

COMPREHENSIVE SAFETY ACTION PLAN



CHAPTER 5 *COUNTERMEASURES*

INTRODUCTION

This chapter of the Guthrie CSAP defines the countermeasure-based recommendations for the highest priority corridors. A total of 5 corridors were selected for further study based on crash history roadway geometry, existing intersection control, and context. In addition to the targeted recommendations for the study corridors, a Systemic Countermeasures Toolbox was developed for the City to utilize. This toolbox consists of a variety of roadway countermeasures that can be used by the City of Guthrie to enhance safety on city roadways.

Systematic Countermeasure Toolbox

Targeted Recommendations



Systemic Countermeasure Toolbox

The Systemic Countermeasure Toolbox details specific safety countermeasures that can be implemented in Guthrie to enhance roadway safety. Countermeasures in the toolbox can be applied to any roadway in the City, though roads that are within disadvantaged census tracts or on the high injury network is recommended to be prioritized. Additionally, all countermeasures in the toolbox are included in the [FHWA's Proven Safety Countermeasures](#) list. Implementing countermeasures on roadways can have a significant impact on the number of severe crashes in Guthrie. The systemic countermeasures toolbox shown in **Table 13** is a comprehensive collection of strategies and countermeasures developed to address safety issues.

Each countermeasure in the toolbox receives Crash Modification Factor (CMF) ID and a CMF score. According to the Crash Modification Factor Clearinghouse, CMF is defined as a factor that indicates the ratio of crashes that would be expected after implementing a countermeasure. CMFs with a value less than 1.0 indicate an expected decrease in crashes. CMFs greater than 1.0 indicate an expected increase in crashes.

Table 13. Systemic Safety Countermeasures

SAFETY EMPHASIS AREAS	CMF ID	CMF	OCCUPANT PROTECTION	INTERSECTIONS	MOTORCYCLES & ATVS	VULNERABLE ROAD USERS	UNSAFE SPEED	ROADWAY & LANE DEPARTURES	IMPAIRED DRIVING	COMMERCIAL MOTOR VEHICLES & WORK ZONES
APPROPRIATE SPEED LIMITS	11288	0.856	●		●	●	●			●
BIKE LANES	10737	0.435				●	●			
CORRIDOR ACCESS MANAGEMENT	178	0.69		●						
CROSSWALK VISIBILITY ENHANCEMENTS	4123	0.6		●		●				
DEDICATED LEFT- AND RIGHT-TURN LANES AT INTERSECTIONS	MULTIPLE	0.52 – 0.86*		●						
ENHANCED DELINEATION FOR HORIZONTAL CURVES	2431	0.82			●		●	●		●
LONGITUDINAL RUMBLE STRIPS AND STRIPES ON TWO-LANE ROADS	6852	0.742	●		●	●	●	●	●	●
MEDIANS AND PEDESTRIAN REFUGE ISLANDS	2219	0.29	●		●	●	●	●	●	
PEDESTRIAN HYBRID BEACONS	10585	0.883				●	●	●		
RECTANGULAR RAPID FLASHING BEACONS (RRFB)	11158	0.31		●		●				
REDUCED LEFT-TURN CONFLICT INTERSECTIONS	10867	0.7029		●						
RETROREFLECTIVE BACKPLATES	1410	0.85		●					●	
ROADWAY RECONFIGURATION	2841	0.53	●		●	●	●	●		
ROUNDBABOUTS	10089	0.495	●	●			●			
SIDEWALKS	11246	0.598				●				
SYSTEMIC APPLICATION OF MULTIPLE LOW-COST COUNTERMEASURES AT STOP-CONTROLLED INTERSECTIONS	8874	0.734		●						
TARGETED LIGHTING	582	0.68			●	●		●		●
WIDER EDGE LINES	4737	0.635						●	●	
YELLOW CHANGE INTERVALS	4203	0.99		●						



Appropriate Speed Limits

Speed limit signs often match the speed limits established by state law. Agencies or municipalities with the authority to set speed limits can establish speed limits that differ from the statutory speed limits or designate areas as reduced speed zones, and many are doing so. Roadway safety experts agree that speed control is one of the most effective methods for reducing fatal and serious injury crashes.

Drivers may be unaware of conditions along a corridor and choose speeds that feel appropriate to them but may not be safe for all users - particularly vulnerable groups like children and older adults.

Figure 18. Appropriate Speed Limits



Source: Adobe Stock



CMF: 0.856

Safety Emphasis Area Addressed:

Unsafe Speeds, Vulnerable Road Users, Occupant Protection, Commercial Motor Vehicles and Work Zones, Motorcycles and All-Terrain Vehicles

Bike Lanes

Bike lanes are designated sections of a roadway that are reserved for bicycles and are typically marked with pavement markings and signage. Bike lanes provide cyclists with their own dedicated space to ride and improve safety conditions by reducing conflicts with motor vehicles, encouraging more people to choose bicycling as a mode of transportation. **Adding bike lanes has been shown to significantly reduce crashes by up to 49% on urban four-lane undivided roads, and by 30% on two-lane undivided roads according to FHWA.**

Figure 19. Bike Lanes



Source: Adobe Stock



CMF: 0.435

Safety Emphasis Area Addressed:

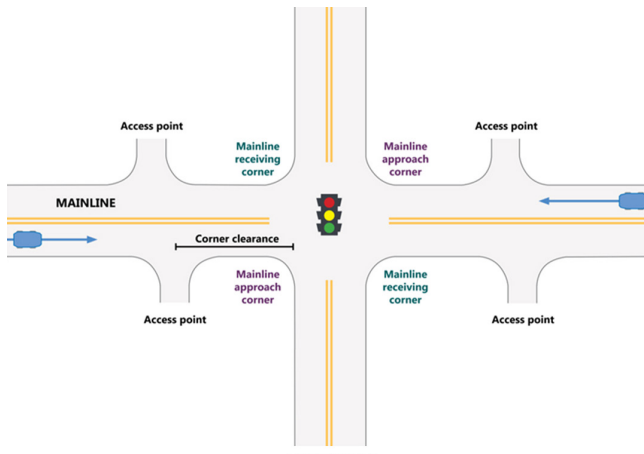
Unsafe Speeds, Vulnerable Road Users



Corridor Access Management

Access management involves the planning and regulation of where vehicles can enter or exit a roadway, including intersections and driveways. When applied thoughtfully, it can improve safety for all users, support walking and biking, and reduce delays and congestion. Common strategies include spacing intersections appropriately, adding protected turn lanes, and limiting conflict points. **Along urban and suburban arterials, effective access management can lead to a 25% to 31% reduction in fatal and injury crashes.**

Figure 20. Corridor Access Management



Source: FHWA



CMF: 0.69

Safety Emphasis Area Addressed:
Intersections

Crosswalk Visibility Enhancements

Crosswalk visibility enhancements include a range of strategies that can be used individually or together to improve safety. High-visibility crosswalks, often made with inlay or thermoplastic tape, are designed to be easily seen by both drivers and pedestrians from a distance. Upgraded lighting improves visibility by using forward-facing fixtures that create a strong contrast and better illuminate pedestrians. Additional signage and pavement markings can warn drivers in advance that a crosswalk is ahead. **These improvements, especially high-visibility crosswalks, have been shown to reduce pedestrian injury crashes by up to 40%.**

Figure 21. Crosswalk Visibility Enhancements



Source: Adobe Stock



CMF: 0.6

Safety Emphasis Area Addressed:
Vulnerable Road Users, Intersections



Dedicated Left- and Right-Turn Lanes at Intersections

Auxiliary turn lanes designed for left or right turns create a dedicated space for vehicles to slow down or stop without disrupting the flow of through traffic. These lanes help reduce delays and improve safety by separating turning vehicles from moving traffic, especially at intersections. **They are particularly effective at two-way stop-controlled intersections, where dedicated turn lanes can lead to a 28% to 48% reduction in total crashes.**

Figure 22. Dedicated Left- and Right-Turn Lanes at Intersections



Source: Adobe Stock



CMF: 0.52 – 0.86

Safety Emphasis Area Addressed:
Intersections

Enhanced Delineation for Horizontal Curves

Enhanced delineation for horizontal curves involves a variety of strategies used before and within the curve to help drivers navigate safely. Pavement markings, including center and edge lines, guide drivers in maintaining proper lane position. In-lane curve warning markings—typically solid center lines on two-lane roads—signal that a curve is ahead. Retroreflective strips on signposts help catch drivers' attention at night by reflecting headlights, while delineators—reflective devices mounted on posts or barriers—help drivers stay aligned with the road. Chevron signs placed along the outer edge of a curve indicate its direction and reinforce safe navigation. Visibility can be further improved by upgrading to larger, more reflective signs. Advanced tools like dynamic curve warning systems detect vehicle speeds and alert drivers when they're approaching a curve too quickly. **One of the most effective measures, Sequential Dynamic Chevrons, has been shown to reduce fatal and injury crashes by up to 60%.**

Figure 23. Enhanced Delineation for Horizontal Curves



Source: Adobe Stock



CMF: 0.82

Safety Emphasis Area Addressed:
Roadway & Lane Departures, Unsafe Speeds,
Motorcycles and All-Terrain Vehicles,
Commercial Motor Vehicles and Work Zones

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Longitudinal rumble strips are grooves or raised patterns milled or painted into the roadway surface that produce noise and vibration to alert drivers when they begin to drift out of their lane. These strips are typically placed along the shoulder, edge line, or centerline of undivided roads to help prevent vehicles from unintentionally crossing into oncoming traffic or off the roadway. **On two-lane rural roads, longitudinal rumble strips have been shown to reduce head-on fatal and injury crashes by 44% to 64%.**

Figure 24. Longitudinal Rumble Strips and Stripes on Two-Lane Roads



Source: Adobe Stock



CMF: 0.742

Safety Emphasis Area Addressed:

Roadway & Lane Departures, Unsafe Speeds, Vulnerable Road Users, Impaired Driving, Occupant Protection, Commercial Motor Vehicles and Work Zones, Motorcycles and All-Terrain Vehicles

Medians and Pedestrian Refuge Islands

In urban and suburban areas, medians help separate motorized and non-motorized road users typically by pavement markings, raised areas, or islands. They provide a safe refuge for pedestrians crossing streets. **A median with marked crosswalks can lead to a 46% reduction in pedestrian crashes.**

A pedestrian refuge island is a type of median designed to give people a safe place to wait while crossing the road. **These islands can significantly improve safety, contributing to a 56% reduction in pedestrian crashes.**

Figure 25. Medians and Pedestrian Refuge Islands



Source: Adobe Stock



CMF: 0.29

Safety Emphasis Area Addressed:

Roadway & Lane Departure, Unsafe Speed, Vulnerable Road Users, Impaired Driving, Occupant Protection, Motorcycle and All-Terrain Vehicles



Pedestrian Hybrid Beacons

The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross busy or higher-speed roadways, especially at midblock crossings or intersections without stop signs or signals. PHBs are particularly effective on roads with three or more lanes or in areas with heavy traffic. In communities where PHBs are new, public education may be needed to help drivers and pedestrians understand how to use them. **When implemented, PHBs can reduce pedestrian crashes by up to 55%.**

Figure 26. Pedestrian Hybrid Beacon



Source: Adobe Stock



CMF: 0.883

Safety Emphasis Area Addressed:

Roadway & Lane Departure, Unsafe Speed,
Vulnerable Road Users

Rectangular Rapid Flashing Beacons (RRFB)

A rectangular rapid flashing beacon (RRFB) is a pedestrian-activated traffic control device used at crosswalks to increase visibility and alert drivers people crossing. When activated, the RRFB emits a rapid, alternating pattern of flashing lights that signals drivers to yield to pedestrians crossing the street. **According to FHWA, RRFBs can achieve motorist yielding rates as high as 98% at marked crosswalks, even in areas with varying speed limits, crossing distances, and numbers of travel lanes.**

Figure 27. Rectangular Rapid Flashing Beacons



Source: FHWA



CMF: 0.31

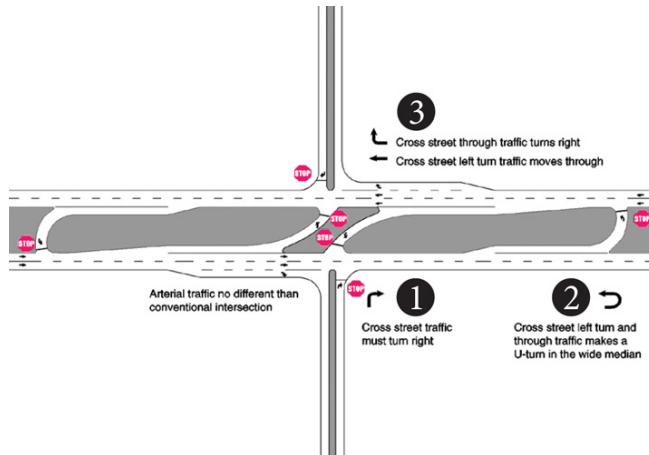
Safety Emphasis Area Addressed:

Intersections, Vulnerable Road Users

Reduced Left-Turn Conflict Intersections

Reduced left-turn conflict intersections are roadway designs that change how left turns are made, typically by redirecting drivers to make a U-turn at a designated location. This design reduces conflict points, simplifies decision-making, and lowers the risk of severe crashes—such as head-on and angle collisions. **Reduced left-turn conflict intersections have been shown to reduce fatal and injury crashes by up to 54%.**

Figure 28. Reduced Left-Turn Conflict Intersections



Source: FHWA



CMF: 0.7029

Safety Emphasis Area Addressed:
Intersections

Retroreflective Backplates

A retroreflective backplate is a traffic signal enhancement that frames the signal with a 1- to 3-inch yellow retroreflective border. This border increases the signal's visibility by creating greater contrast against the surrounding environment, making it easier for drivers to see during the day and at night. **Retroreflective backplates have been shown to reduce total crashes by up to 15%.**

Figure 29. Retroreflective Backplates



Source: Adobe Stock



CMF: 0.85

Safety Emphasis Area Addressed:
Intersections, Impaired Driving



Roadway Reconfiguration

A roadway reconfiguration typically involves converting an existing four-lane roadway into a three-lane roadway. This type of change can improve safety, calm traffic, and make the roadway more accessible for all users, including people walking or biking. By creating space for bike lanes or pedestrian areas, roadway reconfigurations help make streets more “complete” and contribute to a higher quality of life. **In 4-lane to 3-lane conversions, total crashes can be reduced by up to 47%.**

Figure 30. Roadway Reconfiguration



Source: FHWA

Roundabouts

A roundabout is a circular intersection where traffic moves continuously around a central island, with vehicles entering yielding to those already inside. This design reduces conflict points, improves traffic flow, and enhances overall safety compared to traditional intersections. **Roundabouts can lead to a 78% to 82% reduction in fatal and injury crashes.**

Figure 31. Roundabouts



Source: Adobe Stock

Sidewalks

A sidewalk is a designated path alongside a street meant specifically for pedestrians, providing a safe space for pedestrians to walk separated from vehicle traffic. Sidewalks improve safety by reducing the risk of pedestrian-vehicle collisions, encouraging walking as a transportation option, and ensuring accessibility for people of all ages and abilities. **When present, sidewalks can lead to as much as an 89% reduction in crashes involving pedestrians walking along roadways.**

Figure 32. Sidewalks



Source: Adobe Stock



CMF: 0.598

Safety Emphasis Area Addressed:

Vulnerable Road Users

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

A systemic approach to improving safety at stop-controlled intersections involves implementing a package of low-cost countermeasures, such as enhanced signage and pavement markings. These treatments help increase driver awareness and recognition of intersections and potential conflicts. **This strategy is associated with a 10% reduction in fatal and injury crashes across various locations, intersection types, and areas.**



Source: FHWA



CMF: 0.734

Safety Emphasis Area Addressed:

Intersections



Targeted Lighting

Although fatal crashes happen at similar rates during the day and night, the risk is much higher after dark. Nighttime fatality rates are three times higher than during the day, even though only about 25% of vehicle miles are traveled at night. One reason is that at higher speeds, drivers may not have enough time to react to hazards that only become visible within their headlights' range. Improving roadway lighting helps make the road more visible and safer for everyone. Adequate lighting, meeting or exceeding minimum recommended levels of horizontal and vertical illuminations support safer conditions for all road users. It also enhances personal security for people walking or biking along or across roadways. **Lighting upgrades, whether at intersections or along corridors, can reduce nighttime pedestrian crashes by up to 42%.**

Figure 33. Targeted Lighting



Source: Adobe Stock



CMF: 0.68

Safety Emphasis Area Addressed:

Intersections, Roadway & Lane Departures, Vulnerable Road Users, Commercial Motor Vehicles and Work Zones, Motorcycles and All-Terrain Vehicles

Wider Edge Lines

Edge lines are pavement markings placed along the outer edges of travel lanes to help drivers better identify the road's alignment, especially in low-visibility conditions. Increasing the width of these lines from the standard 4 inches to 6 inches can improve lane visibility and driver guidance. **On rural freeways, wider edge lines have been associated with up to a 22% reduction in fatal and injury crashes.**

Figure 34. Wider Edge Lines



Source: FHWA



CMF: 0.635

Safety Emphasis Area Addressed:

Roadway & Lane Departures, Impaired Driving



Yellow Clearance Intervals

The yellow clearance interval is the time a yellow light is displayed between the green and red light phases of a traffic signal. Properly timing this interval is critical for safety, as it helps drivers stop safely without encouraging them to speed through the intersection. Running Red-lights is a major cause of crashes and fatalities, and a well-timed yellow signal can promote safer driving behavior and effective speed management. **When appropriately timed, yellow clearance intervals can reduce red-light running by 36% to 50%.**

Figure 35. Yellow Clearance Intervals



Source: Adobe Stock



CMF: 0.99

Safety Emphasis Area Addressed:
Intersections



Targeted Recommendations

Five roadway segments were selected from the high injury network as study corridors for the CSAP. The chosen corridors received targeted recommendations that will improve safety on some of the most unsafe roads in Guthrie. The five study locations were selected based on the following criteria:

Figure 36. Study Corridor Selection Criteria

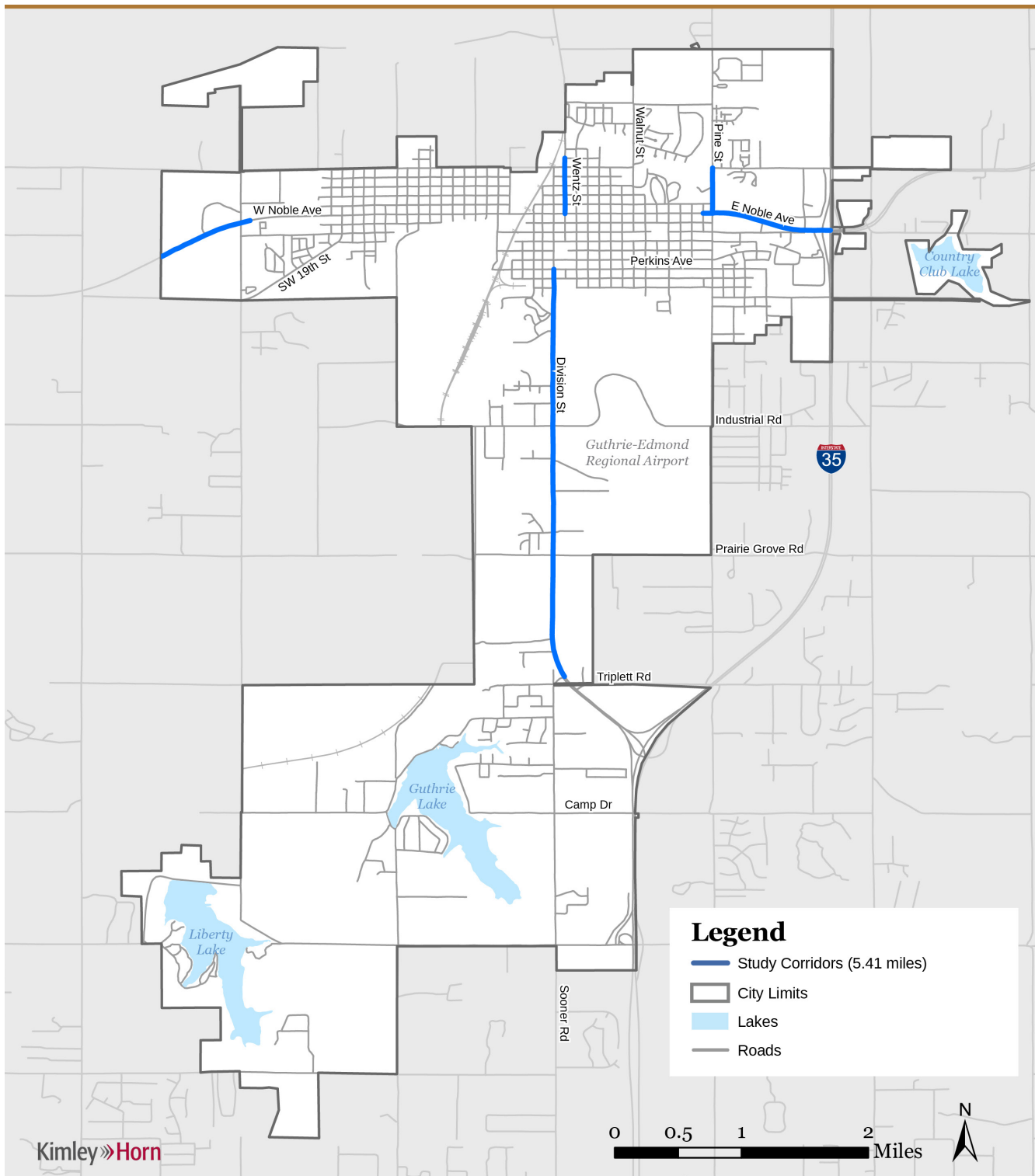
Equity	Engagement	Feasibility	Priority Corridor
- Disadvantaged Areas (USDOT ETC Explorer) - Transportation Disadvantaged Areas (USDOT ETC Explorer)	- Social Pinpoint Map Survey Comments - SSC Study Area Comments (from Meeting 2) - SSC Priority Corridor Selection (from Meeting 3)	- Current Roadway Projects - ODOT On/Off System	- Located on the HIN - Fatal Crashes

Table 14 below lists the five study corridors:

Table 14. Study Corridors

HIN SEGMENTS	LIMITS		LENGTH (MILES)	CRASHES			TOTAL KABS	AADT
	FROM	TO		K	A	B		
W Noble Ave	City Limits	320' W of Academy Rd	0.63	1	2	3	6	9,700
E Noble Ave	N Poplar St	I-35	0.80	0	1	15	16	11,200
N Wentz St	E Jefferson St	E Noble Ave	0.43	1	0	0	1	3,500
N Pine St	E College Ave	E Noble Ave	0.35	0	1	8	9	4,000
S Division St	Perkins Ave	Sooner Rd	3.20	1	3	18	22	13,105

Exhibit 13. Study Corridors





W Noble Ave

FROM CITY LIMITS TO ACADEMY RD

EXISTING CONDITIONS

- Primary/Principal Arterial
- 9,700 vehicles per day
- Two-lane undivided roadway
- 55 mph speed limit

CRASH SUMMARY

19 Total Crashes	1 Fatal Crash
0 Pedestrian & Bicyclist Crashes	2 Suspected Serious Injury Crashes
13 Intersection Related Crashes	3 Suspected Minor Injury Crashes

CONTRIBUTING FACTORS

Improper Turn

31.6%

Failed to Yield or Stop

26.3%

Driver Inattention

15.8%

Followed Too Close

10.5%

MANNERS OF COLLISION

Rear-End

36.8%

Angle-Turning

26.3%

Right-Angle

21.1%

Sideswipe-Same

10.5%

50%

50%

SAFETY EMPHASIS AREAS



Lane Departures



Impaired Driving



Vulnerable Road Users



Intersection Safety



Speed Related



Commercial Motor Vehicles & Work Zones

Exhibit 14. W Noble Ave

W NOBLE AVE

W Noble Ave is a two-lane undivided roadway serving as the primary route for those entering and exiting Guthrie on the west side of town. The segment being studied spans 0.63 miles from City Limits to just east of Academy Rd. Due to the roadway conditions, speeding is an issue along this segment of the corridor. The recommended countermeasures are intended to create a safer corridor through addressing crashes related to speeding and intersection safety.

CORRIDOR RECOMMENDATIONS

Roadway
Reconfiguration



Install Traffic
Signal



Lighting



Add Left
Turn Lane



Pavement
Markings



Lighting



0 250 500 1,000 Feet



E Noble Ave

FROM N POPLAR ST TO I-35 FRONTAGE RD

EXISTING CONDITIONS

- Primary/Principal Arterial
- 11,200 vehicles per day
- Four-lane undivided roadway
- 45 mph speed limit

CRASH SUMMARY

91 Total Crashes

0 Fatal Crash

0 Pedestrian & Bicyclist Crashes

1 Suspected Serious Injury Crashes

79 Intersection Related Crashes

8 Suspected Minor Injury Crashes

CONTRIBUTING FACTORS

Failed to Yield or Stop

53.8%

Improper Lane Change, Pass, or Turn

24.2%

Followed Too Close

7.7%

Driver Inattention

6.6%

50%

MANNERS OF COLLISION

Angle-Turning

51.6%

Right-Angle

17.6%

Rear-End

16.5%

Sideswipe-Same

5.5%

50%

SAFETY EMPHASIS AREAS



Lane Departures



Intersection Safety



Impaired Driving



Speed Related



Vulnerable Road Users



Commercial Motor Vehicles & Work Zones

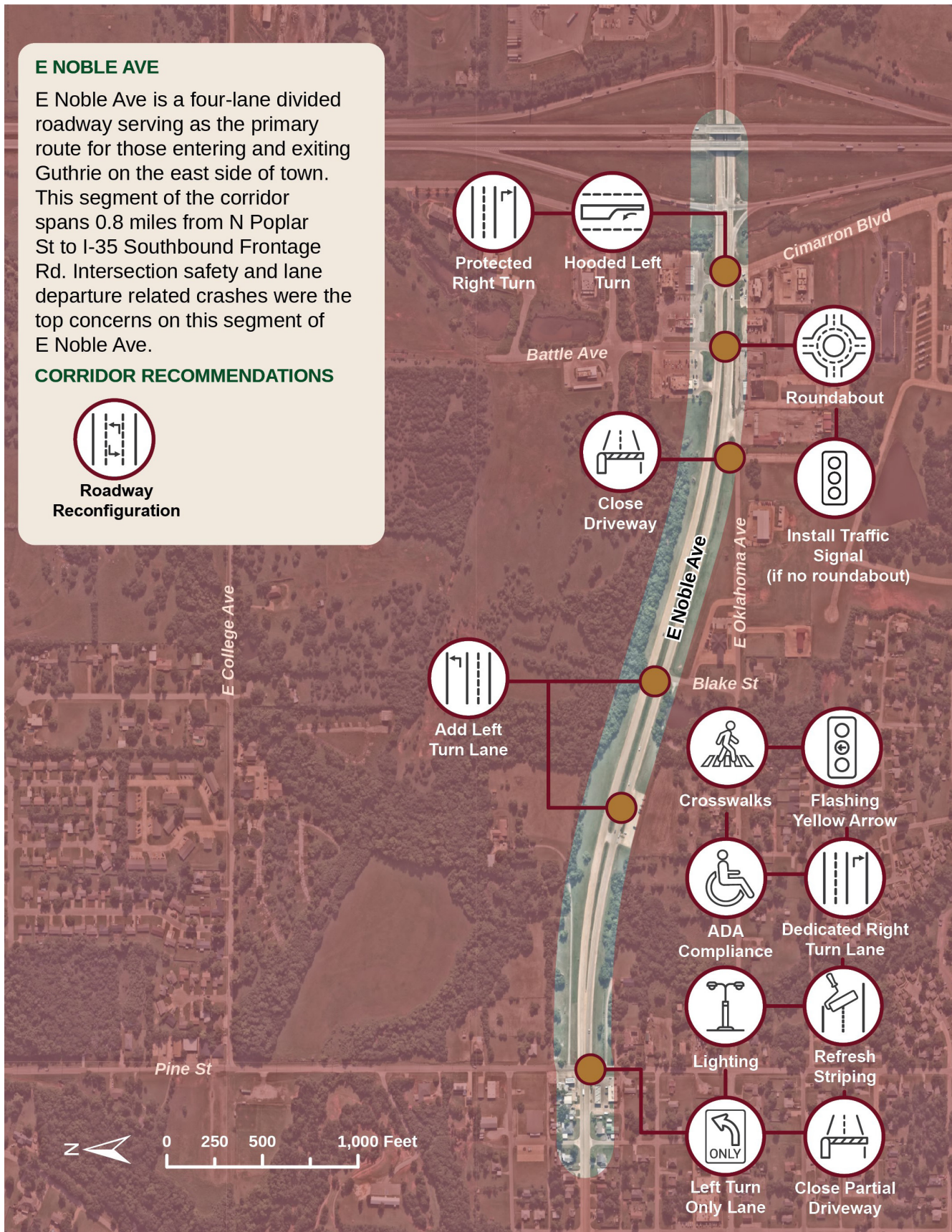
Exhibit 15. E Noble Ave

E NOBLE AVE

E Noble Ave is a four-lane divided roadway serving as the primary route for those entering and exiting Guthrie on the east side of town. This segment of the corridor spans 0.8 miles from N Poplar St to I-35 Southbound Frontage Rd. Intersection safety and lane departure related crashes were the top concerns on this segment of E Noble Ave.

CORRIDOR RECOMMENDATIONS

**Roadway
Reconfiguration**





N Wentz St

FROM E JEFFERSON AVE TO NOBLE AVE

EXISTING CONDITIONS

- Primary/Principal Arterial
- 3,500 vehicles per day
- Two-lane undivided roadway
- 35 mph speed limit

CRASH SUMMARY

25 Total Crashes	1 Fatal Crash
0 Pedestrian & Bicyclist Crashes	0 Suspected Serious Injury Crashes
21 Intersection Related Crashes	0 Suspected Minor Injury Crashes

CONTRIBUTING FACTORS

Failed to Yield or Stop

36.0%

Improper Back, Start, or Turn

24.0%

Driver Inattention

20.0%

Driving While Intoxicated

8.0%

MANNERS OF COLLISION

Rear-End

32.0%

Right-Angle

32.0%

Angle-Turning

8.0%

Other

8.0%

50%

50%

SAFETY EMPHASIS AREAS



Lane Departures



Impaired Driving



Vulnerable Road Users



Intersection Safety

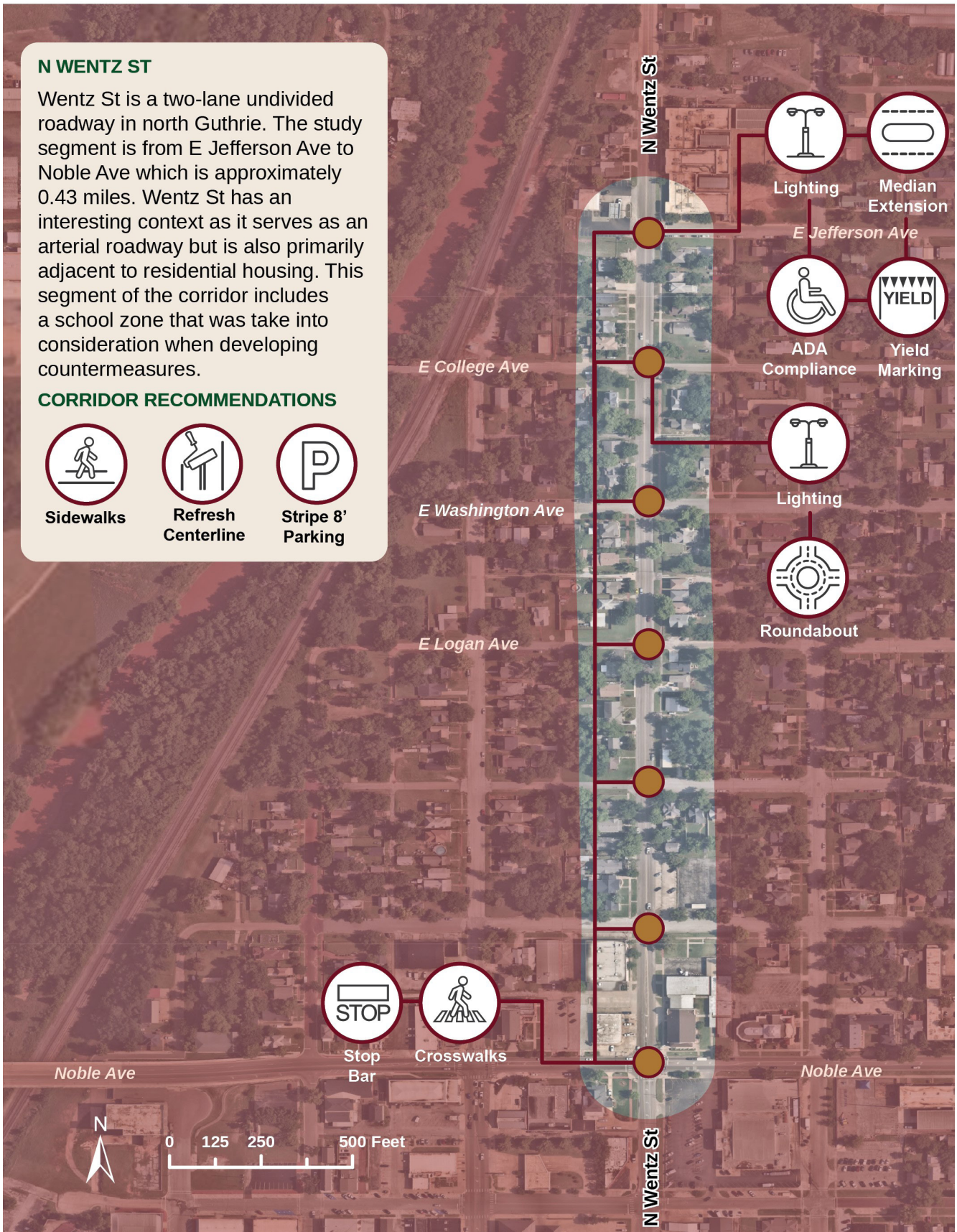


Speed Related



Commercial Motor Vehicles & Work Zones

Exhibit 16. N Wentz St





N Pine St

FROM E COLLEGE AVE TO NOBLE AVE

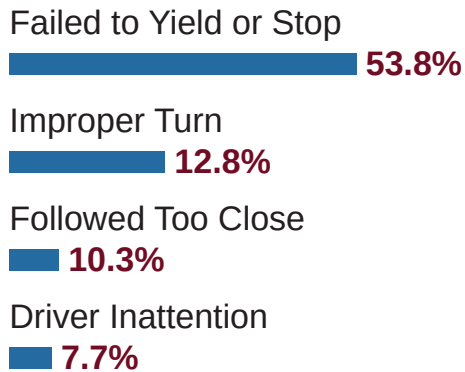
EXISTING CONDITIONS

- Minor Arterial
- 4,000 vehicles per day
- Two-lane undivided roadway
- 35 mph speed limit

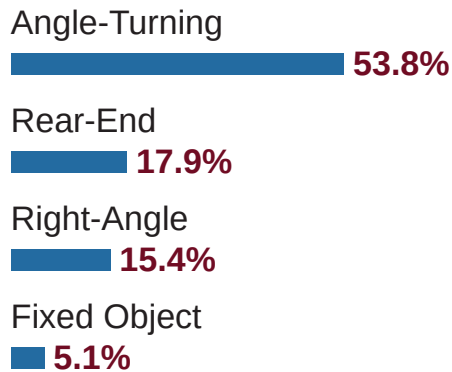
CRASH SUMMARY

39 Total Crashes	0 Fatal Crash
0 Pedestrian & Bicyclist Crashes	1 Suspected Serious Injury Crashes
39 Intersection Related Crashes	7 Suspected Minor Injury Crashes

CONTRIBUTING FACTORS



MANNERS OF COLLISION



50%

50%

SAFETY EMPHASIS AREAS



Lane Departures



Impaired Driving



Vulnerable Road Users



Intersection Safety

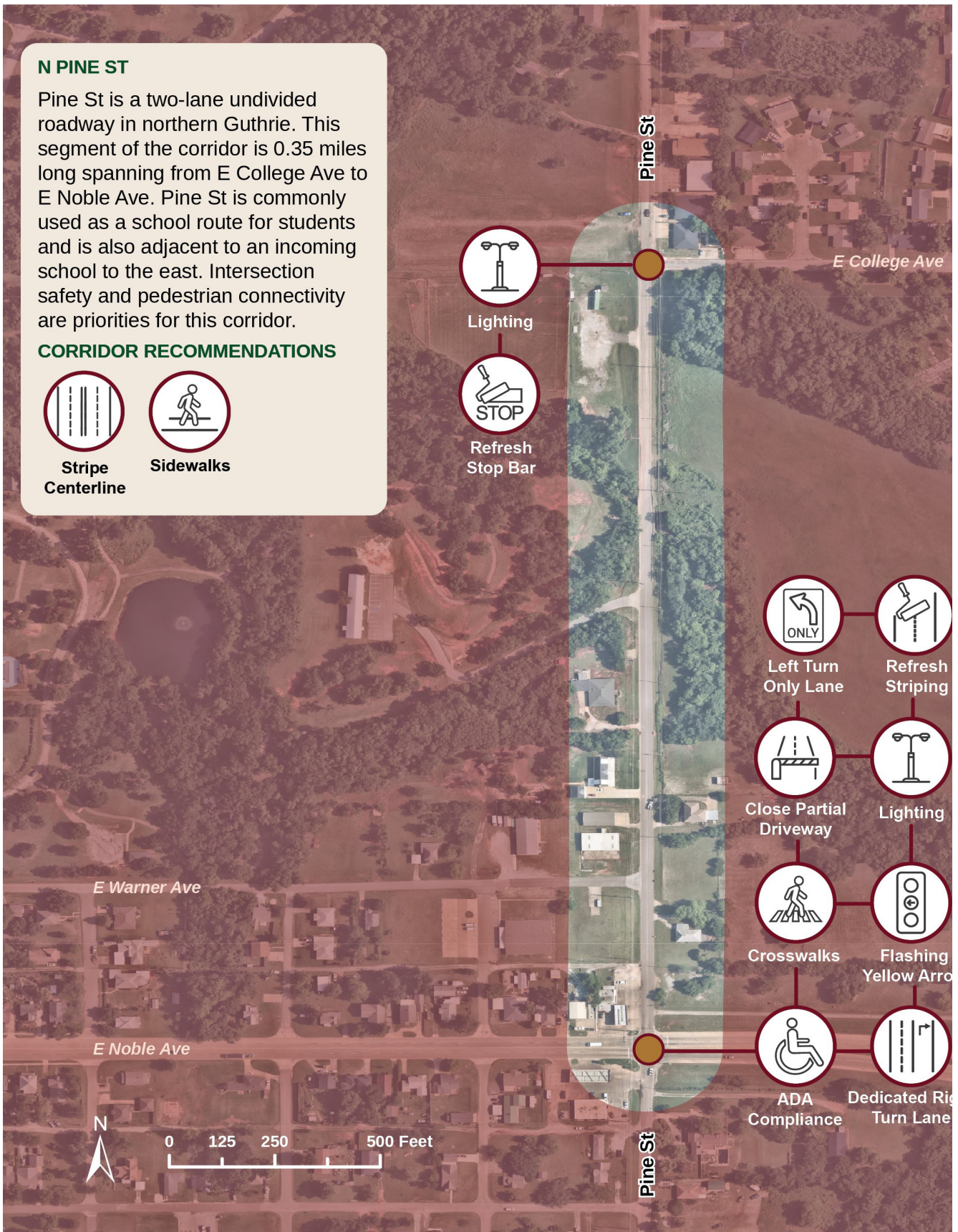


Speed Related



Commercial Motor Vehicles & Work Zones

Exhibit 17. N Pine St





S Division St

FROM PERKINS AVE TO SOONER RD

EXISTING CONDITIONS

- Primary/Principal Arterial
- 13,100 vehicles per day
- Three-lane / Four-lane undivided roadway
- 45 mph speed limit

CRASH SUMMARY

195 Total Crashes	0 Fatal Crash
2 Pedestrian & Bicyclist Crashes	3 Suspected Serious Injury Crashes
68 Intersection Related Crashes	17 Suspected Minor Injury Crashes

CONTRIBUTING FACTORS

Failed to Yield or Stop

26.2%

Improper Turn

21.0%

Followed Too Close

21.0%

Driver Inattention

13.3%

MANNERS OF COLLISION

Angle-Turning

39.5%

Rear-End

29.7%

Right-Angle

9.2%

Fixed Object

5.6%

50%

50%

SAFETY EMPHASIS AREAS



Lane Departures



Impaired Driving



Vulnerable Road Users



Intersection Safety

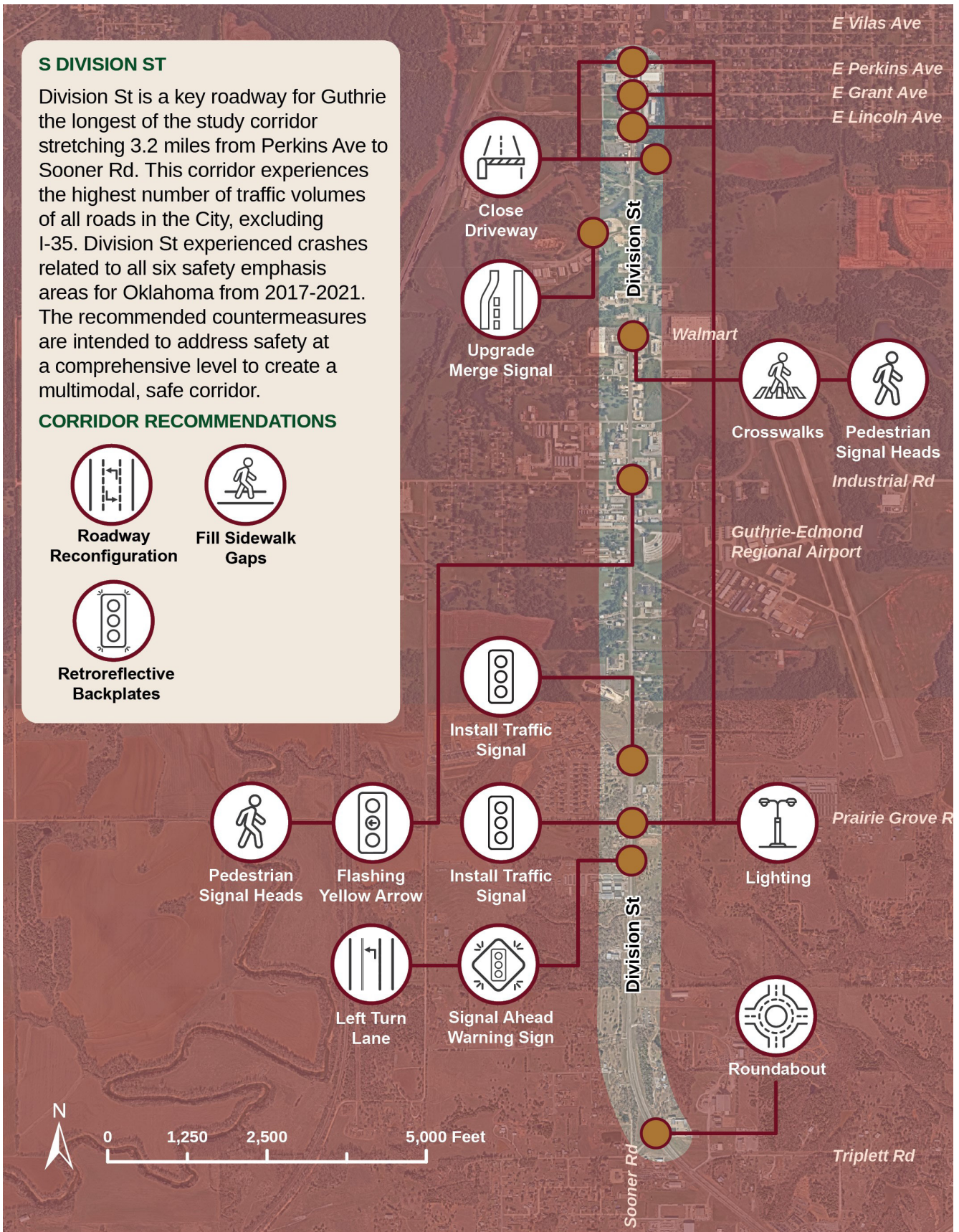


Speed Related



Commercial Motor Vehicles & Work Zones

Exhibit 18. S Division St





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