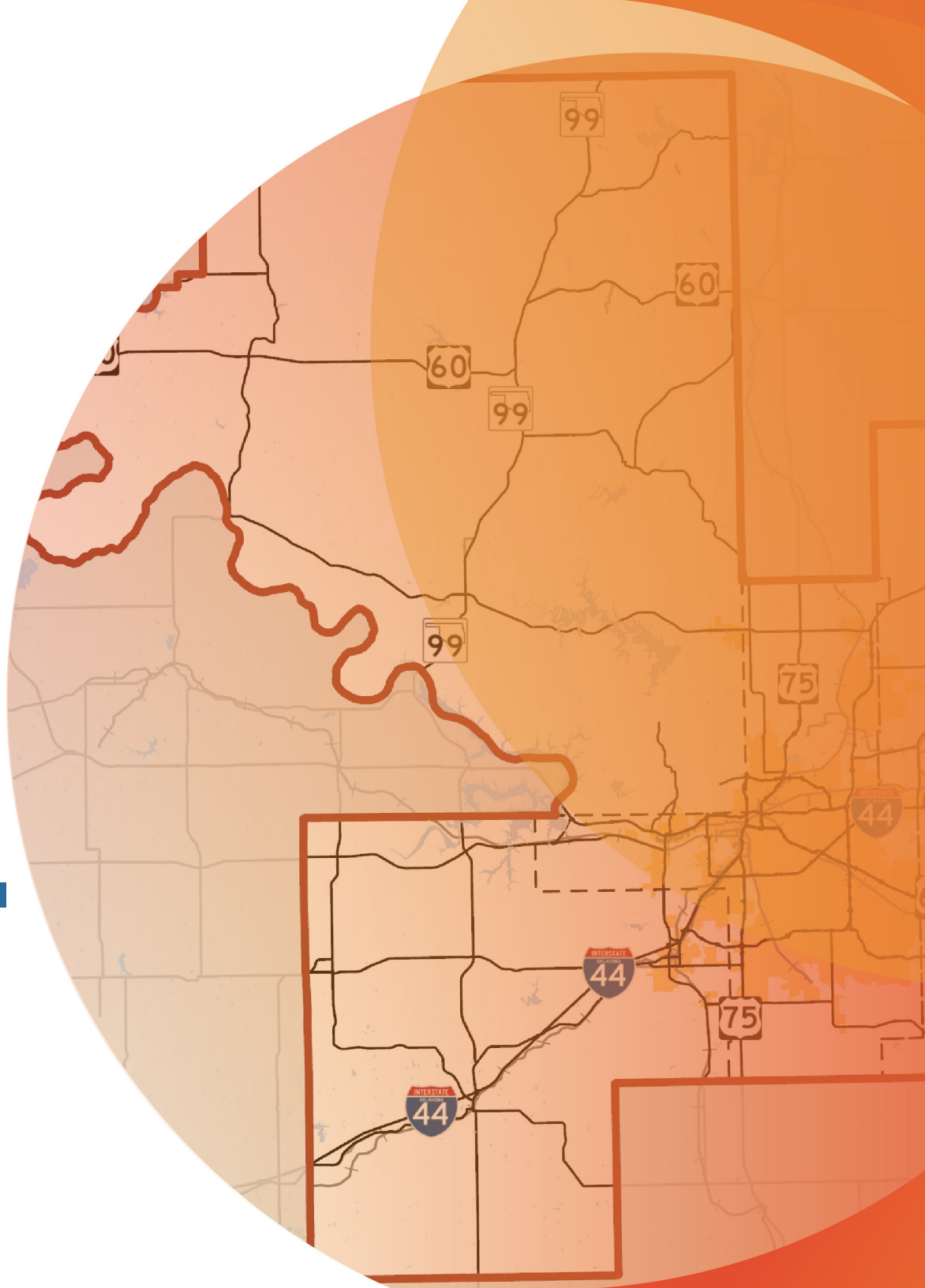
INCOG

LOCAL ROADS SAFETY ACTION PLAN

2025 UPDATE

THE INDIAN NATIONS COUNCIL OF GOVERNMENTS



FINAL DRAFT | JUNE 2025

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Photo Location: Tulsa, Oklahoma

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GLOSSARY

INCOG (Indian Nations Council of Governments): The Indian Nations Council of Governments (INCOG) is a voluntary association of local and tribal governments in the Tulsa metropolitan area in northeast Oklahoma. Established in 1967, INCOG is one of 11 Councils of Governments in the State of Oklahoma, and one of several hundred regional planning organizations across the country. INCOG is the designated Metropolitan Planning Organization (MPO) for the Tulsa Transportation Management Area, which includes All of Tulsa County as well as portions of the adjoining counties in the region. Because of this, INCOG is responsible for coordinating federal, state, and local agencies to create a cohesive, safe, and effective transportation network for the region's most urbanized area.

LRSAP (Local Roads Safety Action Plan): A plan to analyze the current state of traffic safety in the region and provide region-wide countermeasures as well as targeted recommendations for the region's most high-risk road networks.

Vision Zero: A traffic safety initiative that enacts change by prioritizing the principles of safe road design, enforcement, education, and community engagement with the goal of eliminating traffic fatalities and severe injuries.

USDOT (U.S. Department of Transportation): The federal agency providing funding for the LRSAP

SS4A (Safe Streets and Roads for All grant): The SS4A grant works to provide funding to improve traffic safety by reducing transportation-related fatalities and serious injuries

FHWA (Federal Highway Administration): The federal agency which has published the safe system approach

Safe System Approach: The framework and mechanism by which the Vision Zero Action Plan can be implemented

LRSAP AC (Local Road Safety Action Plan Advisory Committee): One of several partners working with INCOG, who are primarily responsible for overseeing the plan's actions and initiatives to ensure goals are met efficiently and effectively. The committee provides continuous guidance, supports implementing agencies, monitors progress, and adjusts for emerging challenges. Additionally, the LRSAP AC fosters collaboration among stakeholders—including residents, regional entities, and external departments— facilitates communication and promotes community engagement to maintain momentum and accountability.

HIN (High-Injury Network): A network of roads, intersections, or other transportation infrastructure that experiences an above average rate of fatalities or roadway injuries.

KAB's (Fatalities – K, Serious Injuries – A, Minor Injuries – B): The functional measure of the injury severity for any person involved in a crash.

Crash Modification Factor (CMF): A measure indicating the expected change in crash occurrences after implementation.\

CMF Clearinghouse: An online repository of CMF's that serves as a search engine to allow users to search for CMF's for a specific countermeasure.

Systemic Countermeasures Toolbox: A countermeasure toolbox is a comprehensive list of countermeasures and improvements designed to address specific traffic safety issues.

Six "E's" of Safety: the components of an integrated and comprehensive framework, which includes: Engineering, Education, Evaluation, Equity, Enforcement, and Encouraging. This can be deployed at all levels to enhance the user experience and improve safety.

SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats Analysis): A framework intended to identify strengths, weaknesses, opportunities, and threats presented under the existing conditions of our roadways in the INCOG region.

Oklahoma Strategic Highway Safety Plan (SHSP): A yearly plan working in conjunction with the national highway safety improvement program (HSIP) as a comprehensive framework for reducing highway fatalities and serious injuries on public roads.

Metropolitan Planning Organizations (MPO's): a policy board of an organization created and designated to carry out the metropolitan transportation planning process.

ArcGIS: Geographic information systems software program used to develop the heat maps and high-injury network (HIN) maps for the local roads safety action plan report.

Crash Analysis: A series of comprehensive and robust data-driven methods used to analyze crash data and identify streets and intersections where concentrations of serious and fatal crashes occur.

Crash Density: The number of crashes in a particular area, not considering factors such as roadway classification, traffic volumes, or severity of the crash.

Emphasis Areas: The top safety concerns based on crash severity and frequency

Action Matrix: A list of best practices in roadway safety and changes recommended in accordance with the five (5) pillars.

Property Damage Only (PDO): A type of crash where no injuries were reported to any persons, and is limited instead to the damage the crash inflicted on the

Critical Crash Rate Analysis (CCR): This analysis assesses the safety performance of road segments or intersections, aiming to identify locations with a higher likelihood of severe crashes.

Roadway functional classification: The assigned classification of all current roadways based on each roadway's mobility and access to destinations, usually divided into the three categories of arterials, collectors, and local roads.

AASHTO (American Association of State Highway Transportation Officials): A standards setting body for highway and transportation departments across the nation that developed the CCR.

Highway Safety Manual (HSM): Published by the American Association of State Highway Transportation Officials (AASHTO), it is the recognized source of information and methods for quantitatively evaluating traffic safety performance on existing or proposed roadways.

Transportation Demand Management (TDM): A set of strategies aimed at maximizing traveler choices to improve travel reliability.

HMVMT (per Hundred Million vehicle miles traveled): The unit of measure used to measure the total distance traveled by all vehicles in the region.

Safety best practices: Incorporating elements of safety action plans from peer MPO's to provide insight into strategies that work best for project development, foster collaboration, and in effective strategies of implementation.

EXECUTIVE SUMMARY

Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

EXECUTIVE SUMMARY

Indian Nations Council of Governments (INCOG) received federal funding to update the Local Roads Safety Action Plan (LRSAP) for the 5-county region including Creek, Osage, Rogers, Tulsa, and Wagoner Counties as a part of the US Department of Transportation's (USDOT) Safe Streets and Roads for All (SS4A) grant. The SS4A grant works to provide funding to improve traffic safety by reducing transportation-related fatalities and serious injuries. The LRSAP will analyze the current state of traffic safety in the region and provide region-wide countermeasures as well as targeted recommendations for the region's most high-risk networks.

The INCOG region has accepted the Vision Zero pledge and has committed to reaching their goal through the Safe System Approach outlined in this plan. The INCOG LRSAP was kicked off in July 2024 and will run through adoption in June 2025. This plan is organized into three parts, each pertaining to a different phase in the project's development.

The SS4A program serves as a key driving force behind the LRSAP, aligning with the Federal Highway Administration's (FHWA) Safe System Approach. This approach prioritizes safety by aiming to eliminate all traffic fatalities and severe injuries through principles focused on safer road design, enforcement, education, and community engagement. While this document provides guidance on a comprehensive implementation framework to improve roadway safety for new projects, it is crucial to incorporate a simliar framework when evaluating the safety aspects and roadway design elements for other roadway projects, where feasible. The guiding principles of the Safe System Approach and this document are outlined in **Chapter 1**, providing a framework for integrating safety into every aspect of the plan:

With these safety principles in mind, the LRSAP Advisory Committee (LRSAP AC) collaborated to establish a mission that clearly communicates how this plan will serve the community and stakeholders in the future. This vision for the INCOG LRSAP reflects a commitment to improving roadway safety and ensuring that all transportation decisions are made through a lens of safety and equity:

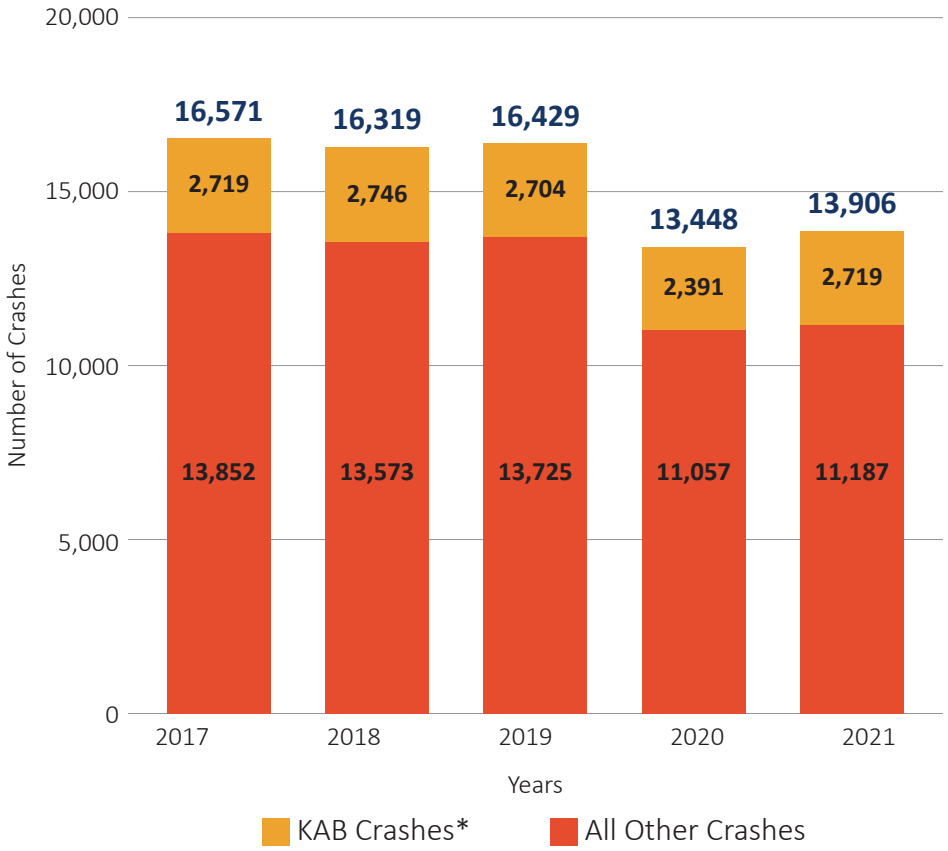
"We are committed to eliminating all traffic fatalities and serious injuries by embracing Vision Zero and following the Safe System Approach."

Chapter 1 of the Plan, titled Process and Purpose, provides an empirical understanding of existing conditions and key safety considerations, setting the stage for **Chapter 2** of the Plan. **Chapter 2** analyzes the regionwide crash history, identifies safety emphasis areas, and evaluates the equitable distribution of safety resources, ensuring a data-driven foundation for decision-making.

CHAPTER 1

Chapter 1 defines the purpose of the LRSAP and provides an overview of the 10-month planning process. It also outlines the safety guiding principles that shaped the Plan's development. Additionally, it includes a summary of the 2022 Local Road Safety Plan and a review of key safety best practices, laying the foundation for subsequent analysis and recommendations.

FIGURE 1. CRASHES PER YEAR



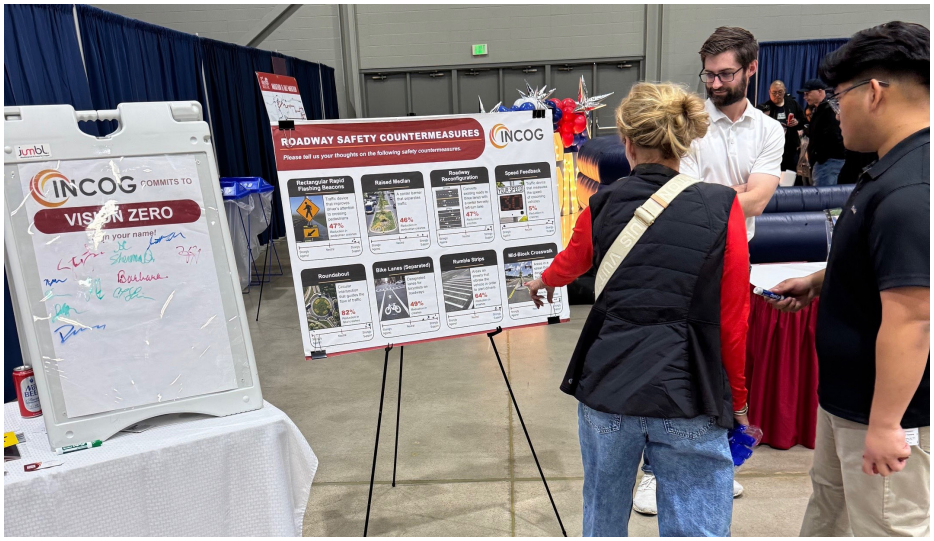
**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

FIGURE 2. SAFE SYSTEM APPROACH

Source: FHWA

Chapter 1 also describes the public engagement process, listing the online and in-person events realized throughout the process and the various activities the public participated in.

FIGURE 3. PHOTOS FROM POP-UP EVENTS AND PUBLIC WORKSHOPS



CHAPTER 2

Chapter 2 discusses the results of the high-injury network (HIN) study. A high-injury network is a network of roads, intersections, or other transportation infrastructure that experiences an above-average rate of KABs (Fatalities – K, Serious Injuries – A, Minor Injuries – B). Identifying and prioritizing these networks are foundational to the success of an LRSAP. The HIN will be essential in allowing INCOG to:

Prioritize safety improvements

Implement and monitor improvements

Allocate and distribute resources

Continuously review and update with the most recent crash data

The development of the HIN also provides a comparison of crash densities between roadway segments. **Table 1** below outlines the corridors with the highest densities within each county. These densities are quantified by the Critical Crash Rate Ratio, which compares the rate of crashes on these segments to the average rate. .

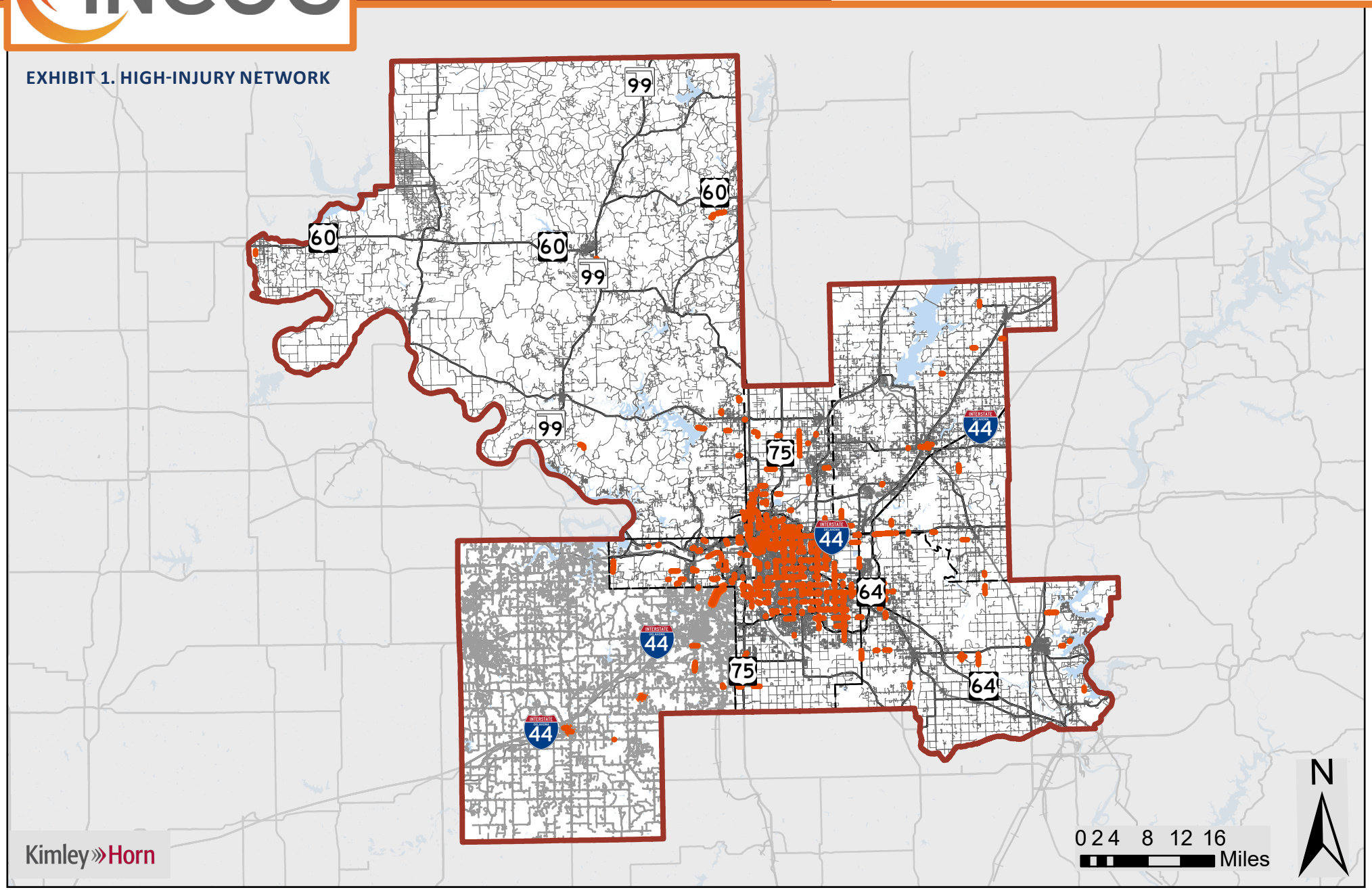
TABLE 1. TOP HIN CORRIDOR PER COUNTY

COUNTY NAME	CORRIDOR NAME	TOTAL KABs	CRITICAL CRASH RATE RATIO
Creek	New Sapulpa Rd	40	13.0
Osage	N Lombard Rd	5	9.1
Rogers	N Muskogee Ave	3	14.7
Tulsa	E Virgin St	15	12.1
Wagoner	N 55th Street E	2	18.6

INCOG Local Roads Safety Action Plan

High-Injury Network

EXHIBIT 1. HIGH-INJURY NETWORK



CHAPTER 3

Chapter 3 includes the Safety Countermeasure Toolbox, which was developed to include Systemic Countermeasures that can be used throughout the entire INCOG road network to improve the level of roadway safety. The toolbox in **Chapter 3** presents a comprehensive set of strategies and interventions aimed at addressing specific traffic safety challenges. While not every systemic countermeasure listed by the FHWA was factored into the safety toolbox, this list provides deployable countermeasures for the crash types and design contexts within the INCOG Region, and other treatments may be utilized for specific projects or specific locations.**Table 2** provides a summary of these countermeasures, each of which is associated with a Crash Modification Factor (CMF)—a measure indicating the expected change in crash occurrences after implementation. Countermeasures with lower CMFs generally yield the greatest reduction in crashes. These CMF values are sourced from the CMF Clearinghouse, ensuring data-driven decision-making in safety improvements.

TABLE 2. COUNTERMEASURES SUMMARY

COUNTERMEASURES	CMF	CONTEXT (URBAN/RURAL)
Raised Medians	0.29	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
Roundabouts	0.59	Both
SafetyEdge^{SM}	0.591	Rural
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
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
Bike Facilities	–	Urban
Curb Extensions	–	Urban
Add New Paved Shoulder	0.67	Rural

FIGURE 4. EXAMPLE OF RAISED MEDIANS

Source: Adobe Stock

FIGURE 5. EXAMPLE OF A ROUNDABOUT

Source: Adobe Stock

CHAPTER 4

Chapter 4 concludes the Plan with an implementation matrix that provides actionable strategies to advance roadway safety throughout the INCOG region through policy and procedural improvements while providing recommendations to implement the Countermeasure Toolbox. Guidance is also included to update the Plan. Finally, the LRSAP aims to inform upcoming project prioritization and funding allocations using the findings of the LRSAP. The Action Matrix is organized by the five (5) pillars of the Safe System Approach. Actions are grouped under their corresponding pillar.

THE FIVE PILLARS

CHAPTER 1

PROCESS & PURPOSE

Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

CHAPTER 1: PROCESS & PURPOSE

BACKGROUND

The Indian Nations Council of Governments (INCOG) developed a Local Road Safety Plan (LRSP) in 2022, aiming to improve safety for all roadway users on city streets and county roads in the region. Since this plan was completed, INCOG has decided to update the plan, taking a deeper dive into the most dangerous corridors and intersections in the region and creating tailored countermeasures and recommendations for those areas. The current LRSP provides a region-wide analysis providing systemic countermeasures and detailed listings of potential project locations. The LRSAP will update the region and corridor-wide systemic countermeasures and provide policy and process changes based on the crash analysis and the public outreach process.

Indian Nations Council of Governments Background

Located in northeast Oklahoma, INCOG is one of the 11 councils of government in the state of Oklahoma. INCOG comprises local and tribal governments from the Cherokee, Muscogee (Creek), and Osage nations. This council of governments provides services for three (3) Tribal Nations, five (5) counties, and more than fifty (50) towns and cities. INCOG is the designated Metropolitan Planning Organization (MPO) for the Tulsa Transportation Management Area, which includes All of Tulsa County as well as portions of the adjoining counties in the region. Because of this, INCOG is responsible for coordinating federal, state, and local agencies to create a cohesive, safe, and effective transportation network for the region's most urbanized area.

SAFETY GUIDING PRINCIPLES

INCOG's current LRSP was updated into a **Safety Action Plan** through the lens of three traffic safety principles. This update to INCOG's current LRSP aims to bring INCOG closer to its current goal of eliminating fatal and severe injuries on local roads in the region by further improving traffic safety. The three principles used to guide this traffic safety plan are Vision Zero, Safe System Approach, and the Six "E's" of safety – these principles will be referred to as guiding principles. This update will further assist the region's leaders in informed decision-making when identifying projects that will significantly improve traffic safety in the region.

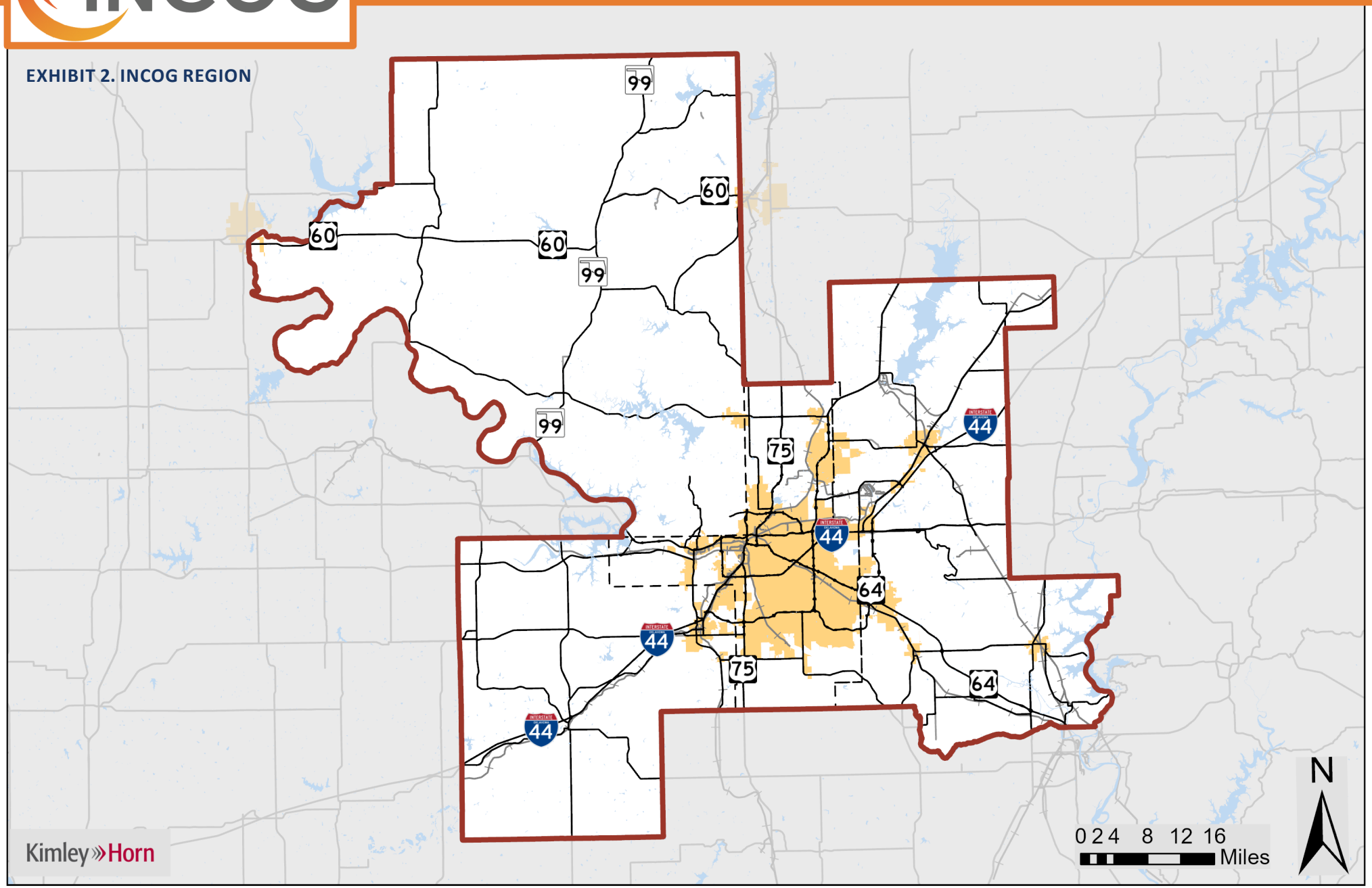
This update to INCOG's current LRSP aims to bring INCOG closer to its current goal of eliminating fatal and severe injuries on Local Roads in the region by further improving traffic safety.

INCOG Local Roads Safety Action Plan

Project Base Map

INCOG

EXHIBIT 2. INCOG REGION



Kimley»Horn

Vision Zero

Vision Zero is a traffic safety initiative that enacts change by prioritizing the principles of safe road design, enforcement, education, and community engagement. Through this comprehensive approach, Vision Zero aims to eliminate traffic fatalities and severe injuries. The initiative recognizes that human error is inevitable; therefore, road systems should be designed to mitigate the consequences of mistakes. By emphasizing a comprehensive approach to crash-related injury reduction, regions can experience improvements in quality of life, safety, and community mobility. INCOG has recently adopted a resolution embracing Vision Zero, and thereby is building a future where everyone makes it home at the end of each day, regardless of how they choose to travel in the region.

The Vision Zero initiative differs from other approaches because it creates a shift in the community by challenging the idea that traffic injuries and fatalities are simply a byproduct of modern transportation networks. Instead, it promotes the idea that there is a possibility of creating safe and accessible transportation for all and opens the opportunity to influence real change in a community. Although the Vision Zero goal is large, every step closer to the goal, every reduction in a traffic-related injury or fatality, has a tremendous positive impact on a community.

Safe System Approach

The Safe System Approach is the framework and mechanism by which this Vision Zero Action Plan can be implemented Six key principles can be utilized to implement the elements of the Safe System Approach, and are as follows:.

DEATH OR SERIOUS INJURY IS UNACCEPTABLE

Focusing attention on preventing fatal and severe crashes over minor crashes so residents are better protected on the public roads.

HUMANS MAKE MISTAKES

Human error is inevitable, inevitably leading to crashes, but a roadway system that accounts for and accommodates this fact can mitigate the effects (avoiding serious injury or death).

HUMANS ARE VULNERABLE

Human tolerance to crashes is a recognized and measurable benchmark (kinetic energy transfer can be measured) and should be incorporated into design considerations.

RESPONSIBILITY IS SHARED

No single party is responsible for crash prevention alone, but collectively all parties are responsible. This includes transportation designers and engineers, users, law enforcement, vehicle manufacturers, and publicly appointed decision-makers.

SAFETY IS PROACTIVE

Rather than responding to tragedy, measures should be taken beforehand to identify and mitigate potential risks.

REDUNDANCY IS CRUCIAL

Affecting change requires strengthening all Safe System elements. If one element fails, redundancy prevents systemwide failure, ensuring people are protected.

The Safe System Approach is a principles-based approach to eliminate serious and fatal injuries. This approach acknowledges that humans make mistakes that can be offset through traffic safety planning. Efforts to mitigate or lessen the physical impacts on the human body include enhancing existing roadway design, reducing speeds, physically separating automobiles from alternative road users, and technological advancements in vehicles (lane departure assist, autonomous emergency braking, etc.).

There are five complementary objectives outlined by the U.S. Department of Transportation (USDOT) that correspond to and support the implementation of the Safe System Approach detailed below:

1. **Safer Road Users** bear the burden of responsibility for complying with the rules and regulations of the roadway.
2. **Safer Vehicles** are responsible for mitigating or preventing the potential impacts of crashes. Active safety measures can help prevent crashes, while passive measures can lessen the implications of a crash. This includes not only vehicle manufactures, but vehicle owners too. Ensuring proper vehicle maintenance—headlights, turn signals, brake lights, brakes, etc.—creates a safer driving environment for everyone and reduces the chances of crashes.
3. **Safer Speeds** have a direct correlation with an increased rate of survival in crashes. Reducing speed reduces impact, improves visibility, and affords drivers additional breaking time. Roads should also be designed to elicit the target speeds.
4. **Safer Roads** are not defined by their design alone. Instead, the road design, construction, maintenance, operation, and countermeasures work collaboratively to improve safety.
5. **Post-Crash Care** accounts for the actions of those responding to a crash, whether emergency services, law enforcement, or clean-up.

FIGURE 6. SAFE SYSTEM APPROACH

Source: FHWA

Six "E's" of Safety

Similar to how the Safe System Approach works, the Six "E's" of Safety are the components of an integrated and comprehensive framework. While every community's composition and understanding of safety varies, the Six "E's" can be deployed at all levels to enhance the user experience and improve safety.

ENGINEERING

Projects and interventions in support of Vision Zero may be implemented through the built environment to improve safety. The primary goal is to calm traffic and improve safety for all users. Examples of engineering projects that have been proven include the implementation of safety countermeasures or traffic calming measures that reduce speeding.

EDUCATION

Can improve safety by raising awareness of transportation choices, furthering, or establishing the benefits of multimodal transportation, and demonstrating the proper way to utilize the system, thus reducing the margin of error.

EVALUATION

Can support both proactive and responsive measures. Understanding the when, where, and why of crashes allows us to respond to historical trends and adjust to improve future safety. Similarly, careful evaluation can help avoid potential issues before they reach greater severity.

EQUITY

Efforts must be made to acknowledge and rectify the imbalance and additional burden that disadvantaged populations carry. Vulnerable and disadvantaged populations are historically under-served and deserve access to the same information and infrastructure as everyone else.

ENFORCEMENT

Can ensure that traffic laws and regulations are being followed by system users while also ensuring that profiling does not occur. Enforcement can also target and prioritize problem behaviors like speeding and other dangerous behaviors over minor infractions.

ENCOURAGING

The community to further their knowledge and understanding of safety principles can be fun and interactive. Events and activities can support and promote better behavior.

Local Road Safety Plan (2022)

The 2022 Local Road Safety Plan was created to address the concern of traffic safety on local roads in the region. This previous plan did not explicitly adopt Vision Zero, but the Board of Directors has more recently adopted a seperate resoultion embracing the principles of Vision Zero. It was developed using 2010-2019 crash data analysis and utilized the framework provided by the Safe System Approach. This previous plan was developed during the COVID pandemic and therefore had limited opportunities for stakeholder engagement. The 2025 LRSAP update will take the 2022 LRSP and through building on prior work find ways to improve the plan. The 2022 LRSP was developed in accordance with the Oklahoma Strategic Highway Safety Plan (SHSP) and provides strategies and action items to improve traffic safety on INCOG's local roads. The 2022 LRSP's vision, mission, and goal are:

VISION

Incorporate the 6 E's approach (Engineering, Enforcement, Education, Evaluation, Emergency Services, and Equity) to reach zero deaths.

MISSION

Establish a Culture of Safety where EVERYONE helps to ensure their own safety and the safety of others through their actions, attitudes, and behaviors.

GOAL

Reduce annual traffic fatalities and serious injuries by 25 percent by 2030.

The 2022 LRSP defined emphasis areas for lane departures, Native American fatalities, Intersections, non-motorized users, young/old drivers, and behavior. INCOG stakeholders identified nearly 100 countermeasure strategies and actions for each emphasis area. These components will be evaluated for their relevancy with updated crash statistics, an in-depth equity assessment, and a robust public engagement process.

Safety Best Practices

At the beginning of the project, the consultant team reviewed best practices and innovative strategies from peer Metropolitan Planning Organizations (MPOs) to inform the development of the INCOG Local Roads Safety Action Plan. The Safety Action Plans (SAPs) selected for review were based on geographic proximity, population size, and similar characteristics, emphasizing regions with completed or nearly completed plans. Plans reviewed included those from:

- **WAMPO** (Wichita Area Metropolitan Planning Organization): Comprehensive Safety Action Plan (2023)
- **ACOG** (Association of Central Oklahoma Governments, Oklahoma City): Regional Safety Action Plan (2024)
- **MAPA** (Metropolitan Area Planning Agency, Omaha): Vision Zero Omaha Action Plan (2023)
- **NWARPC** (NW Arkansas Regional Planning Commission): NW Arkansas Safety Action Plan (2023)
- **MRMPO** (Mid-Region Metropolitan Planning Organization, Albuquerque): Vision Zero Action Plan (2021)

Additional plans were analyzed for specific elements relevant to INCOG's needs. The findings provide insights to guide the Safety Action Plan, support project prioritization processes, and promote collaboration among regional entities. The review looked at safety data collection methods, data analysis strategies, methods for equity analysis, how SAPs incorporated interagency collaboration, best practices in project development, and methods for transparency and reporting. A detailed summary of these plans is provided in **Appendix D**.

PUBLIC ENGAGEMENT OVERVIEW

Community engagement is an essential component of the planning process. All input from community members allows the Safety Action Plan Team to understand the issues of all road users in the INCOG region to ensure the plan meets their needs. Additionally, providing ample opportunities to receive community concerns and opinions creates more advocates of the plan and grows support for more impactful implementation of the plan's recommendations. The Public Engagement for the INCOG Local Roads Safety Action Plan included the following opportunities for participation:

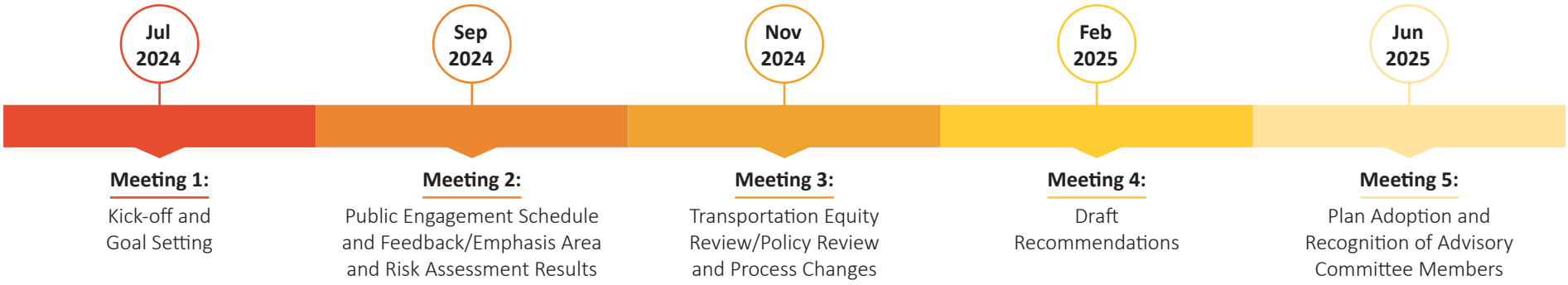
- LRSAP Advisory Committee (AC)
- Public Pop-ups
- Public Workshops
- Tribal Nations Meetings
- INCOG Technical & Policy Committees
- Public Hearing to the INCOG Board of Directors
- Online Engagement

Appendix A dives deeper into the details of the engagement events, including dates, activities, and goals of the events hosted. A summary of the Online engagement is also provided.

PROJECT TIMELINE

The INCOG LRSAP kicked off in June 2024, and the planning process spanned until February 2025. A timeline for the LRSAP AC meetings is displayed in **Figure 7**.

FIGURE 7. PROJECT TIMELINE



Members of the LRSAP AC acted as advocates for the planning process and champions of the plan during its implementation. In the first LRSAP AC meeting, a mission statement was crafted to define the plan's purpose and reinforce a commitment to serving stakeholders and the broader community:

"We are committed to eliminating all traffic fatalities and serious injuries by embracing Vision Zero and following the Safe System Approach."

The LRSAP AC participated in various exercises, including a SWOT Analysis, HIN refinement, countermeasure prioritization, future INCOG Project Prioritization, and Implementation Plan refinement. The LRSAP AC also defined a target to reduce roadway fatalities and severe injuries. INCOG adopted this target and states, **"INCOG commits to reducing traffic fatalities and serious injuries by 50% by 2035."** Once the date is reached and the goal is accomplished, INCOG will reevaluate the target for refinement or establish a new target for future dates.

CHAPTER 2

CRASH ANALYSIS

Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

CHAPTER 2: CRASH ANALYSIS

CRASH DENSITY

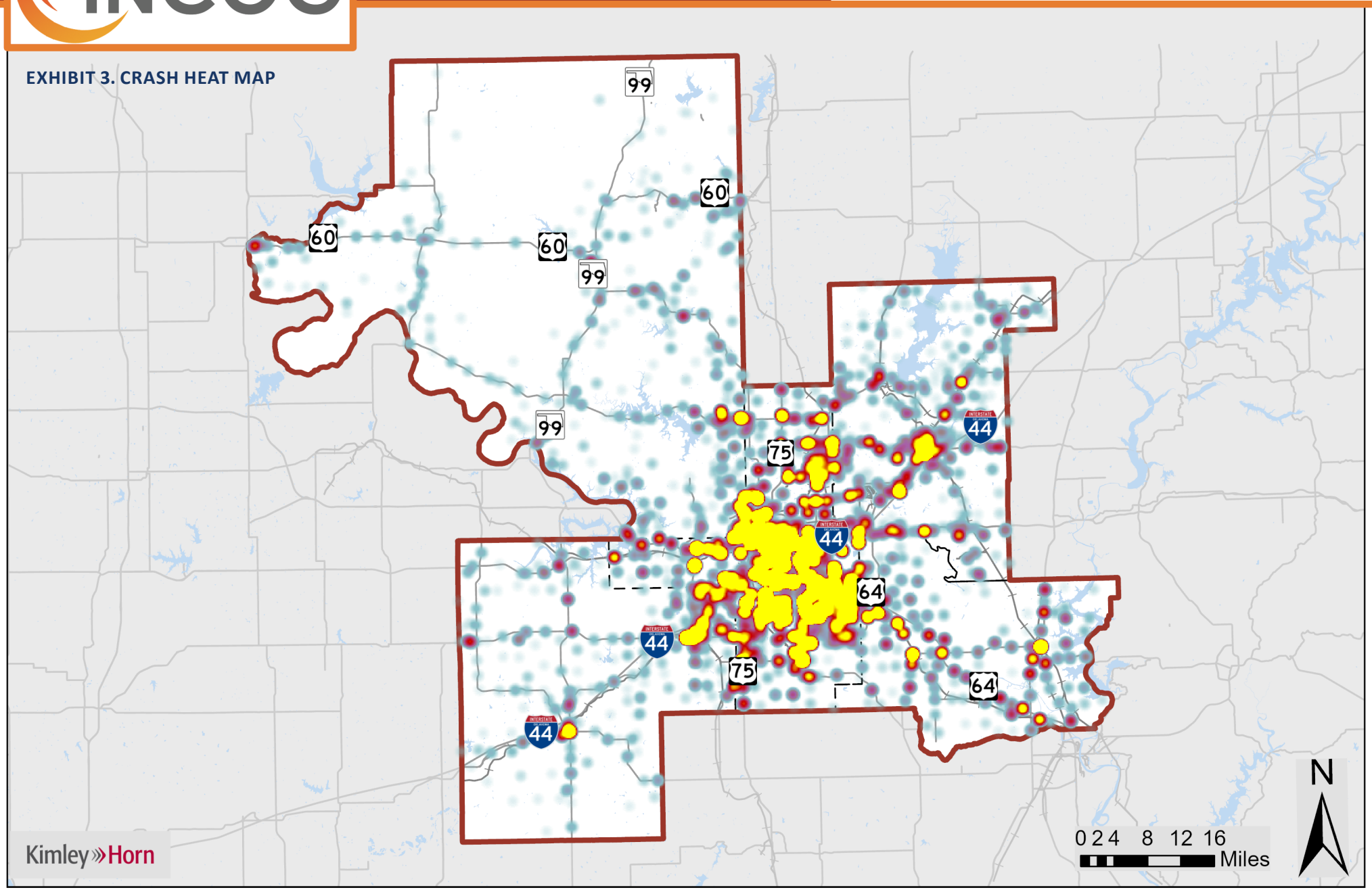
Exhibit 3 shows the crash heat map of total crashes in the INCOG Region from 2017-2021. This heat map displays unweighted crash density, which does not consider crash characteristics such as roadway classification, traffic volumes, or severity. The greatest densities of crashes in the region occurred in and around the Tulsa region along major arterials. A few areas in Rogers and Wagoner Counties also exhbited high rates of crashes during the study period. **Appendix C** also provides the annual rates of fatality per 100,000 population for every incorporated community and every county within the INCOG region.

By identifying road segments with a higher likelihood of severe crashes, this tool can promote the prioritization of high-risk segments/points in a region's transportation network.

INCOG Local Roads Safety Action Plan
Crash Heat Map

INCOG

EXHIBIT 3. CRASH HEAT MAP



Emphasis Areas

The top safety emphasis areas in the region guided the INCOG LRSAP. Emphasis areas are the top safety concerns based on crash severity and frequency. Targeting these emphasis areas provides the biggest impact on improving traffic safety in the region. These safety emphasis areas are:

LANE DEPARTURES

A lane departure crash occurs when a vehicle leaves the traveled way. It is the top emphasis area (most common) in the state of Oklahoma. there are several types of lane departures and crashes classified under a lane departure crash including: 1) off-center head-on crashes, and 2) side swipe crashes. Although INCOG's rate of lane departure crashes is below the state's, it is still a top emphasis area, accounting for 21.7% of crashes.

IMPAIRED DRIVING

Impaired driving is a crash involving occupants who are impaired. Impairment can include alcohol, drugs, and some medications, as well as physical impairments such as drowsiness and poor vision. Impaired driving accounts for 23.1% of crashes in Oklahoma and 16.1% of crashes in the INCOG region.

OCCUPANT PROTECTION

Occupant protection crashes refer to crashes involving unrestrained occupants. Proper use of seatbelts and child safety seats directly increases crash survival rates, making this emphasis area a top three (3) emphasis area for Oklahoma (24.7%) and INCOG (20.2%).

UNSAFE SPEEDING

Operating a vehicle at a speed unsafe for the roadway or the current conditions increases the chances and severity of a crash. Unsafe speed crashes often go underreported, and therefore, the true effects and rates of unsafe speed crashes are likely more severe than noted. Unsafe speed crashes account for 21.4% of crashes in Oklahoma and 17.6% of crashes in INCOG.

INTERSECTIONS

Intersection-related crashes are crashes that happen in or near an intersection. Intersections pose a safety risk due to the increased number of potential points of conflict for vehicles and vulnerable road users. Traditional intersection projects have focused on adding turning lanes, which has increased the distances pedestrians have to cross. Wide streets should have pedestrian refuges and medians. Intersection-related crashes are the top leading factor in INCOG, accounting for 32.3% of crashes in the region, compared to the state of Oklahoma, where intersection-related crashes only make up 24.7%.

WORK ZONES

Work zone crashes are crashes that occur in a marked designated work zone. The Manual on Uniform Traffic Control Devices (MUTCD) requires that sidewalks remain open or are rerouted, but work zones still pose a unique safety concern due to the presence of factors such as workers, heavy machinery, reduced lane width, unclear lane markings, lane/road closures, and speed limit changes. Work zone-related crashes occur for only 2.4% of crashes in Oklahoma, while rates in the INCOG regions rise to 6.1%.

VULNERABLE ROAD USERS

Vulnerable road users, as described by The National Safety Council, are “those unprotected by an outside shield, as they sustain a greater risk of injury in any collision with a vehicle and are therefore highly in need of protection against such collisions”. Projects to address Vulnerable Road User (VRU) safety includes 1) traffic signaling changes that prohibits a right turn at a red light, 2) Improving pedestrian signals, 3) eliminating sidewalk gaps, 4) and adding ADA accessible ramps and audio at signals. Vulnerable Road User crashes account for 15.9% of crashes in Oklahoma and 12.2 % in the INCOG region.

MOTORCYCLES

Motorcyclists, being VRUs, are also at increased risk in a collision due to the lack of an outside shield and increased speeds compared to a pedestrian or bicyclist crash. Motorcyclist crashes make up 14.4% of crashes in Oklahoma and 10.8% in the INCOG region.

HIN Development & Results

The HIN was created by selecting segments based on a data-driven approach coupled with qualitative refinement. A further description of the HIN development is provided in **Appendix B**. **The goal of the HIN** is to contain the maximum number of fatal, severe injury, and possible injury (KAB) crashes on the least number of roadways.

The model results were refined and cleaned by removing one-crash segments, which resulted in a ratio greater than 1.0. This was done to prioritize corridors experiencing high-severity crashes. The cleaned model contained segments with a crash rate higher than expected and experienced at least one high-injury crash between 2017-2021. Any resulting gaps between segments were examined to be linked or filled with the intention of creating a consistent and contiguous HIN.

The resulting HIN for the INCOG LRSAP consists of 1.5% of the total road network in the region while capturing 53.7% of fatal, severe injury, and possible injury crashes and 59.6% of fatal crashes.

The following steps can be taken to implement and monitor future improvements once the HIN is established:

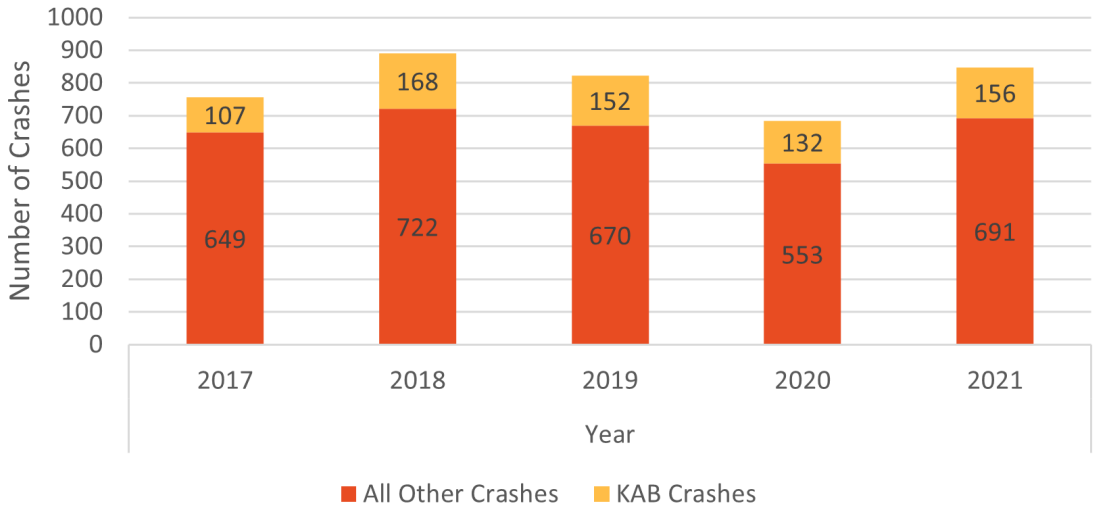
1. ***Prioritize safety improvements:*** Safety improvements (countermeasures) for the identified high-risk locations can be prioritized based on the analysis results and crash patterns. This could involve implementing engineering measures such as roadway redesign, installing traffic control devices, improving lighting, or enhancing pedestrian and cyclist safety.
2. ***Resource allocation:*** Allocation and distribution of the resources needed to implement the safety improvements. This may include funding, personnel, and coordination with other agencies or stakeholders.
3. ***Implement and monitor improvements:*** Implement the planned safety improvements and closely monitor their effectiveness. It is important to track crash data after the improvements have been implemented to assess their impact on critical crash rates and overall safety performance.
4. ***Continuously review and update:*** Review the critical crash rate analysis results regularly and update the prioritization of safety improvements as new crash data becomes available. This ensures that resources are allocated to the locations with the greatest potential for reducing severe crashes.

Top Corridors per County

Creek County

Critical Crash Rate Analysis of Creek County's local road network identified five (5) road segments totaling ___ miles and containing ___ KAB crashes. These road segments contain a total of eight (8) fatal crashes, 14 serious injury crashes, and 58 minor injury crashes. The total combined length of these five (5) segments is 4.1 miles. **Table 3** summarizes these five (5) corridors and **Exhibit 4** displays their location.

FIGURE 8. CREEK COUNTY CRASHES PER YEAR



**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

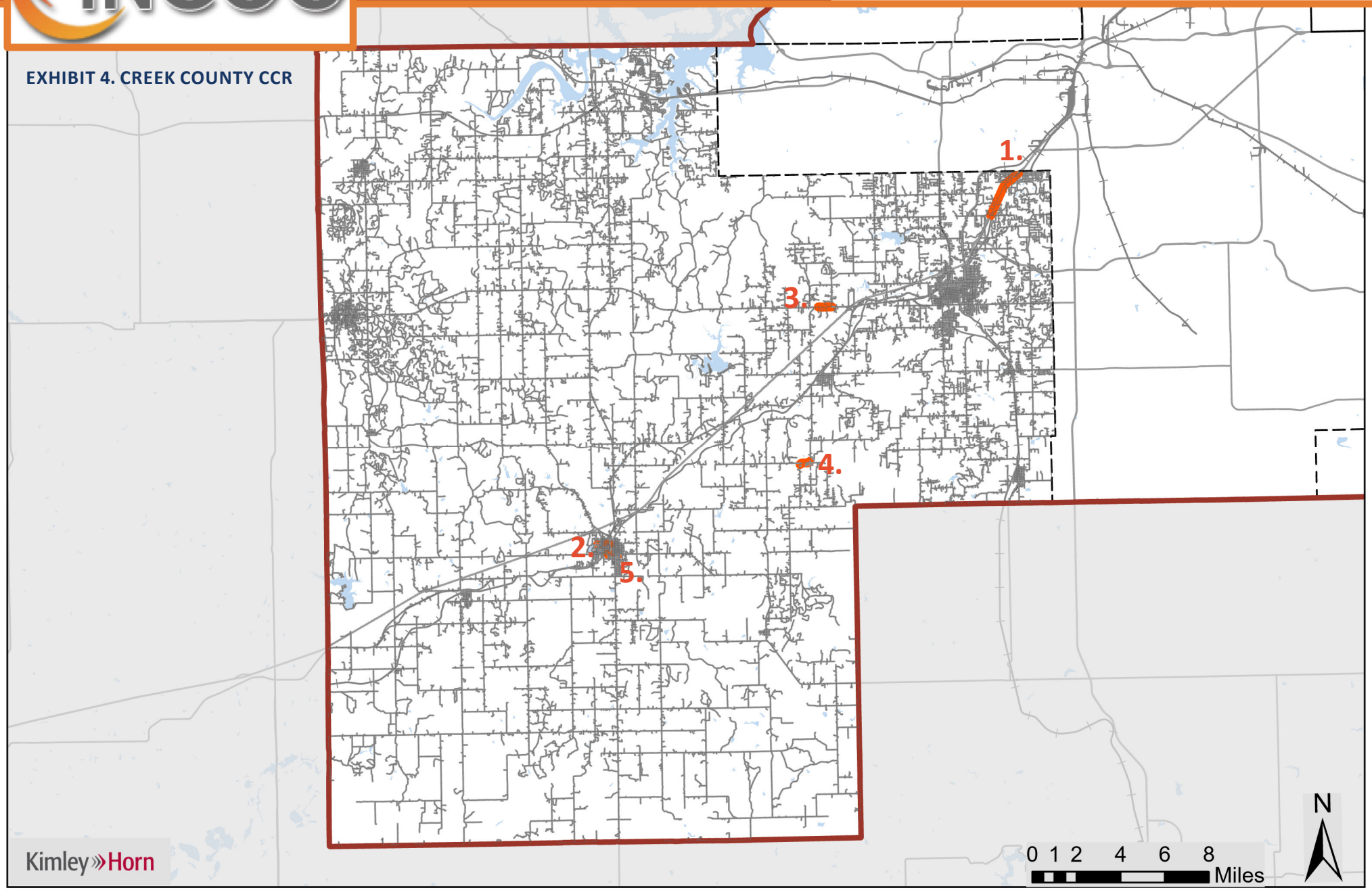
TABLE 3. CREEK COUNTY TOP 5 CORRIDORS

	CORRIDOR NAME	ORIGIN	ENDING	LENGTH (MI.)	TOTAL KABS	CRITICAL CRASH RATE RATIO
1	New Sapulpa Rd	County Border N	W 81st St	1.5	40	13.0
2	East 1st Ave	S Elm St	S Oak St	0.5	7	12.7
3	W 121st St S	S 201st W Ave	S 193rd West Ave	0.5	3	7.3
4	Slick Rd	Kellyville Ranch Rd	Private Drive	1	2	4.5
5	W 8th Ave	N Spruce St	N Main St	0.6	4	3.0
			TOTAL MILES	***4.1***	**56**	

INCOG Local Roads Safety Action Plan

Creek County CCR

EXHIBIT 4. CREEK COUNTY CCR

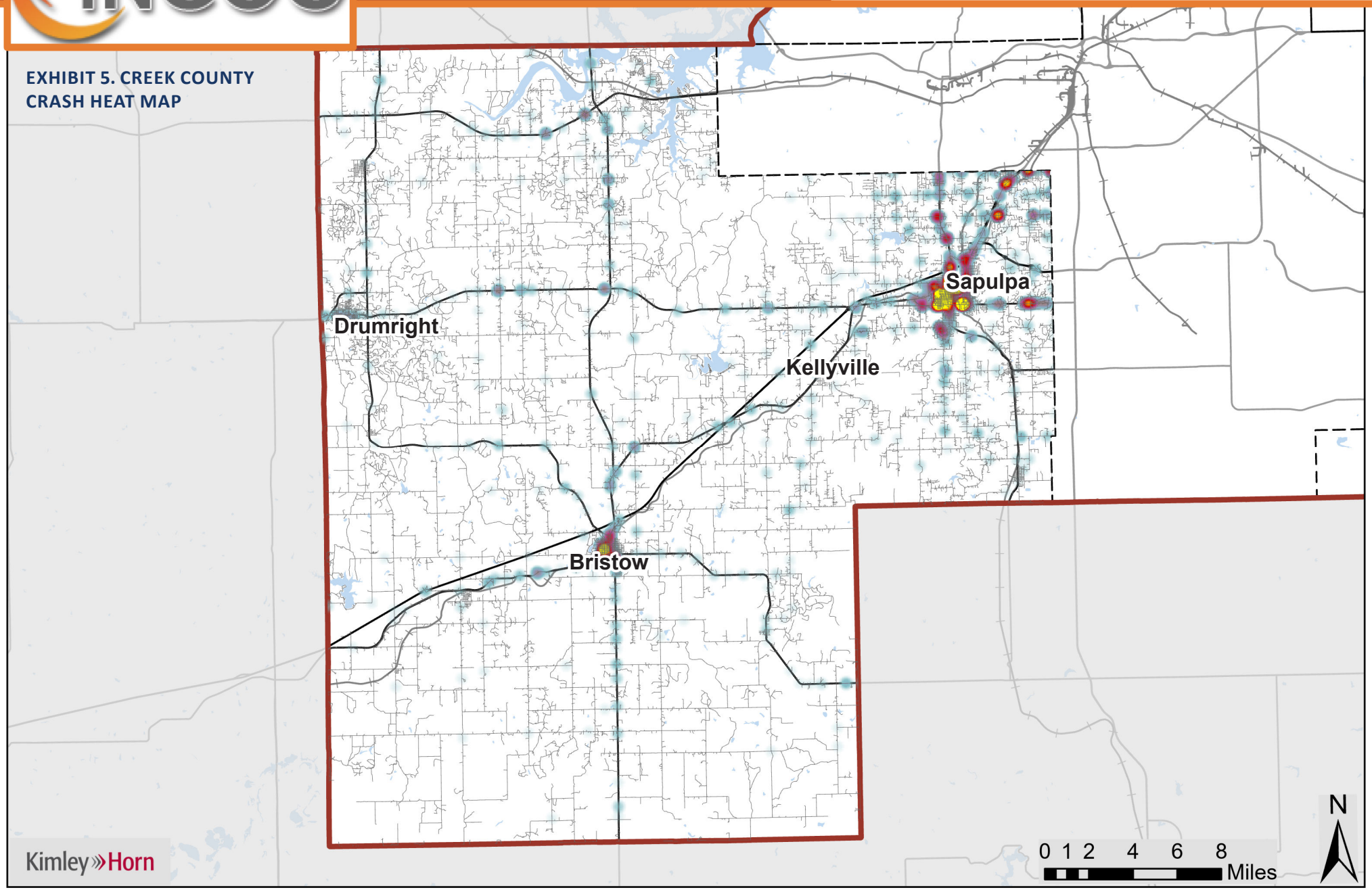


Kimley»Horn

INCOG Local Roads Safety Action Plan

Creek County Crash Heat Map

EXHIBIT 5. CREEK COUNTY CRASH HEAT MAP



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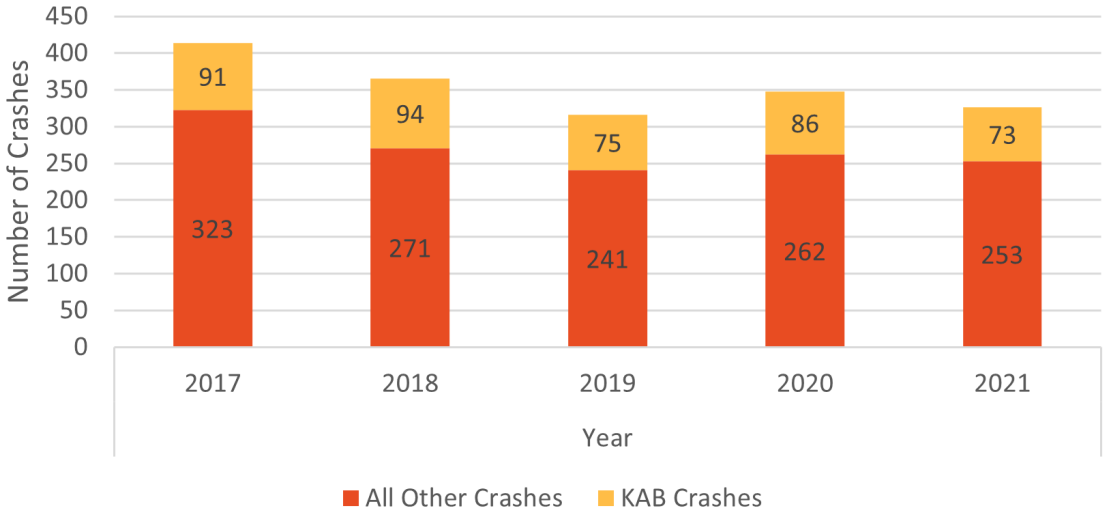
Osage County

Critical Crash Rate Analysis of Osage County's local road network identified five (5) road segments totaling only 11.1 miles and containing 30 KAB crashes. These road segments contain three (3) fatal crashes, eight (8) serious injury crashes, and 19 minor injury crashes. These segments identified for potential High-Injury Network segments are in central Osage County as well as around county boundaries. **Table 4** summarizes these five (5) corridors and **Exhibit 6** displays their location.

FIGURE 9. OSAGE COUNTY CRASHES PER YEAR



**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

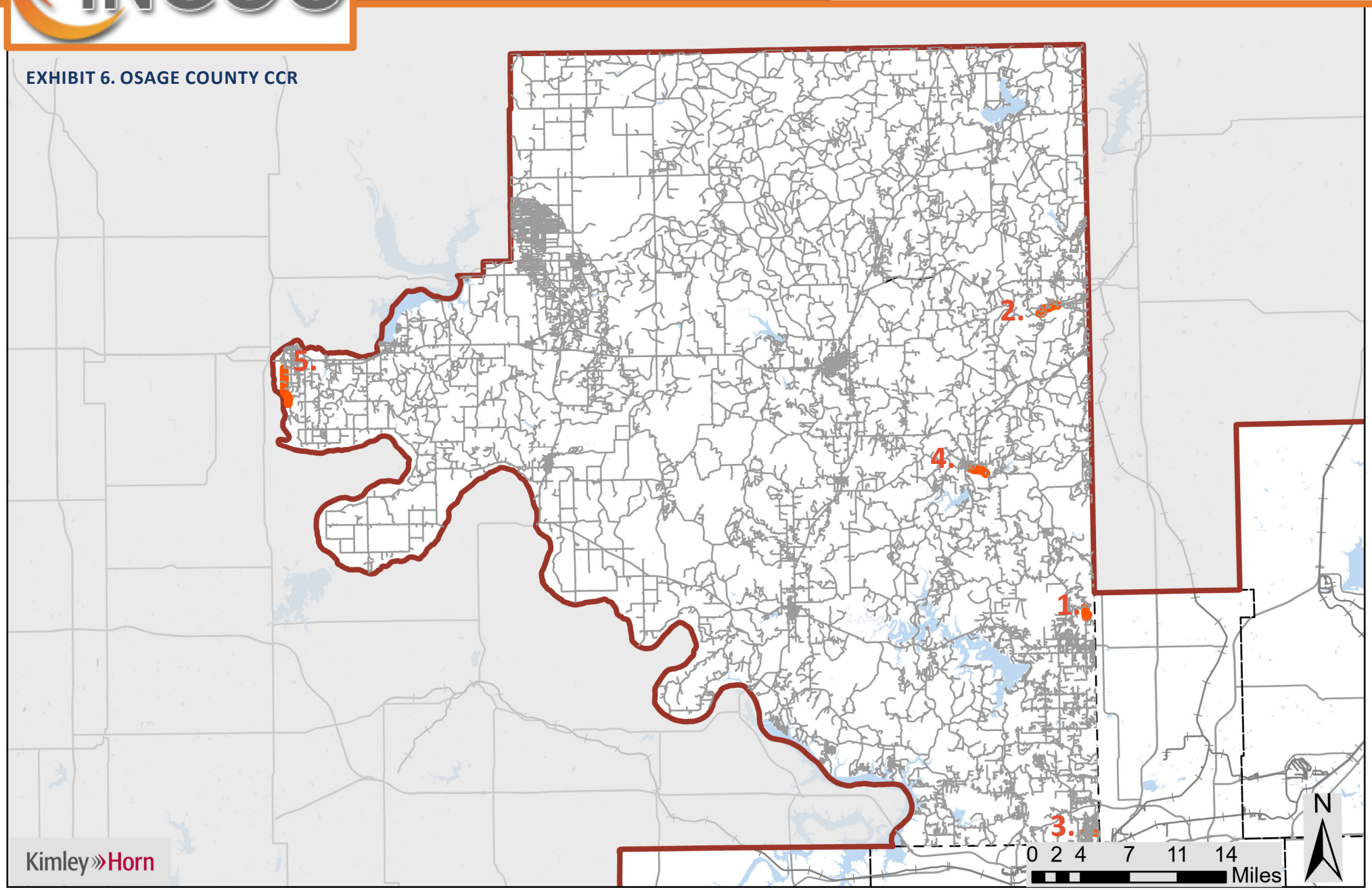
TABLE 4. OSAGE COUNTY TOP 5 CORRIDORS

	CORRIDOR NAME	ORIGIN	ENDING	LENGTH (MI.)	TOTAL KABS	CRITICAL CRASH RATE RATIO
1	N Lombard Ln	176th St N	Star Mountain Rd	0.6	5	9.1
2	Co Rd 2706	Private Road 2705	Private Drive	2.8	7	6.9
3	W Newton St	Gilcrease Museum Rd	W Osage Dr	1	8	4.9
4	5th St	2nd St	Co Rd 2351	1	6	4.8
5	Old River Rd	Private Drive	Private Drive	2.6	5	2.9
			TOTAL MILES	***8.0***	***31***	

INCOG Local Roads Safety Action Plan

Osage County CCR

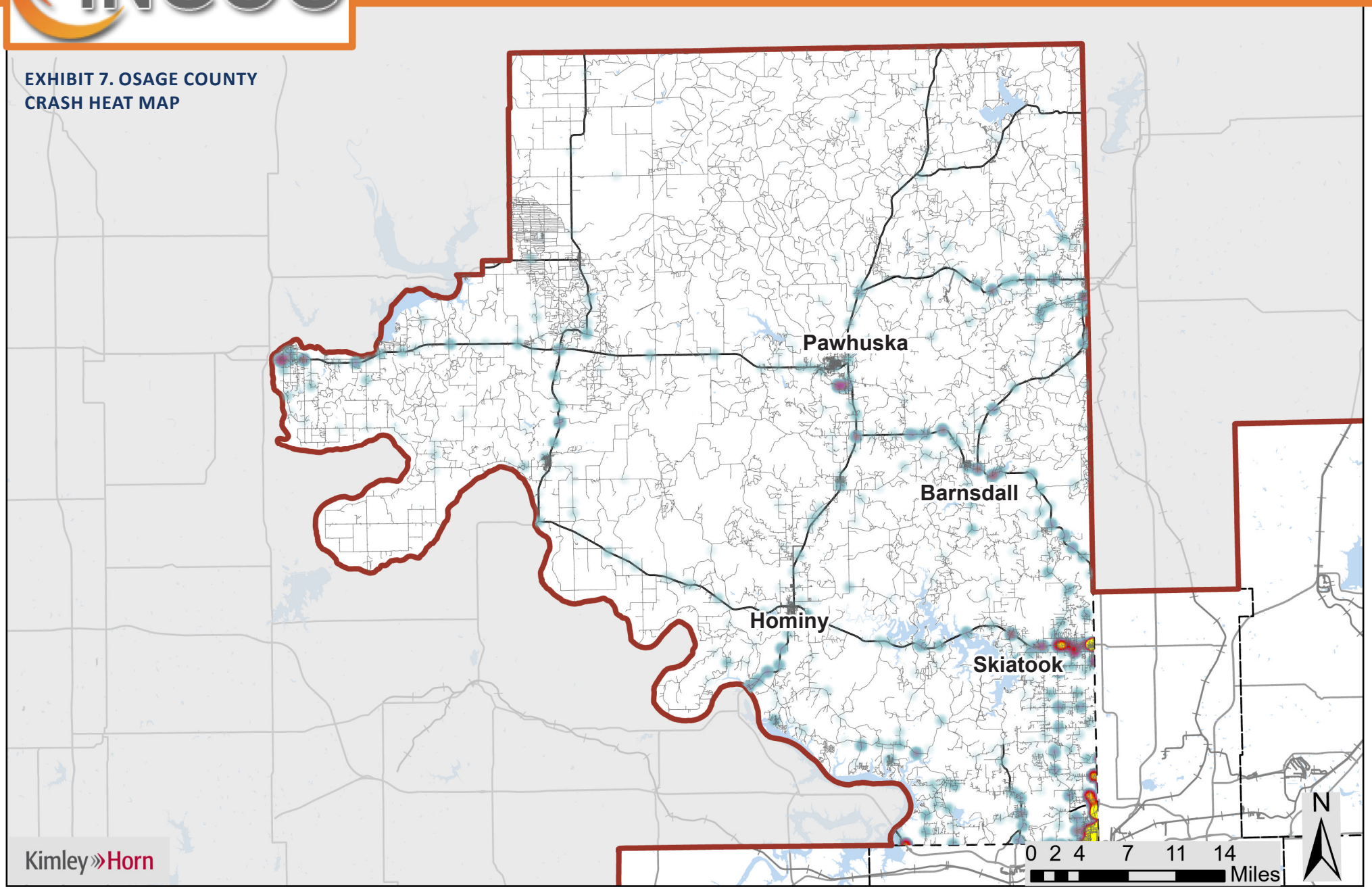
EXHIBIT 6. OSAGE COUNTY CCR



INCOG Local Roads Safety Action Plan

Osage County Crash Heat Map

EXHIBIT 7. OSAGE COUNTY CRASH HEAT MAP



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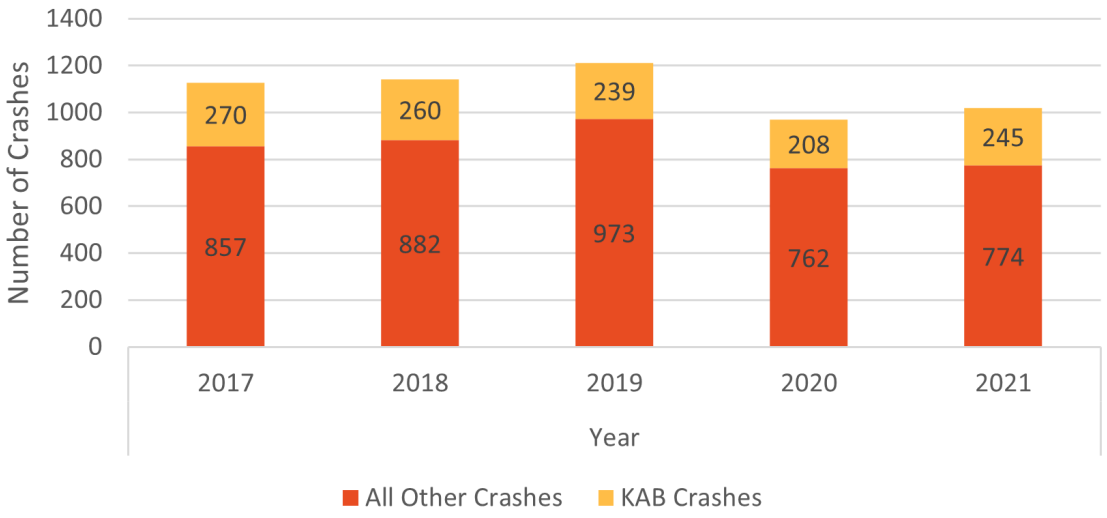
Rogers County

Critical Crash Rate Analysis of Rogers County's local road network identified five (5) road segments totaling only four (4) miles and containing 20 KAB crashes. These road segments contain five (5) fatal crashes, eight (8) serious injury crashes, and seven (7) minor injury crashes. These segments identified for potential High-Injury Network segments are spread throughout the County. **Table 5** summarizes these five (5) corridors and **Exhibit 8** displays their location.

FIGURE 10. ROGERS COUNTY CRASHES PER YEAR



**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

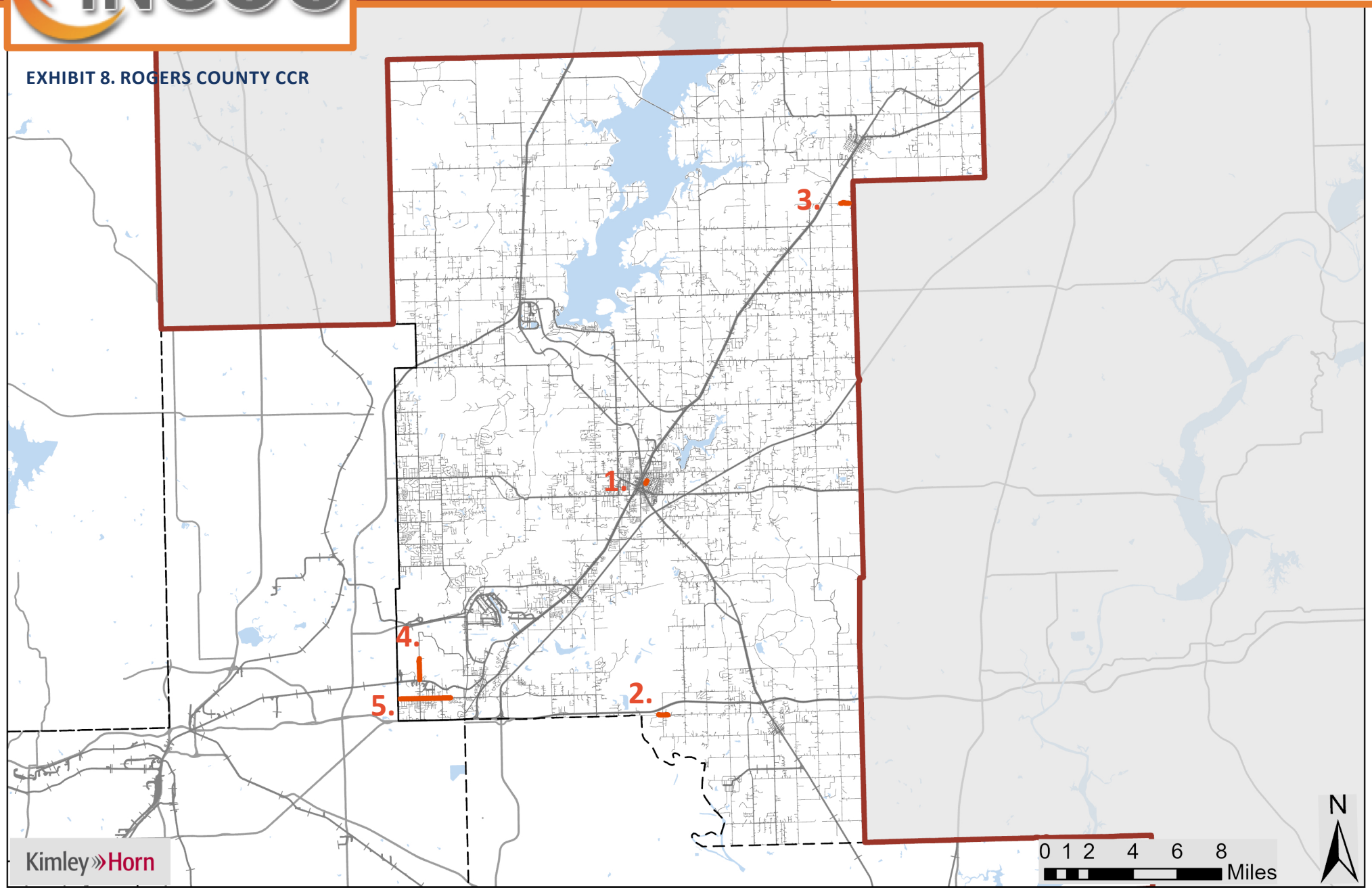
TABLE 5. ROGERS COUNTY TOP 5 CORRIDORS

	CORRIDOR NAME	ORIGIN	ENDING	LENGTH (MI.)	TOTAL KABS	CRITICAL CRASH RATE RATIO
1	N Muskogee Ave	W 7th St	W 9th St	0.15	3	14.7
2	E 590 Rd	–	–	0.5	4	12.6
3	E 360 Rd	–	–	0.35	2	10.9
4	S 4050 Rd	–	–	1	2	7.0
5	E 580 Rd	–	–	2	9	4.6
			TOTAL MILES	***4***	**20**	

INCOG Local Roads Safety Action Plan

Rogers County CCR

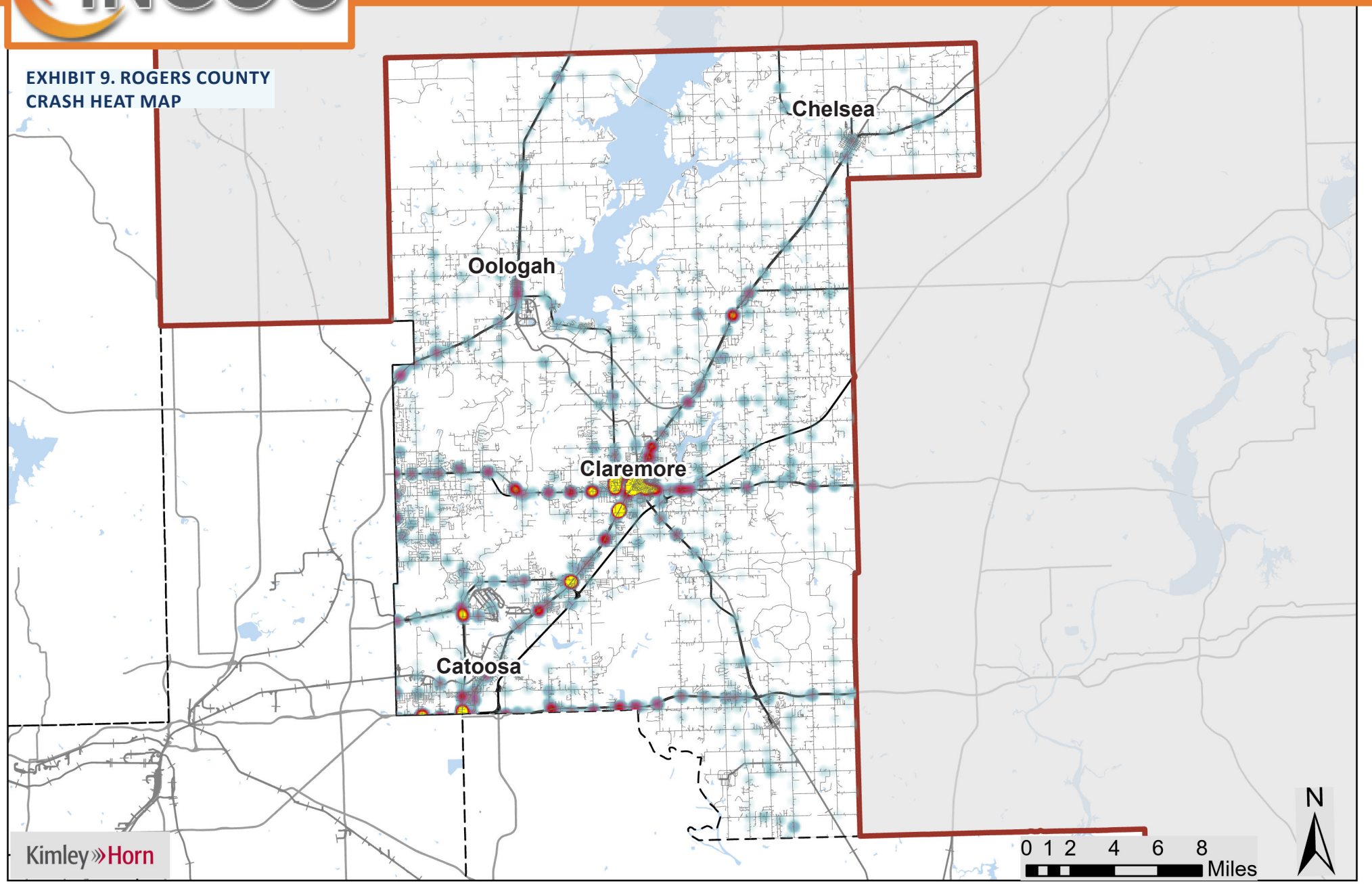
EXHIBIT 8. ROGERS COUNTY CCR



INCOG Local Roads Safety Action Plan

Rogers County Crash Heat Map

EXHIBIT 9. ROGERS COUNTY CRASH HEAT MAP



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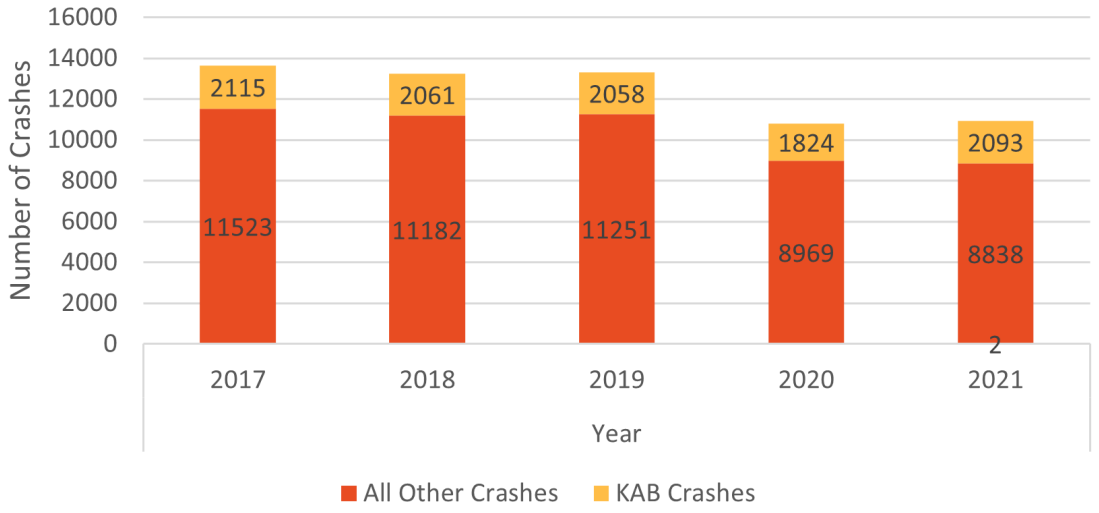
Tulsa County

Analysis of Tulsa County's local road network identified segments with a higher-than-expected crash history and selected the top 10 segments. These segments have a combined total length of 15 miles and contain 568 total KABs. These potential High-Injury Network segments contain 10 fatal crashes, 65 serious injury crashes, and 493 minor injury crashes. Most of these segments are concentrated within Tulsa City Limits. **Table 6** summarizes these 10 corridors and **Exhibit 10** displays their location.

FIGURE 11. TULSA COUNTY CRASHES PER YEAR



**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

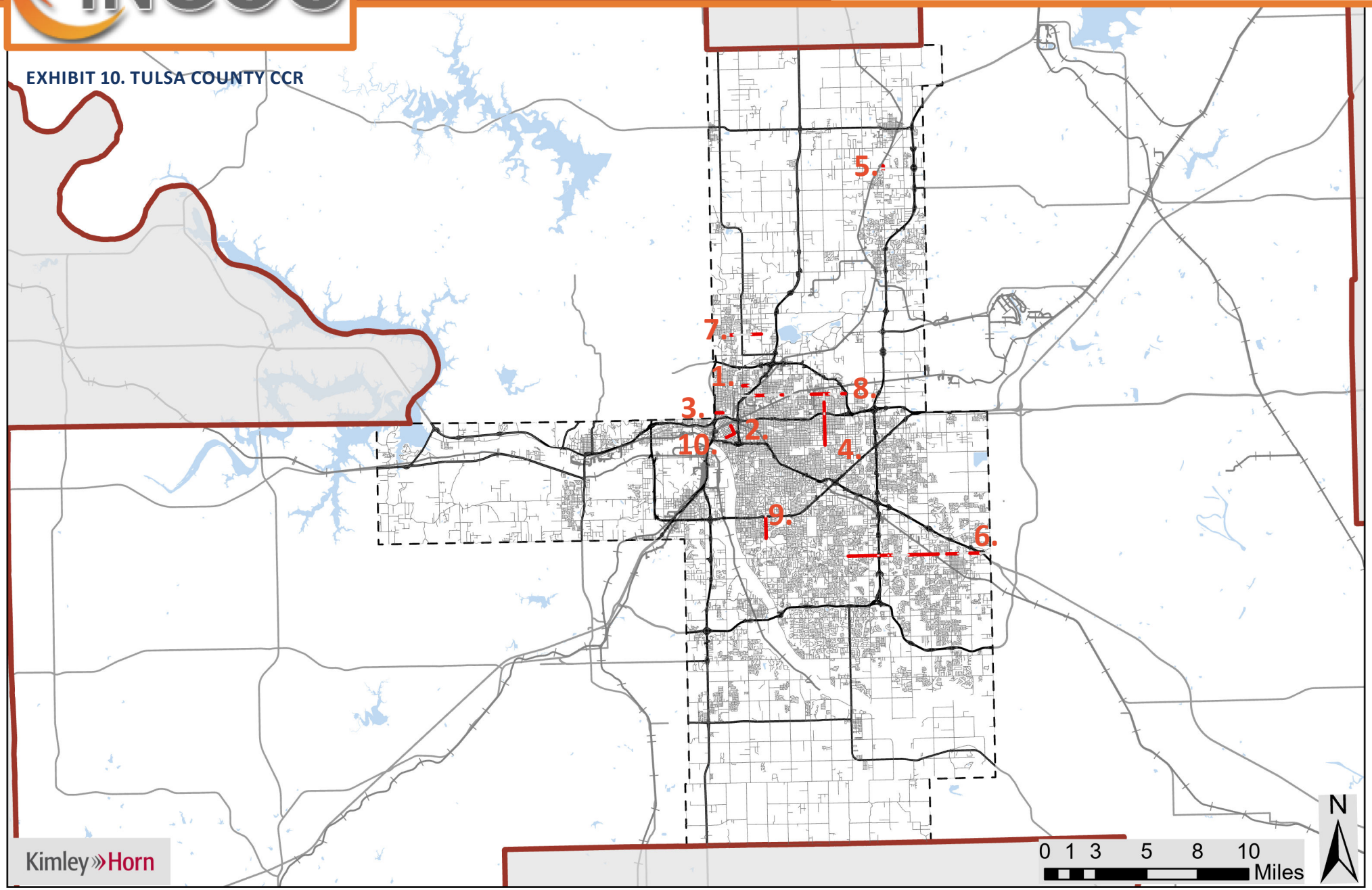
TABLE 6. TULSA COUNTY TOP 10 CORRIDORS

	CORRIDOR NAME	ORIGIN	ENDING	LENGTH (MI.)	TOTAL KABS	CRITICAL CRASH RATE RATIO
1	E Virgin St	S Peoria Ave	North Xanthus Ave	0.65	15	12.1
2	S Elgin Ave	East 8th St	East 2nd St	0.5	17	6.6
3	W Haskell Pl	N Denver Ave	N MLK Jr Blvd	0.3	5	6.2
4	N 65th E Ave (N Sheridan Rd)	E Pine St	E 15th St	2.5	99	5.5
5	N Hwy 169/N Garnett Rd & E 126th St N Intersection	–	–	–	8	5.4
6	E 71st St	S Memorial Dr	S 23rd St	7	337	4.9
7	E 46th St N	N MLK Jr Blvd	N Lewis Ave	2	27	4.9
8	E 15th St N (E Pine St)	S Peoria Ave	Private Fist Class Albert E. Schwab, Medal of Honor Memorial Highway	5	111	4.7
9	S Lewis Ave	E Skelly Dr	E 61st St	1	85	4.6
10	E 8th St	S Elgin Ave	S Cheyenne Ave	0.86	15	4.4
			TOTAL MILES	***19.81***	**719**	

INCOG Local Roads Safety Action Plan

Tulsa County CCR

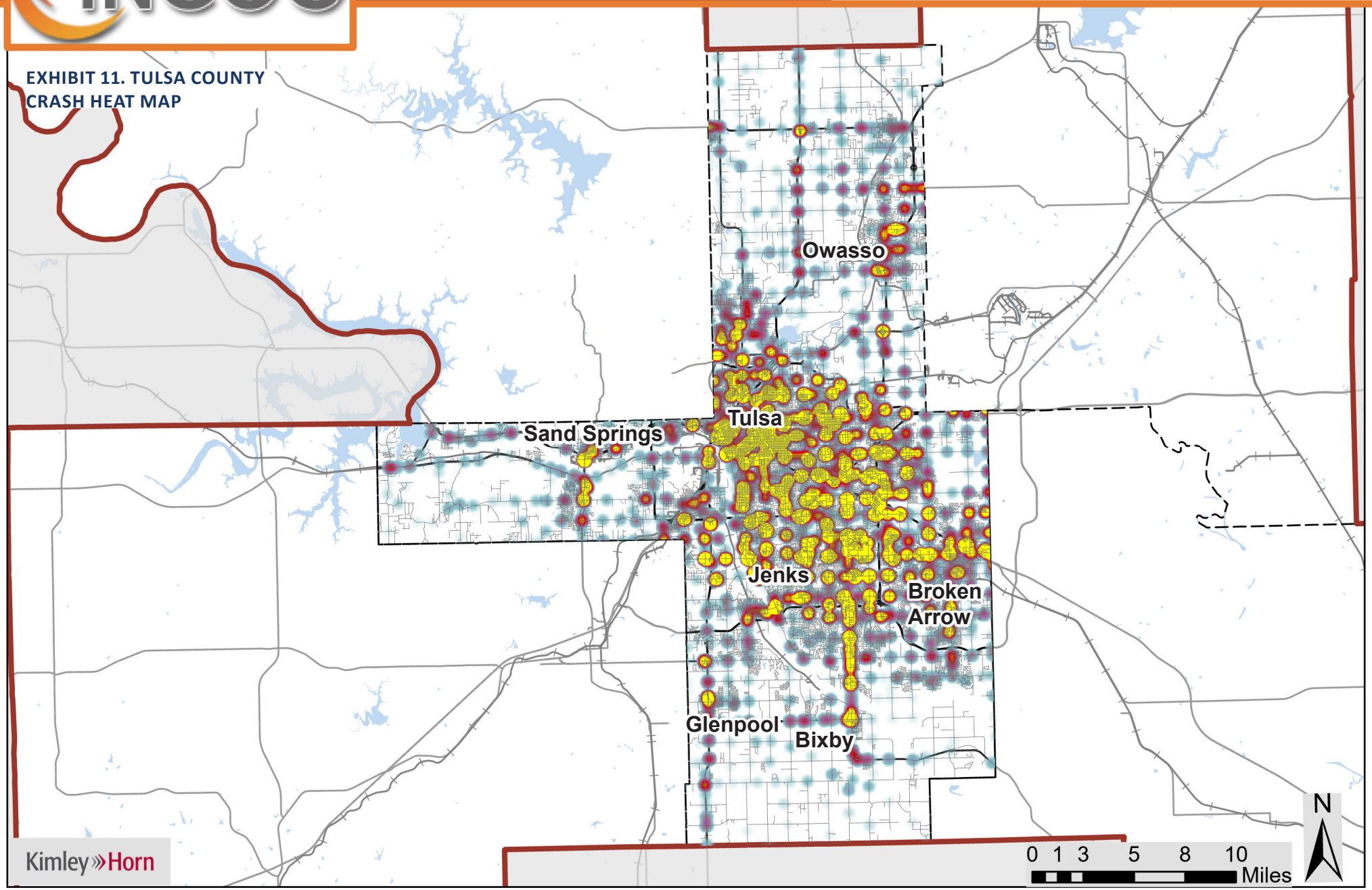
EXHIBIT 10. TULSA COUNTY CCR



INCOG Local Roads Safety Action Plan

Tulsa County Crash Heat Map

EXHIBIT 11. TULSA COUNTY CRASH HEAT MAP



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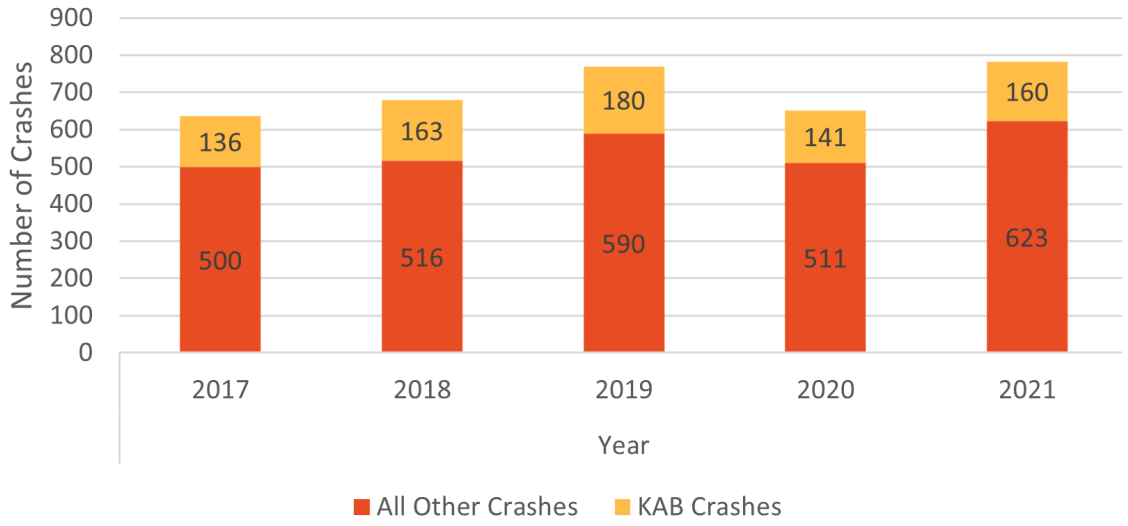
Wagoner County

Wagoner County's Critical Crash Rate Analysis identified five (5) segments for consideration from the High-Injury Network. These segments contain 45 KABs with a combined length of 4.6 miles. These segments contain a total of seven (7) fatal crashes, six (6) severe injury crashes, and 32 minor injury crashes. **Table 7** summarizes these 10 corridors and **Exhibit 12** displays their location.

FIGURE 12. WAGONER COUNTY CRASHES PER YEAR



**K – Fatal Crash; A – Serious Injury Crash; B – Minor Injury Crash*

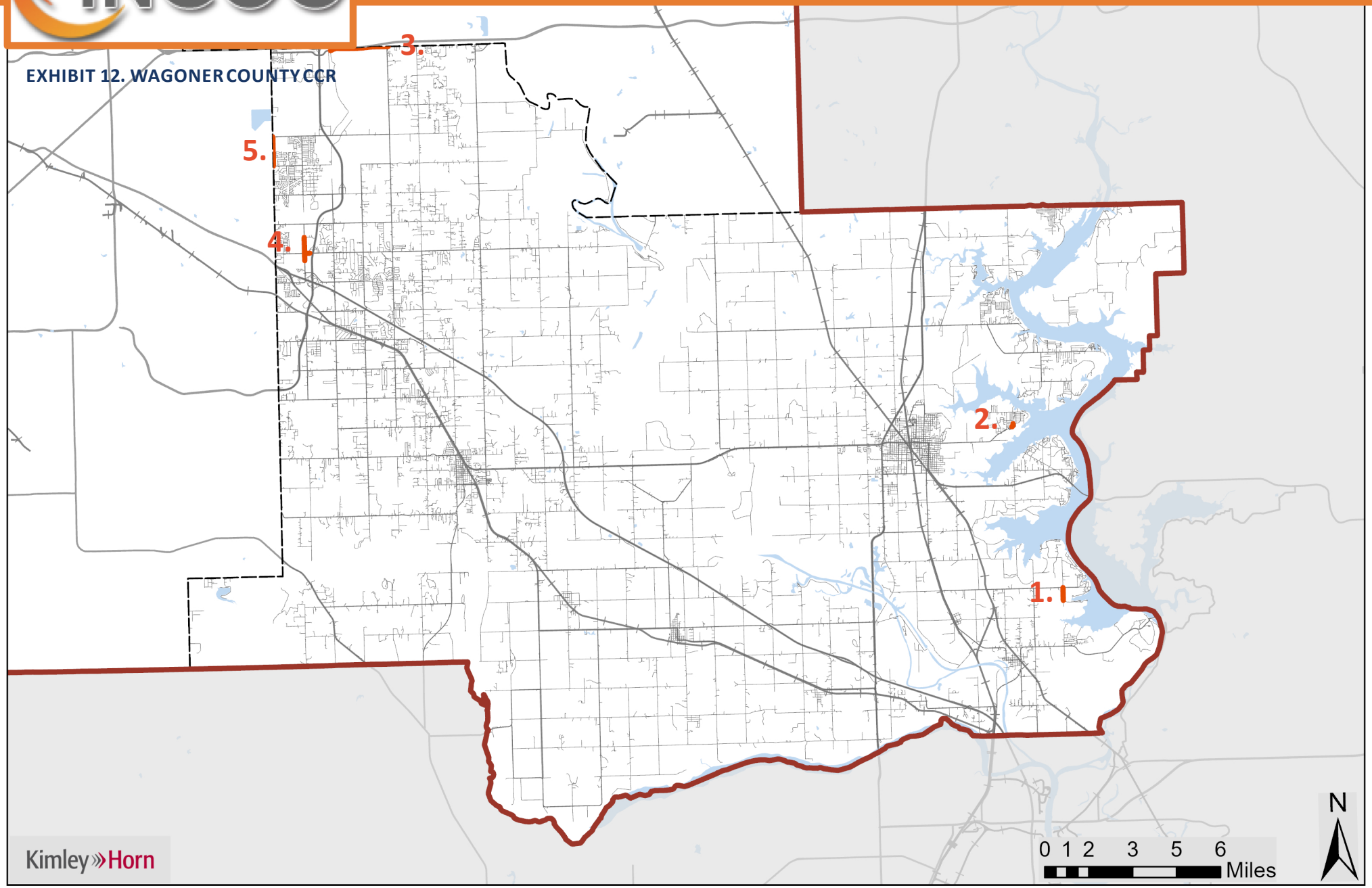
TABLE 7. WAGONER COUNTY TOP 5 CORRIDORS

	CORRIDOR NAME	ORIGIN	ENDING	LENGTH (MI.)	TOTAL KABS	CRITICAL CRASH RATE RATIO
1	N 55th St E	E 100th St N	Wahoo Bay Rd	0.45	2	18.6
2	Toppers Rd	Clay Rd	E 724 Rd	0.14	1	11.7
3	E Admiral Pl	E 11th St	S 257 E Ave	2	2	6.8
4	N 37th St/E Kenosha St Intersection	–	–	1	1	5.7
5	County Line Rd	E 31st St	E 41st St S	1	1	4.6
			TOTAL MILES	***4.59***	**7**	

INCOG Local Roads Safety Action Plan

Wagoner County CCR

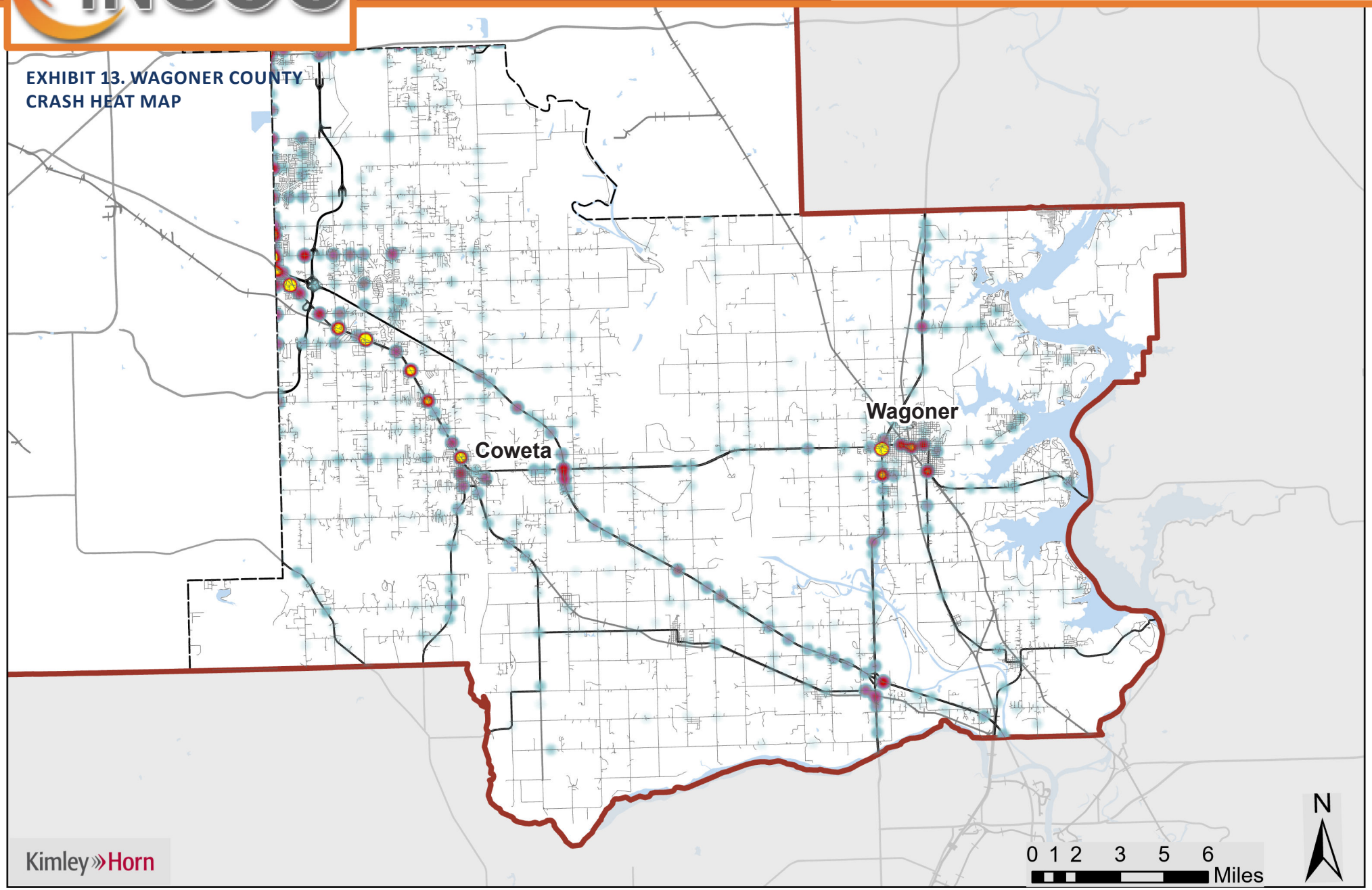
EXHIBIT 12. WAGONER COUNTY CCR



INCOG Local Roads Safety Action Plan

Wagoner County Crash Heat Map

EXHIBIT 13. WAGONER COUNTY CRASH HEAT MAP



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CHAPTER 3

COUNTERMEASURES

Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

CHAPTER 3: COUNTERMEASURES

This chapter introduces a Systemic Countermeasure Toolbox, featuring a range of roadway safety measures that can be applied beyond the selected corridors into every project opportunity that presents itself as a means to enhance overall safety. Each subsection details individual countermeasures with a brief description of their applicability and provides some guidance for appropriate deployment.

SYSTEMIC COUNTERMEASURES

This section of the LRSAP describes systemic countermeasures that can be implemented across the INCOG region to enhance safety. Preference will be given to roadways and intersections along the HIN and areas of greatest need identified within the equity analysis.

A countermeasure toolbox is an extensive list of countermeasures and improvements designed to address specific traffic safety issues. INCOG will be equipped with a range of options and resources to improve safety and effectively enhance roadway performance. The systemic countermeasure toolbox is outlined in the table below, with each countermeasure assigned a corresponding Crash Modification Factor (CMF). The CMF represents the expected ratio of crashes after implementing the countermeasure. These values are sourced from the CMF Clearinghouse, a national resource that compiles reliable studies, educates users and supports research to enhance the accuracy of CMF assignments. This list provides deployable countermeasures for the crash types and design contexts within the INCOG Region, but other treatments may be utilized for specific projects or specific locations.

INCOG will be equipped with a range of options and resources to improve safety and effectively enhance roadway performance.

TABLE 8. COUNTERMEASURES SUMMARY

COUNTERMEASURES	CMF	CONTEXT (URBAN/RURAL)
Raised Medians	0.29	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
Roundabouts	0.59	Both
SafetyEdge^{SM}	0.591	Rural
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
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
Bike Facilities	–	Urban
Curb Extensions	–	Urban
Add New Paved Shoulder	0.67	Rural

Raised Medians

A raised median is a physical barrier or divider in the center portion of the roadway that separates opposing lanes of traffic on a roadway. Raised medians have a functional and aesthetic value. They are 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. Most useful on high volume, speed, and driveway density roads. Installing a raised median has a CMF of 0.29.

FIGURE 13. RAISED MEDIANS

Source: INCOG –Riverside Drive, Tulsa, OK

Rectangular Rapid Flashing Beacon (RRFB)

An RRFB is a pedestrian-activated safety device installed at crosswalks to enhance visibility and alert drivers to the presence of pedestrians. RRFBs consist of two, rectangular-shaped yellow indicators, each with a light emitting diode (LED)-array-based light source. When activated 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. They are most effective at multi-lane crossings with posted speeds below 40 miph. Additionally, RRFB's should be installed at the median of the roadway if there is a pedestrian refuge or other type of median already present. 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.

FIGURE 14. RECTANGULAR RAPID FLASHING BEACON (RRFB)

Source: Adobe Stock

FIGURE 15. PEDESTRIAN REFUGE ISLANDS

Source: Adobe Stock

Pedestrian Refuge Islands

Pedestrian Refuge Islands are dedicated pedestrian "islands" in the middle of intersections that provide a safe place for vulnerable road users to stop when crossing a large and busy intersection. They 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.

FIGURE 16. MIDBLOCK CROSSINGS

Source: FHWA

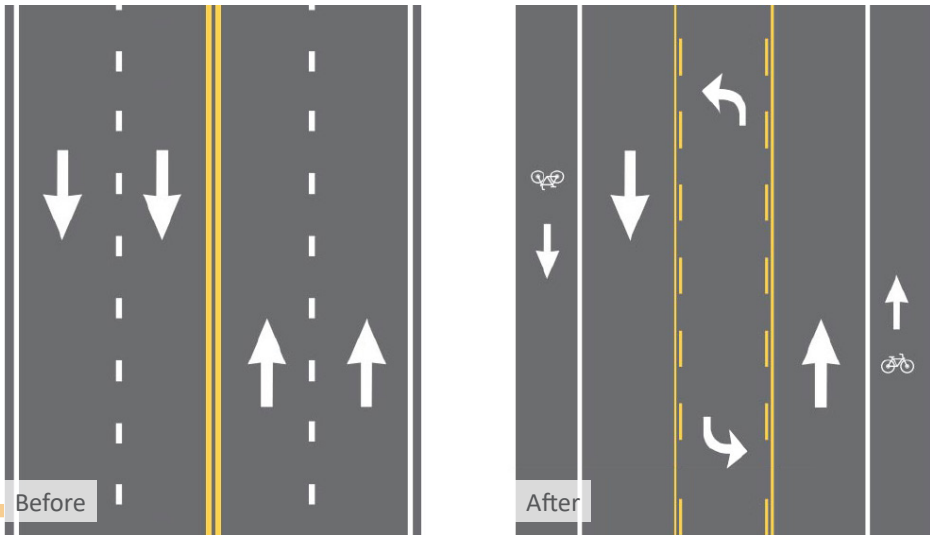
Midblock Crossings

Designated pedestrian crossings away from an intersection. An 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 by alerting drivers to pedestrian crossings and encouraging pedestrians to use dedicated crossing points. These treatments should be implemented at key locations where there are large expanses between pedestrian crossings at intersections. This countermeasure can be paired with other countermeasures in this toolbox to increase impact. Installing Midblock Crossings has a CMF of 0.45.

Roadway Reconfiguration

A Roadway Reconfiguration typically involves converting an existing four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a center two-way left turn lane. Implementing a roadway reconfiguration can improve safety, calm traffic, and provide better mobility and access for all users. Opportunity to repurpose the existing ROW, giving an opportunity to improve mobility by making space for the addition of bike lanes or shared-use paths. Additionally, with the inclusion of a center turn lane, rear-end crashes can be greatly reduced due to the removal of conflict points during turning movements and through traffic. In the context of a 4-lane to 3-lane reconfiguration, a road segment can experience up to a 47% reduction in total crashes.

FIGURE 17. ROADWAY RECONFIGURATION



Source: FHWA

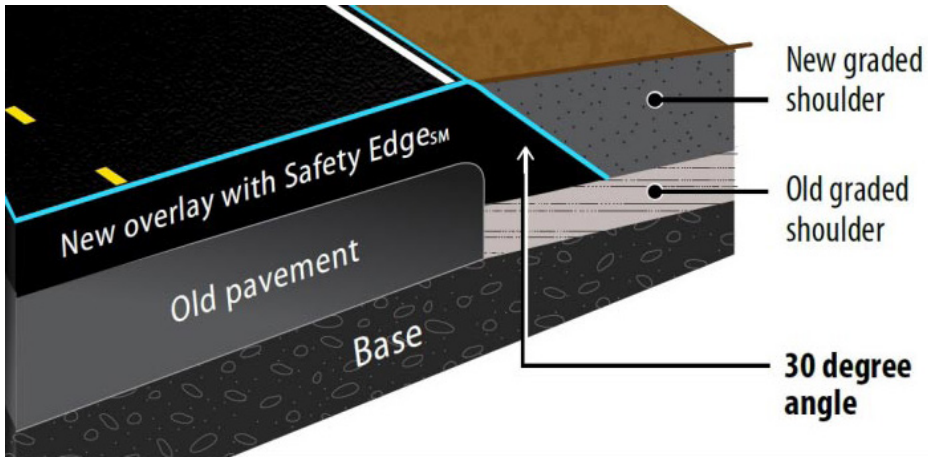
Roundabouts

Intersection with a circular configuration that safely and efficiently moves traffic around a central island. Vehicles entering a roundabout must yield to traffic already circulating within, promoting a smooth and efficient flow of traffic. Roundabouts are designed to reduce vehicle speeds, establish clear right-of-way, and minimize conflict points while contributing to a better flow of traffic and reduced congestion. Crash severities are typically decreased due to a natural decrease in speeds. Roundabouts lead to a 78-82% reduction in fatal and injury crashes.

FIGURE 18. ROUNDABOUTS

Source: INCOG – Roundabout at Aquarium Drive, E 101st Street, and E 7th Street, Jenks, OK

FIGURE 19. SAFETYEDGE[SM]



Source: FHWA

SafetyEdge[SM]

A SafetyEdge[SM] is a low-cost treatment implemented in conjunction with pavement resurfacing to minimize drop-off-related crashes. This countermeasure is typically implemented on rural highways and can be categorized as a shoulder treatment. SafetyEdge[SM] can provide drivers with the opportunity to return to their travel lane while maintaining control of their vehicle. Safety benefits of this treatment include an 11% reduction in fatal and injury crashes, a 21% reduction in run-off-road crashes, and a 19% reduction in head-on crashes.

FIGURE 20. SIDEWALKS

Source: INCOG – Reconciliation Way and MLK Boulevard, Tulsa, OK

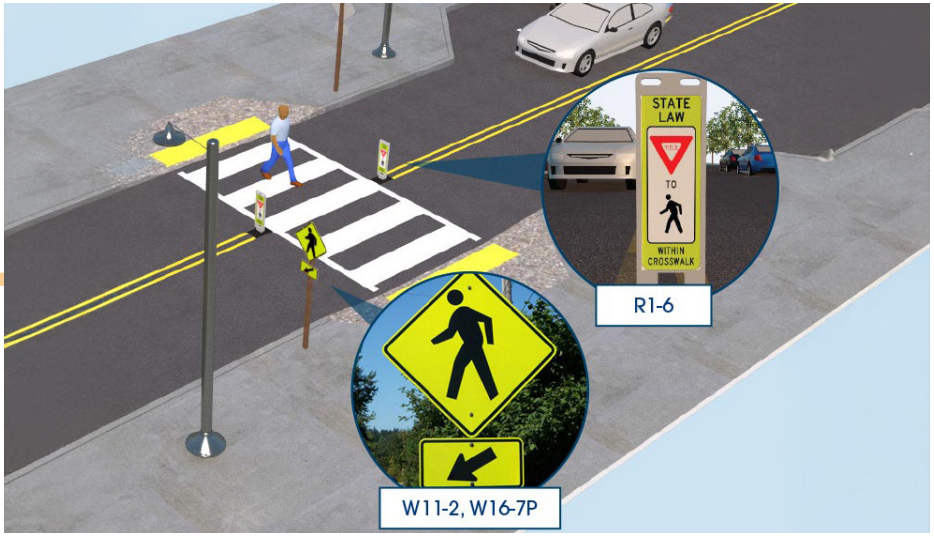
Sidewalks

A defined space or pathway for use by a person traveling by foot or using a wheelchair. Sidewalks provide a safe and separate space for pedestrians of all ages and abilities. They improve the safety and mobility of pedestrians by increasing separation, reducing the risk of collision with vehicles, and promoting walking as a mode of transportation by increasing comfortability. Sidewalks can reduce pedestrian crashes by as much as 50%. In the INCOG region there are 500 miles of sidewalks, yet many communities experience gaps in sidewalk network connectivity.

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.

FIGURE 21. CROSSWALK VISIBILITY ENHANCEMENTS



Source: FHWA

Corridor Lighting

Fatal crashes during daylight and darkness are about equal, but the nighttime fatality rate is three times higher, even though only 25% of vehicle miles traveled (VMT) are at night. Higher speeds may prevent vehicles from stopping in time when hazards or changes appear 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%.

FIGURE 22. CORRIDOR LIGHTING

Source: Adobe Stock

FIGURE 23. RUMBLE STRIPS

Source: Adobe Stock

Rumble Strips

Rumble Strips improve traffic safety by alerting drivers when they leave the traveled way. When a driver strays from the travel lane, rumble strips produce a noise and vibration that alerts 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.

FIGURE 24. HIGH-CONTRAST LANE MARKINGS

Source: INCOG – Riverside Drive, Tulsa, OK

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.

Retroreflective Backplates

A backplate frames a signal head with a 1-to-3-inch yellow retroreflective border. It improves the signal head's visibility by introducing a controlled contrast background. Retroreflective backplates are also more visible and conspicuous in both daytime and nighttime conditions, which can assist with intersections, distracted driving, and impaired driving crashes. Installing retroreflective backplates has a CMF of 0.85. While this is a high CMF, deployment at a system-wide scale can be relatively inexpensive and can provide widespread benefits.

FIGURE 25. RETROREFLECTIVE BACKPLATES

Source: Adobe Stock

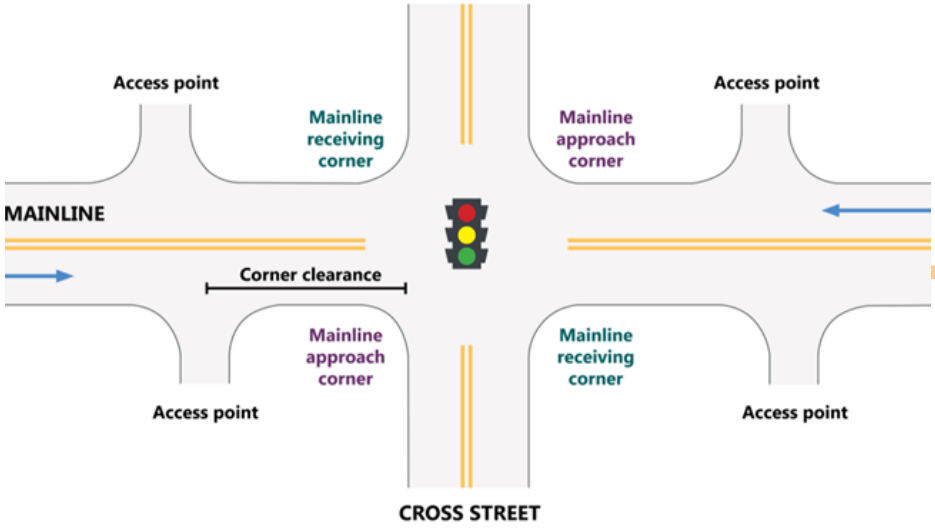
Appropriate Speed Limits

Using appropriate speed limits increases roadway safety by implementing speed limits that consider factors such as school/work zones, visibility, elevation changes, curves, congestion, and vulnerable road users. Implementing appropriate speed limits into street design increases roadway safety for all users. Speeding increases the fatality of all collisions, and this low-cost method of speed control reduces the danger of speed-related collisions. A pedestrian impacted by a vehicle traveling at 30 mph has a 45% chance of survival, with that percentage of survival decreasing exponentially as the speed of the vehicle increases. In the INCOG region 50% of trips are shorter than three (3) miles yet many city streets and county roads have excessively high speed limits endangers roadway users while not enhancing mobility.

FIGURE 26. APPROPRIATE SPEED LIMITS

Source: Adobe Stock

FIGURE 27. ACCESS MANAGEMENT



Source: FHWA

Access Management

Access Management involves the planning, implementation, and regulation of entry and exit locations along a roadway. Proper access management can improve safety for all travel modes and roadway users by limiting points of collision and improving traffic congestion. Safety benefits include a 25% to 31% reduction in fatal and injury crashes along urban/suburban arterials.

FIGURE 28. SPEED FEEDBACK SIGNS

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, visually indicating the speed of approaching vehicles or a warning message. The 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.

Wider Edge Lines

Edge lines are the pavement markings at the edge of travel lanes, 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 width of 4 inches to the maximum normal width of 6 inches. Wider edge lines are an effective, low-cost method of increasing traffic safety by improving travel lane visibility. They can reduce crashes by up to 22% for fatal and injury crashes on rural freeways.

FIGURE 29. WIDER EDGE LINES

Source: FHWA

BIKE FACILITIES

Bike facility improvements include Bike Lanes, Bicycle Boulevards, Signed Bicycle Routes, and Side Paths. Bike facilities provide cyclists with a designated roadway area to ride, improving safety by reducing conflict points between cyclists and motorists, while encouraging multimodal transportation. The expected reduction in crashes varies widely by facility type and by degree of separation. Generally, a greater speed difference between vehicles and bicycles requires a higher level of separation.

FIGURE 30. BIKE FACILITIES

Source: Adobe Stock

FIGURE 31. CURB EXTENSIONS

Source: INCOG – W 22nd Street and S Nogales Avenue, Tulsa OK

Curb Extensions

Curb Extensions visually and physically narrow the roadway, creating a safer and shorter pedestrian crossing while increasing the available space for pedestrians or other amenities. They also help with speed reductions and increased safety. There is currently no CMF for Curb Extensions.

FIGURE 32. ROADWAY SHOULDER

Source: FHWA

Paved Shoulders on 2-Lane Arterials

Paved shoulders on two-lane rural arterials are critical for improving safety, providing space for disabled vehicles, and reducing run-off-road crashes, which are a leading cause of severe injuries and fatalities. They also enhance mobility for bicyclists and agricultural equipment, which are common in rural areas within INCOG's region. Additionally, shoulders contribute to roadway longevity by protecting pavement edges from deterioration.

CHAPTER 4

IMPLEMENTATION PLAN

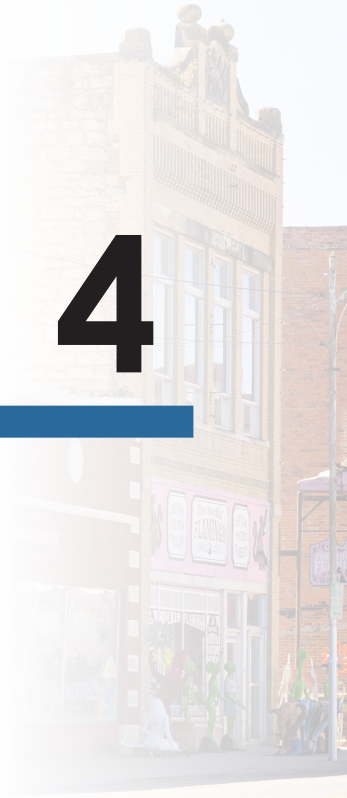


Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

CHAPTER 4: IMPLEMENTATION PLAN

INTRODUCTION

> ***This LRSAP provides an opportunity to amplify elements that support a safer system and suggest new actions, policies, and procedures that are currently missing or could benefit from updates based on the state of the practice.***

While infrastructure investments are vital to eliminating future severe and fatal injury crashes, a Safe System Approach also recognizes how engineering, enforcement, and education decisions are an outcome of planning, design, and policy guidelines in place when the decisions are made. This LRSAP provides an opportunity to amplify elements that support a safer system and suggest new actions, policies, and procedures that are currently missing or could benefit from updates based on the state of the practice.

This section outlines recommended actions that build on previous planning efforts to address current challenges, optimize performance for both new and existing roadway projects, and align with best practices. Some recommendations reflect proposed changes to policies and standards related to sidewalk infrastructure and other active transportation investments to ensure connected continuous facilities. Other recommendations explore code or program incentives that support the adoption of active transportation by making it more convenient for residents to bike or walk as part of their daily routines.

These recommendations will require a concerted and ongoing effort that may include new partners, such as the city or county governments, to review and adjust elements of their policies that impact traffic safety and transportation infrastructure. Next steps toward success will require ongoing coordination between INCOG, its partner jurisdictions, and development of more detailed steps to achieve the actions below. Together, these policy and regulatory updates will enhance INCOG's efforts to achieve Vision Zero by creating a safer and more supportive environment for all active transportation modes.

To enhance the safety and accessibility of INCOG's roadways in alignment with Vision Zero, it is crucial to evaluate the impact of infrastructure projects on vulnerable populations and health outcomes over time. If evaluation efforts show that positive health and safety outcomes are not spread equitably across diverse community groups such as low-income residents, seniors, people of color, and individuals with disabilities, adjustments to implementation should be made.

The actions in the following tables amplify or recommend changes to actions documented in other INCOG plans and draw from best practices within each pillar. In total, 38 actions are recommended across the five (5) pillars. It is imporant to note that the cost that is estimated to be associated with each action can vary widely depending on the action category, which may include procedural, operational, construction, or policy recommendations. Additionally, timeframes include Short (0-2 years), Medium (2-5 years), and Long (> 5 years).

THE FIVE PILLARS

ACTION MATRIX

TABLE 9. SAFER PEOPLE ACTION MATRIX

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SP1	Launch public workshops, events, and campaigns: 1. Promoting safe driving and road use. 2. Promoting courtesy towards pedestrians and bicyclists. 3. On dangers of distracted driving. 4. Reducing aggressive driving. Use targeted messaging via social/local media; partner with local organizations to share educational materials. This could build on Travel with Care and other campaigns.	INCOG, Local Governments	Local Governments, School Districts, ODOT, Law Enforcement, Tribal Governments, Advocacy Organizations	Mid-Term	Medium
SP2	Launch public education initiatives on correct usage of new traffic facilities (bike lanes, HAWK signals, midblock crosswalks, roundabouts, etc.)	INCOG, Local Governments	Local Governments, School Districts, Law Enforcement, ODOT, Tribal Governments	Short-Term	Low
SP3	Promote school and workplace education programs that encourage responsible driving behaviors and transportation safety. Consider incentives for responsible driving. (Incentives could also be combined with TDM efforts in #SP8.)	INCOG	School Districts, Law Enforcement, Department of Labor, Chamber of Commerce	Short-Term	Low-Medium
SP4	Coordinate with school districts to create Safe Routes to School (SRTS) programs that improve pedestrian routes with crosswalks, lighting, and sidewalks.	INCOG or School Districts	Local Governments, Law Enforcement, Tribal Governments, ODOT	Mid-Term	Medium
SP5	Enhance enforcement of speeding, red-light running, reckless driving with targeted patrols, prioritizing high-injury network corridors.	Law Enforcement		Short-Term	Low
SP6	Conduct training for law enforcement on pedestrian and bicycling laws to ensure accurate understanding and enforcement.	Law Enforcement	INCOG, ODOT	Short-Term	Low
SP7	Improve pedestrian and bicyclist safety infrastructure around public transit stops.	INCOG	Local Governments, MTTA, INCOG, ODOT, Tribal Governments	Mid-Term	Medium
SP8	Promote Transportation Demand Management (TDM) to improve road safety by reducing Vehicle Miles Traveled (VMT) and lowering traffic risks.	INCOG	Local Governments, ODOT, Tribal Governments	Mid-Term	Medium
SP9	Continue to engage local governments, community organizations, and Tribal Governments in decision-making to build trust and cultivate safety champions across agencies.	INCOG	Local Governments, INCOG, Tribal Governments	Short-Term	Low

TABLE 9. SAFER PEOPLE ACTION MATRIX (CONTINUED)

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SP10	Provide opportunities for staff to attend Safe System, Vision Zero, and other safety-related webinars, trainings, and conferences. Invite elected officials and key decision-makers to participate in these educational opportunities as well.	INCOG	Local Governments, INCOG, Tribal Governments	Short-Term	Low
SP11	Ensure that relevant staff—including engineers, planners, communications, police, and others—receive ongoing safety training to effectively implement the Safety Action Plan at all levels.	INCOG	Local Governments, INCOG, Tribal Governments	Short-Term	Low
SP12	Conduct an annual review of traffic crash data, safety metrics, and progress toward completed safety projects. Make this report accessible to the public.	INCOG	Local Governments, INCOG, Tribal Governments	Short-Term	Low

TABLE 10. SAFER SPEEDS ACTION MATRIX

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SS1	Implement Vulnerable Road User (VRU) safety countermeasures, focusing on mode separation and infrastructure improvements such as sidewalks, protected bike facilities, safe crossings, and speed management along high-crash intersections and corridors.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Ongoing	Varies
SS2	Use radar speed feedback signs at high crash locations to discourage speeding and rotate periodically to prevent driver desensitization.	Local Governments	INCOG, School Districts, Local Governments, ODOT, Tribal Governments	Short-Term	Low
SS3	Advocate for a statewide legislative framework to allow for speed enforcement cameras, aligning with best practices from other states to enhance safety, reduce speeding, and improve compliance. Ensure they are used fairly, transparently, and with a clear focus on safety—not revenue. Prioritize implementation in areas with pedestrians, especially near schools.	Coalition of Tulsa Area Governments	Local Governments, School Districts, INCOG	Short-Term	Low
SS4	Deploy flashing stop and warning signs at critical locations.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Short-Term	Medium
SS5	Introduce traffic calming and speed reduction measures on High-Injury Network segments, areas where highway ramps lead directly onto neighborhood (25 mph) streets and at high-pedestrian areas (i.e., parks, schools, downtown). Prioritize low-cost but permanent countermeasures.	Local Governments	INCOG, Tribal Governments	Mid-Term	Medium
SS6	Utilize the Safe System Approach to setting speed limits.	ODOT	Coalition of Tulsa Area Governments, INCOG, Tribal Governments	Short-Term	Low
SS7	Establish incentive programs to reduce and eliminate speeding, such as registration fee reductions, tax rebates, toll discounts, etc. Consider partnering with insurance companies to offer lower premiums for drivers with clean records or participation in safe-driving programs.	ODOT	Local governments, OTA, OTC, Tribal Governments; INCOG	Mid-Term	Low

TABLE 11. SAFER ROADS ACTION MATRIX

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SR1	Evaluate the High-Injury Network for locations to install proven safety countermeasures that prevent fatal and severe injury crashes for all roadway users.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Ongoing	Medium
SR2	Develop regional safety treatment design and implementation guidelines for agencies to ensure consistent facility design accommodating all users.	INCOG	Local governments, Tribal Governments	Mid-Term	Medium
SR3	Prioritize vulnerable road user safety improvements in underserved communities where infrastructure does not support safe walking and biking.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Short-Term	Medium
SR4	To improve roadway safety, use low-cost systemic countermeasures such as pavement markings, high-visibility backplates, lighting, and updated signage.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Short-Term	Low
SR5	Expand protected or separated bike lanes and pedestrian infrastructure to enhance the comfort and safety of vulnerable road users. Conduct community engagement to address concerns and gather input before constructing separated bike projects.	Local Governments	INCOG, Local Governments, ODOT, Tribal Governments	Mid-Term	Medium
SR6	Determine which specific countermeasures provided in the systemic countermeasures toolbox enhance safety for all roadway users and provide guidance on their specific applications within the INCOG Region.	INCOG	Local Governments, ODOT, Tribal Governments	Mid-Term	Low
SR7	Improve bike route connectivity and wayfinding, particularly in downtown areas and along primary arterials, to create a more intuitive, comfortable, and safe cycling network.	Local Governments	INCOG, ODOT	Long-Term	Medium
SR8	Leverage road maintenance prioritization processes to implement low-cost treatments, such as restriping lane widths or improving crosswalk visibility, to encourage safer behaviors, reduce speeds, and minimize hazards.	Local Governments	Local Governments, ODOT, Tribal Governments	Short-Term	Low

TABLE 11. SAFER ROADS ACTION MATRIX (CONTINUED)

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SR9	Conduct regular Road Safety Audits on High-Injury Network corridors to identify appropriate crash countermeasures and prioritize improvements.	INCOG	Local Governments, County Governments, Tribal Governments	Mid-Term	Medium
SR10	Implement a Complete Streets policy and network and adopt transportation planning methodologies (data-driven analysis, public engagement, cost-benefit analysis, etc.) and prioritization processes that support a safe and comfortable multi-modal network.	INCOG	Local Governments, County Governments, Tribal Governments	Short-Term	Low
SR11	Prioritize safety criteria in local funding decision-making processes. Use the High-Injury Network to prioritize roadway construction projects that include safety countermeasures and complete streets design elements.	INCOG	Local Governments, County Governments, Tribal Governments, ODOT	Short-Term	Medium
SR12	Establish a committee that conducts a crash review and roadway audit within 48 hours after a fatal crash to understand what went wrong and how to prevent future fatal and serious injuries at that location.	INCOG	Local Governments, County Governments, Tribal Governments, ODOT	Short-Term	Low

TABLE 12. SAFER VEHICLES ACTION MATRIX

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
SV1	Promote vehicle maintenance awareness programs to ensure residents keep vehicles in safe operating condition (especially brakes, tires, lights, and mirrors)	INCOG	Local Governments, County Governments, Tribal Governments	Short-Term	Low
SV2	Educate the public about the dangers of oversized and high-profile vehicles (such as trucks and SUVs) and encourage safer driving habits for operators of these vehicles.	INCOG	Local Governments, County Governments, Tribal Governments	Short-Term	Low
SV3	Encourage fleet operators to invest in vehicles equipped with modern safety features, such as lane departure warning, automatic emergency braking, blind spot sensors, and pedestrian detection technology.	Local Governments	County Governments, Tribal Governments, Local Businesses	Long-Term	High
SV4	Equip municipal vehicles with side underride guards to prevent pedestrians, cyclists, and motorcyclists from being pulled under the wheels, reducing severe injury.	Local Governments	Local Governments, County Governments, Tribal Governments	Mid-Term	High

TABLE 13. POST-CRASH CARE ACTION MATRIX

	ACTION	LEAD AGENCY	PARTNERS	TIMEFRAME	COST
PC1	Improve emergency response times by optimizing traffic signal preemption for emergency vehicles.	Local Governments	INCOG, County Governments, Tribal Governments	Mid-Term	Medium
PC2	Conduct regular training for first responders on the latest crash response protocols and quick clearance strategies and foster interagency coordination to improve response times and reduce roadway congestion after incidents.	Local Governments	INCOG, County Governments, Tribal Governments	Short-Term	Low
PC3	Provide education to Law Enforcement on crash data recording and its importance to investment prioritization. Improve crash data collection and data quality on crashes and injuries to better understand trends and refine safety initiatives.	Local Governments	INCOG, County Governments, ODOT, Tribal Governments	Short-Term	Low
PC4	Establish a city-backed counseling program to assist victims and witnesses in coping with trauma, PTSD, and recovery challenges.	Local Governments	County Governments, Tribal Governments, Local Businesses	Mid-Term	Medium

PLAN ADMINISTRATION

INCOG and its partners are responsible for administering the Plan. INCOG Staff will oversee the day-to-day implementation, monitoring, and amendments of the Plan. This section details the administration activities. INCOG should work to integrate the above recommendations into their work plans with more specific next steps and responsible parties.

INCOG Transportation Planning Program

Through the Safe System Approach, the Transportation Planning Program will primarily oversee the administration and annual updates to the INCOG Board of Directors.

INCOG Board of Directors

The INCOG Board of Directors will play a pivotal role by providing continuous guidance and direction to staff and other boards and commissions and making decisions on budget allocations and regulatory modifications as specified in the Implementation Plan.

Other Boards, Committees, and Commissions

Various INCOG boards, committees, and commissions are designated to review and guide specific initiatives. They will play a crucial role in implementing the recommendations in the Implementation Plan that align with their focus areas.

LRSAP Advisory Committee and Other Partners

The LRSAP AC plays a crucial role in implementation by overseeing the plan's actions and initiatives to ensure goals are met efficiently and effectively. The committee provides continuous guidance, supports implementing agencies, monitors progress, and adjusts for emerging challenges. Additionally, the LRSAP AC fosters collaboration among stakeholders—including residents, regional entities, and external departments—facilitates communication and promotes community engagement to maintain momentum and accountability. Within the INCOG region, County and City governments will also assist in advancing the goals of the LRSAP. Their participation in the Implementation Plan will assist INCOG with specific actions and accomplish actions that INCOG jurisdiction limits.

Amending the Plan

INCOG's LRSAP reflects a specific point in time, anticipating adjustments as the region evolves. To ensure the long-term viability of the vision, the implementation approach must be flexible and responsive to changing crash patterns. The Transportation Planning Program will deliver annual updates to the INCOG Board of Directors on the progress of the Implementation Plan, including adjustments to the High-Injury Network as trends shift. Additionally, a comprehensive review and update of the Plan should occur every five years to stay aligned with these trends as new data arises and reassess the relevance of the action plan strategies.

TABLE 14. PLAN UPDATES AND TIMEFRAMES

PLAN UPDATE LEVEL	RECOMMENDED FREQUENCY	APPROVED BY
Minor Revision *Text or wording changes, not affecting recommendations*	As Needed	LRSAP Advisory Committee
Major Revision *Any change substantively changing a recommendation*	As Needed	LRSAP Advisory Committee
LRSAP Implementation Progress Report	Annually	INCOG Board of Directors
Full Plan Update	Every Five Years	INCOG Board of Directors

Lessons Learned

The completed plan provides a solid foundation and sound framework for addressing key issues; however, through its development, the Planning Team identified a few scope limitations, methodological challenges, and additional topics worth exploring in greater depth. These insights serve as valuable lessons learned that can guide refinements and expanded focus areas in the next five-year update. The following components are recommended inclusions for INCOG's consideration for the next LRSAP update:

- Existing Conditions Maps to set the stage for the crash analysis task.
- Crash History Maps that identify locations for a variety of topics including but not limited to Contributing Factors, Severities, and Crash Types.
- The development of Crash Profiles that provide an analysis of combinations of environmental and design characteristics that yield the highest densities and severities of crashes throughout the INCOG Region. This analysis will equip INCOG with the knowledge of specific roadway characteristics that need to be reevaluated on future safety projects and can create a better focus when deploying safety countermeasures from the toolbox.
- An approach of High-Injury Network development that separates analysis and compares roadways by County. The vast differences in roadway design were greatly illuminated, as each county is experiencing significantly different traffic safety issues. Analyzing each county independently will allow for a more even distribution of roadway segments to focus on at a regional scale.

- The identification of specific roadway segments for further evaluation. INCOG should consider selecting key problematic segments to conduct Roadway Safety Audits which will yield targeted corridor recommendations to improve safety at key locations.
- Schematic Designs of selected Targeted Recommendations.
- Interactive Crash Dashboard. This publicly available dashboard will allow for a transparent display of crash data and HIN information.

While these additions can be incorporated into the next INCOG LRSAP Update, it is also recommended that individual cities undertake their own local Comprehensive Safety Action Plan processes to further focus on roadway safety issues within their jurisdictions. Given that this Plan identifies issues and recommendations at a regional scale, having community specific plans will empower municipalities to advance roadway safety and qualify for additional grand opportunities for implementation at a regional, state, and national scale.

FUTURE PROJECT PRIORITIZATION

The LRSAP also informs the prioritization of future projects that INCOG receives funding applications for. The LRSAP Planning Team reviewed a few scoring criteria to identify ways to incorporate traffic safety and advance the goals of the LRSAP through future projects. Revamping the project selection and funding process is critical to ensuring that transportation investments align with the goals of the LRSAP, prioritizing safety and equity in roadway improvements. By refining the scoring criteria, INCOG can more effectively allocate resources to projects with the greatest potential to reduce fatal and serious injury crashes. A key adjustment involves removing Property Damage Only (PDO) crashes from consideration, as Vision Zero emphasizes the prevention of severe crashes rather than minor incidents. Including PDO crashes may skew data and lead to inequitable outcomes, as reporting inconsistencies exist across jurisdictions, particularly in lower-income and rural areas. Additionally, ensuring that projects from smaller and rural areas remain competitive is essential, as these communities often face unique safety challenges despite having fewer miles in the High-Injury Network.

To strengthen the objectivity and effectiveness of the scoring process, INCOG should assign higher points to projects with the most effective CMFs, as these interventions have been proven to yield significant safety improvements. A combination of this methodology can also be yielded when considering the costs associated with each countermeasure and some projects with lower CMFs, but a lower cost and widespread effectiveness can also be considered. Consideration should also be given to multijurisdictional projects, as they often have a broader regional impact and require collaboration across agencies, making them more complex yet highly valuable. However, even while this document does provide guidance on improving roadway safety for new projects, no higher priority should be given on the merits of whether the roadway design elements are entirely new, or maintaining proven safety countermeasures. INCOG should formally adopt these scoring adjustments through a transparent review and approval process, engaging stakeholders to build consensus. By refining the selection criteria based on data-driven safety priorities, and objective evaluation methods, INCOG can ensure that funding decisions align with Vision Zero goals and effectively improve roadway safety for all users.

APPENDIX

Photo Location: Osage County, Oklahoma

Credit: Roberto - stock.adobe.com

A

Photo Location: Jenks, Oklahoma

Credit: 4kclips - stock.adobe.com

INCOG

APPENDIX A

LRSAP ADVISORY COMMITTEE

The Local Roads Safety Action Plan Advisory Committee (LRSAP AC) played a central role in guiding the planning process, fostering consensus, and taking ownership of the plan while offering essential feedback at key project milestones. The AC included first responders, ADA officials, city engineers, transit agencies, school districts, and tribal nations officials from across the region. LRSAP AC meetings were held on the following dates:

- **Meeting 1:** Kick-off and Goal Setting – July 11, 2024
- **Meeting 2:** Public Engagement Schedule and High-Injury Network Results – September 5, 2024
- **Meeting 3:** Transportation Equity Review, Policy Review, Process Changes – November 7, 2024
- **Meeting 4:** Draft Recommendations – February 6, 2025
- **Meeting 5:** Plan Adoption and Recognition of Advisory Committee Members – June 2025

Members of the LRSAP AC acted as advocates for the planning process and champions of the plan during its implementation. In the first LRSAP AC meeting, a mission statement was crafted to define the plan's purpose and reinforce a commitment to serving stakeholders and the broader community:

"We are committed to eliminating all traffic fatalities and serious injuries by embracing Vision Zero and following the Safe System Approach."

The LRSAP AC participated in various exercises, including a SWOT Analysis, HIN refinement, countermeasure prioritization, future INCOG Project Prioritization, and Implementation Plan refinement. The LRSAP AC also defined a target to reduce roadway fatalities and severe injuries. INCOG adopted this target and states, **"INCOG commits to reducing traffic fatalities and serious injuries by 50% by 2035."** Once the date is reached and the goal is accomplished, INCOG will reevaluate the target for refinement or establish a new target for future dates.

PUBLIC ENGAGEMENT

Public Engagement for the INCOG LRSAP included public events such as pop-up events, workshops, and online engagement. Support from the community plays an important role in the continued success and implementation of the Plan. Public Engagement involved residents, community leaders, and other key stakeholders to ensure the Plan accurately reflected the public's safety concerns.

Public Events

In-person public pop-up events and workshops were used to engage the public in the planning process. The pop-up events allowed residents to interact with the project team, understand the importance of safety in the Region, and share with residents how they can improve traffic safety in their communities. These events were held publicly to generate awareness about the Local Roads Safety Action Plan and Vision Zero.

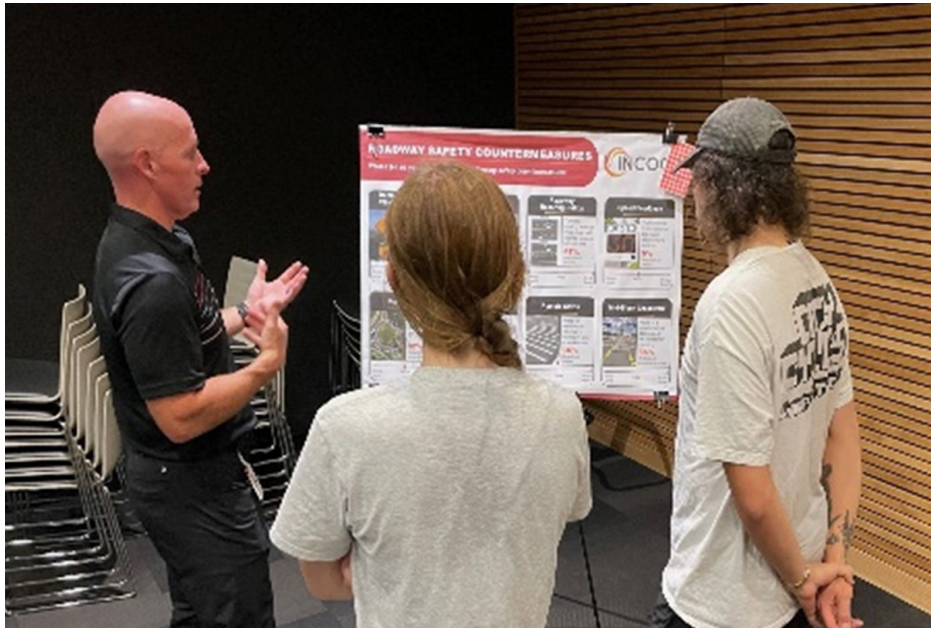
Public Pop-ups

Between October and December 2024, seven (7) public pop-ups were held to educate the community, raise awareness of the plan and its purpose, and receive feedback on the public's safety concerns. These pop-up events were held at local events such as the Tulsa Run, Safety Spooktacular, Shine on Greenwood, Tulsa Farmers Market, Skiatook Tree Lighting, and more. At these events, over six hundred (600) direct individual connections with the public were made, and five hundred (500) business cards with QR codes for the safety survey were handed out. **From these events, 25% of participants committed to Vision Zero.**

Team members interacted with the public at these events, gaining feedback on the public's thoughts on different safety countermeasures. Community members attending these pop-up events showed general interest in raised medians, separated bike lanes, roundabouts, and backplates with retroreflective boards.

FIGURE 33. POP-UP EVENT PARTICIPANTS

FIGURE 34. PHOTOS FROM PUBLIC WORKSHOPS



Public Workshops

Five (5) public workshops were held in late October. These workshops were geared at analyzing the Safety Analysis results, creating the High-Risk Network, and finding potential countermeasures. During these workshops, the project's team worked with attendees to analyze crashes by type to find targeted and systemic potential approaches grouped by emphasis area.

Tribal Nations Meetings

The INCOG LRSAP Study Area is completely encompassed within the Tribal Boundaries of three Nations: Cherokee, Osage, and Muscogee (Creek). Additionally, the Muscogee (Creek) and Cherokee Nations are currently undergoing their own Safety Action Plan processes. The INCOG LRSAP Planning Team conducted a series of meetings with each Tribal Nation to understand their unique safety concerns and share relevant information and data for the ongoing SAP processes. For both the Cherokee and Muscogee Nations' independent Safety Action Plans, the INCOG High-Injury Network will serve as a valuable resource in guiding their HIN development efforts.

INCOG Technical & Policy Committees

Throughout the project, Kimley-Horn and INCOG Staff provided periodical updates to the INCOG Technical & Policy Committees. These updates included public engagement, safety analysis, and the Draft Plan. These committees also participated during the comment period before the Plan was taken to the Board of Directors for approval.

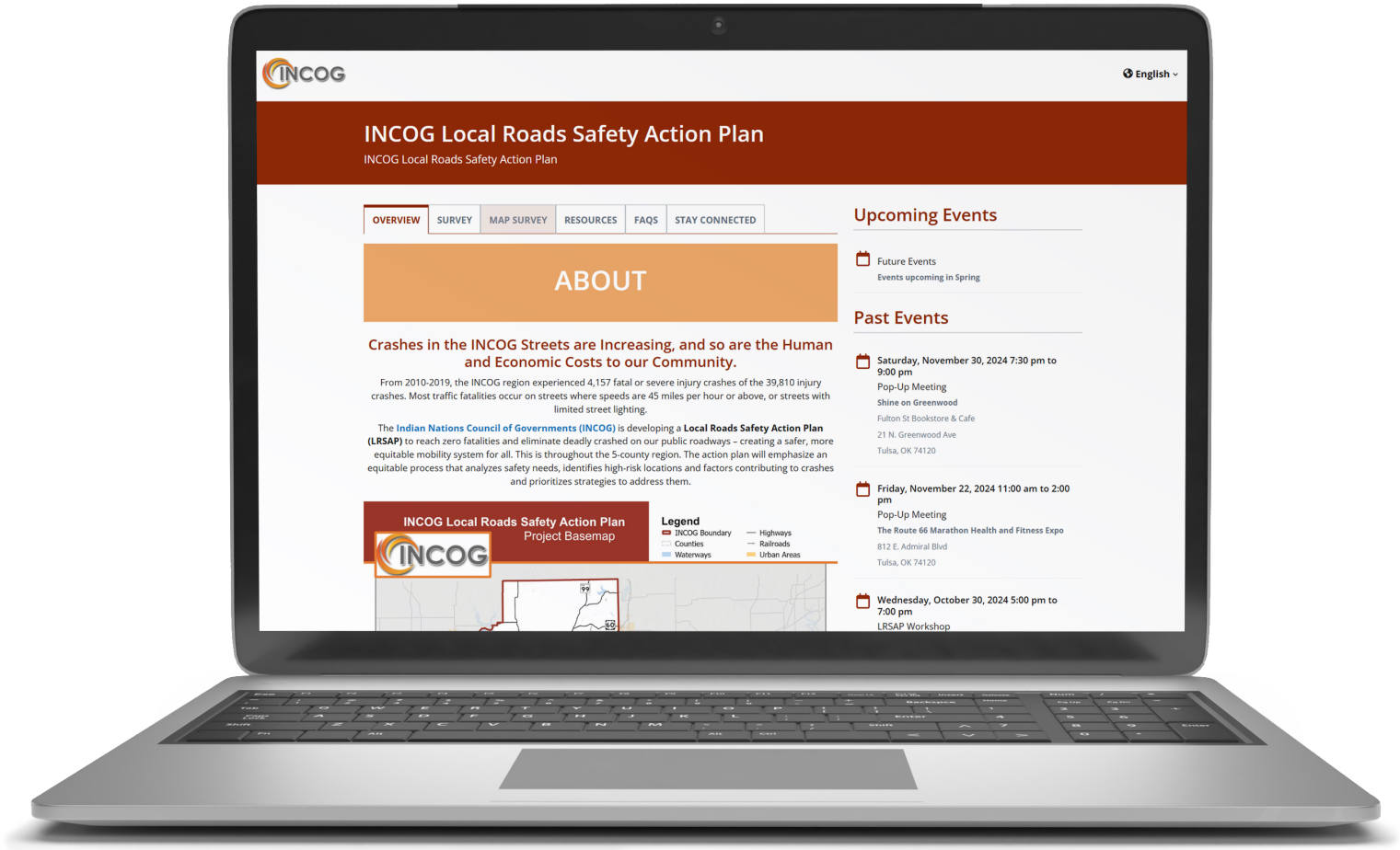
Public Hearing (INCOG Board of Directors)

At the conclusion of the process, the Plan was presented to the INCOG Board of Directors for their approval and adoption. This meeting was held on June 17th.

Online Engagement

Social Pinpoint was used throughout the Plan's development serving as a central online hub for information. The project website contained information on upcoming events, links to surveys and other helpful information, contact information, FAQs, and the Plan itself. These online surveys provided members of the community an opportunity to provide input on safety in the region. This effort received helpful feedback from both residents and stakeholders in the region.

FIGURE 35. PROJECT WEBSITE LANDING PAGE

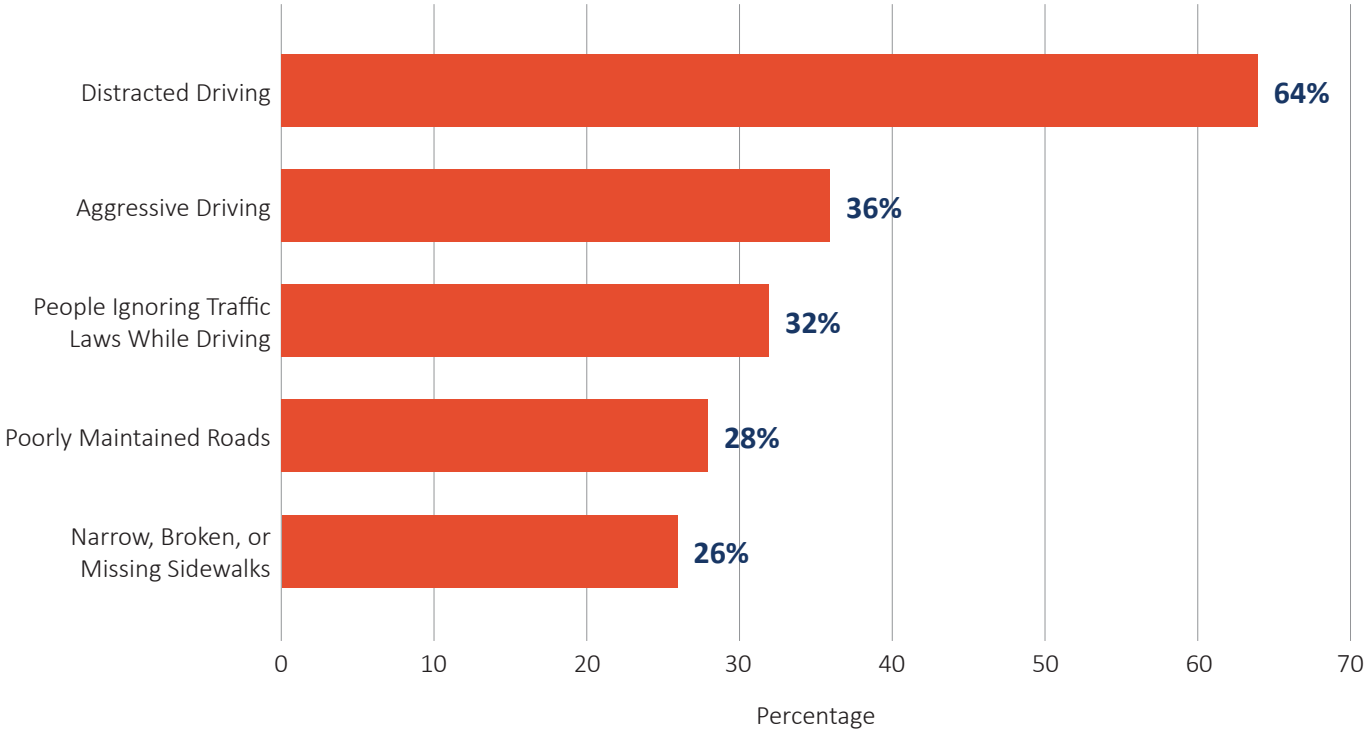


Written Survey

The written safety survey aimed at gathering information on demographics, commute, mode choice, and roadway safety concerns. Survey respondents were evenly divided, with the majority age ranging from 30 to 74. Most respondents live and work in the City of Tulsa; 49% live in the City of Tulsa, 13% in Broken Arrow, 9% in Tulsa County, and 7% in Rogers County. Data regarding where respondents worked showed 48% City of Tulsa, 23% Tulsa County, 13% Other, and 8% City of Owasso. It was found that most households have a 10–30-minute commute and use a car as the primary mode, while 56% of respondents support reducing speed limits to slow down unsafe drivers. The top three traffic safety concerns identified were Distracted Driving (64%), Aggressive Driving (36%), and People Ignoring Traffic Laws while Driving (32%).

Respondents showed support for investing in making active and public transportation safer and more accessible. 82% support investment in Pedestrian Safety, 67% support investment in Bicycling Safety, and 69% support investment in public transportation. Investment in Enforcement and Education is also important to most respondents. 79% show support for funding educational programs for driver safety and enhanced enforcement.

FIGURE 36. TOP 5 SAFETY CONCERNS



Map Survey

The Map Survey aimed to gather location-specific traffic safety concerns from the community. The survey received fifty-nine (59) contributions, with the majority of contributions, all but two (2), located in Tulsa. The top traffic safety concern from contributors was pedestrian safety (28.8%), followed by intersection safety (22%) and bicycle safety (13.6%).

FIGURE 37. MAP SURVEY SAFETY CONCERNS

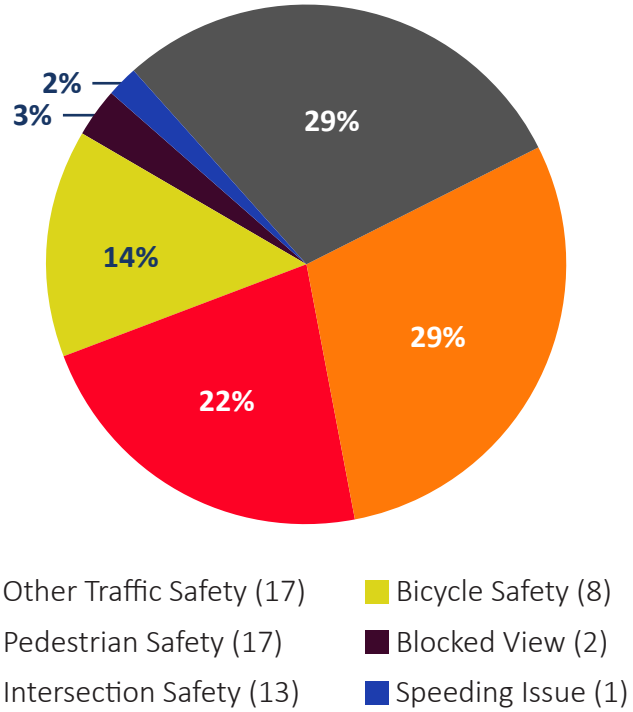
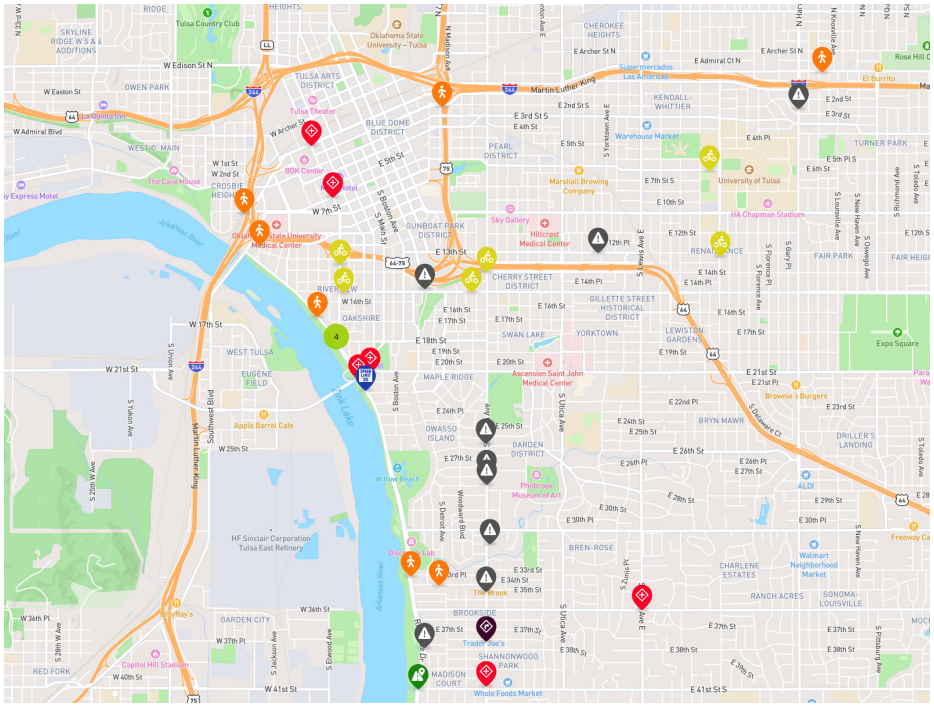


FIGURE 38. MAP SURVEY



Engagement Summary

Key Takeaways/Themes from Engagement

Responses from the Written Safety Survey highlight the **community's desire for a safer, more efficient, and more bicycle and pedestrian-friendly City** with efficient transit options.

ADDRESSING THESE ISSUES THROUGH:

Targeted infrastructure upgrades

Better traffic management

Enhanced enforcement

Enhanced education

COULD SIGNIFICANTLY ENHANCE SAFETY AND IMPROVE ACCESSIBILITY FOR ALL ROAD USERS.

B

Photo Location: Jenks, Oklahoma

Credit: 4kclips - stock.adobe.com

APPENDIX B

CRITICAL CRASH RATE ANALYSIS METHOD

The Critical Crash Rate (CCR) Analysis is a network screening method developed by the American Association of State Highway Transportation Officials (AASHTO) and included in the Highway Safety Manual (HSM). This analysis assesses the safety performance of road segments or intersections, aiming to identify locations with a higher likelihood of severe crashes. By identifying road segments with a higher likelihood of severe crashes, this tool can promote the prioritization of high-risk segments/points in a region's transportation network. The critical crash rate analysis is a valuable tool for identifying and addressing safety issues on our nation's transportation network.

The method for calculating critical crash rates involves comparing road segments with similar roadway functional classifications and contexts. The analysis involves collecting crash data and traffic volume data for a specific roadway segment or intersection over a defined period. By comparing the critical crash rates of different locations, transportation agencies can identify high-crash areas that require attention.

CCR Calculation

An ArcGIS Pro model was created to calculate the critical crash rate and supporting calculations for each roadway segment in the INCOG region. The model assigns crashes, weighted by their severity, to an adjacent segment and performs the calculations in the order outlined by the FHWA. The following section outlines the process used in calculating the critical crash rate using fatal and severe injury crashes from 2017-2021.

Crashes to Segments

Calculating the critical crash rate (CCR) requires four data inputs: roadway functional classification, context, daily traffic volumes, and weighted crash counts. The critical crash rate is calculated by dividing the number of severe crashes (fatalities and serious injuries) by the average daily traffic volume. Comparing road segments of similar functional classifications and normalizing them by their daily traffic volumes allows for the most meaningful results. This rate (CCR) helps identify areas where crashes occur at a higher frequency than traffic volume. The result is a rate of crashes per hundred million vehicle miles traveled (HMVMT).

Weighting

The goal of the LRSAP and Vision Zero is to reduce fatalities and serious injuries, and this crucial step was added to the Critical Crash Rate Calculation.

Calculate Variables

The critical crash rates are calculated using the variables and equations outlined in the FHWA's Highway Safety Manual (HSM). The critical crash rate compares the difference between the observed crash rate and the expected crash rate. The observed crash rate represents the fatal and serious injury crashes on each road segment per hundred million vehicle miles traveled (HMVMT). For the expected average crash rate per HMVMT, the daily volumes for each functional class were normalized. Roadways were only compared to other roadways of a similar functional classification. Once calculated, his equation highlights the segments that display a higher-than-expected crash rate than similar roadways.

Calculate Critical Crash Rate Ratio (CCRR)

A ratio is used to identify the magnitude of the difference between the observed and expected crash rates. If the ratio is greater than 1.0 or the observed crash rate is higher than the expected crash rate, then the segment's crash history is greater than roadways of similar functional classification, daily volumes, and context. Segments with a ratio of 1.0 or greater are then flagged as potential HIN segments.

C

Photo Location: Jenks, Oklahoma

Credit: 4kclips - stock.adobe.com

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APPENDIX C

COUNTY FATALITIES PER 100K POPULATION (ANNUAL RATE)

COUNTY	POPULATION	FATALITIES (2017-2021)	FATALITIES/100K
CREEK	71,754	66	18.4
WAGONER	80,981	59	14.6
ROGERS	95,240	69	14.5
OSAGE	45,818	33	14.4
TULSA	669,279	361	10.8

CITY FATALITIES PER 100K POPULATION (ANNUAL RATE)

CITY	POP	FATALITIES (2017-2021)	FATALITIES/100K
Fair Oaks	73	1	274.0
Liberty	153	2	261.4
Kellyville	1,019	3	58.9
Mounds	932	1	21.5
Catoosa	7,440	7	18.8
Sapulpa	21,929	16	14.6
Tulsa	413,066	263	12.7
Coweta	9,654	6	12.4
Mannford	3,262	2	12.3
Skiatook	8,450	5	11.8
Wagoner	7,621	4	10.5
Glenpool	13,691	7	10.2
Chelsea	1,991	1	10.0
Sand Springs	19,874	9	9.1
Drumright	2,560	1	7.8

CITY FATALITIES PER 100K POPULATION (CONTINUED)

CITY	POP	FATALITIES (2017-2021)	FATALITIES/100K
Pawhuska	2,984	1	6.7
Bixby	28,609	9	6.3
Broken Arrow	113,540	33	5.8
Claremore	19,580	5	5.1
Bristow	4,248	1	4.7
Owasso	38,240	8	4.2
Verdigris	5,256	1	3.8
Collinsville	7,881	1	2.5
Jenks	25,949	1	0.8
Avant	301	0	0.0
Barnsdall	1,034	0	0.0
Burbank	123	0	0.0
Depew	411	0	0.0
Fairfax	1,136	0	0.0
Foraker	18	0	0.0
Foyil	368	0	0.0
Grainola	31	0	0.0
Hominy	3,329	0	0.0
Inola	1,890	0	0.0
Kiefer	2,187	0	0.0

CITY	POP	FATALITIES (2017-2021)	FATALITIES/100K
Lawrence Creek	121	0	0.0
Liberty CDP	214	0	0.0
Lotsee	6	0	0.0
Oilton	885	0	0.0
Okay	505	0	0.0
Oologah	1,305	0	0.0
Osage	177	0	0.0
Porter	561	0	0.0
Prue	374	0	0.0
Redbird	89	0	0.0
Shamrock	65	0	0.0
Shidler	328	0	0.0
Slick	151	0	0.0
Sperry	1,115	0	0.0
Talala	258	0	0.0
Tullahassee	83	0	0.0
Valley Park	19	0	0.0
Webb	58	0	0.0
Wynona	370	0	0.0

D

Photo Location: Jenks, Oklahoma

Credit: 4kclips - stock.adobe.com

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APPENDIX D

SAFETY BEST PRACTICES MEMORANDUM

TOOLE DESIGN

327 ½ SOUTHWEST BOULEVARD
KANSAS CITY, MO 64108

816.301.6510 X164
TOOLEDESIGN.COM

MEMORANDUM

December 19, 2024

To: Thomas Dow, Director of Transportation and Programs
Organization: INCOG
From: Tammy Sufi and Briam Amaya
Project: INCOG Local Roads Safety Action Plan

Re: Safety Best Practices Review

Introduction and Purpose

The task focused on reviewing best practices and innovative strategies from peer Metropolitan Planning Organizations (MPOs) to inform the development of the INCOG Local Roads Safety Action Plan. Comparable Plans were examined from peers selected based on geographic proximity, population size, and similar characteristics, with emphasis on regions with completed or nearly completed plans. Plans reviewed included those from the Association of Central Oklahoma Governments (ACOG) in Oklahoma City, the Wichita Area Metropolitan Planning Organization (WAMPO) in Wichita, and the Metropolitan Area Planning Agency (MAPA) in Omaha. Additional plans were analyzed for specific elements relevant to INCOG's needs. The findings provide insights to guide the Safety Action Plan, support project prioritization processes, and promote collaboration among regional entities.

Plans Reviewed for Best Practices & Innovative Strategies

- **WAMPO** (Wichita Area Metropolitan Planning Organization): Comprehensive Safety Action Plan, 2023
- **ACOG** (Association of Central Oklahoma Governments): Regional Safety Action Plan (Approval Pending)
- **MAPA** (Metropolitan Area Planning Agency): Vision Zero Omaha Action Plan (2023)
- **NWARPC** (NW Arkansas Regional Planning Commission): NW Arkansas Safety Action Plan (2023)
- **MRMPO** (Mid-Region Metropolitan Planning Organization): Vision Zero Action Plan (2021)

Safety Data Collection

The following provides an overview of how each region collected and utilized safety data to inform their safety planning and decision-making processes.

Quantitative Data

WAMPO The study team conducted a review of crashes in the WAMPO area using a 10-year review of data to draw meaningful conclusions.

ACOG The Regional Safety Action Plan (RSAP) analyzed crash data from the Oklahoma Highway Safety Office for 2017-2021 to guide decision-making and identify safety priorities in Central Oklahoma.

MAPA The study leveraged extensive crash data and multiple sources to develop a detailed analysis of high-risk areas:

- This study used the most recently available 10-years of crash data (2011–2020) to create both an All Modes (Vehicles, Cyclists, Pedestrians, etc.) High Injury Network (HIN) and a separate Pedestrian HIN. The plan also created a high injury intersection (HII) analysis.
- Data sources included the City of Omaha, Nebraska DOT, the US Census Bureau, and Replica (a “big data” tool).

NWARPC The plan team reviewed crash history and identified trends, risk factors, and high-risk locations using databases such as the Fatality Analysis Reporting System (FARS) and Arkansas Department of Transportation (ARDOT) data.

MRMPO Crash data was acquired from the NMDOT Traffic Safety Division through UNM’s Traffic Research Unit. The study used several data types including, but not limited to:

- Crash data to identify locations to prioritize and identify the most appropriate countermeasures for a given location.
- Demographic data from the Office of Equity and Inclusion and the New Mexico Community Data Collaborative to understand and support equitable distribution of resources.
- Traffic counts, pedestrian and bicyclist counts, and speed data to better understand existing conditions at specific locations.
- Input from road users and other stakeholders to understand their lived experience.
- Land use data to understand context in different areas.

Qualitative Data and Public Engagement

WAMPO used the following forms of engagement to further understand safety conditions and inform the planning process:

- The Transportation Safety Technical Advisors (TSTA) provided feedback and guidance on the plan's development. This group consisted of WAMPO region safety professionals who provided feedback on emphasis areas, challenges and solutions, and prioritization.
- A public survey and online map gathered insights on safety attitudes, behaviors, enforcement, equity, and investment priorities.
- A Transportation Safety Committee meeting, held as a public open house, shared findings with the community and used interactive tools to gather feedback on missing strategies priority countermeasures.

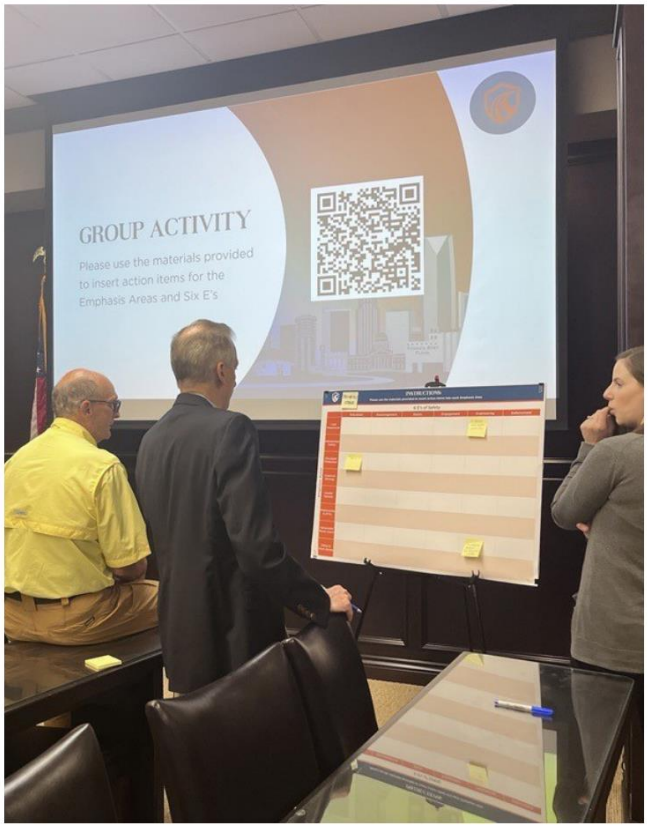

Figure 1: For ACOG, the RSAP Planning Team was established to help guide the planning process, engage the public, build consensus, and provide critical feedback at major milestones

ACOG adopted the following for public outreach:

- Online engagement in English and Spanish.
- An interactive map and survey regarding traffic safety and concerns.
- A Regional Safety Summit to raise awareness of safety initiatives in Central Oklahoma for the year ahead and concurrent public workshops and pop-up events.
- Organized a public workshop and conducted outreach to engage residents in learning about the RSAP and to gather input on transportation safety in Central Oklahoma.
- Nine virtual work sessions to ensure cohesiveness between ACOG, the planning team, and cities within ACOG's boundary

MAPA utilized a collaborative approach involving technical experts to address safety concerns comprehensively:

- Each focus area had a 5-10 member Technical Advisory Committee (TAC) that identified issues and solutions across all modes of transportation.
- Focus Groups addressed data-driven solutions, education, and accountability.

NWARPC gathered qualitative data through various community outreach methods:

- Pop-up events, safety demonstration site walks, and listening sessions.
- An online survey and interactive map.

MRMPO used the following methods:

- A Vision Zero Prioritization Survey to gather feedback from residents about how to prioritize Vision Zero efforts.
- Walking assessments to engage residents.
- Input from road users and other stakeholders to better understand their lived experience, including how they travel and their level of comfort getting around using different modes.
- Presentations to groups like the American Transportation Services Association (ATSSA) - New Mexico Chapter, City of Albuquerque (CABQ) Transit Advisory Board, and the Greater Albuquerque Bicycling Advisory Committee to raise awareness and gather feedback.

Data Analysis

The MPOs employed a range of methods to systematically analyze and synthesize both quantitative and qualitative data.

WAMPO incorporated the following techniques:

- Dot graphs, bar graphs, and an interactive map to illustrate participant preferences, visualize trends in safety concerns, and highlight key locations of concern. These were then used to help guide decisions on safety improvements.
- Bar graphs were used to illustrate crash trends related to property damage, injury, serious injury, and fatal crashes.
- Other tables, diagrams, graphs, and maps illustrated crashes by jurisdiction, WAMPO area crash types, major crash type frequencies, and other related data.

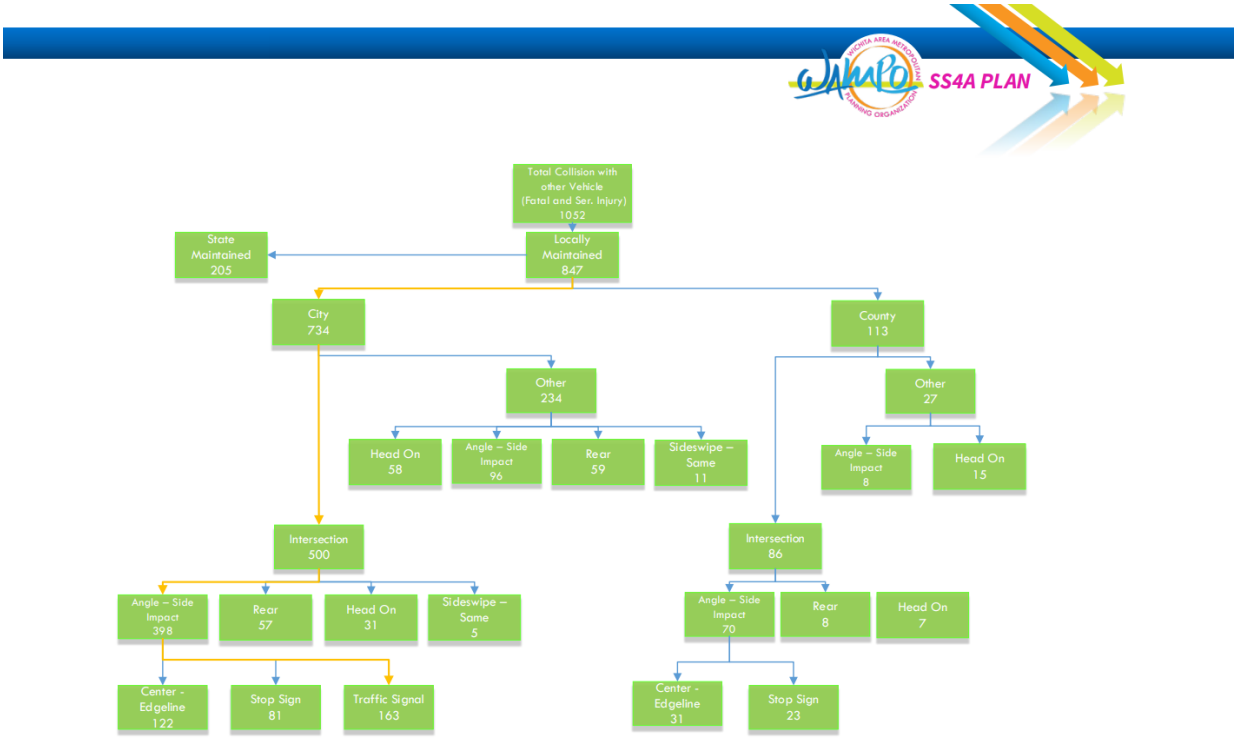

Figure 2: WAMPO Crash Tree Diagram

- A crash tree diagram (above) to illustrate the various types of collisions involving motor vehicles. This diagram visually breaks down the data, categorizing incidents based on the nature of the crash, such as head-on collisions, rear-end accidents, side impacts, and other relevant interactions (see pg. 29, 35 of WAMPO report). This type of diagram is not commonly used in this type of analysis.

- Heat maps illustrated the types, intensities, and locations of various crashes. These heat maps included: Collisions with Other Motor Vehicles, Fatal & Injury Crashes, Angle Crashes, Vulnerable Road User Crashes, and more (see pg. 27 of WAMPO report).

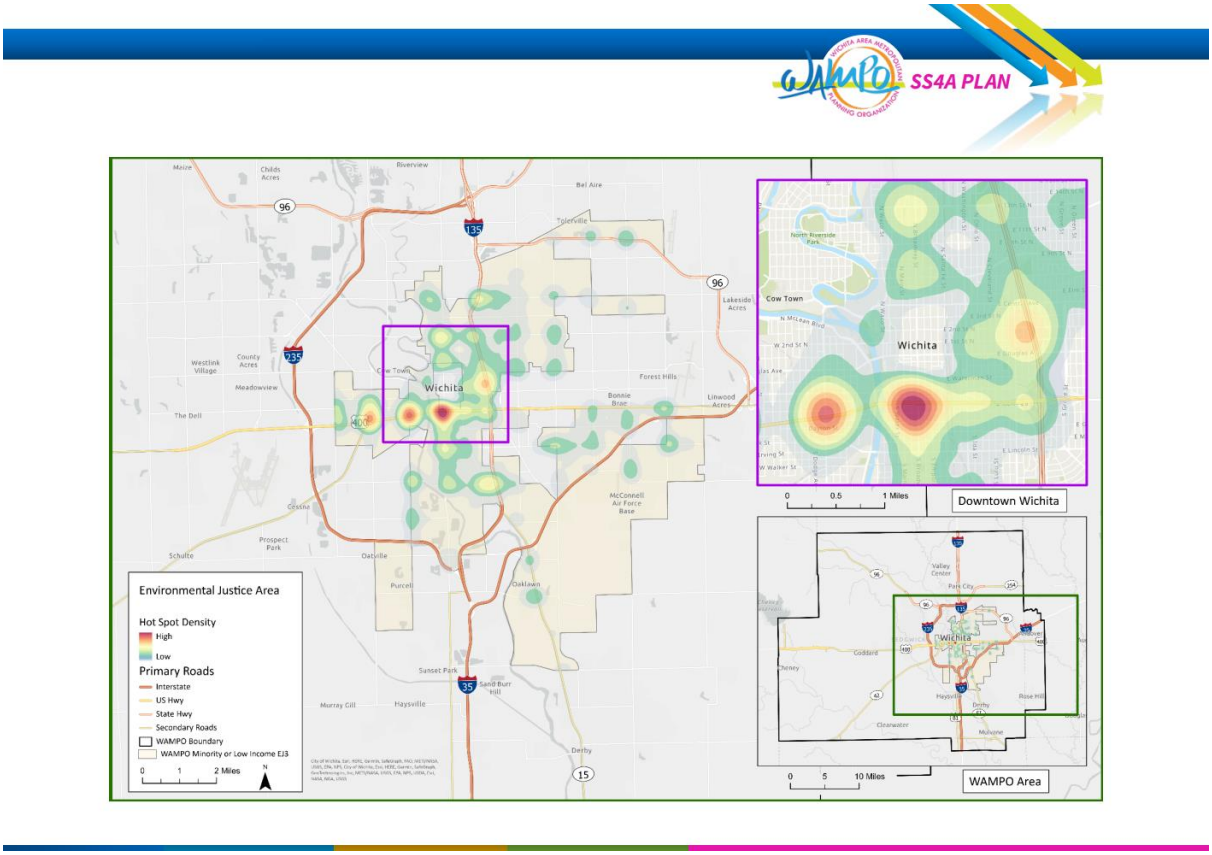

Figure 3: WAMPO, Environmental Justice Fatal and Serious Injury Crash Heat Map

- Maps of the top 100 locations for speed-related crashes, unsignalized intersection crashes, signalized intersection crashes, and vulnerable user crashes helped visualize and identify high-risk areas. This mapping can be used to prioritize safety interventions and resource allocation for reducing crashes at these critical locations.

ACOG utilized the following:

- Maps, tables, charts, and diagrams to highlight crash history.

- Visualized Crash Trends, Contributing Factors, Collision Types, Crash Heat Map, and Bicycle/Pedestrian, Speed, Impaired Driving, and Roadway Departure Crashes.

  Please note, the ACOG RSAP is still being drafted and has not been formally adopted.

YEAR	TOTAL CRASHES	K – FATAL		A – SEVERE INJURY		B – MINOR INJURY	
2017	26,595	129	0.5%	531	2.0%	2,223	8.4%
2018	22,899	114	0.5%	508	2.2%	2,325	10.2%
2019	22,237	115	0.5%	463	2.1%	2,242	10.1%
2020	17,448	129	0.7%	384	2.2%	1,824	10.5%
2021	21,146	142	0.7%	435	2.1%	1,965	9.3%

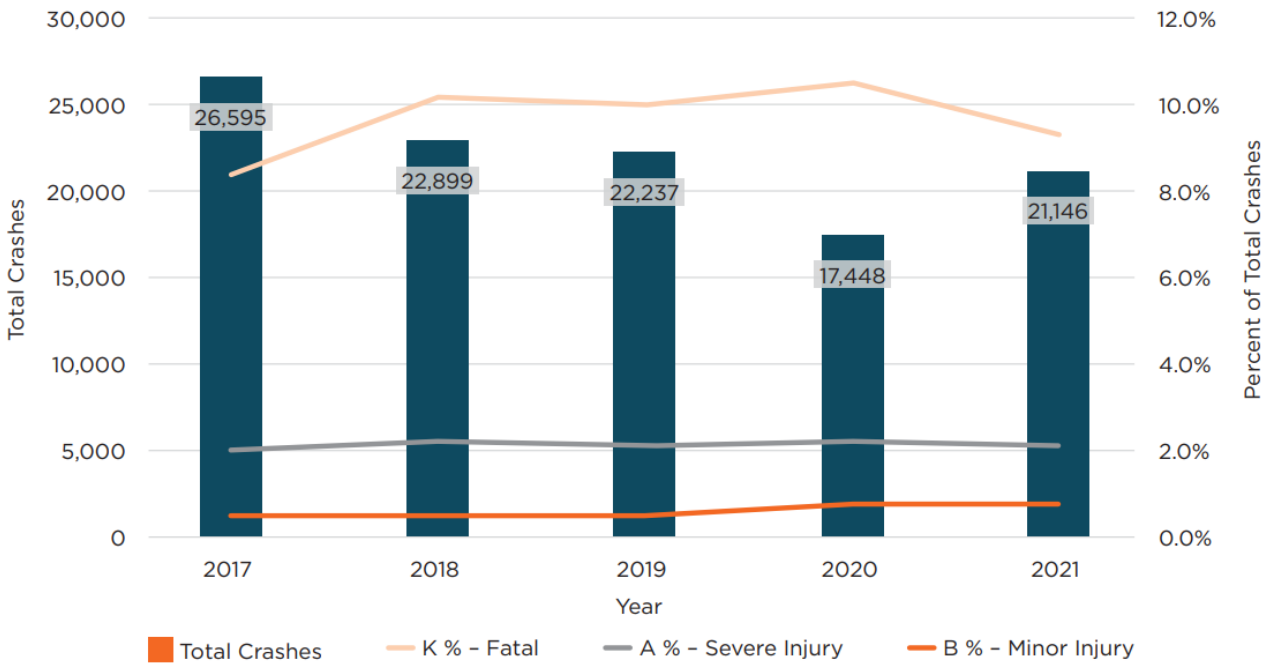

Figure 4: ACOG Table and Graph showing crash trends from 2017-2021

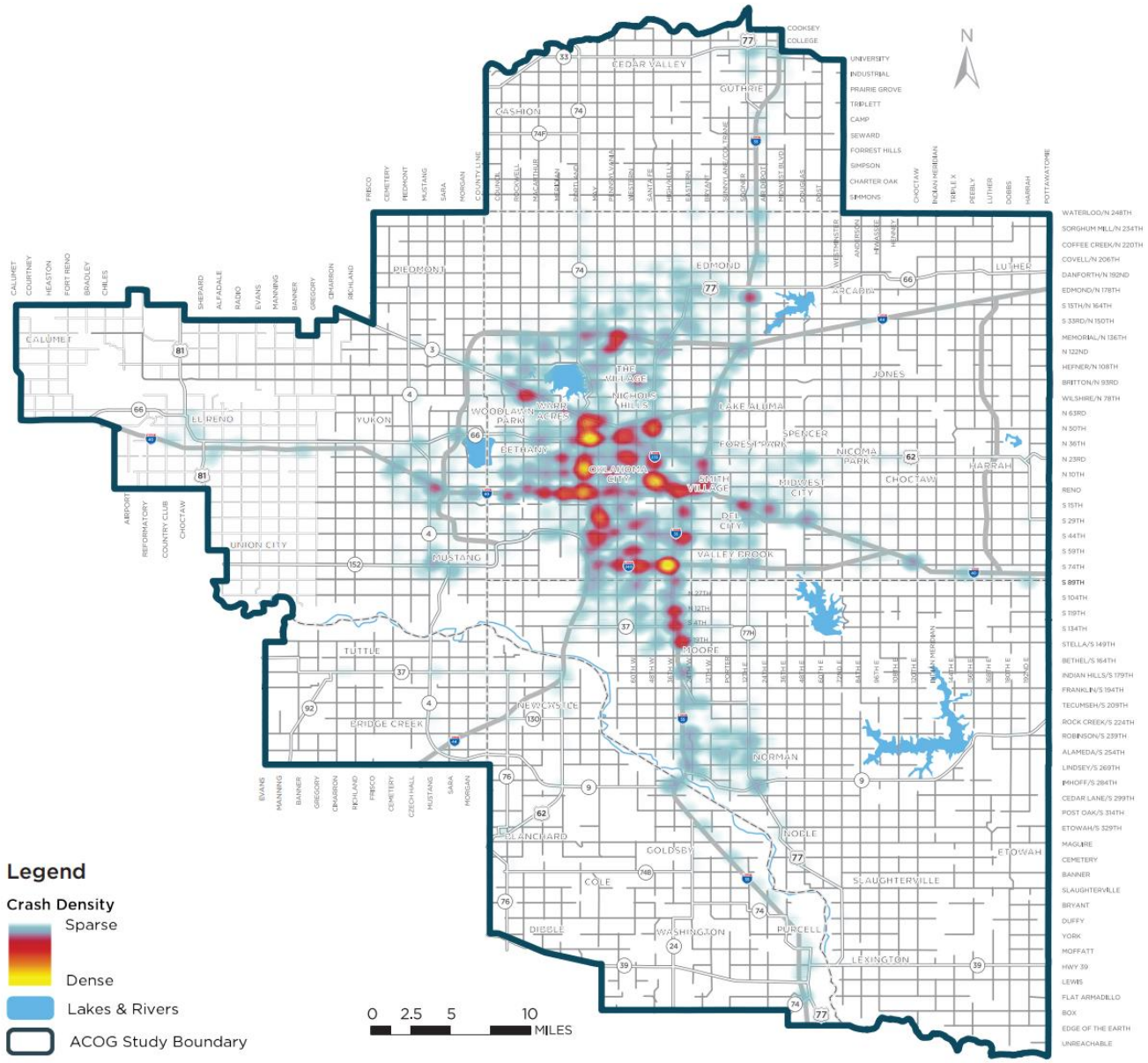

Figure 5: ACOG Crash Heat Map (2017-2021)

Please note, the ACOG RSAP is still being drafted and has not been formally adopted.

MAPA applied the following:

- A High Injury Network (HIN) map identifying areas with the highest pedestrian fatalities and serious injuries in Omaha, enabling targeted resource allocation.
- A Pedestrian HIN map with highlighted clusters of pedestrians Killed & Seriously Injured (KSI) crashes, emphasizing the vulnerability of pedestrians.

- A High-Risk Network (HRN) identified unsafe streets based on attributes like lane count, median presence, and volume-to-capacity ratio.

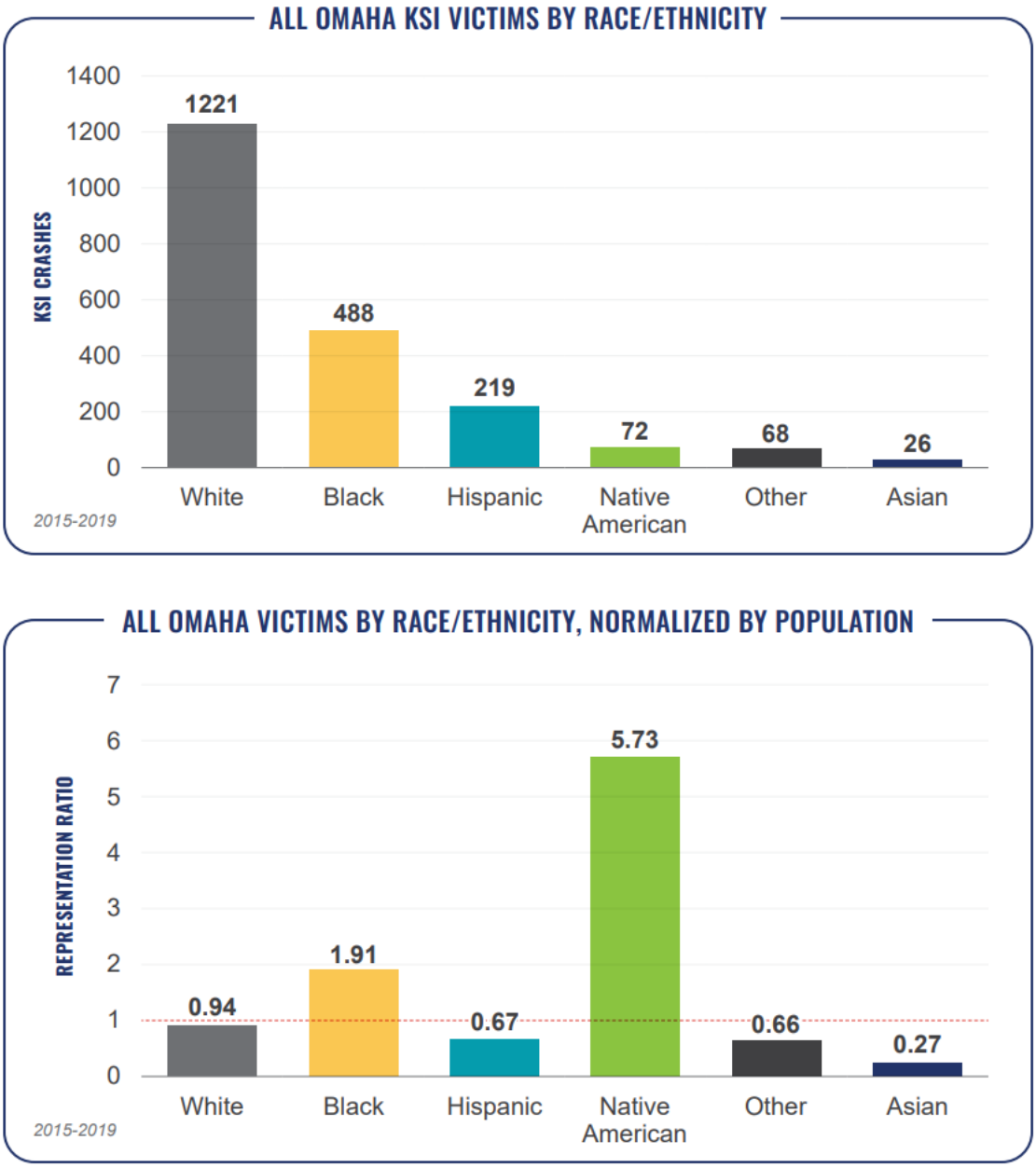

Figure 6: MAPA KSI Crash Rates Compared to Race

- A bar graph titled Focus Area - Equity grouped KSI by race (white, black, Hispanic, etc.), while another bar graph normalized KSI crashes by race to compare rates relative to the local population.
- A graph on high-risk arterial roads displayed KSI crashes on minor arterials by one-way/two-way designation and another graph for bike and pedestrian KSI crashes.
- Pie charts illustrated KSI crashes by intersection or roadway segment, transportation mode (bike, pedestrian, motorcycle, vehicle), and by sex involved, among others.

NWARPC used the following summary maps:

- Equity Analysis Overlap and High Injury Network (HIN) Map: This map highlights corridors with the most fatal and serious injury crashes and identifies historically disadvantaged communities, persistent poverty areas, and locations with varying social vulnerability.
- All Modes Crash Map: This map represents crash locations across the region for all transportation modes.
- Survey Comments Map: This map highlights areas where residents voiced concerns about safety, traffic, or infrastructure, identifying locations needing improvement.

MRMPO adopted the following methods and tools:

- High Fatal + Injury Network (HFIN) Map that identifies the most dangerous corridors and intersections with fatal and injury crash rates above the city mean. This tool aids decision-making by prioritizing targeted interventions for the most significant safety impacts.
- Eight (8) city-selected indicators to identify and map vulnerable communities such as: per capita income, population aged 65+, population aged 17 and under, people with a disability, etc (see pg. 24).
- Various infographics, tables, and graphs that document the relationship between pedestrian fatalities by vehicle speed, fatalities per 100,000 by vulnerability score of crash location, and top contributing factors by crash severity.
- A pie diagram showing Top Contributing Factors (TCF) to crashes based on law enforcement's assessment of the most significant behaviors causing accidents.

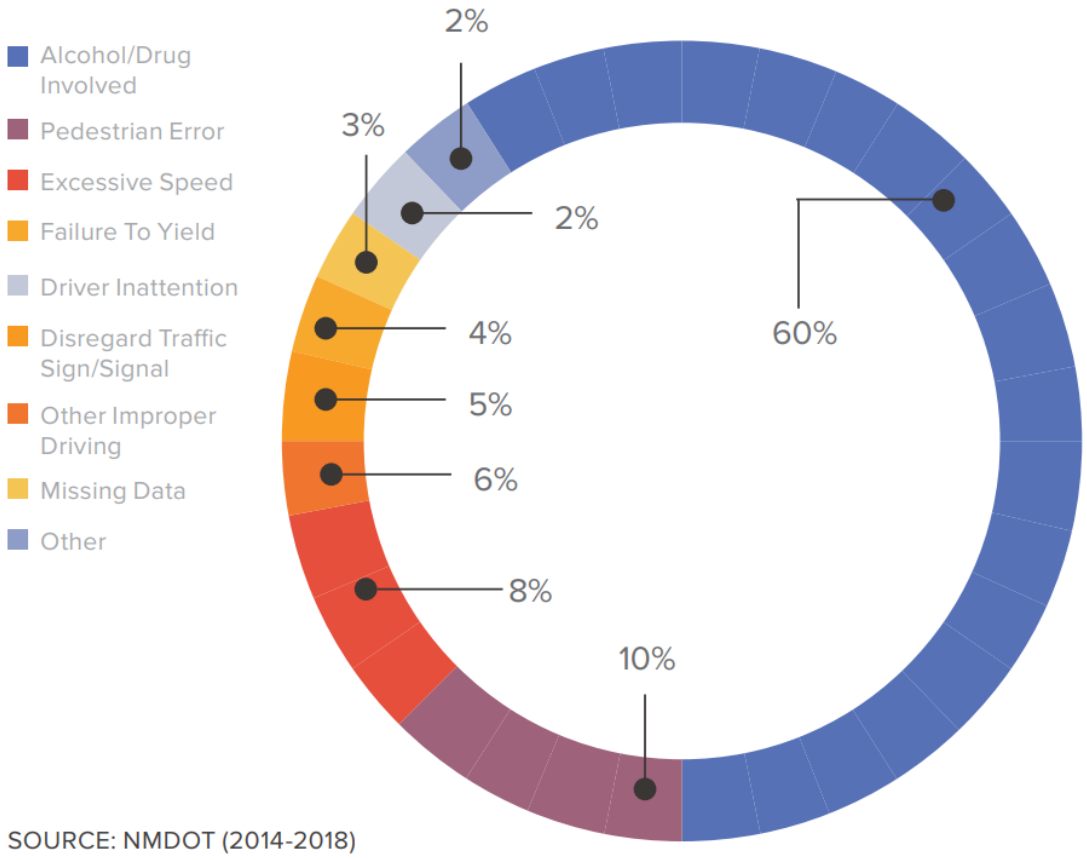

Figure 7: MRMPO Top Contributing Factors for Fatal Crashes

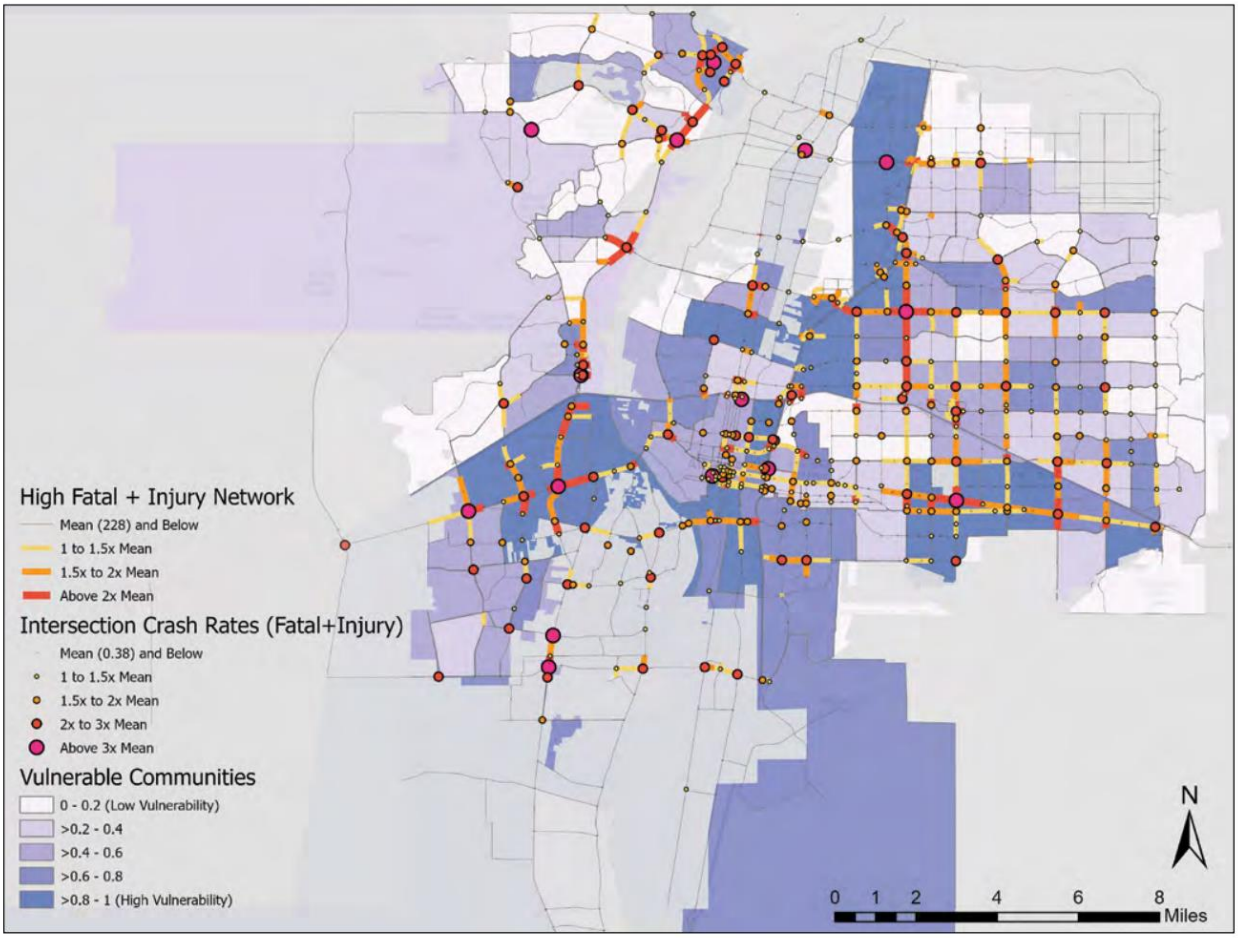

Figure 8: MRMPO, Fatal + High Injury Network Map

Implementation

This section outlines key implementation strategies developed by the MPOs based on the safety data collected.

WAMPO Key actions included:

- WAMPO created ICT Safe: A Regional Transportation Coalition. This coalition is tasked with updating the document and executing the plan's initiatives (see: WAMPO Safety)
- The Transportation Safety Technical Advisors were invited to share insights, feedback, and solutions.

ACOG has committed to the following countermeasures:

- Sidewalk gaps should be filled.
- Upgrade all ramps to be ADA compliant.
- Traffic signal heads should allow protected left-turns.
- Add luminaires and trim vegetation to improve visibility.
- Provide mid-block crossings.
- Implement leading pedestrian intervals for enhanced pedestrian visibility.
- Install high-visibility crosswalks.
- Construct pedestrian refuge islands and narrow travel lanes.

MAPA will rely on the following methods and tool:

- Omaha has more arterial crashes than the national average.
    - MAPA aims to reduce arterial crashes by enhancing traffic control measures and roadway designs through its Comprehensive Safety Action Plan
- Helmet and restraint (seatbelt/carseat) use is lower than in similar cities.
    - To improve restraint and helmet usage, MAPA will implement educational campaigns and increase law enforcement visibility to boost compliance
- One-way roads are particularly dangerous.
    - The agency is considering converting one-way streets to two-way configurations to enhance safety and lower traffic speeds
- More fatal and serious injury crashes occur on moderately congested roads than on heavily congested or uncongested ones.
    - To address higher crash rates on moderately congested roads, MAPA plans to manage congestion effectively while promoting active transportation options.

NWARPC The project team used these data to recommend installing proactive systemic safety measures to identify and mitigate safety risks before crashes occur. Examples include:

- Pedestrian-scale lighting along the HIN, especially at trail crossings and along arterials.
- Daylighting intersections by removing obstacles that block sight lines in town centers and high-volume pedestrian areas.
- Implementing leading pedestrian intervals at signalized intersections, particularly on applicable HIN corridors.

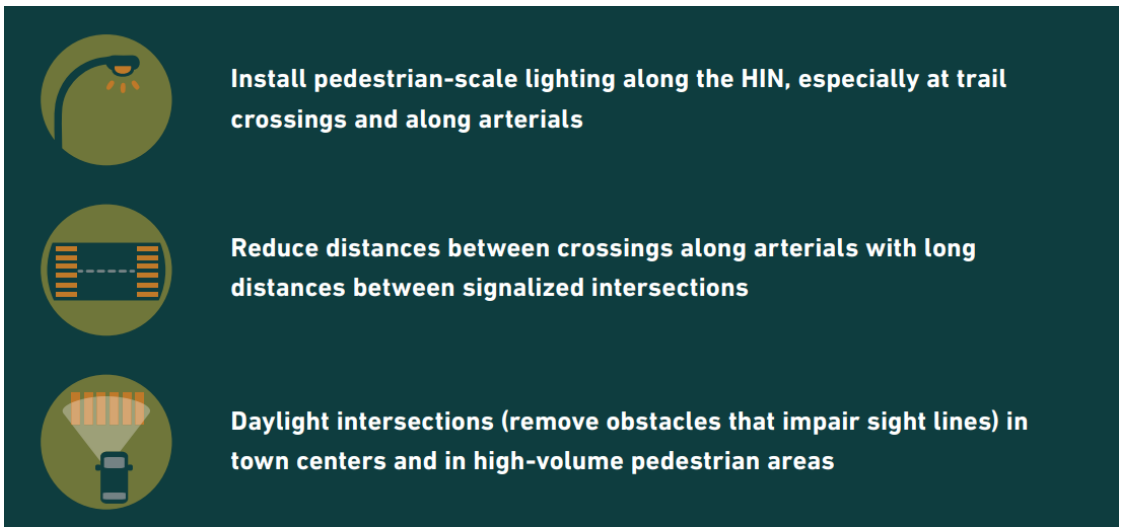

Figure 9: NWARPC Proactive Systemic Safety Countermeasures

MRMPO: The team used the data to make informed decisions on topics such as:

- Engineering + Design: Prioritize safety for all road users and implement complete streets design principles in road design and construction.
    - Implement roundabouts to calm traffic and create safe pedestrian crossings, allowing vehicles to reduce speed effectively.
    - Incorporate wide sidewalks lined with street trees to create safe, comfortable spaces for pedestrians.

- Provide bike lanes with buffers and physical separation to enhance safety for all users.

- Safe Speeds: Implement speed management strategies such as reducing posted speeds, prioritizing areas along HFIN, in vulnerable communities, and near schools, parks, and other community facilities.

- Policy and Regulation Practice: Establish and advocate for proactive, equitable policies and practices prioritizing safety for all roadway users.

Equity Analysis and Recommendations

This section outlines targeted strategies to address inequities.

WAMPO To conduct their equity analysis:

- Crash data were sorted by the WAMPO Environmental Justice (EJ) boundaries for minority and low-income populations, sorted by crash type and heat mapped.

ACOG Equity was an important consideration in determining how ACOG and organizations in Central Oklahoma should prioritize future investments.

- The identification of disadvantaged census tracts played a large role in the analysis of corridors for this action plan. This allowed the project identification process to not only look at the crash history, but also equity opportunities for the region in terms of safety.
- The disadvantaged census tracts were mapped which assisted in identifying necessary infrastructure and policy improvement in these areas. The plan encourages future safety considerations in Central Oklahoma beyond the ACOG RSAP. ACOG will use the equity analysis as a scoring criterion during project selection.
- The highest priority study corridors were selected with input from ACOG staff and scored based on equity, engagement, feasibility, and crash severity.

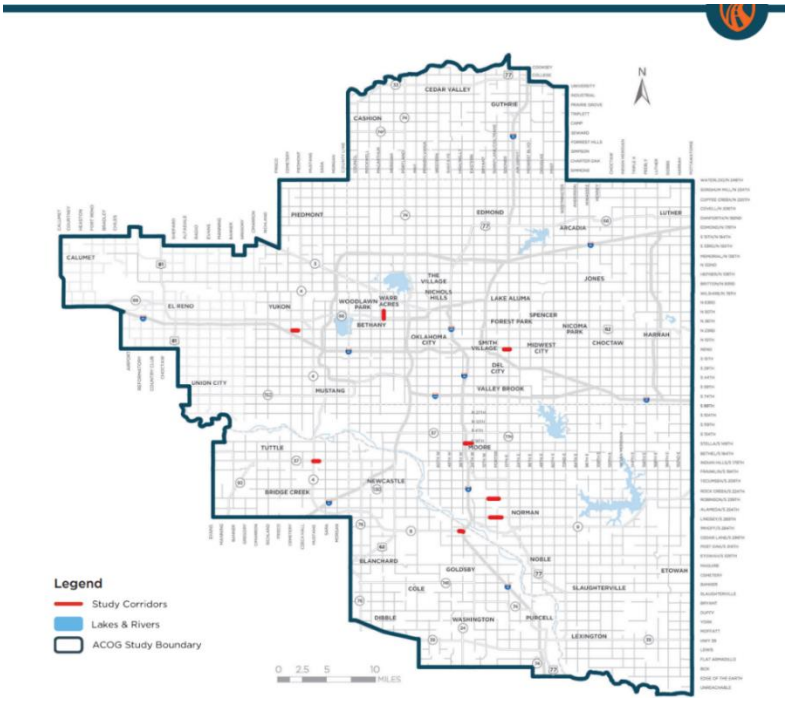

Figure 10: For ACOG eight (8) road segments on the High Injury Network were selected as priority corridors for countermeasure recommendations that improve safety on the ACOG's most unsafe roads.

MAPA

- The city will prioritize solutions for areas of greatest need to ensure safe access for all and reduce KSI crash disparities. Following the data helps create equitable solutions toward zero fatal and serious injury crashes.
- The plan urges the city to offer financial aid for driver's education to low-income teens, raising awareness of safe driving practices.

NWARPC

- The Plan outlined safety measures tailored to the unique needs of different communities. For example, areas with higher pedestrian traffic may benefit from enhanced crosswalks and pedestrian signals.
- The Plan developed safety-focused educational campaigns tailored to diverse communities, offering information in multiple languages and accessible formats.

MRMPO

- The city worked with the City's Office of Equity and Inclusion and the New Mexico Community Data Collaborative.
- City departments, leaders, local agencies, institutions, and community organizations in Albuquerque are collaborating on a Vision Zero strategy that uses data and prioritizes equity to improve dangerous corridors and intersections, ensuring community involvement in making the city safer.
- Solutions may include adding pedestrian crossings in high-crash areas and prioritizing accessibility improvements for people with disabilities.
- To build trust, Vision Zero should prioritize traffic safety initiatives in vulnerable communities, emphasizing community agency and collaboration with local organizations. Enforcement efforts must target top contributing factors and incorporate community engagement and equity.
- Albuquerque will train law enforcement offices in Vision Zero priorities, including equity, data and reporting needs, and enforcement based on Top Contributing Factors.
- The city eliminated transit fares for youth and older adults (announced February 4, 2021).

Regional Interagency Collaboration

INCOG can use the following methods to enhance tracking and communication of project safety performance, and establish systems that foster more efficient and effective collaboration:

WAMPO

- WAMPO will convene stakeholders, either in person or virtually, at a minimum of one (1) time a year to discuss progress and associated challenges with implementing the Countermeasure Toolbox and Implementation Plan. The meeting will focus on the “outcomes” for each action. Upon conclusion of the meeting(s), progress will be documented, and the Implementation Plan updated, as needed.
- WAMPO will remain informed of current and new local and statewide safety programs, policies, plans, guidelines, and/or standards. Based on this information, WAMPO can continue to identify opportunities to build upon the current Implementation Plan.

ACOG has started by identifying all agencies that should be consulted during the implementation of the corresponding action in addition with the ACOG Transportation Planning Services Department (see pg. 112 of ACOG Plan). The document is not explicit regarding methods for improved tracking and communication.

MAPA

- This document is guided by a project team and a Technical Advisory Committee (TAC) of citizens, safety advocates, non-profits, transit agencies, Omaha Police, Fire, Planning and Public Works, and consultants.
- The initiative will target community support, crisis intervention, collaborative justice and healthcare partnerships, and rehabilitation- and evidence-based sentencing for DUI citations.
- The city will establish an Executive Committee for the Vision Zero Action Plan, including diverse decision-makers to ensure long-term leadership and accountability for zero traffic fatalities and severe injuries.
- The city will collaborate with stakeholders to secure funding for Vision Zero through internal budget appeals and external partnerships with MPOs and Foundations.
- The city will strengthen partnerships between departments like Omaha Police and Public Works to collect and share critical data, developing guidelines for future project and policy refinement.
- The city will enhance the link between Vision Zero implementers and the City Council to clarify priorities and expected outcomes for community safety and quality of life.

NWARPC

- Created a centralized online portal that aggregates safety data from various agencies, such as crash reports, traffic volume, and pedestrian counts. The portal is designed to be user-friendly and accessible to all stakeholders.
- Develop standardized protocols for data collection and reporting among member agencies to ensure uniformity, including guidelines on data types, frequency, and analysis methods.
- Organize biannual or annual safety summits for member agency representatives to review safety performance, share insights, and collaborate on initiatives, focusing on fostering dialogue and developing joint strategies.

MRMPO

- Albuquerque Police Department, Department of Municipal Development, and Mid-Region Council of Governments staff meet monthly as the Vision Zero Task Force to review fatal crash reports, identify trends, and explore ways to improve reporting.
- City departments, leaders, local agencies, and community organizations in Albuquerque will collaborate on a Vision Zero strategy that uses data and prioritizes equity to improve high-risk corridors. This will ensure community involvement in enhancing safety.
- The MPO will share inter-agency collaboration, including project data, lessons learned, and best practices.

- The city will Inform city departments and partner agencies about Vision Zero themes to enhance understanding and identify collaboration opportunities.

Figure 11: MRMPO, Albuquerque City is already starting to implement elements of this Action plan identified as best practices and will continue to expand Vision Zerio initiatives over time.

Project Development Processes

The following outlines how each MPO identified best practices in project development that demonstrate a high level of preparedness for grant applications.

WAMPO To improve WAMPO's safety program and reduce severe crashes, a structured process was established, focusing on key discussions and assessments:

- Key Topics: In the first Technical Safety Advisory Team meeting, six (6) critical areas were identified:
    - Culture: Prioritize safety for the public and transportation agencies.
    - Leadership and Commitment: Secure support from leaders for safety initiatives.
    - Planning: Develop safety-focused plans based on various inputs.
    - Data Analysis: Use accessible crash data for informed decision-making.
    - Project Delivery: Implement projects with safety policies in mind.
    - Safe System Framework: Use the Safe System Approach for decision-making.
- Challenges and Solutions: Stakeholders identified challenges and proposed 42 solutions for improving safety.
- Prioritization: Participants rated the solutions on a scale of 1 to 5, with a score of 5 being the highest priorities for the CSAP. The highest scores were:
    - WAMPO shares and provides education on the final CSAP with local agencies, advocacy organizations, and WAMPO committees. (Rank 4.6)
    - Update high crash locations at a minimum of every 5 years. (Rank: 4.5)
    - Include transportation safety as an explicit part of the vision for all municipalities in the region. (Rank: 4.4)
    - Update high risk locations at a minimum of every 5 years. (Rank 4.4)
    - Provide resources to local agencies on high-value and effective safety countermeasures. (Rank: 4.4)
- Documentation: The results were documented to guide future planning and implementation, ensuring critical solutions are prioritized in the safety program.

ACOG The consultant created a Systemic Countermeasure Toolbox which details systemic countermeasures that can be implemented in all cities of the region to improve safety (see page. 97 of ACOG report). The toolbox is organized by safety emphasis area. Priority should be given to roads along the HIN and disadvantaged census tracts to lessen severity among crashes.

MAPA The Prioritized Projects were formulated by integrating the High Injury Network (HIN) and High Injury Intersections (HII), and then segmenting them into coherent projects based on their contextual locations. The projects underwent further refinement with data from the High-Risk Network (HRN) and the Public Input maps. To adjust for potential double counting, an iterative process was employed. Subsequently, proposed countermeasures were linked to each project through a high-level planning analysis. This procedural approach allows them to compute a safety benefit-to-cost ratio (BCR) and prioritize projects with the most significant potential impact. Projects were classified into five (5) groups. All BCR calculations were based on the latest FHWA guidance. Priority 1 projects an average BCR above 5.0, while lower-priority projects may require more resources but can support broader goals like economic development, rehabilitation, or operational objectives (see page 70 for details).

- **Creating Projects:** The consultant made a list of safety projects by looking at dangerous roads and intersections and grouping them based on where they were located.
- **Using Data:** The consultant used extra information from high-risk areas and public feedback maps to improve these project ideas.
- **Safety Benefits:** Each project was linked to possible safety improvements, allowing them to calculate how beneficial each project would be compared to its cost. This helped them determine which projects were most important.
- **Project Categories:** Projects are sorted into five (5) priority groups based on their BCR:
    - **Priority 1:** Projects with a BCR above 5.0 are very promising for improving safety.
    - **Lower priority:** Projects with a BCR below 1.0 might not be as effective along but can still help when combined with other goals like economic development.
- **Next Steps:** The text mentions tables that show these proposed projects to help reduce traffic deaths. The detailed information is in another section, and they emphasize that these ideas are just a starting point for more study before anything gets built.

NWARPC The plan documented each proposed project with detailed descriptions, potential benefits, estimated costs, and timelines. It emphasized collaboration among agencies and stakeholders, highlighting supporting partners, as many funding sources prefer projects involving multiple entities.

MRMPO The Vision Zero Task Force and City Staff will monitor progress on this Action Plan by evaluating projects and tracking specified indicators. An annual progress report will highlight completed projects and indicator advancements. In 2025, the city will update the plan to reflect changing trends and new priorities (see page 49).

Transparency and Reporting

The following strategies ensure transparency and effective reporting on transportation safety.

WAMPO

- WAMPO will develop a fatal crash review committee that includes representatives from each jurisdiction within the WAMPO planning area. The committee will provide annual regional reports documenting the results of the committee's discussions and analysis of fatal crashes.

- WAMPO will continue communicating and sharing its Vision Zero Report and results of the CSAP with TSTA members and the rest of the region.

ACOG Annual plan adoption report meetings have been scheduled.

MAPA

- Omaha will create an annual Vision Zero Report to evaluate progress, guide decision-making, and identify adjustments for the Vision Zero Action Plan (VZAP), showcasing successes and promoting transparency in the city's commitment to a safer transportation system.

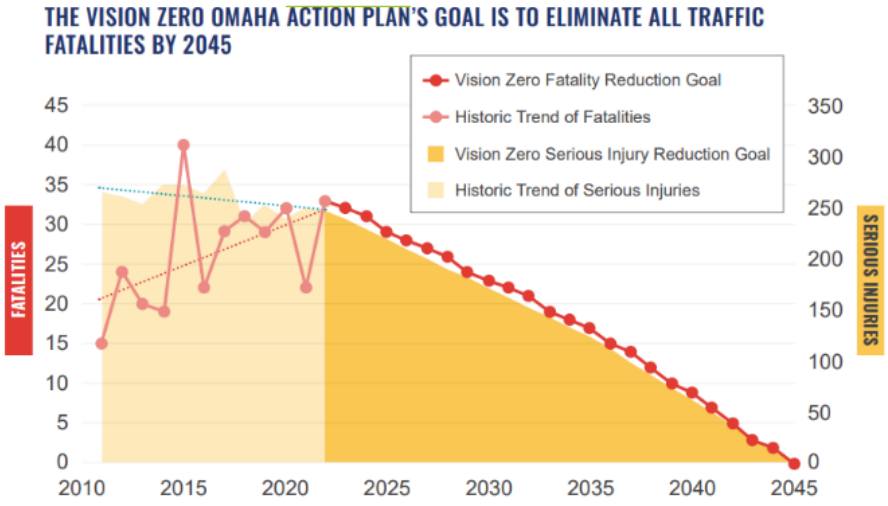

Figure 12: MAPA, Omaha's Vision Zero Action Plan is a comprehensive and data-drive plan to eliminate traffic fatalities and serious injuries on Omaha's streets.

NWARPC

- The Northwest Arkansas Regional Planning Commission used an ESRI GIS Storyboard to deliver statistics, strategies, and their regional vision.
- They also created a Safety Webinar Series as a resource during plan development and afterward. Webinars included topics such as The Safe System Approach, local and regional commitment to safe streets, and linking safety and mobility justice.

MRMPO

- Interagency working group policy reports on traffic safety and road design will be published.
- The Vision Zero Task Force will work with local media to improve traffic crash reporting, reduce victim-blaming, and increase education. Annual reports will feature case studies, best practices, updates, and local design countermeasures. Establish a crash reporting policy.

E

Photo Location: Jenks, Oklahoma

Credit: 4kclips - stock.adobe.com

INCOG

APPENDIX E

EQUITY REVIEW MEMORANDUM

TOOLE DESIGN

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MEMORANDUM

December 16, 2024

To: Thomas Dow, Director of Transportation and Programs
Organization: INCOG
From: Kaylyn Levine and Tammy Sufi, Toole Design
Project: INCOG Local Roads Safety Action Plan

Re: Equity Analysis

Introduction

This memo describes the approach and results of the INCOG Safety Action Plan's equity analysis. We conducted an equity analysis to identify and prioritize the needs of communities that have been historically and presently underrepresented in transportation planning. This analysis identifies socioeconomic trends, transportation investments, and policy decisions that highlight which communities experience benefits and which communities experience disparities. The goal of this analysis is to help achieve equitable transportation outcomes by influencing and guiding project selection, complementary policies, project prioritization, community engagement, and future planning. By focusing investment within communities with the greatest need, we can move the needle towards achieving transportation equity.

Our five-step approach to this analysis begins with defining equity and our framework. Then, we expand on the historical context of the INCOG region and how past events and experiences connect to current transportation system outcomes. This memo then presents the results of the spatial analysis along with descriptive statistics and relationships to the high injury network. We conclude the equity analysis with current complementary practices in the region advancing equity goals and key takeaways of this work.

Equity Framework

Equity Definitions and Principles

In transportation planning, equity refers to the fair distribution of costs and benefits of system infrastructure and outputs. However, to address the injustices that create inequity, we must operationalize a definition of equity that recognizes the existing disparities and the historical factors that create the current state of our region and transportation systems. **In this analysis, we define equity as understanding and addressing injustices that are rooted in systemic racism and disinvestment, with the goal of determining who has been and is being harmed by transportation planning and policy decisions and reducing harm in the future.**

Data and Methods

This equity analysis synthesizes quantitative data from the 2022 5-Year American Community Survey (ACS) and the U.S. Department of Transportation's Equitable Transportation Community (ETC) Explorer. These data

sources provide socioeconomic data that informed our spatial and narrative analysis of transportation equity. We also conducted a holistic and rigorous review of literature, history, news articles, and practice to identify people and places experiencing disproportionate outcomes due to past and current injustices. When transportation disadvantage overlaps socioeconomic disadvantage, communities may lack the resources they need to access critical destinations. Therefore, understanding how identities, socioeconomics, and safety risks align is a key aspect of working towards transportation equity.

Framework

We employed a history-and trauma-informed approach to analyze equity in the INCOG region. Black and Indigenous communities in the greater Tulsa region experienced racial violence in the early twentieth century, resulting in disparities that remain to the present day (Darity et al., 2024). Research has identified a causal link between racial violence and declines in Black homeownership, Black entrepreneurship, and political participation (Darity et al., 2024). The framework we use in this analysis illustrates the role of racism in the reproduction of inequities and helps identify strategies to address them through the safety action planning process (Ingram et al., 2020).

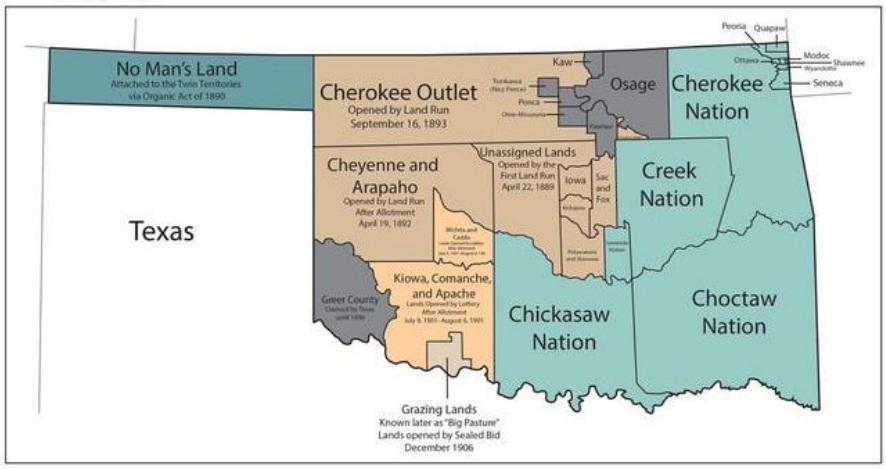

Figure 1: Map of Tribal Nations in Oklahoma in 1889 (Casteel, 2021).

Dominant narratives of U.S. history often leave out the experiences of Black, Indigenous, and people of color (BIPOC) communities. However, these events have social, economic, physical, and emotional effects on contemporary society (Greenwood, 2015). In Tulsa, income and wealth differs by race, ethnicity, and tribal groups. Research indicates that there are significant disparities in wealth accumulation across racial, ethnic, and tribal groups in the greater Tulsa region (Biu et al., 2021). The National Asset Scorecard for Communities of Color was implemented in the Tulsa Metropolitan Statistical Area to understand socioeconomic conditions for groups left out of existing national datasets like the U.S. Census. Tulsa has a racialized wealth structure, with White households having the highest median net worth while racial and ethnic groups have less wealth and greater debt. White residents of the Tulsa region also have higher rates of homeownership compared to BIPOC communities (85% to 40-76%, respectively).

Historical racial bias and discrimination has a persistent and harmful impact on BIPOC communities. Transportation infrastructure investments and policy decisions (e.g., highway projects) have compounding and long-lasting implications on community structure, safety, and quality of life (Thomas et al., 2022). The disproportionate and inequitable outcomes for BIPOC communities from transportation planning decisions is preventable through understanding our past actions and operationalizing practices informed by experiences.

To initiate repair and change, we need to acknowledge how the past and current conditions affect current travel patterns and traffic safety. This approach centers communities and neighborhoods for a holistic blend of historical and current equity outcomes. The first section focuses on recognition and repair for Black and Indigenous communities in the INCOG boundary area. We also discuss other communities that experience disproportionate vulnerabilities, and how intersectionality compounds disadvantage. Then, we focus on a regional spatial analysis

of the INCOG area. We end the memo with the current strategies and progress towards equity being made in the region as well as key takeaways from this analysis to inform planning and practice (Thomas et al., 2022).

Historical Context: Centering People and Place

Tribal Nations

The INCOG region's history revolves around indigenous settlement. Between 1830 and 1850, approximately 100,000 indigenous people experienced forced displacement when Congress passed the Indian Removal Act, pushing communities west of the Mississippi River (Darity et al., 2024). Known as the Trail of Tears, this relocation act included deception, genocide, and the seizing of economic resources from indigenous groups. Today, about 50% of Oklahoma's land area is federally recognized tribal land (Wamsley, 2020). Thirty-nine federally recognized tribal nations remain within Oklahoma (Darity et al., 2024). The City of Tulsa is about 70% Muscogee Nation lands and contains Cherokee Nation and Osage Tribe lands as well (Tulsa Preservation Commission, 2015; Wamsley, 2020).

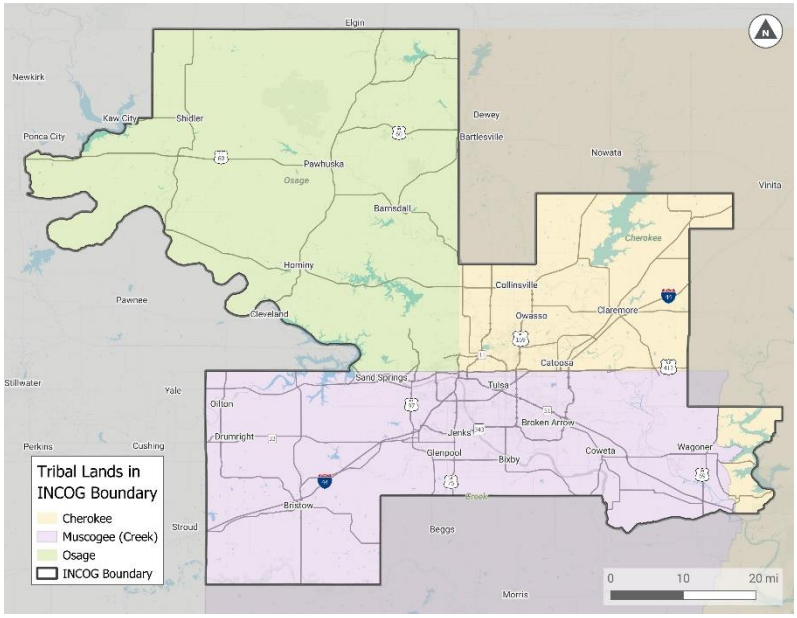

Figure 2: Map of tribal lands within INCOG's boundaries.

Osage Reign of Terror

Indigenous residents experienced widespread fear and uncertainty during the Osage Reign of Terror. Between 1920-1930, at least 60 Osage people lost their lives at the hands of White settlers in the region who wanted to acquire their wealth from oil (Blakemore, 2023; May, 2018). During the height of the 1923 oil boom in Oklahoma, the Osage tribe earned over thirty million dollars in revenue (Schilling, 2023). While several White residents were held responsible, many of the crimes remain unsolved (May, 2018).

The impacts of the Osage Reign of Terror and the Trail of Tears on tribal communities in the INCOG region are apparent today. The forced displacement, manipulation, deception, and unjust seizure of economic resources from indigenous groups in Oklahoma have resulted in lasting disparities (Darity et al., 2024). Tribal communities are more likely to be low-income, transit dependent, have higher rates of zero vehicle households, and experience significant transportation challenges compared to other groups in the U.S. context (Ndembe et al., 2021). There have also been a series of recent disputes surrounding the policing of indigenous residents within Tulsa's city limits. In 2023, a federal court ruled that Tulsa police cannot cite indigenous residents for traffic violations like speeding because the city is located within the Muscogee Nation (Murphy, 2023). This contentious decision challenges local authority and fuels the mistrust of police that many BIPOC communities experience.

Table 1: Descriptive statistics of equity variables between the Osage region and the INCOG region. The communities living in the Osage Tribal region are more likely to be indigenous and experience transportation cost burdens compared to the INCOG region. Transportation cost burden refers to the percent household income spent on transportation, including transit fares, vehicle maintenance and insurance, gasoline, and commuting behavior.

	Osage Tribe	INCOG Region
Percent Native Population	11%	7%
Percent Hispanic Population	4%	11%
Percent Black Population	5%	7%
Percent Asian Population	0%	3%
Percent Other Non-White Population	1%	3%
Percent Households in Poverty	12%	13%
Percent Transportation Cost Burdened	19%	18%

Table 2: Transportation safety statistics for tribal regions and the INCOG region. The majority of the High Injury Network is located on Muscogee lands. Osage and Muscogee tribal regions experience fewer crashes than expected based on the percentage of the High Injury Network located there. However, Cherokee tribal regions experience disparate safety impacts, with 23% of the INCOG region's total crashes and 17% of the INCOG region's High Injury Network.

	Osage Tribe	Muscogee Nation	Cherokee Nation	INCOG Region
Miles of High Injury Network	12	203	45	266
Serious Injury Crashes	81	1303	397	1807
Fatal Crashes	20	317	120	490
Total FSI Crashes	101	1620	517	2297

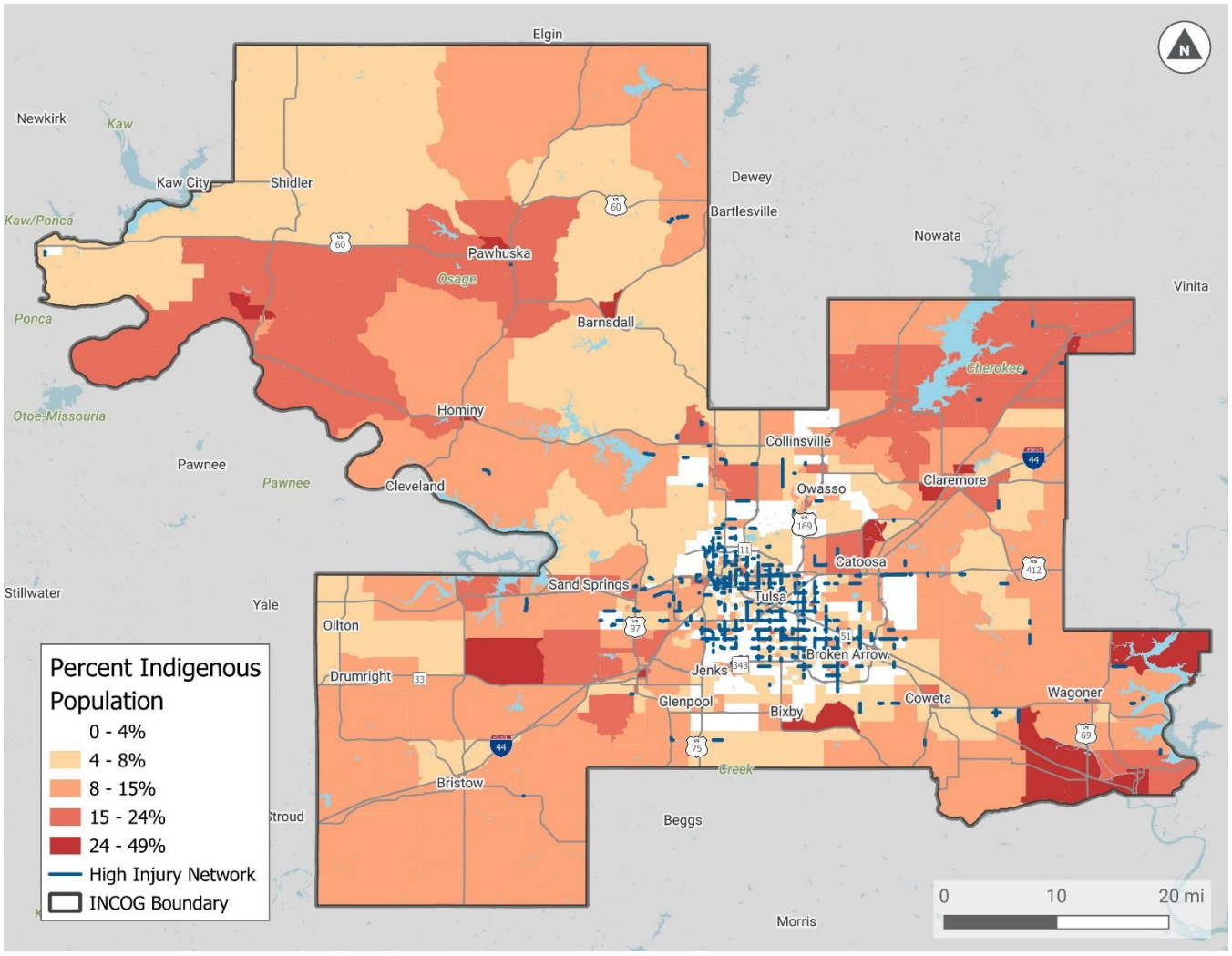

Figure 3: Map of the INCOG region's Indigenous population density alongside the High Injury Network. The Network is concentrated in Tulsa County, while Indigenous residents primarily preside in the outer counties.

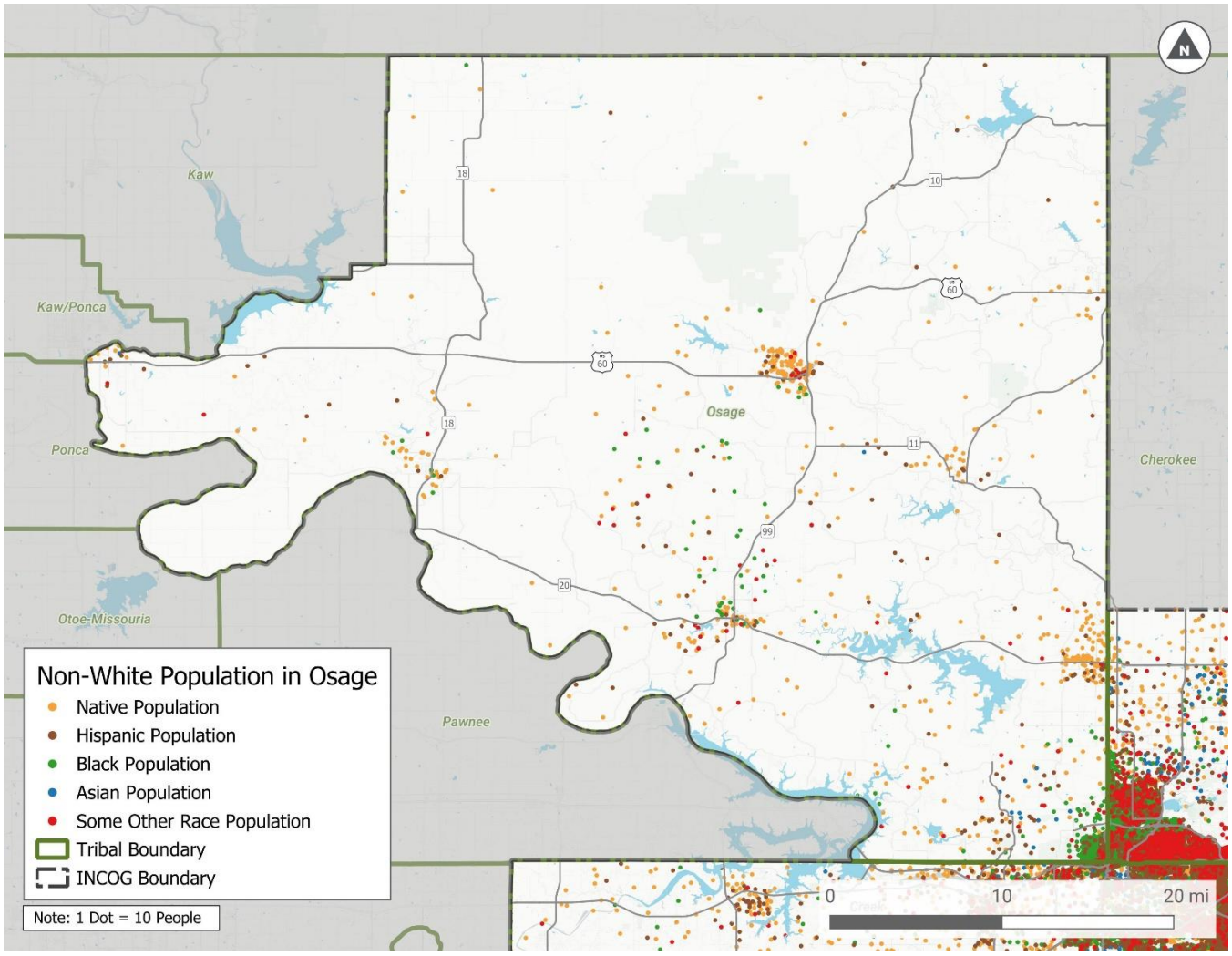

Figure 4: Racial composition and density map of the Osage Tribe region. Indigenous residents live across the Osage Tribe region, with higher densities near towns and cities.

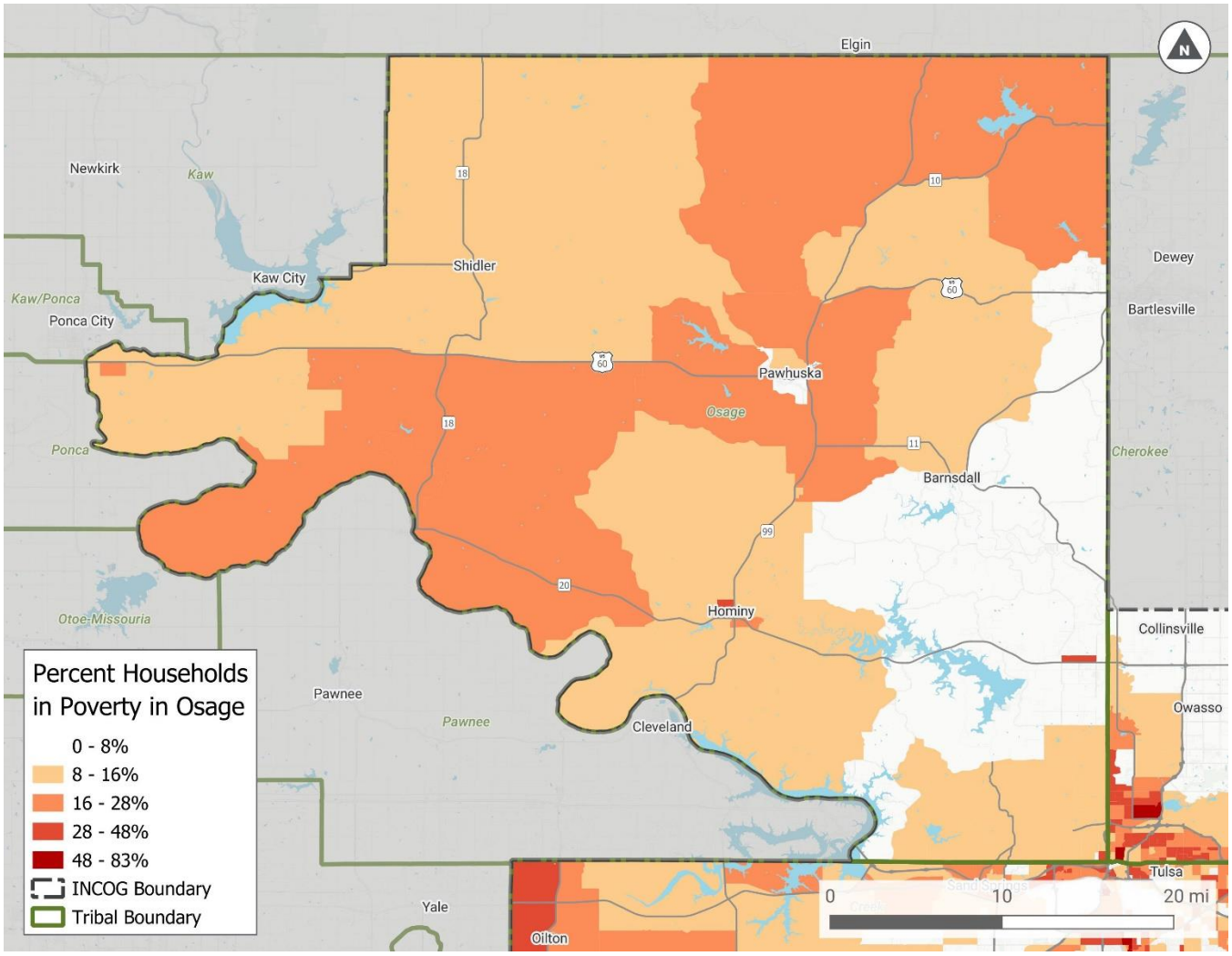

Figure 5: Map of the percentage of households in poverty in the Osage Tribe region. Farther away from the Tulsa metropolitan area, poverty is more prevalent.

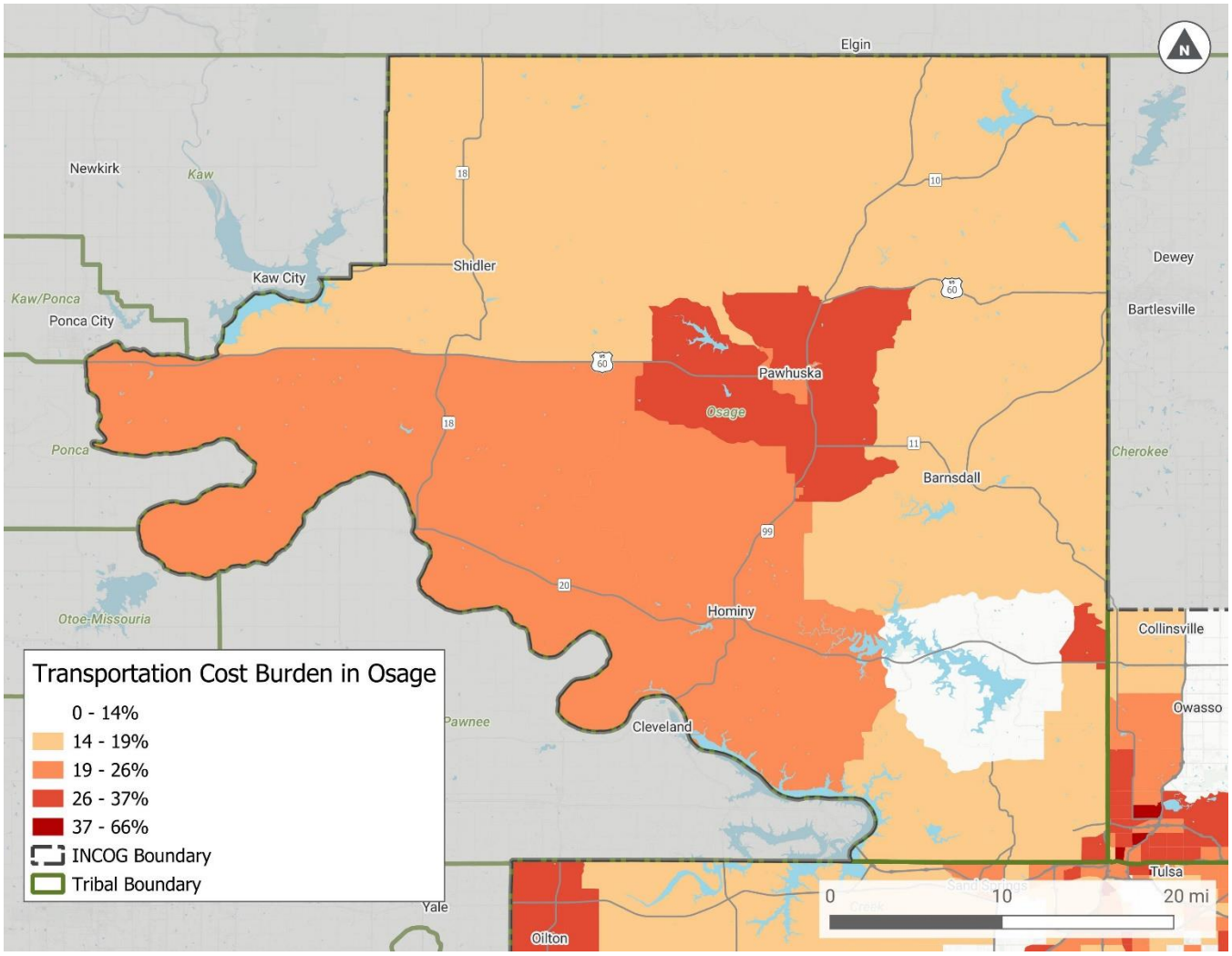

Figure 6: Map of the transportation cost burden on Osage Tribe lands within INCOG. Transportation cost burdens increase with distance from the Tulsa metropolitan area, and are highest in the central and southwestern areas.

Systemic Racism

In the late 1800s following the Civil War, Black settlers with newfound freedom migrated to Oklahoma to create over 50 towns on land within the Indian Territory (O'Dell, 2024). Known as *All-Black Towns*, these communities prospered on agriculture and experienced safety, security, and virtually no discrimination, unlike most of the other racially mixed settlements in the southern United States at the time (O'Dell, 2024). By the early 1900s, most of these communities were affected by an exodus of residents to Canada in response to Jim Crow laws and by the financial crisis caused by the Great Depression (O'Dell, 2024). However, today fourteen All-Black Towns remain, and their legacy of political and economic opportunity are significant. The INCOG region contains two All-Black Towns, Red Bird and Tullahassee.

Figure 7: Past and current All-Black Towns in Oklahoma (Stantec, 2023).

The INCOG region has a legacy of racial inequity that is rooted in systemic racism and perpetuated by policies and practices that reinforce disparities for Black communities (Human Rights Watch, 2020). In greater Tulsa, Black communities have experienced disparities in education, accessibility, health, housing, social rights, and economic benefits that stem from events, policies, and actions perpetuating racial violence (Human Rights Watch, 2020). Discrimination continues to occur against Black residents of Tulsa today in the form of disinvestment, resource gaps, poverty, mistrust of police, and aggressive policing (Human Rights Watch, 2020).

1921 Tulsa Race Massacre in the Greenwood District

The events of the Red Summer, spanning into the fall of 1919, led to increasing racial tensions in Black communities across the country. Over twenty-six cities experienced racially motivated attacks, setting the stage for the 1921 Tulsa Race Massacre (Cornish et al., 2021).

In 1921, the Greenwood District was known as "Black Wall Street" because of the vibrant, successful prosperity of the community and abundance of black-owned businesses. The Greenwood District was situated between the present-day L. L. Tisdale Parkway to the west, I-244 to the south, and the Cherokee Expressway to the east. The neighborhood spanned almost 1.5 miles from north to south, directly north of downtown Tulsa, and was home to approximately 10,000 Black residents. However, the neighborhood was the focal point of a devastating day of racial violence between May 31st and June 1st of 1921. What was initiated by the arrest of a Black man and the threat of lynching escalated to a racial clash that resulted in over 300 Black lives lost and overwhelming property damage and destruction in the Greenwood District (Tulsa Historical Society & Museum, 2024).

Local officials deputized White men, who together with the Tulsa Police and the Oklahoma National Guard, injured an additional 700 residents and destroyed 1,256 homes across 36 city blocks (Tulsa Historical Society & Museum, 2024). As a result, the approximately 10,000 Black residents were displaced (Darity et al., 2024; Parshina-Kottas et al., 2021). Initially, 55 Black men were charged for initiating the riot (Desai, 2021). However,

this was later cleared in 1996. Some experienced homelessness, and others were detained in internment camps. To this date, there have been no reparations or people held responsible for the attack (Human Rights Watch, 2020).

The aftermath of the massacre continued to be tumultuous for the Black community in Tulsa. City leadership made targeted policy decisions that put structures in place to hinder the rebuilding of Greenwood (Human Rights Watch, 2020). The Mayor, City Commission, and Tulsa Real Estate Exchange worked to rezone the Greenwood District from residential to industrial land use. The City of Tulsa changed fire codes to only permit brick buildings, prohibiting Greenwood residents from rebuilding their homes and businesses in affordable wood. Insurance companies also refused to pay property damage claims from the event, leaving Black property and business owners with more financial strain. Lastly, the City of Tulsa developed a master plan to redevelop Greenwood that would push Black neighborhoods farther from downtown (Human Rights Watch, 2020). Together these actions reveal the purposeful planning decisions and actions that harmed instead of helped residents of Greenwood after the massacre. Despite this, the residents of Greenwood were resilient and restored much of the neighborhood and their businesses within the next two decades.

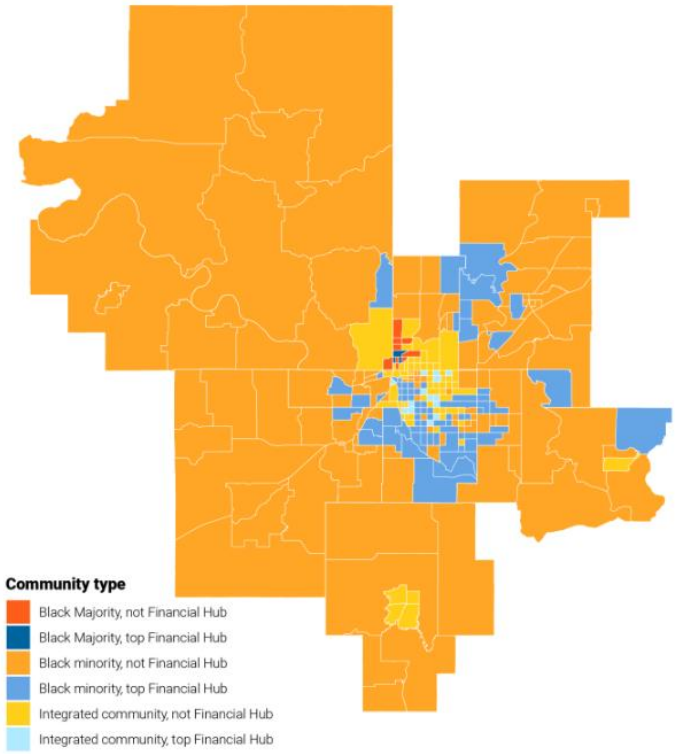

Figure 8: Financial hubs and Black neighborhoods in Tulsa based on 2019 ACS 5-Year Estimates (Perry et al., 2021).

The Brookings Institute has visualized the modern disparities that stem from the massacre. Black neighborhoods in Tulsa no longer contain the economic strength they used to, evident from the location of financial hubs in relation to Black majority neighborhoods (Perry et al., 2021). The displacement of Black residents to North Tulsa is also clear, and this region of the city experiences more poverty and disinvestment than the southern regions (Perry et al., 2021).

Spatial Analysis of Greenwood District

Table 3: Descriptive statistics of equity variables between the Greenwood District and the INCOG region. Greenwood has significantly higher rates of Black communities. In addition, Hispanic population density and households in poverty are higher in Greenwood compared to the region. Residents are almost twice as likely to experience transportation cost burdens.

	Greenwood	INCOG Region
Percent Native Population	6%	7%
Percent Hispanic Population	18%	11%
Percent Black Population	38%	7%
Percent Asian Population	0%	3%
Percent Other Non-White Population	0%	3%
Percent Households in Poverty	32%	13%
Percent Transportation Cost Burdened	31%	18%

Table 4: Transportation safety statistics for tribal regions and the INCOG region. Approximately 1.4% of fatal crashes occurred in Greenwood, despite having only 0.1% of the region's High Injury Network. Therefore, fatal crashes are overrepresented in the Greenwood District.

	Greenwood	INCOG Region
Miles of High Injury Network	0.31	266
Serious Injury Crashes	1	1807
Fatal Crashes	7	490
Total FSI Crashes	8	2297

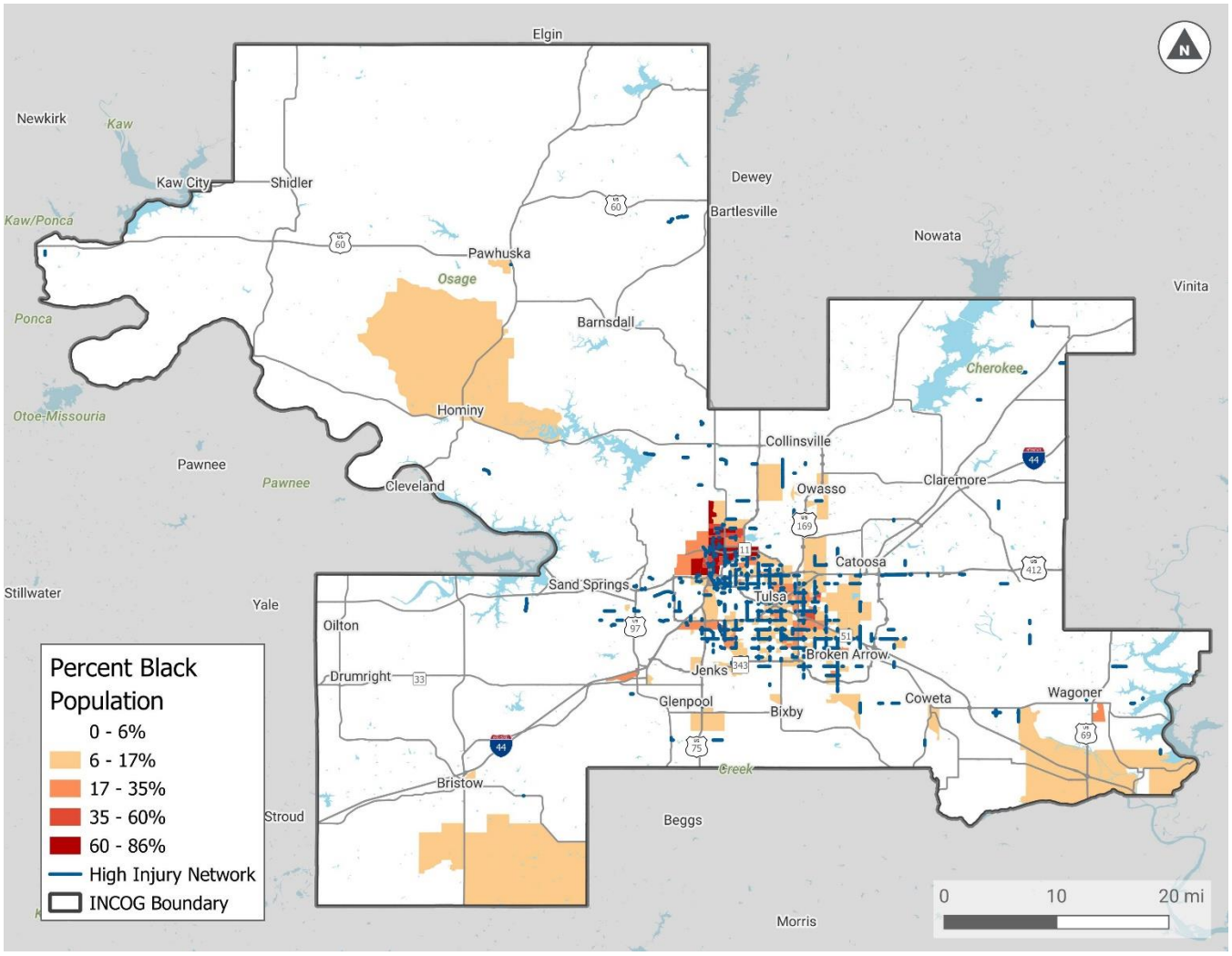

Figure 9: Map of the Black population density within the INCOG region. The High Injury Network aligns with areas with high proportions of Black residents near Tulsa.

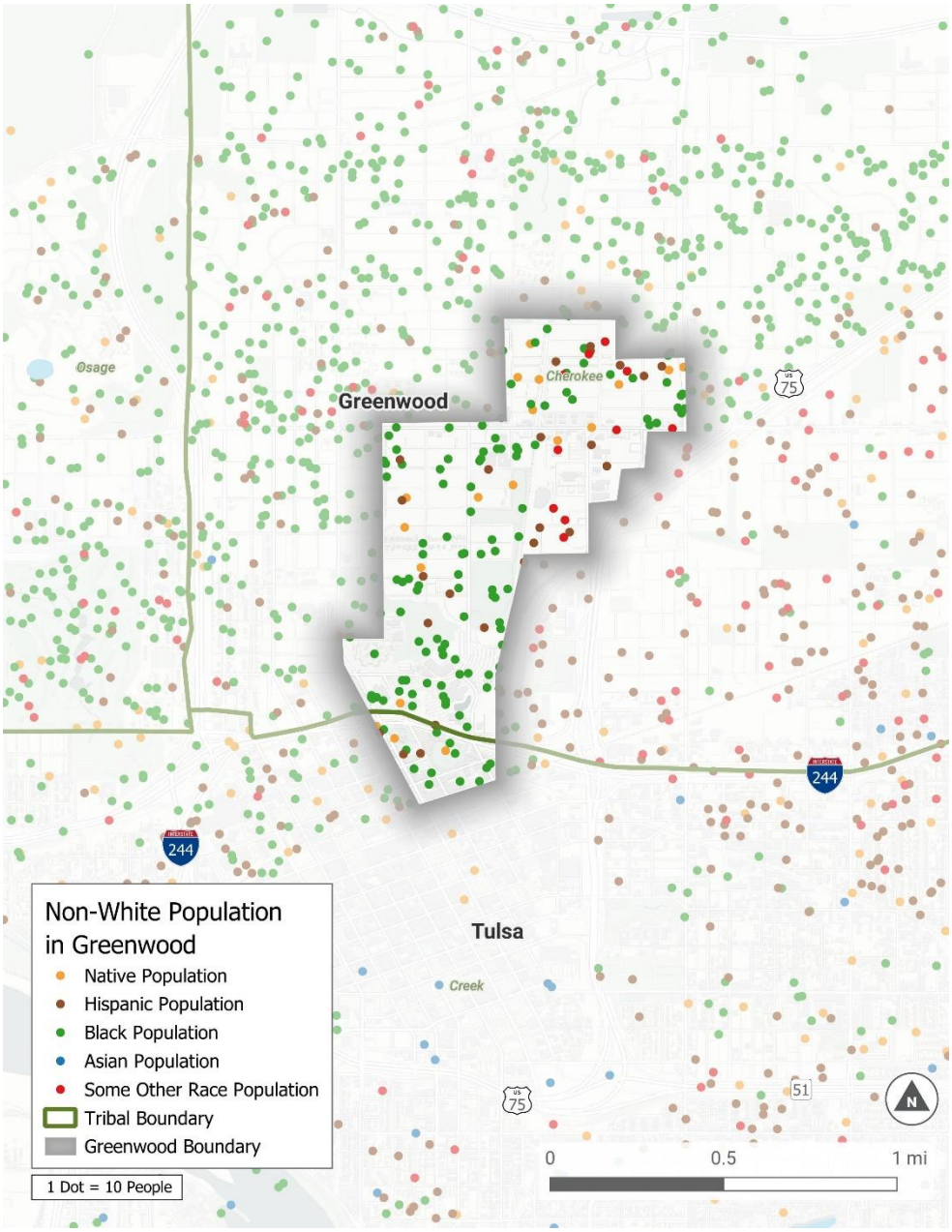

Figure 10: Racial dot density map of Greenwood and the surrounding neighborhoods. Greenwood and northern Tulsa have significantly more communities of color than central Tulsa.

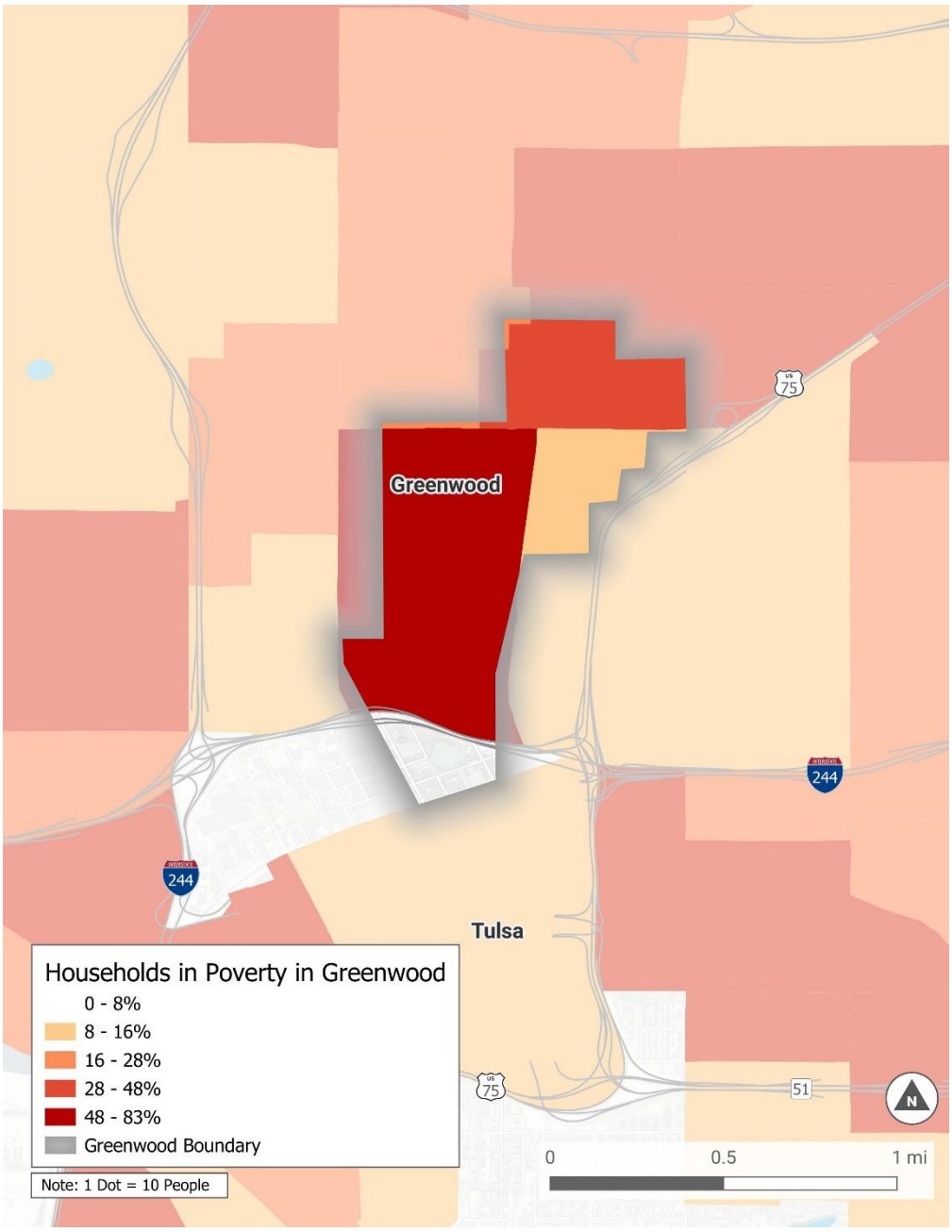

Figure 11: Map of the percentage of households in poverty by census block group. Greenwood has higher poverty rates than central Tulsa.

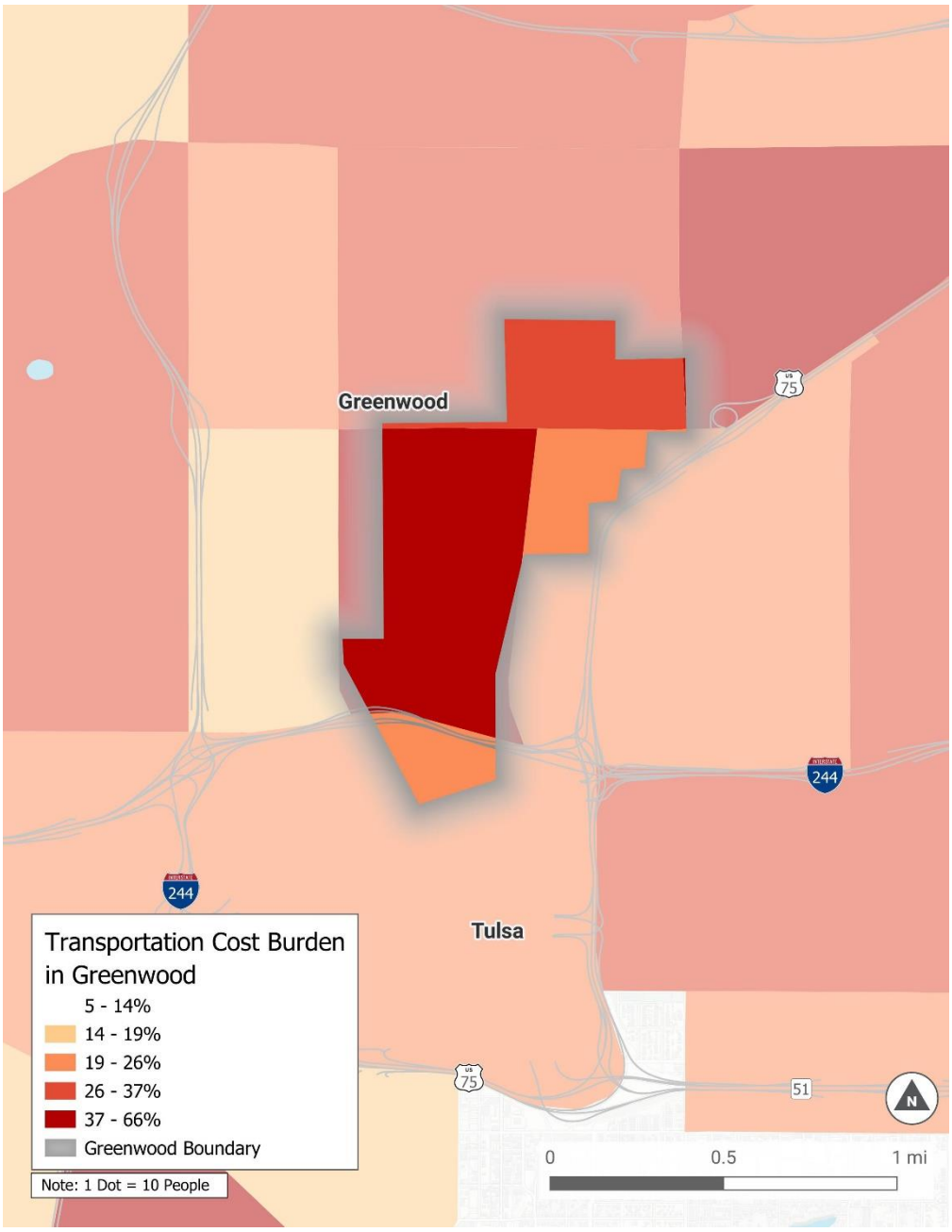

Figure 12: Map of the percentage of households experiencing transportation cost burdens by census block group in Greenwood and the surrounding neighborhoods. Greenwood is within the highest rate category of transportation cost burdens.

Urban Renewal

By the mid-twentieth century, Greenwood and other Black communities experienced another challenge caused by urban renewal. Tulsa was the first city in Oklahoma to initiate urban renewal practices and projects, and the affected communities experienced direct displacement, disinvestment, and a lack of resources.

With the displacement of Black and low-income communities from central Tulsa, the INCOG region experienced the suburbanization of poverty. Communities that experience poverty and displacement or forces that result in movement outwards from the urban core experience lower mobility, accessibility, and educational attainment, poorer health, and more exposure to crime and violence (Mueller et al., 2024).

Redlining

While Greenwood was rebuilding in the 1930s, the area, and approximately 35% of land area within the City of Tulsa, was redlined (Human Rights Watch, 2020). The Home Owners' Loan Corporation (HOLC) and Federal Housing Administration developed a systemic and standardized method to codify racial segregation through zoning neighborhoods based on desirability and investment risk. Redlined areas, which were deemed hazardous by the HOLC, were largely Black communities and as well as other communities of color and indigenous groups. Redlining was used as a strategy to determine eligibility for government insured mortgages and prevented BIPOC communities from securing a loan to purchase a home (Rothstein, 2017).

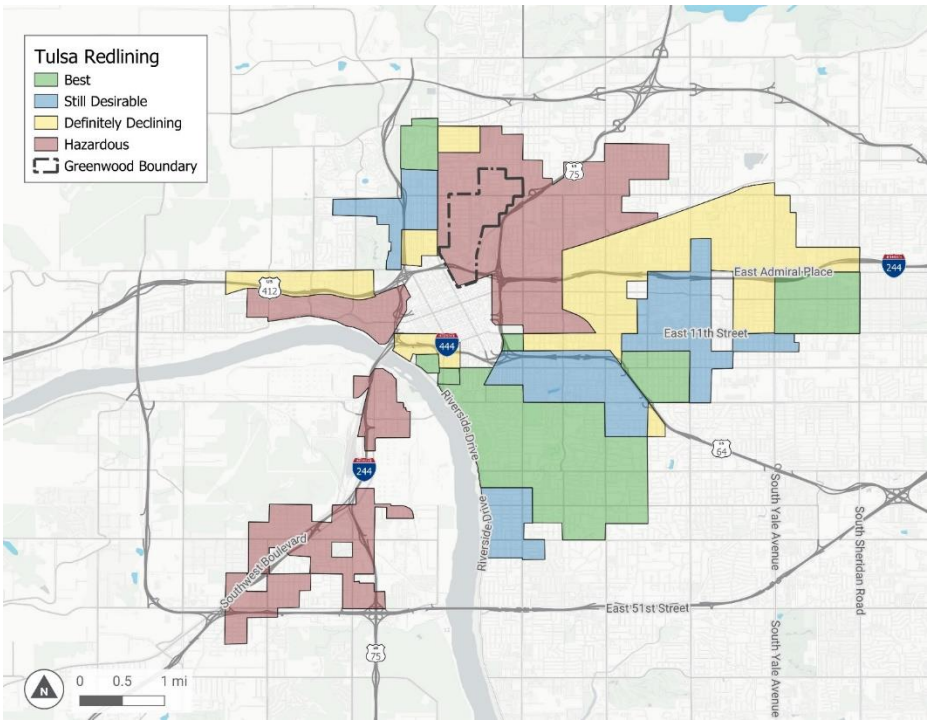

Figure 13: Map of redlined areas of Tulsa, the highway network, and Greenwood's boundaries.

The redlined areas of Tulsa continue to experience disinvestment, inequality, and segregation today. Most redlined neighborhoods are still predominantly communities of color and low-income. Indigenous residents are denied a home loan rate three times as much as other racial groups in Tulsa today (City of Tulsa & Tulsa Area United Way, 2023). Additionally, the median household income in White households is 57% greater than Black households in Tulsa, and Black households are three times more likely to not have regular access to a vehicle (City of Tulsa & Tulsa Area United Way, 2023).

The region is also facing a current redlining dispute. The Department of Justice has charged the American Bank of Oklahoma for discriminating against both Black and Hispanic residents (Miller, 2023). The intentional hinderance of providing loans and other financial supports for Black and Hispanic residents has limited the building of generational wealth and financial stability (Miller, 2023). Redlining, both in the past and the current scandal, contribute to poverty, housing affordability, segregation, and the social climate of the region (Human Rights Watch, 2020).

Spatial Analysis of Redlined Areas

Table 5: Transportation safety statistics for redlined areas within Tulsa. Approximately 5% of the INCOG region's total crashes and 3% of the High Injury Network are within redlined areas.

	Redlined Areas	INCOG Region
Miles of High Injury Network	8.35	266
Serious Injury Crashes	92	1807
Fatal Crashes	17	490
Total Crashes	109	2297

Highway Displacement

A significant component of urban renewal practices across the United States included highway construction that directly displaced marginalized communities. Highway projects fueled the shift to sprawling, suburban development and city roads designed for cars, rather than pedestrians (Rowland, 2024). Catalyzed by the Federal-Aid Highway Act of 1965, the mid-twentieth century is marked by the widescale construction of highways that predominantly disrupted Black and low-income communities. Tulsa was the first city in the state to develop an Urban Renewal Program, and planned projects, public housing projects, and the annexation of land to create suburban towns for predominantly White commuters (Rowland, 2024). In the 1960s, Greenwood was impacted by the construction of four highways. Documented in Tulsa's 1957 Comprehensive Plan, a network of highways named the Inner Dispersal Loop (IDL) were planned and built to circle downtown Tulsa (Human Rights Watch, 2020; Moreno, 2021). The highway projects caused the direct displacement of residents in the immediate area of the highways as well as widespread decreases in mobility and accessibility in what was once a walkable area of the city (Moreno 2021; Sanchez et al., 2004).

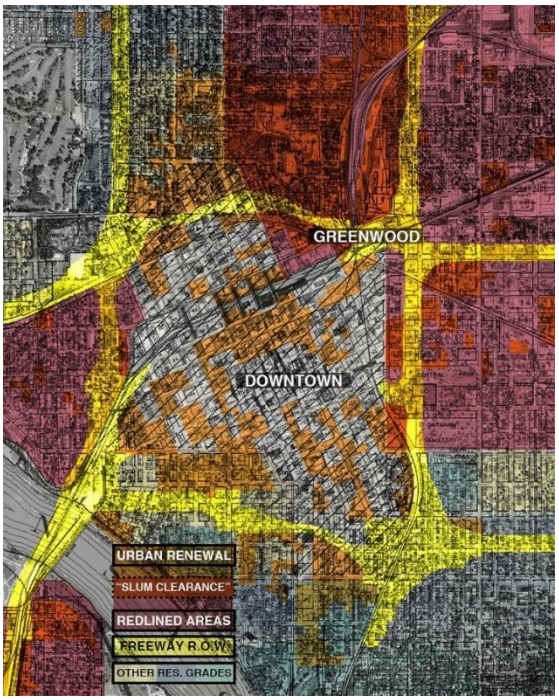

Figure 14: Maps overlaying highway construction with redlined areas and urban renewal sites in downtown Tulsa (Segregation by Design [@segregation_by_design], 2021).

Using eminent domain, predominantly Black-owned land was seized and used for highways. This destruction of Black neighborhoods highlights the racism and discrimination perpetuated by transportation planning and investment.

The neighborhood of Tracy Park, located in southeast Tulsa, was severely impacted by displacement to accommodate U.S. Highway 64 (the Broken Arrow Expressway) and U.S. Highway 75 (Rowland, 2024). Over 250 properties acquired through eminent domain and demolished for highway construction across 84 acres (Rowland, 2024). Additionally, the boundary line between the Cherokee Nation to the north and Muscogee (Creek) Nation to the south, Admiral Boulevard, was also affected by highway construction (Rowland, 2024). Serving as the designation point between north and south Tulsa, Admiral Boulevard was impacted by the construction of

Interstate 244 (Rowland, 2024). The previously thriving street of a business district is now largely vacant and serves as a service road to the interstate (Rowland, 2024). The Tulsa Urban Renewal Authority, responsible for planning the IDL and locating the highways, purposefully targeted communities of color. This not only destroyed community cohesion and property, but also physically separated these communities from other neighborhoods and city resources (Rowland, 2024). The highways also bring negative externalities like noise and air pollution to adjacent communities, highlighting environmental injustices associated with urban renewal (Vock, 2022).

Today, Greenwood is experiencing redevelopment in accordance with the Master Plan for North Tulsa that was adopted in 2022 (Partner Tulsa, 2022). Approximately 56 acres of the neighborhood were slotted for redevelopment after extensive public engagement with Black communities. The goals of the plan include improving multimodal connectivity and the potential removal of I-244 in exchange for an at-grade, multimodal corridor. In addition, Admiral Boulevard was part of a Reconnecting Communities Pilot grant application initiated by the Oklahoma Department of Transportation. The adjacent communities experience disconnected local street networks due to the highway facility, as well as environmental justice concerns like air and noise pollution (Oklahoma Transportation, 2022; Vock, 2022).

Spatial Analysis of Tracy Park and Admiral Boulevard

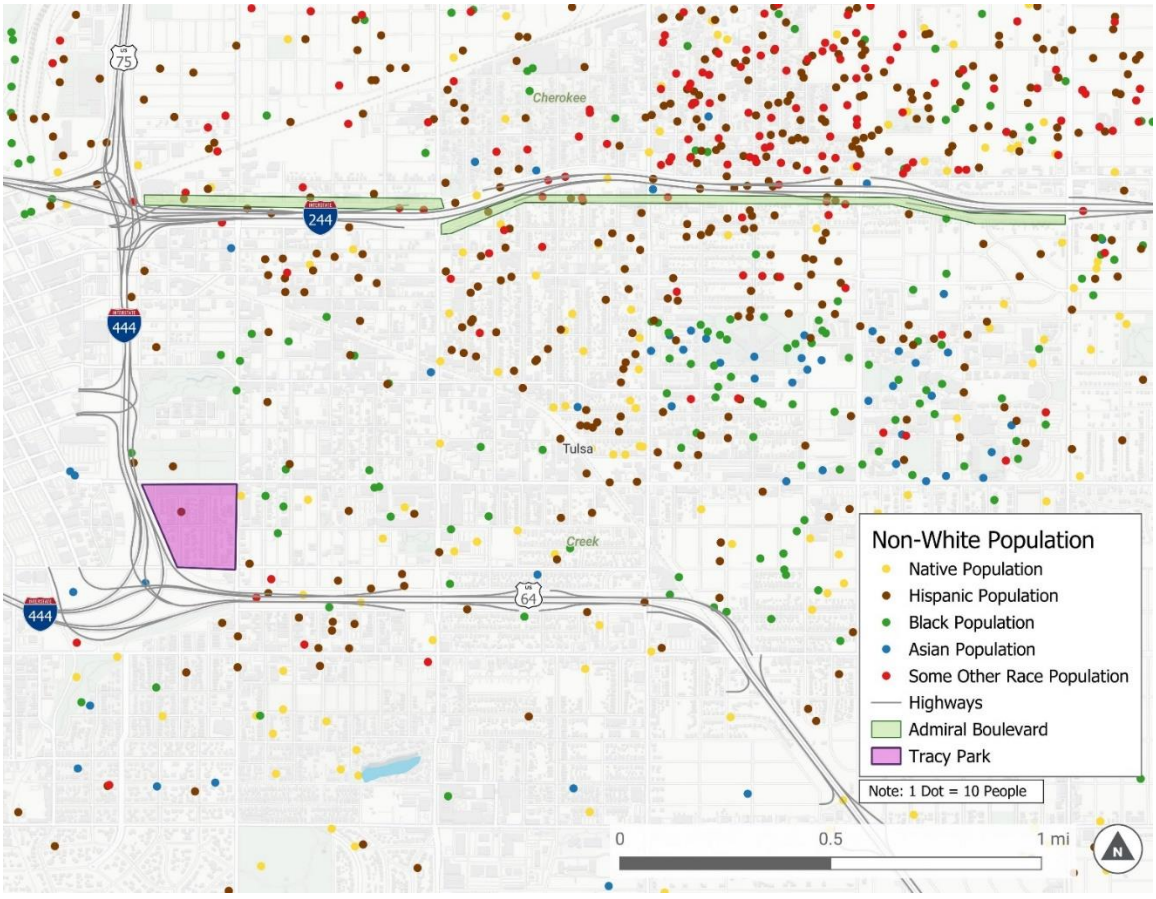

Figure 15: Racial dot density map of communities affected by highway displacement and urban renewal in Tulsa.

Regional Safety Disparities

Rural Land Use Context

Research indicates that a higher rate of serious injury and fatal crashes occur in rural areas compared to urban areas nationwide, and this trend holds true for Oklahoma (Waldheim et al., 2014). According to NHTSA, 59% of Oklahoma crashes occur in rural areas and these crashes have higher fatality rates compared to urban areas (National Highway Traffic Safety Administration, 2024). High-speed rural roadways and farther distances between destinations contribute to high and severe rural crash rates.

Rural residents of Oklahoma feel disconnected from the urban core, especially regarding investment and access to resources (Straub, 2022). Scholarship reveals that rural communities experience distrust of urban areas of Oklahoma and feel that they must solve problems without external support (Straub, 2022). This is relevant to securing transportation for medical emergencies and during disasters (Straub, 2022). Combining lived experiences with quantitative data, we can better identify disparate travel challenges for rural populations. The built environment, compounded with land use patterns and a lack of transportation mode choices, restrict the mobility and accessibility of rural residents (Shay et al., 2016). Rural and tribal regions of the state, including within INCOG's region, operate limited on-demand transit services. However, there is a lack consistent and quality transportation options besides operating a personal vehicle in rural areas (Mistry et al., 2020). Rural households without regular vehicle access are more likely to be socioeconomically disadvantaged than zero-vehicle households in urban areas, exacerbating travel challenges (Barajas & Wang, 2023).

County Disparities

The INCOG region contains five counties as well as 50 cities and towns. Osage, Creek, Rogers, and Wagoner counties have greater proportions of Indigenous communities compared to Tulsa County (Table 6). However, Tulsa County has higher concentrations of Black, Hispanic, Asian, and other communities of color compared to the other counties within the INCOG region. Poverty and transportation cost burden are concentrated in Osage, Creek, and Tulsa counties.

Creek County contains less than 1% of the region's High Injury Network, yet over 7% of serious injury and fatal crashes occur there (Table 7). Rogers County experiences a similar phenomenon, with 4% of the High Injury Network and 11% of the region's total serious injury and fatal crashes. The majority of the High Injury Network and total crashes occur within Tulsa County. While these statistics match population density, they indicate that the surrounding counties experience safety disparities with less planning focus based on the location of the High Injury Network.

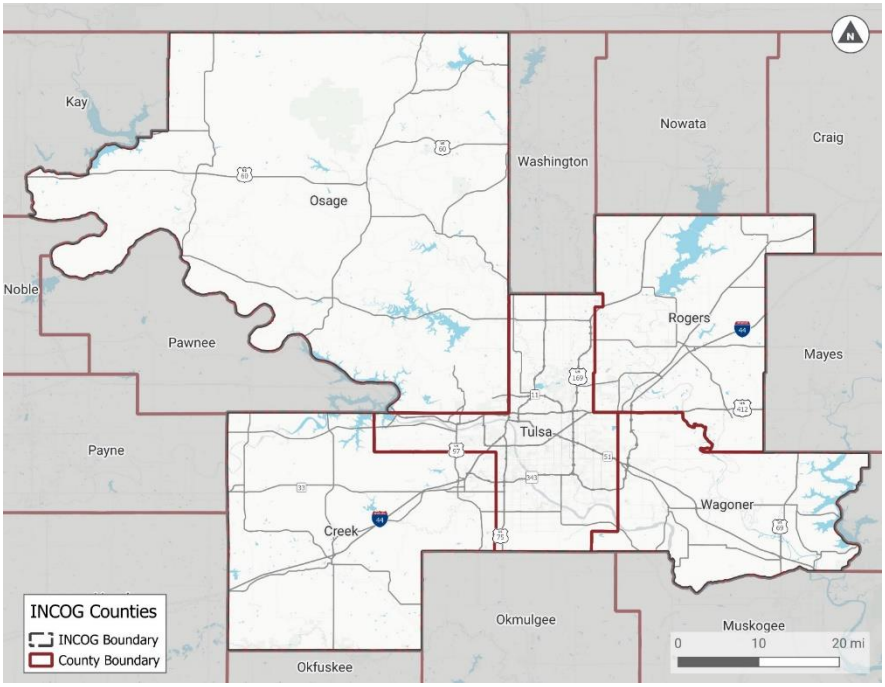

Figure 16: Map of the counties within and around the INCOG boundaries.

Spatial Analysis of INCOG Counties

Table 6: Descriptive statistics of equity variables by county compared to the INCOG region.

	Osage	Creek	Tulsa	Rogers	Wagoner	INCOG Region
Percent Native Population	11%	11%	5%	13%	11%	7%
Percent Hispanic Population	4%	5%	14%	5%	7%	11%
Percent Black Population	5%	2%	10%	1%	4%	7%
Percent Asian Population	0%	1%	4%	2%	2%	3%
Percent Other Non-White Population	1%	1%	4%	1%	2%	3%
Percent Households in Poverty	12%	14%	14%	9%	9%	13%
Percent Transportation Cost Burdened	19%	20%	18%	16%	17%	18%

Table 7: Transportation safety statistics by county compared to the INCOG region. Tulsa and Rogers are the counties with the highest proportion of FSI crashes per person.

	Osage	Creek	Tulsa	Rogers	Wagoner	INCOG Region
Miles of High Injury Network	12	1	217	10	25	266
Serious Injury Crashes	81	100	1340	184	148	1807
Fatal Crashes	20	67	287	68	56	490
Total FSI Crashes	101	167	1627	252	204	2297
Proportion of FSI Crashes per Person	0.22%	0.23%	0.24%	0.25%	0.23%	0.23%

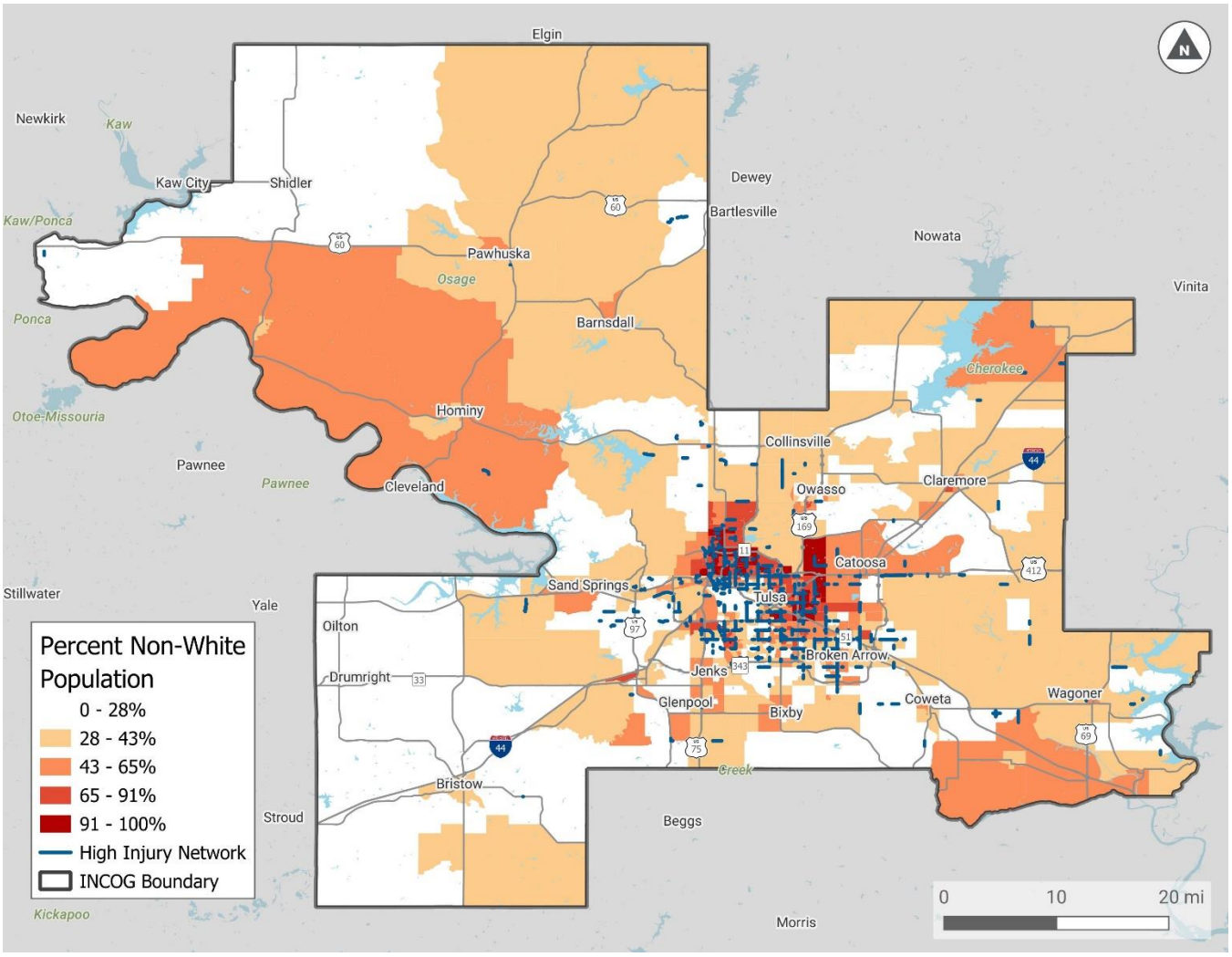

Figure 17: Map of the proportion of non-White communities compared to the location of the High Injury Network. Communities of color are concentrated in Northwest Tulsa, Osage, Wagoner, and Rogers counties. The High Injury Network is disproportionately located within communities of color, revealing that they experience the greatest traffic safety risks.

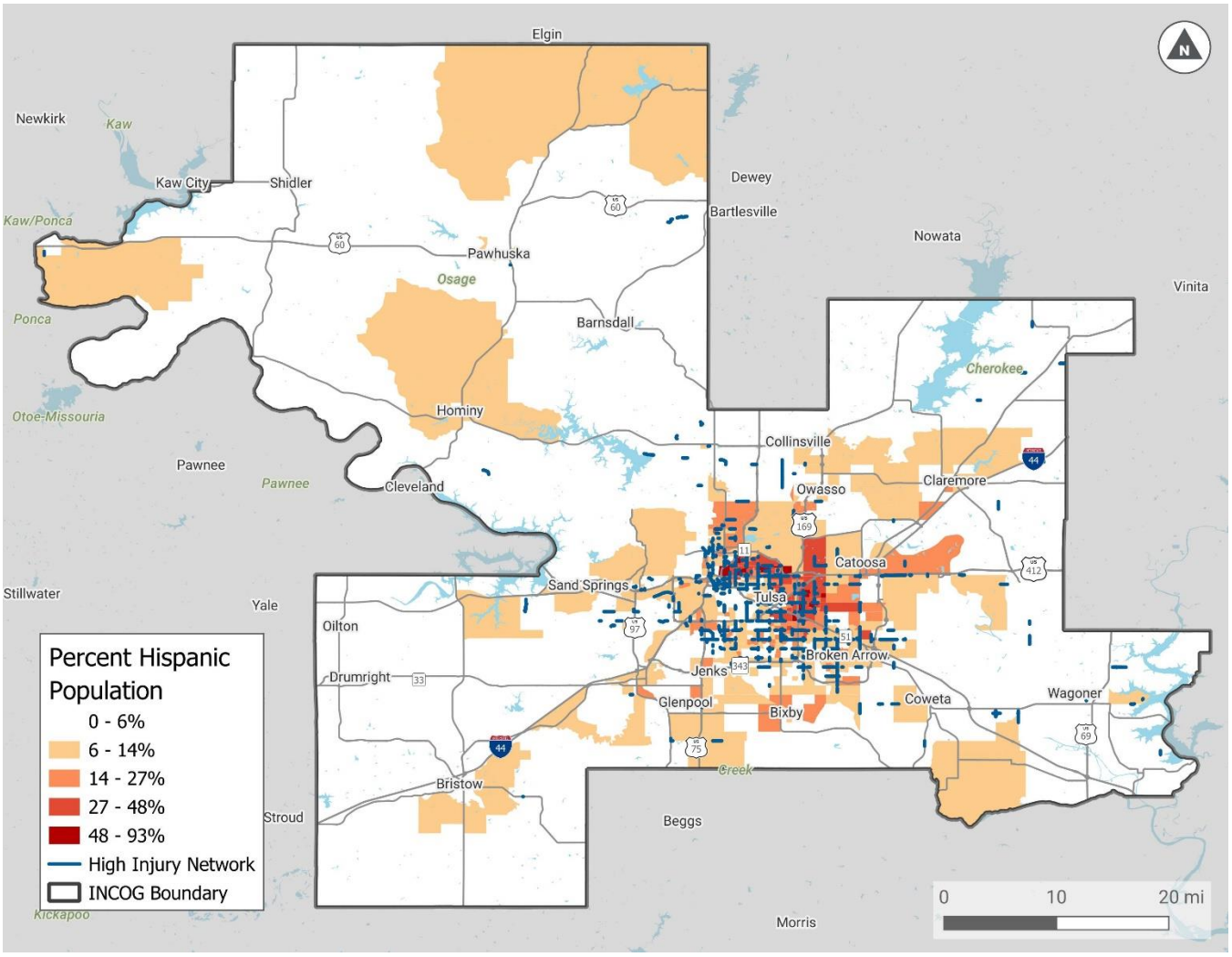

Figure 18: Map of the proportion of Hispanic residents alongside the High Injury Network. Central and southeastern regions of Tulsa have high rates of Hispanic communities and unsafe streets.

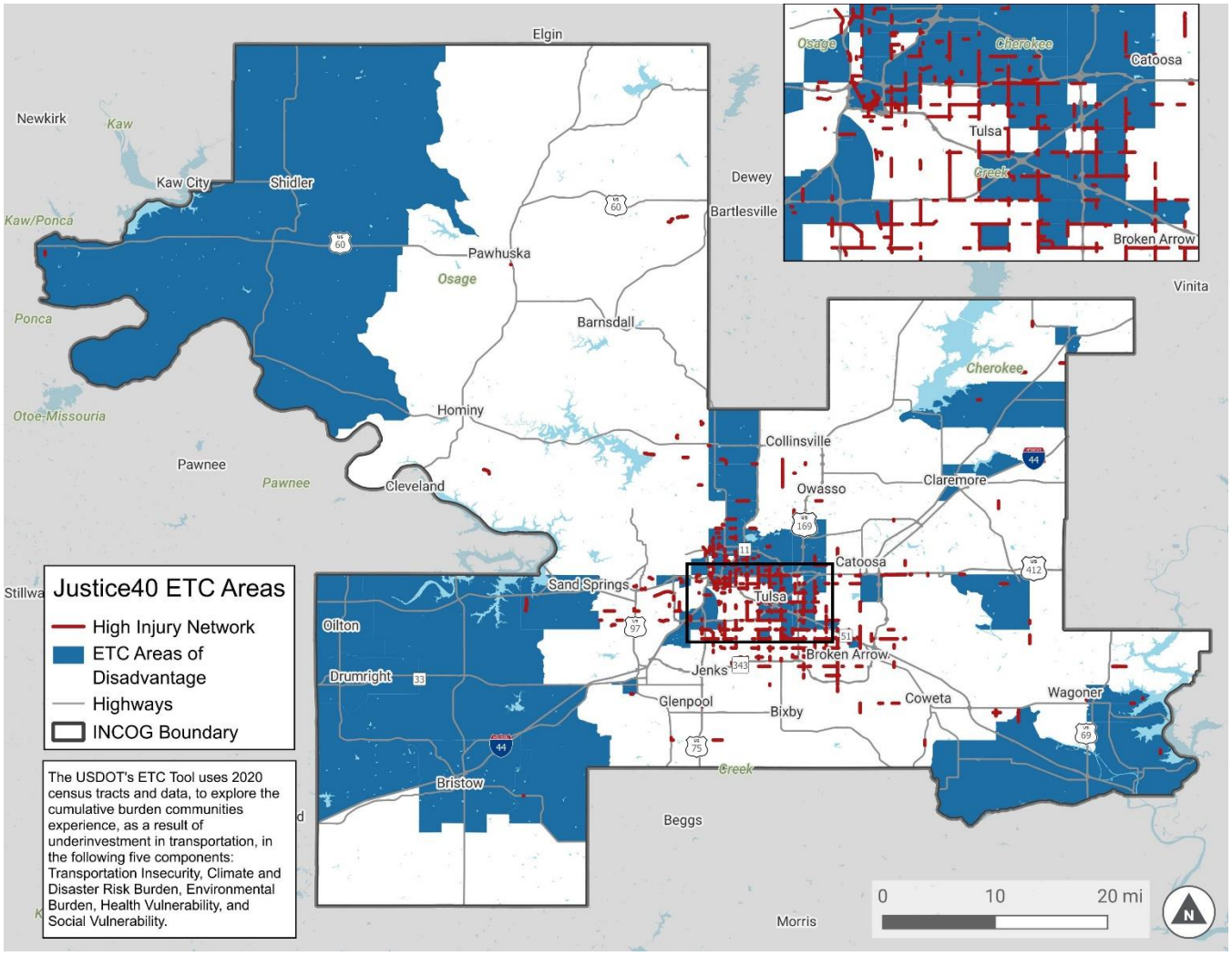

Figure 19: Map of the Justice40 ETC Areas of Disadvantage and the High Injury Network. ETC Areas align with the High Injury Network in the central, southern, and eastern INCOG regions. About 41% of the High Injury Network is located within ETC Areas, despite representing only 39% of INCOG's land area.

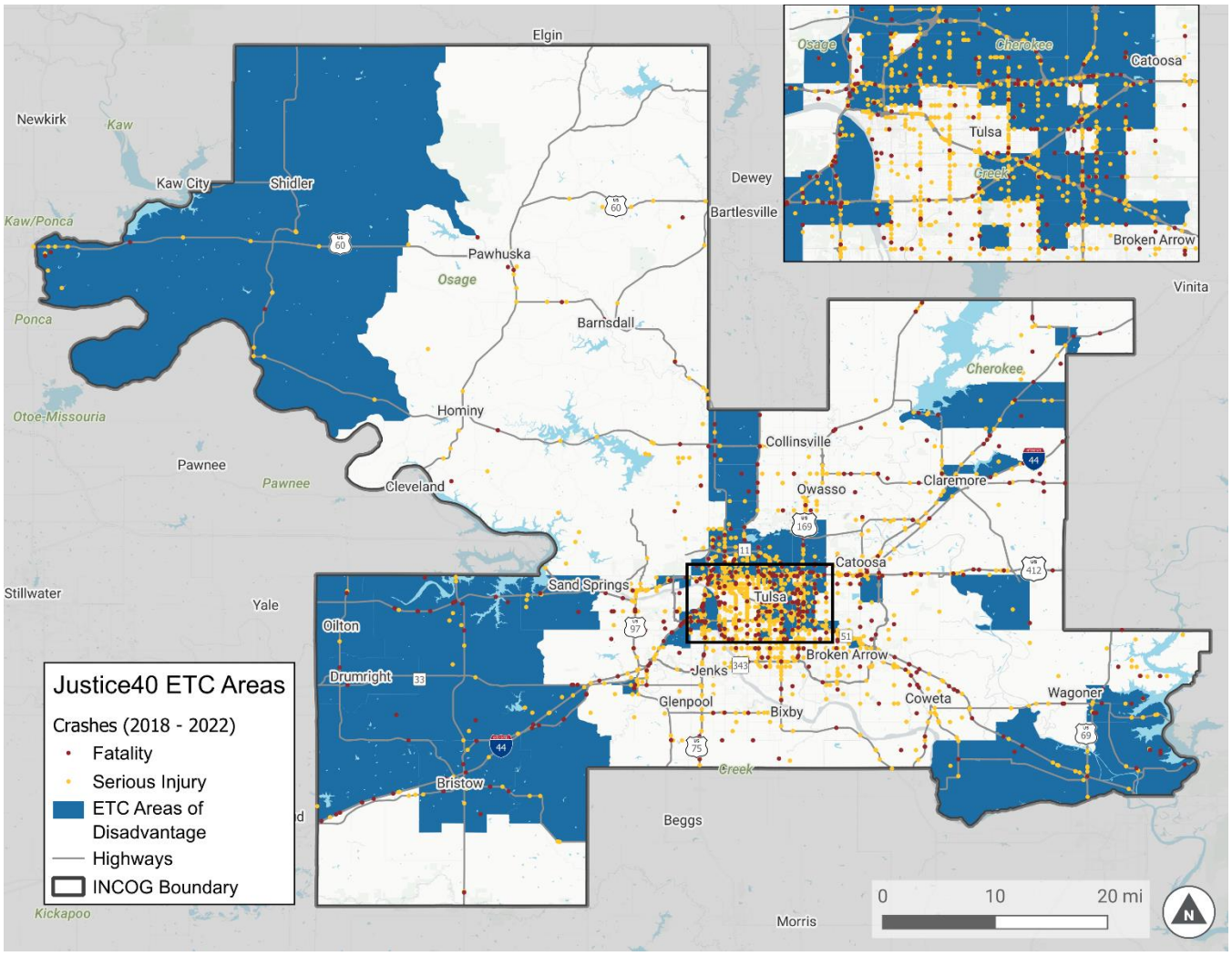

Figure 20: Map of the Justice40 ETC Areas of Disadvantage and the location of serious injury and fatal crashes. Approximately 49% of the total serious injury and fatal crashes occurred within ETC Areas, despite representing only 39% of INCOG's land area.

Regionwide Sociodemographic Analysis and Mapping

Additional Communities to Prioritize

Beyond the history of racial injustices to Black and Indigenous communities, it is important to recognize other communities that experience past and present disproportionate transportation system outcomes. Transportation system resources are not distributed equitably, and therefore, many marginalized communities fail to benefit from investments (Ward & Walsh, 2023). In addition, disadvantaged communities travel less due to high travel costs (time and resources), limited ability to travel, and personal safety concerns (Wang et al., 2021). Communities who experience structural disadvantage and discrimination in transportation planning have lived experiences that should be valued and centered to understand transportation system outcomes like accessibility, mobility, and safety (Lowe et al., 2023). This includes Hispanic, Asian and Pacific Islander, disabled, older adults, youth, gender nonconforming individuals, women, nondrivers, unhoused, immigrants, and non-English speaking communities in transportation equity. Below, we explore the socioeconomic conditions that exist among several of the groups that are known to experience transportation inequity across the INCOG region.

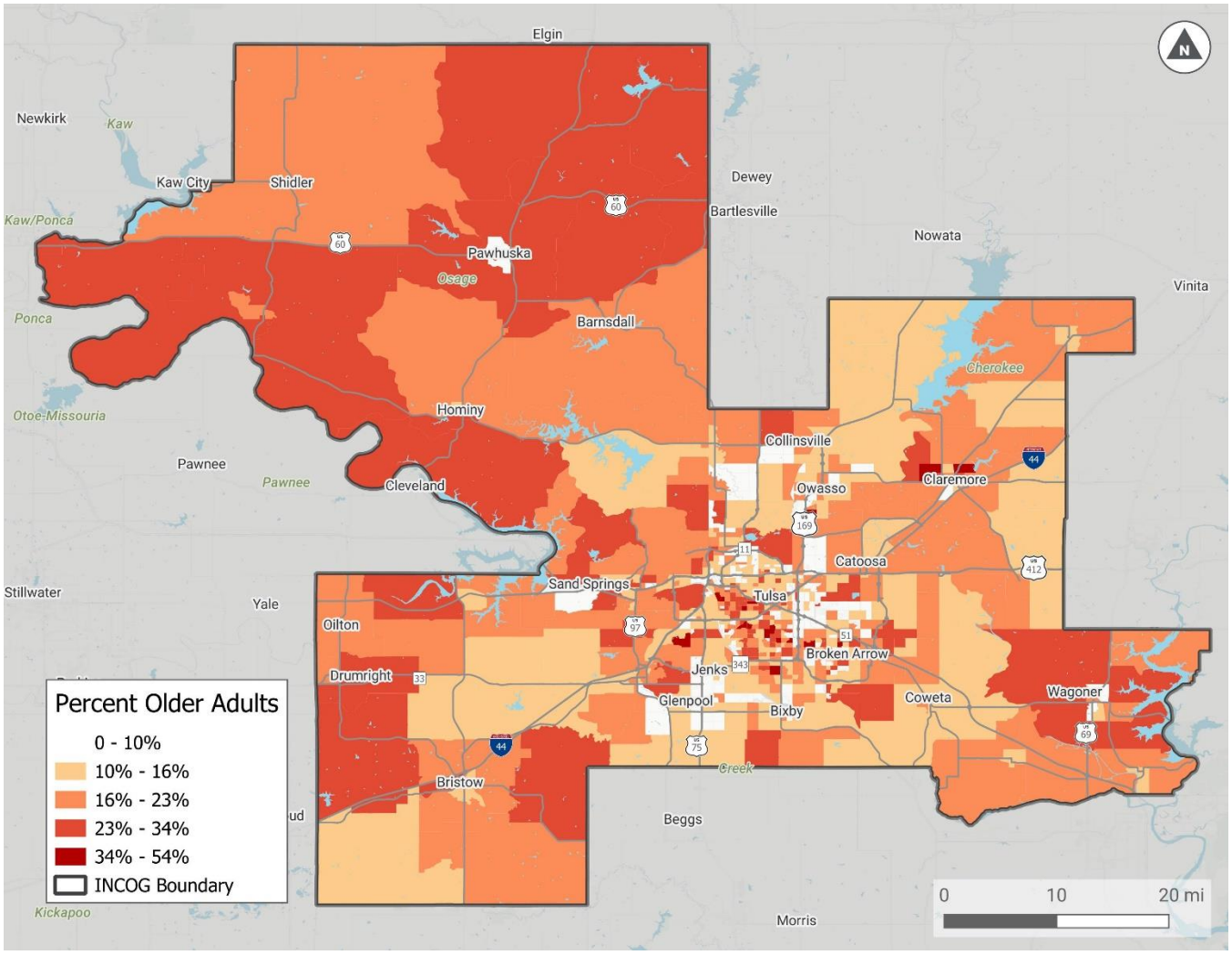

Figure 21: Map of the proportion of older adults across the INCOG region. Osage County has the greatest concentration of older adults, while Tulsa County has the least.

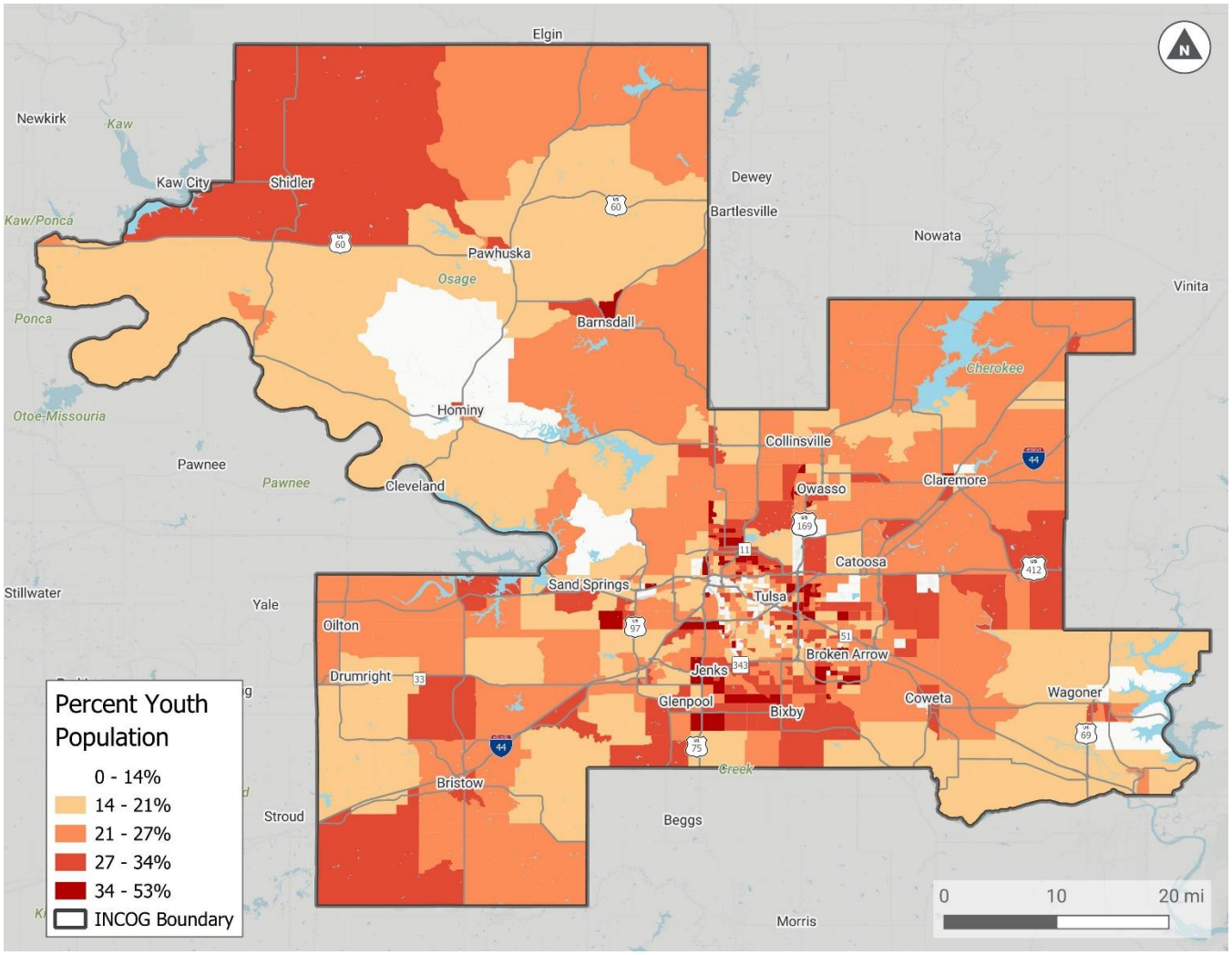

Figure 22: Map of the percentage of the population under 18 in the INCOG region. Youth reside relatively evenly across the region, with the highest proportion living within Tulsa County.

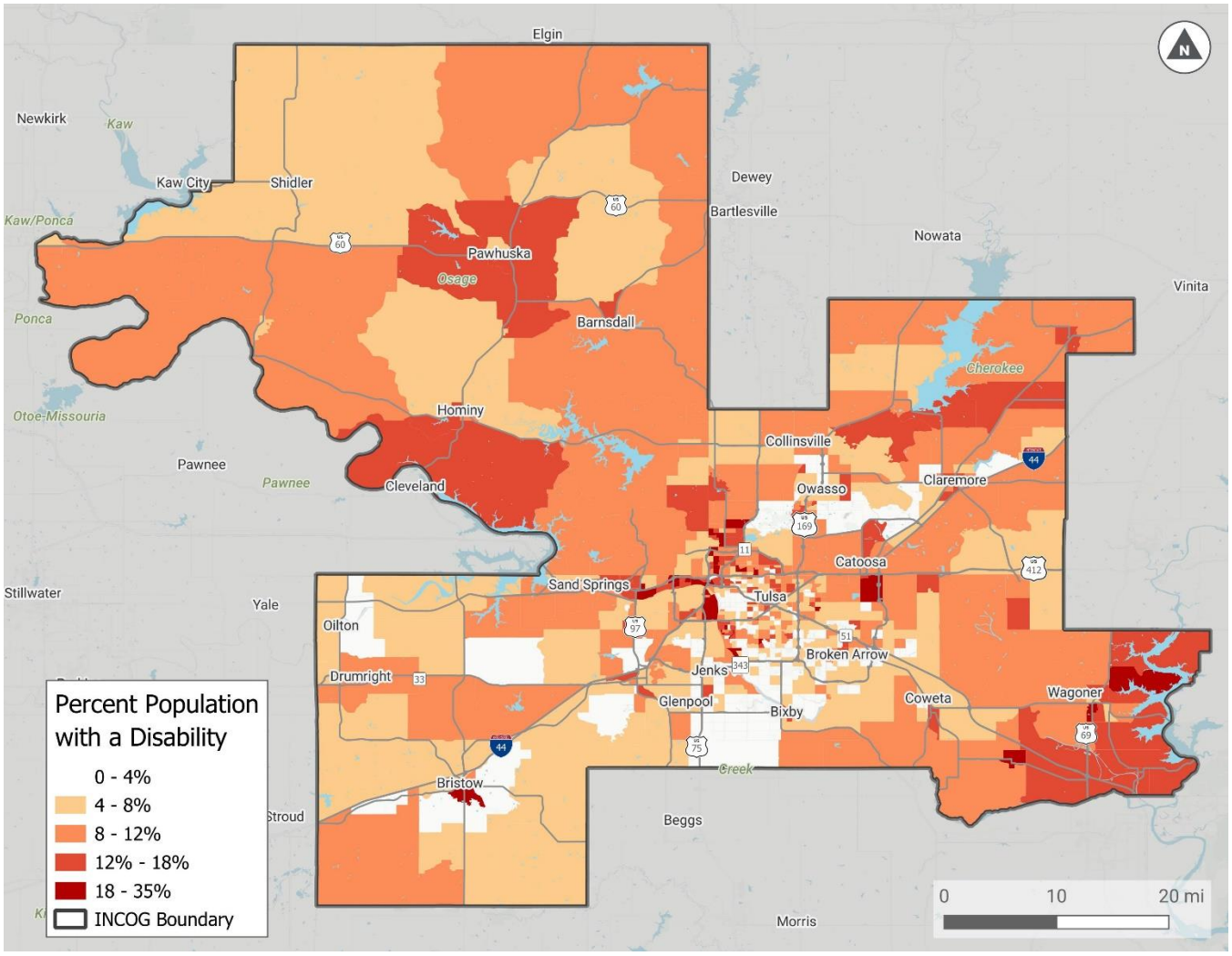

Figure 23: Map of the proportion of residents with a disability. Osage County has the highest proportion of disabled residents.

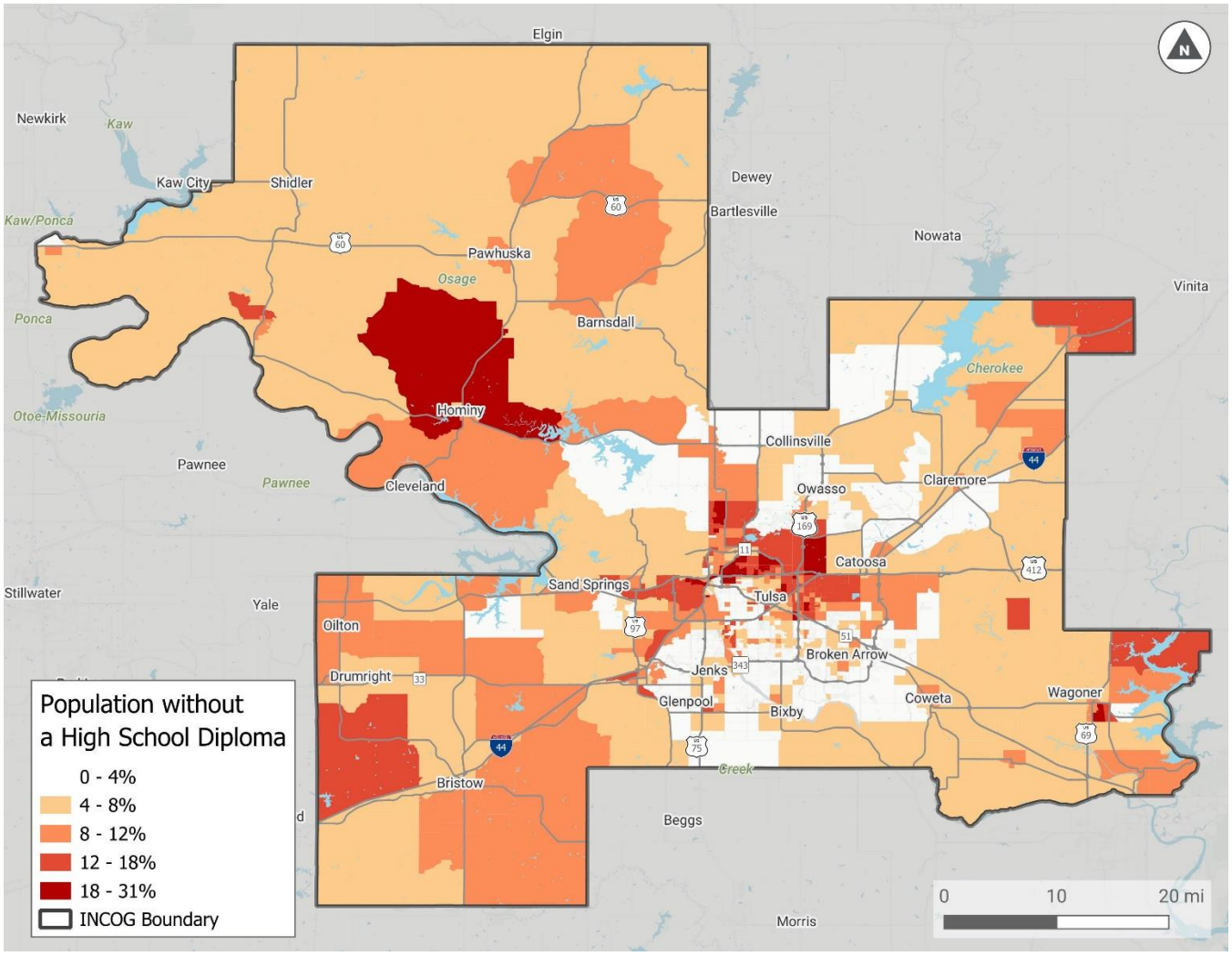

Figure 24: Map of the proportion of residents with less than a high school education. Creek, Osage, and Tulsa counties have the most residents without a high school diploma.

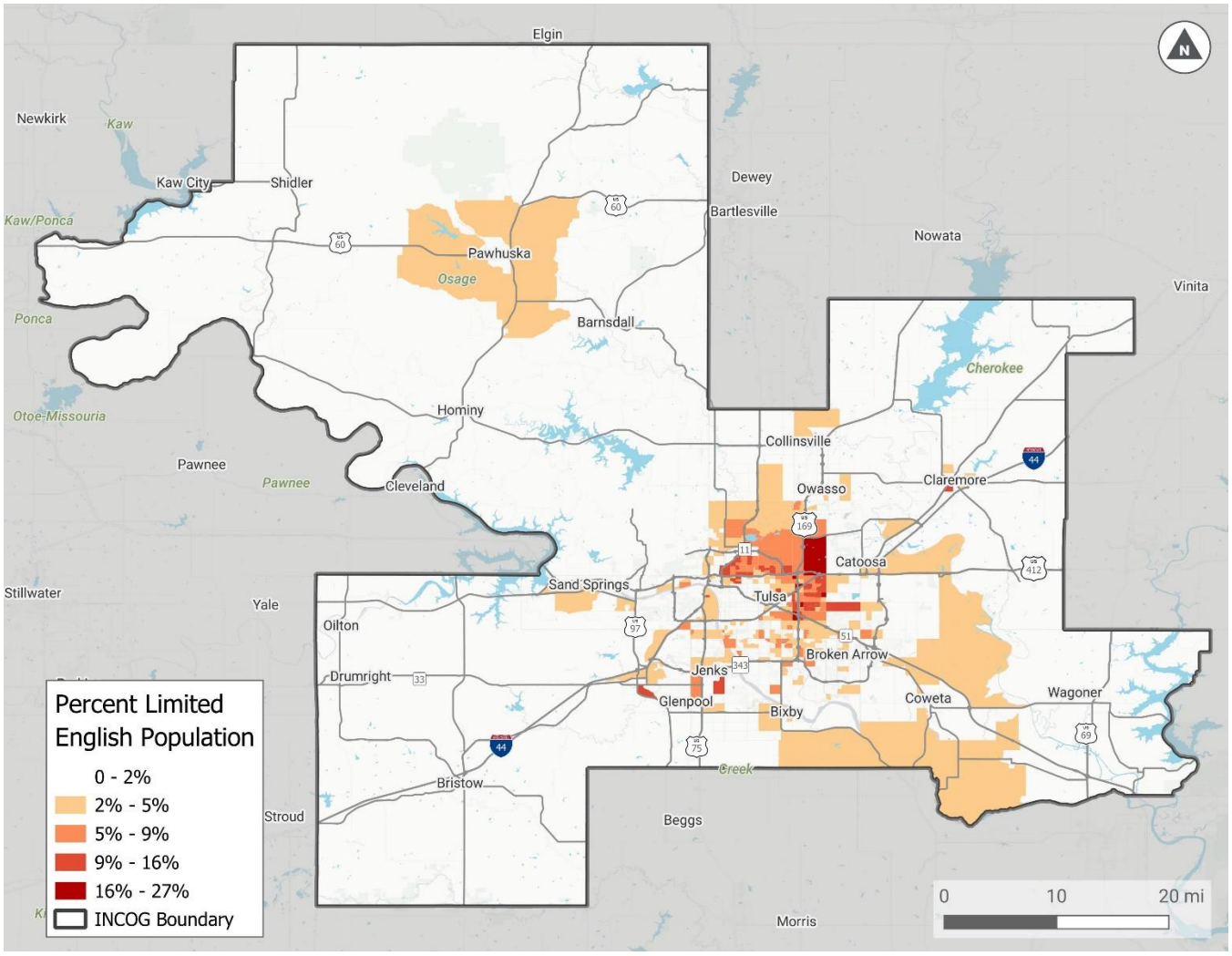

Figure 25: Map of the proportion of residents with limited English proficiency (LEP), with the greatest concentration occurring in Tulsa County. Spanish is the predominant language in LEP households in the region.

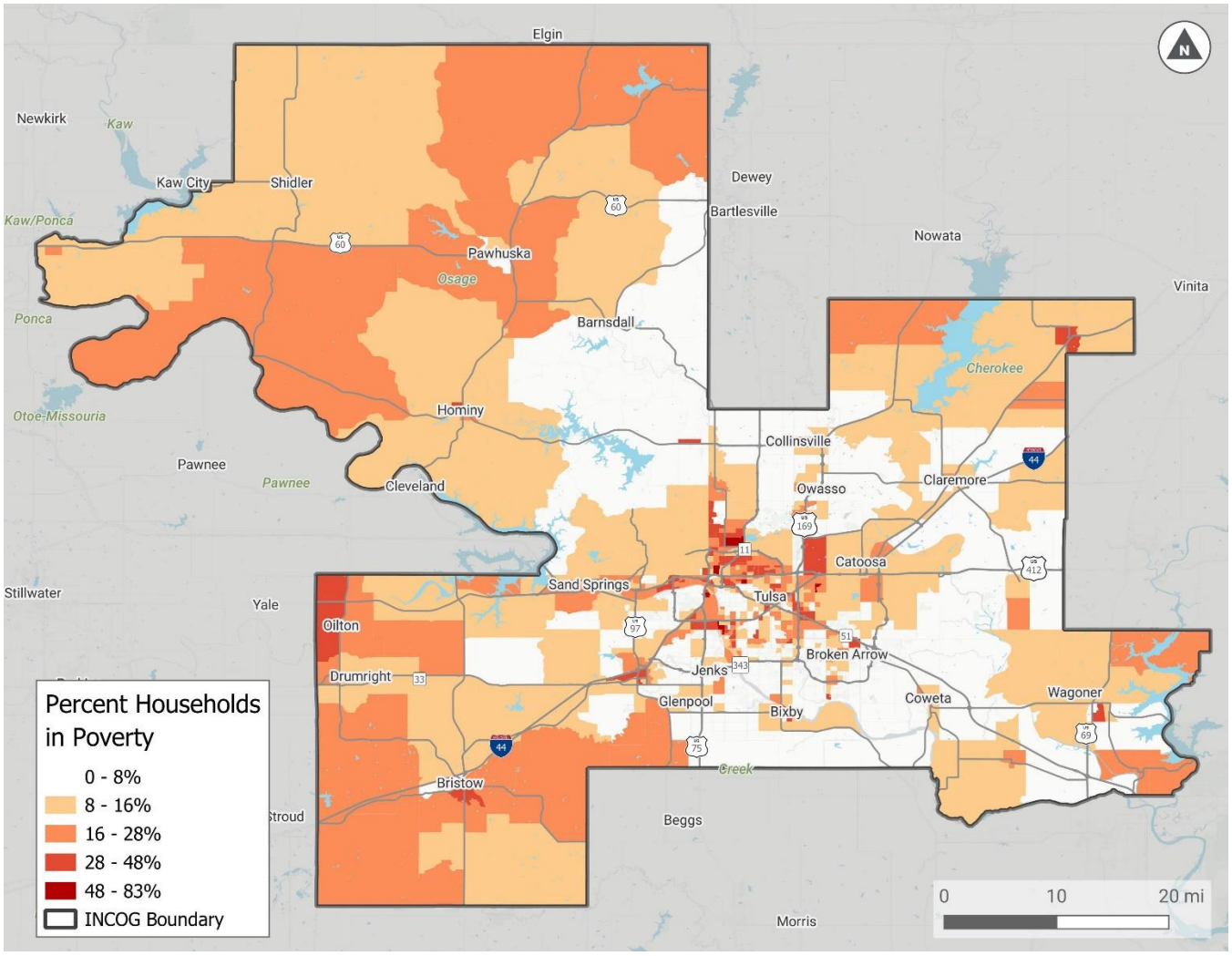

Figure 26: Map of the proportion of households in poverty. Creek and Tulsa counties have the highest poverty rates in the region.

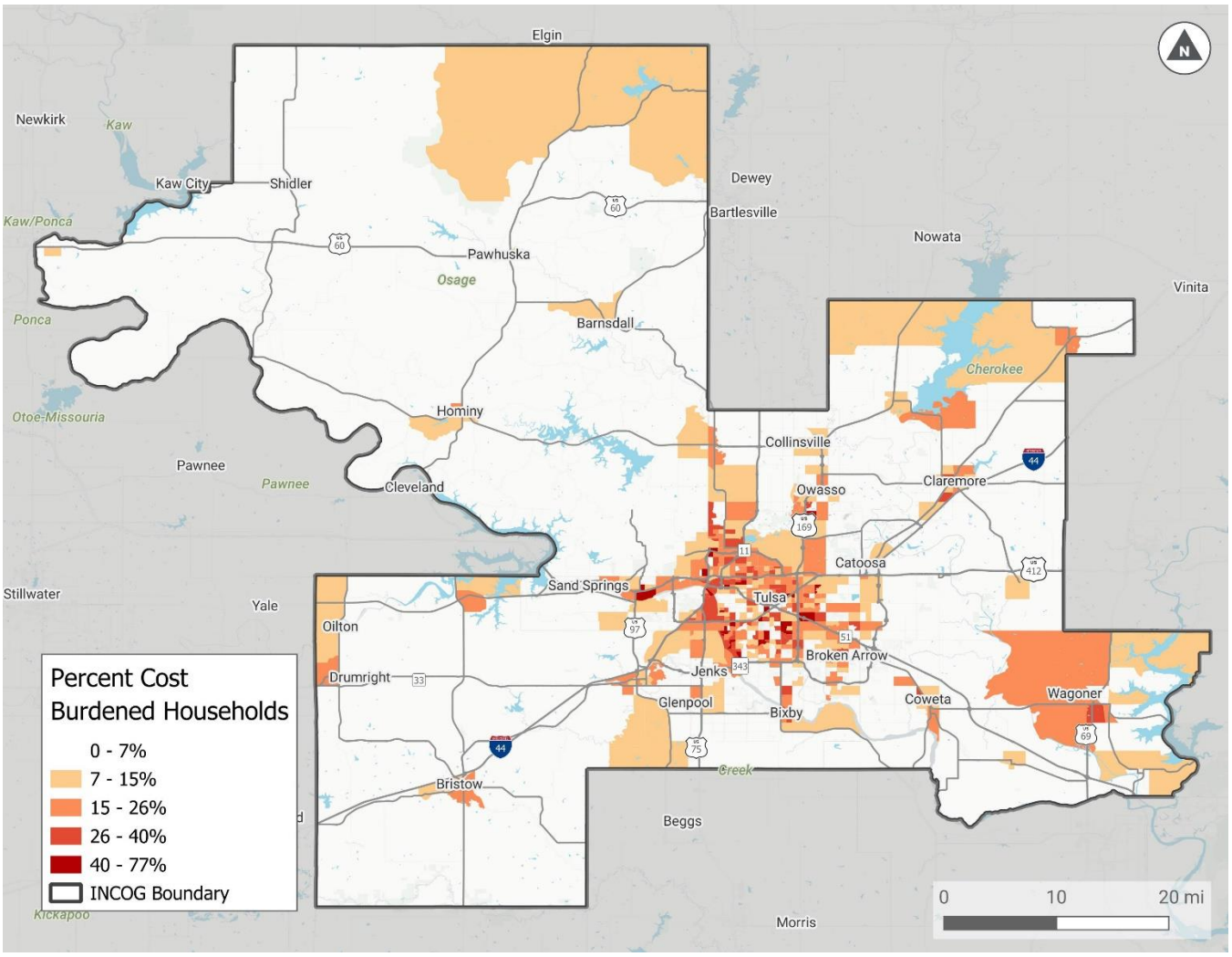

Figure 27: Map of the proportion of households experiencing cost burdens. Cost burdens affect the most residents in Tulsa and Wagoner counties. Cost burden refers to households that spend more than 30% of their monthly income on housing expenses.

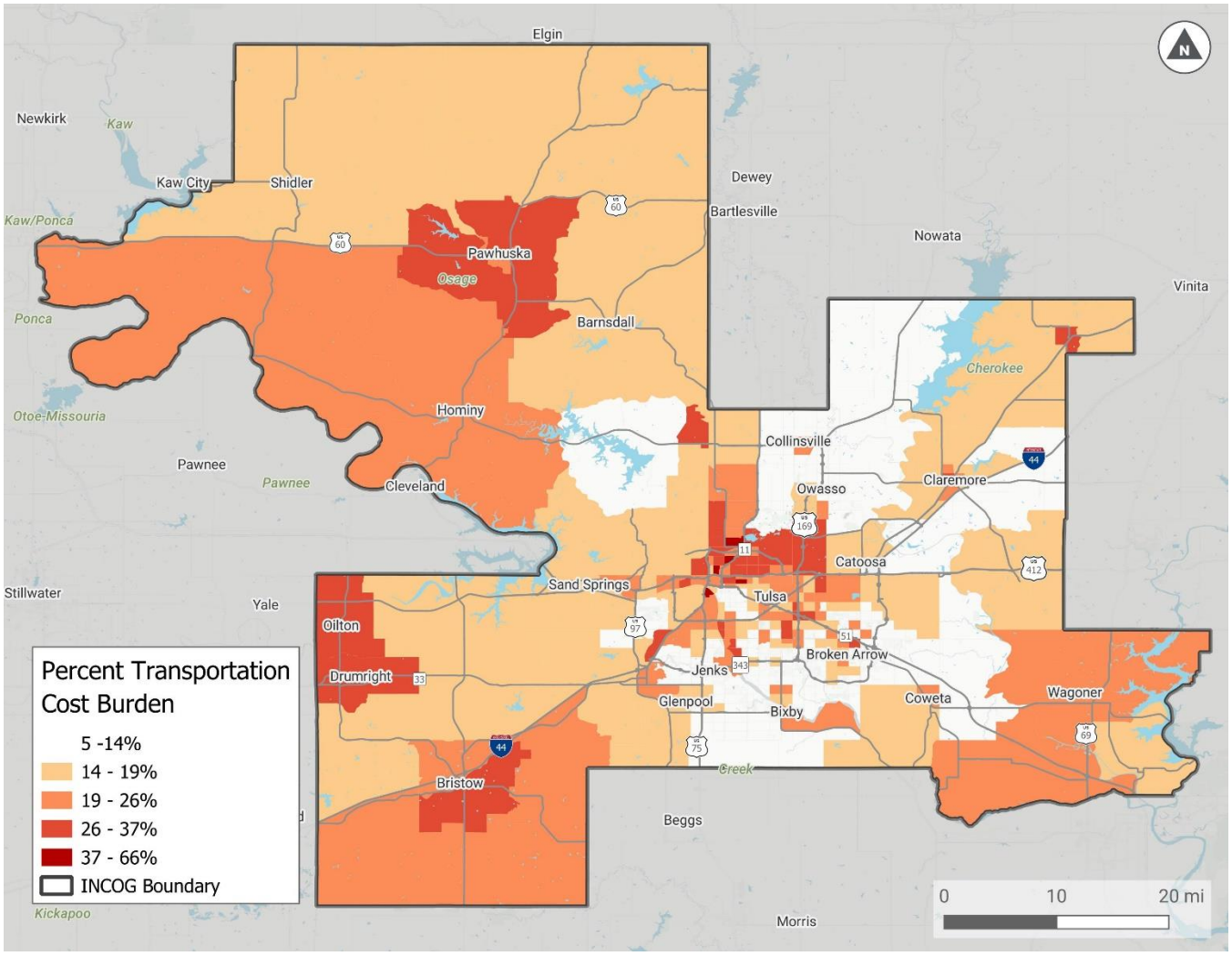

Figure 28: Map of the proportion of households experiencing transportation cost burdens. Central and northern Tulsa County, along with Osage and Creek counties, are most affected by transportation cost burdens.

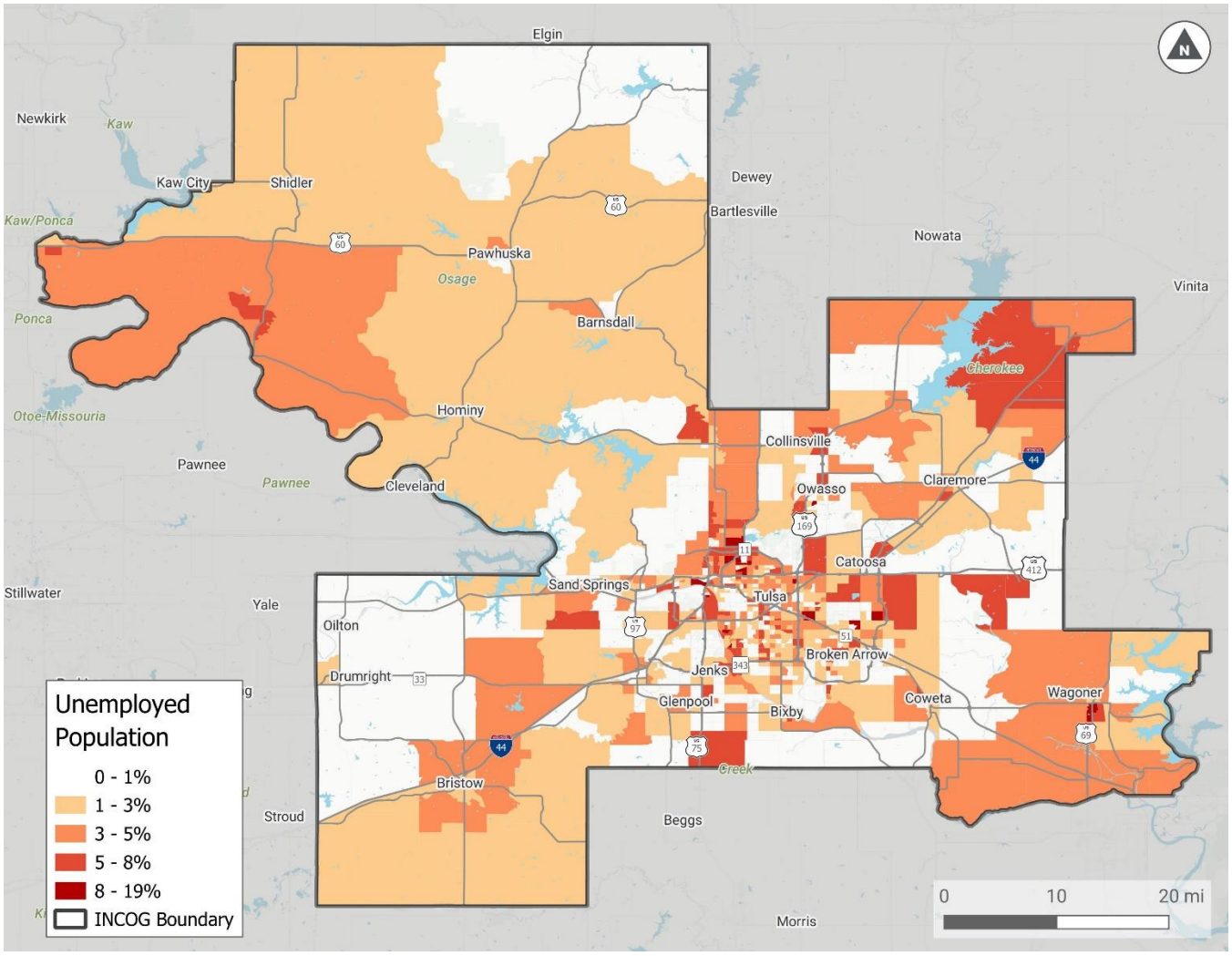

Figure 29: Map of the proportion of unemployed people across the INCOG region. Unemployment rates are highest in Osage and Tulsa counties.

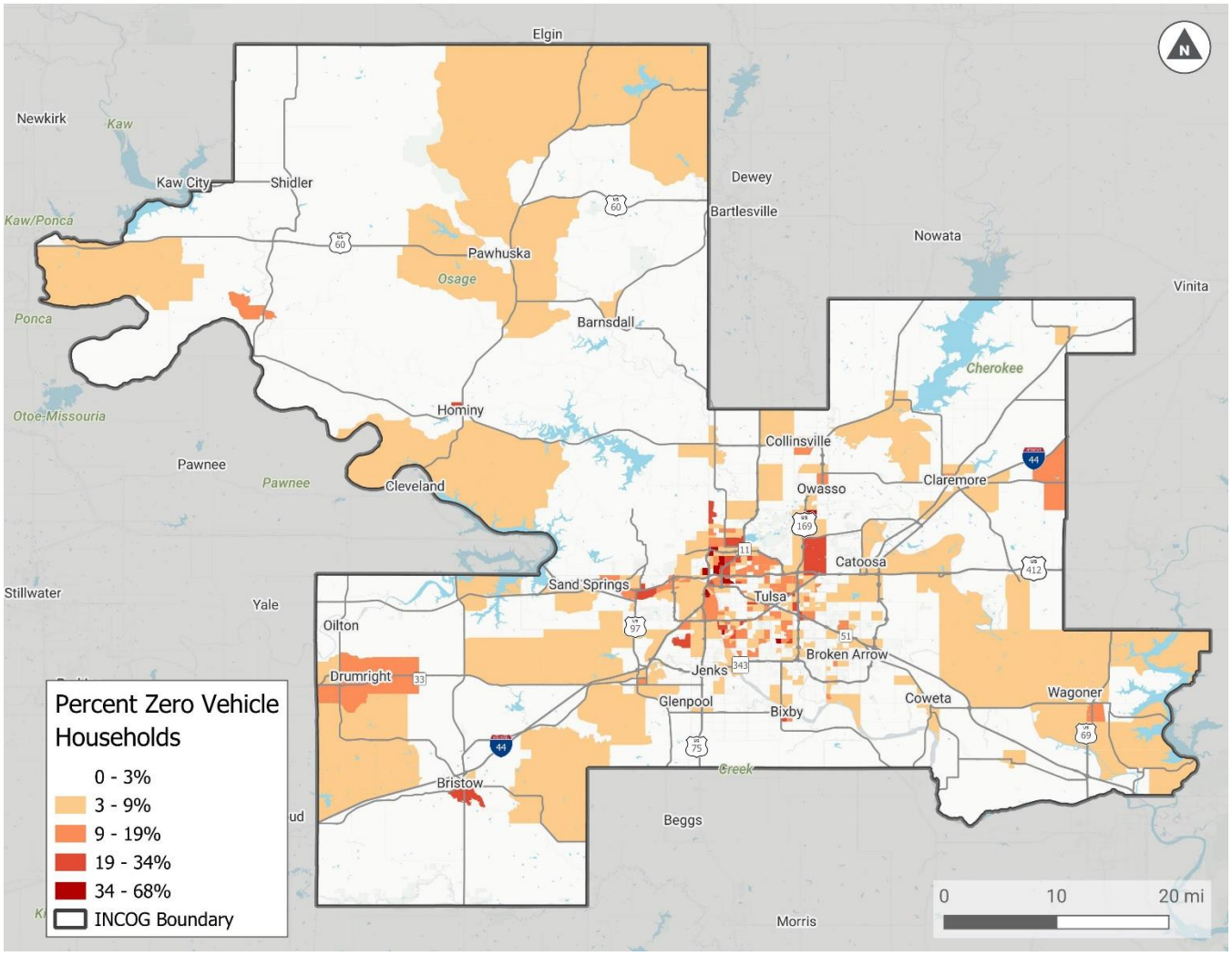

Figure 30: Map of the proportion of households without regular access to a personal vehicle. Tulsa County contains the highest rate of zero-vehicle households, while Wagoner and Rogers counties have the lowest rates.

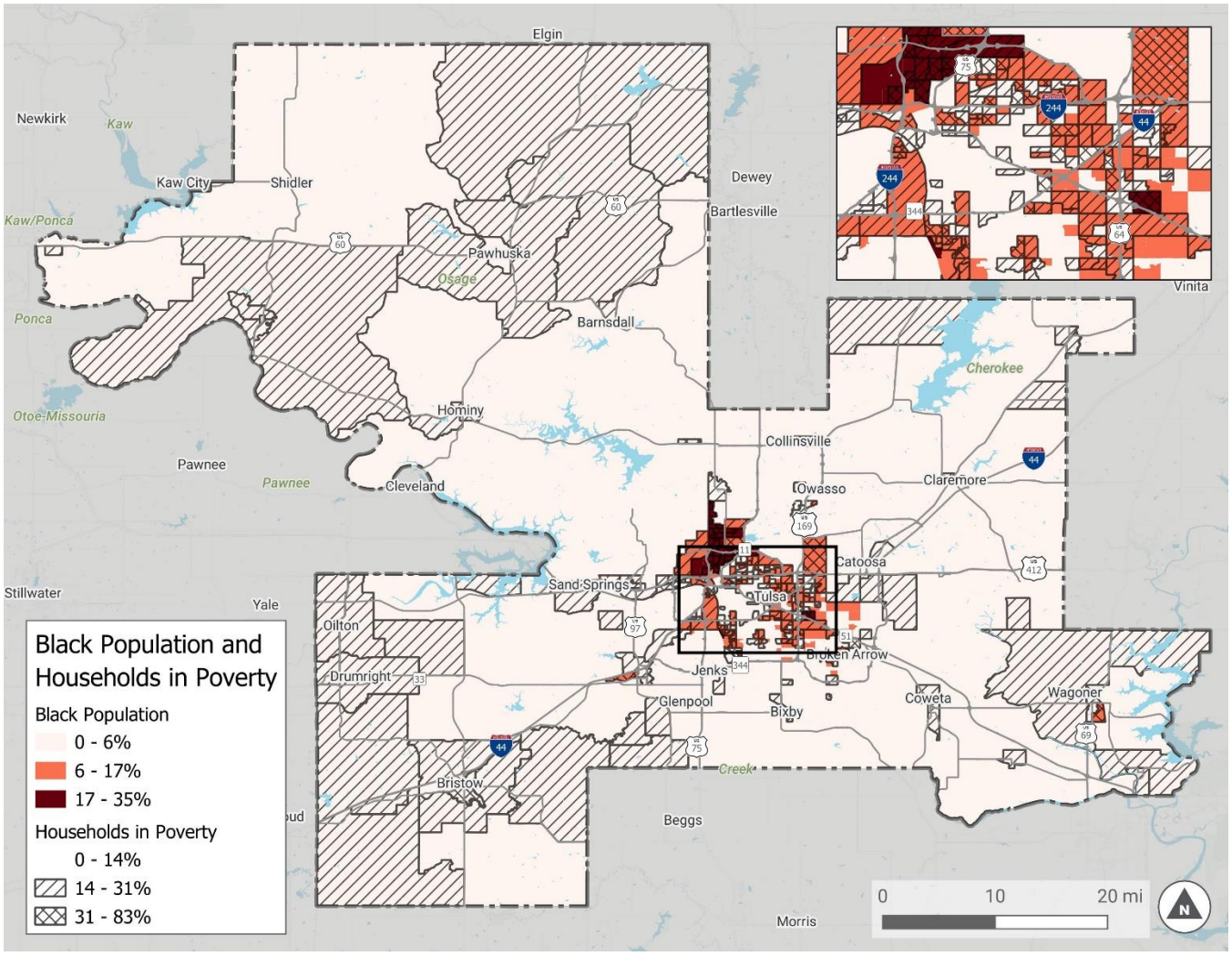

Figure 31: Intersectional map showing the relationship between the proportion of Black residents and households in poverty in the INCOG region. Black residents experience poverty at higher rates in Tulsa than other groups.

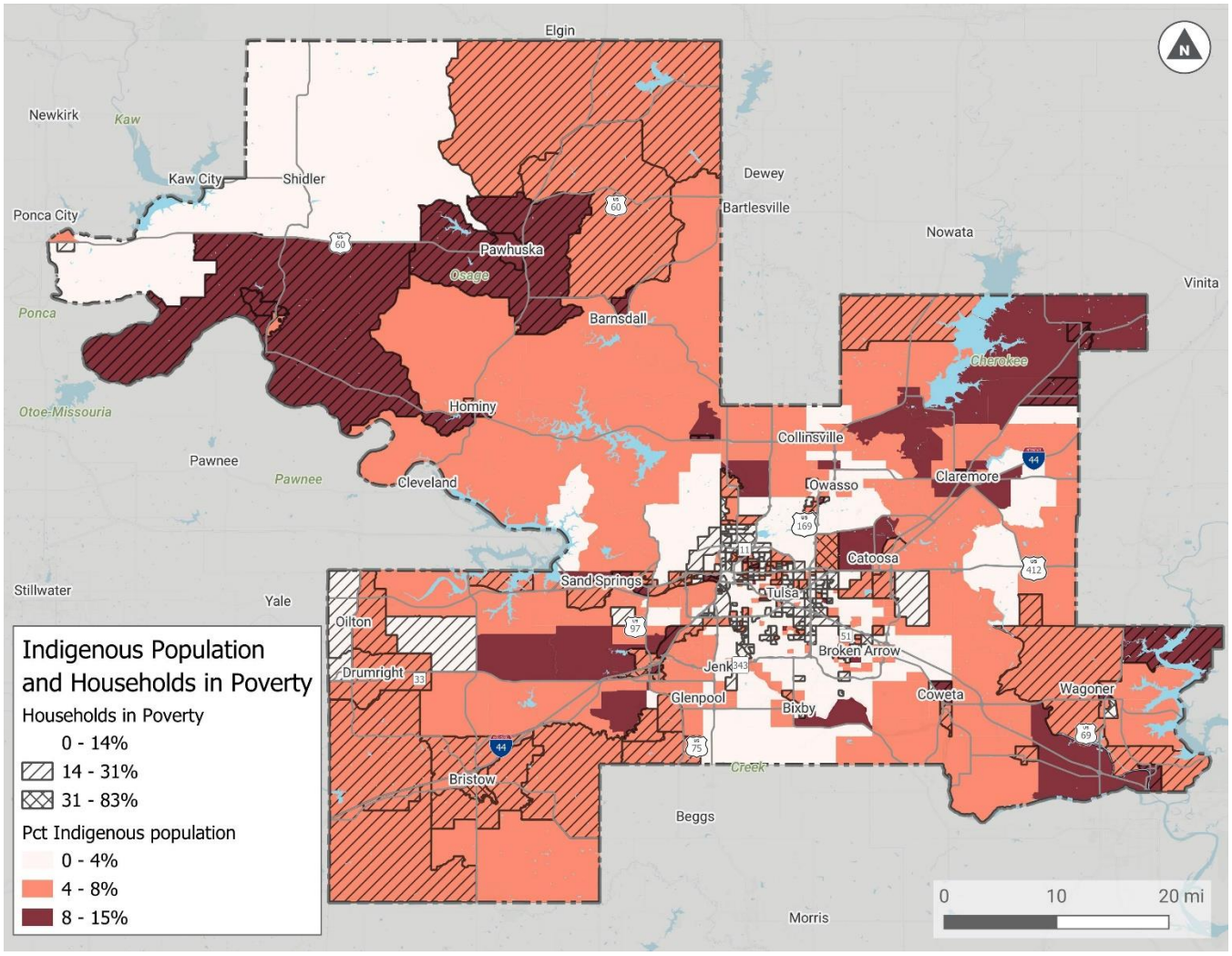

Figure 32: Intersectional map of the proportion of Indigenous residents and households in poverty. Indigenous households experience poverty at higher rates in the outer regions of the INCOG boundary compared to other groups.

Integrating Historical Context and Spatial Analysis to Advance Equity in Safety

Current Practices

There are several notable equity practices underway or recently completed across the region. A former bikeshare program, *This Machine*, launched an equity membership program in 2022. The program provided reduced-price bikeshare memberships to individuals affiliated with partner organizations (e.g., the Tulsa Housing Authority, Tulsa CARES, Food on the Move) as well as individuals with a SNAP or SoonerCare card (Herbert, 2022). Low-income residents were able to take advantage of this affordable membership option and expand their transportation mode choice. During the first month of the program, over 200 rides were completed using the equity membership (Herbert, 2022).

Tulsa's Equality Indicators, a program initiated by the City of Tulsa and the Community Service Council in 2017, tracks disparities in the region with detailed qualitative data (City of Tulsa & Tulsa Area United Way, 2023). The indicators highlight changes over time and the current state of economic opportunity, education, housing, justice, public health, and services (City of Tulsa & Tulsa Area United Way, 2023). The program reports indicators scores by assessing the disparity between population groups as well as quantifying the change in score from the baseline to the present (City of Tulsa & Tulsa Area United Way, 2023). Several indicators relate to transportation planning, including commute time by geography, bus stop concentration by geography, commute time by mode of transportation, and vehicle access by race. The findings are being used to inform policy development and improve equity outcomes.

In 2018, the City of Tulsa launched their Resilient Tulsa strategy, with the goal of centering race and equity in the future visioning of the region. The strategy has four key visions that are reflective of stakeholder and community goals (City of Tulsa, 2018):

1. Create an inclusive future that honors all Tulsans.
2. Equip all Tulsans to overcome barriers and thrive.
3. Advance economic opportunity for all Tulsans.
4. Transform city and regional systems to improve outcomes for all Tulsans.

A focal point of the strategy is to normalize conversations around racial equity through Tulsa's Equity Dialogues. Since the program's inception, the city has trained 90 facilitators and have had about 400 Tulsa residents in attendance across 45 events (City of Tulsa, 2023). The dialogues help residents share experiences, build community cohesion, and discuss equitable solutions for the future (Bloomberg Cities, 2023).

Key Takeaways

The results of this equity analysis will directly inform the INCOG Safety Action Plan. Using a proactive, holistic strategy to consider historical and cumulative impacts of transportation planning and policy decisions allows practitioners to go beyond the scope of individual projects to understand actions within the larger social, economic, and environmental contexts. Improving equity involves more than the fair distribution of transportation system benefits and burdens. This approach mitigates impacts instead of addressing the underlying, systemic causes of inequity and injustice (Thomas et al., 2022).

The equity analysis highlights that areas of historical racial violence continue to experience transportation inequities today. Osage County, home to past and current Osage Tribe members, faces disproportionate poverty, disability, and unemployment rates while experiencing greater transportation cost burdens than the overall INCOG region. Black and Hispanic communities also reside alongside the High Injury Network, increasing their safety risks compared to other racial groups. At the county scale, Creek, Osage, and Tulsa counties have higher

concentrations of communities of color with greater disparities in safety risks, poverty, and transportation cost burdens compared to the greater INCOG region.

The ETC Areas of Disadvantage combine these variables to understand who is most at risk of social vulnerability. Approximately 41% of the High Injury Network and 49% of serious injury and fatal crashes occur in ETC Areas of Disadvantage, despite representing 39% of INCOG's total land area. The communities located with ETC Areas experience disparate safety risks. Recognizing these areas and focusing interventions and investments here can improve the quality of life of at-risk communities.

The results of this equity analysis help reveal how and where transportation system inequities occur, and their relation to past events with ties to race and injustice. In addition, the land use context and current transportation system trends disproportionately impact rural and tribal communities, who also experience socioeconomic disadvantage.

While the findings of this memo help quantify and contextualize current conditions, achieving transportation equity does not end here. This work should be iterative in nature, and continuously be updated with quantitative and qualitative data. Experiences gathered through public engagement processes, including storytelling, complement quantitative data and can capture nuances in safety outcomes and events that are otherwise unknown. Purposeful engagement with key communities that have been historically marginalized and are currently underserved by region's transportation systems should receive targeted investments to improve their quality of life in the future.

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