left-turns with “No Left Turn” sign	0.36
4.A.3	E Boone St	• Illumination	7776	• Install lighting	0.68
4.B.1	Bypass & US-62	• Crosswalk	4123	• Install high-visibility crosswalk	0.6
4.B.2	Bypass & US-62	• Pedestrian Refuge	9120	• Median treatment for ped/bike safety	0.86
4.C.1	Plaza Dr	• Driveway Consolidation	442	• Closure and/or consolidation of driveway access	0.93
4.C.2	Plaza Dr	• Right In Right Out	9821	• Install right-in-right-out (RIRO) operations at stop-controlled intersection	0.55
4.D.1	Harris Cir	• Driveway Consolidation	442	• Reconfigure Harris Cir entrance to one point	N/A
4.E.1	Bliss Ave	• Flashing Yellow Arrow	7730	• Install left turn flashing yellow arrow signals and supplemental traffic signs	0.857
4.E.2	Bliss Ave	• Reflective Backplates	1410	• Add 3-inch yellow retroreflective sheeting to signal backplates	0.85
4.E.3	Bliss Ave	• Crosswalk	4123	• Install high-visibility crosswalk	0.6
4.E.4	Bliss Ave	• Pedestrian Signals	8967	• Implement signing and visibility improvements at signalized intersection	0.732
4.E.5	Bliss Ave	• Driveway Consolidation	442	• Closure or relocation of driveways from functional area of intersection	0.93
4.F.1	E Downing St	• Driveway Consolidation	442	• Closure or relocation of driveways from functional area of intersection	0.93
4.F.2	E Downing St	• Road Alignment	N/A	• Adjust road alignment to accommodate enhance intersection control	N/A
4.F.3	E Downing St	• Traffic Signal Improvements	316	• Install a traffic signal	0.86

CORRIDOR 4: BYPASS/US-62

From E. Boone St. to E. Downing St.

CORRIDOR WIDE

High-Contrast Lane Markings

Rumble Strips

Wider Edge Lines

Appropriate Speed Limits

EXHIBIT 20. CORRIDOR 4 RECOMMENDATIONS



5 CORRIDOR 5: SH-82 NEAR E ALLEN ROAD

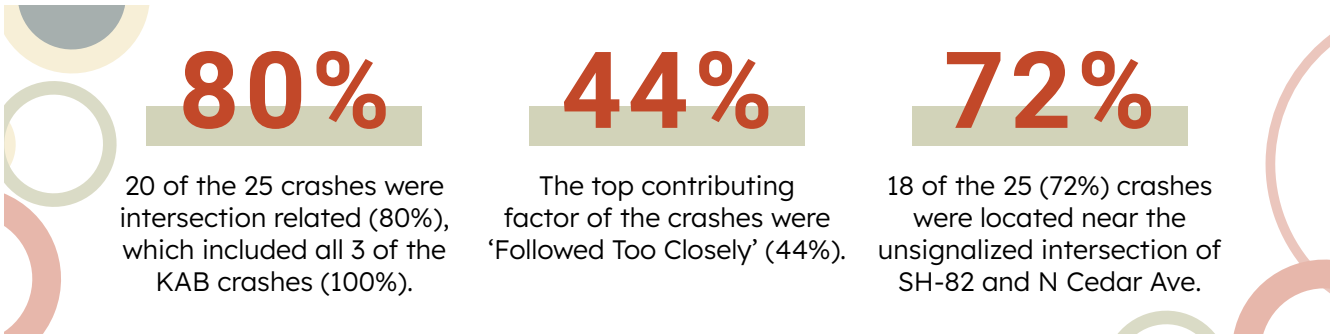


Context

The SH-82 corridor (Corridor 5) is a section of this roadway located near E Allen Road that is 0.71 miles in length. Corridor 4 is located northeast of Downtown Tahlequah and is surrounded by primarily residential and agricultural land uses. The volume of this road is approximately 9,500 vehicles per day. This section of SH-82 is a divided 4-lane roadway. The posted speed limit is 55 MPH. The only signalized intersection along this corridor is at E Allen Road. This corridor serves as main entrance into the core of Tahlequah from the North. It is characterized by a significant curve from the just north of the E Allen Road intersection.

Crash History

There were 25 total crashes on this section of SH-82 between 2017-2021. Of these crashes, 3 were KABs. Key takeaways for crash trends along Corridor 5 were the following:



Corridor Recommendations

It is recommended to install countermeasures along Corridor 5 that would increase driver awareness. These countermeasures include installing high contrast lane markings, wider edge lane lanes, shoulder rumble strips, and improved roadway lighting. Wider edge lines and high contrast lane markings enhance the visibility of the travel lanes throughout the corridor. Installation of shoulder rumble strips along the edge line of the roadway will alert drivers if they begin the depart the roadway.

To further enhance the safety along this corridor, it is important to manage speeds. Management of speed limits along this corridor to safe and adequate speeds is recommended to reduce the severity of crashes; installation of speed feedback signs is a mitigation technique to reduce speeds.

Intersection Recommendations

For Corridor 5, the signalized intersection of SH-82 and Allen Road and the unsignalized intersection of SH-82 and Cedar Avenue have recommendations. It is especially pertinent to address the Cedar Avenue intersection do to the current intersection conditions contributing to the vast majority (72%) of the corridor crashes.

Allen Road

- Install new retroreflective signal backplates.
- Add positive offset left-turn lanes for Northbound and Southbound traffic.
- Install transverse rumble strips on the southbound approach to alert incoming drivers.

Cedar Avenue

- Install a J-Turn intersection.
 - Right-in, right out at both approaches of Cedar Avenue.
 - Install U-turn movement along SH-82, north of Cedar Avenue.

TABLE 12. COUNTERMEASURE CRASH MODIFICATION FACTORS FOR CORRIDOR 5

ID	Location	Recommendation	CMF ID	Countermeasure	CMF
5.1	Corridor	• Install High Contrast Pavement Markings	11280	• Install contrast pavement markings	0.84
5.2	Corridor	• Install Wide Edge Lines	4737	• Install wider edge line (4 in to 6 in)	0.64
5.3	Corridor	• Illumination	581	• Install lighting	0.73
5.4	Corridor	• Speed Management	6885	• Install dynamic speed feedback sign	0.95
5.A.1	Allen Rd	• Reflective Backplates	1410	• Add 3-inch yellow retroreflective sheeting to signal backplates	0.85
5.A.2	Allen Rd	• Positive Left Turn Offset	277	• Introduce a positive offset left turn lane for the NB/SB lanes	0.8
5.A.3	Allen Rd	• Transverse Rumble Strips	8967	• Install transverse rumble strips ahead of signalized intersection	0.66
5.B.1	Cedar Ave	• Install J-Turn Intersection	11150	• Install J-Turn Intersection	0.288

CORRIDOR 5: SH-82

Near E. Allen Rd



CORRIDOR WIDE

Improved Lighting

High-Contrast Lane Markings

Rumble Strips

Wider Edge Lines

Appropriate Speed Limits

EXHIBIT 21. CORRIDOR 5 RECOMMENDATIONS

