Mesa County

Safety Action Plan

Enhancing Roadway Safety in Our Community

Acknowledgments

The Regional Transportation Planning Office (RTPO) of Mesa County, Colorado would like to thank the dedicated team of local government staff, regional leaders, industry experts, transportation consultants, and engaged citizens that provided direction in the development of Mesa County's Safety Action Plan – Enhancing Roadway Safety In Our Community. Together, this team has analyzed crash trends, assessed a variety of effective solutions, and crafted an action plan aimed to eliminate fatal and serious injury crashes on Mesa County roadways.

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We also want to recognize the 117 people who have lost their lives on Mesa County roadways, and the 475 people who were severely injured between 2016 and 2022.

The Mesa County Safety Action Plan looked at local data and peer research to identify safety solutions for all users, including those driving, walking, rolling, biking, riding a motorcycle, and/or other modes. The plan provides strategies to address changes to both roadway user behavior and infrastructure. This Plan is built on a foundation of partnerships from stakeholders who strive to find solutions to make roads safer throughout Mesa County, which includes the Cities of Grand Junction and Fruita and the Towns of Palisade, Collbran, and De Beque. **This plan is dedicated to those who have lost loved ones and who have had their lives significantly impacted by traffic crashes**. Your losses motivate us to strive toward a safer Mesa County.

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Table of Contents

Acknowledgments 02

Table of Contents

Section 1 - *Project Overview* 06

Section 2 - *Establishing the Safety Action Plan's Purpose and Focus* 14

Section 3 - *Establishing Strategies and Actionizing the Plan* 35

DEFINITIONS

Helpful Definitions

Urban and Rural Crashes – crashes were separated into urban and rural classifications based on whether the crash occurred inside or outside a designated urban area. The urban area was based on the Adjusted 2020 Urban Area Boundary.

Killed and Serious Injury Crashes (KSI) - KSI crashes are crashes that resulted in one or more serious injuries or fatalities. Serious injuries are defined as broken extremities, severe lacerations, paralysis, etc. Fatal crashes are defined when one or more people die within 30 days of the crash as a result of the injuries sustained in the collision.

Crash Type – crash types were defined by the State of Colorado Crash Reporting Manual.

First Harmful Event – is the first point of injury or damage in the sequence of events in a crash.

01 Project Overview

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

Project Overview

When considering Mesa County, Colorado, images of the Grand Mesa, stunning red rock formations, downtown Grand Junction, Palisade peaches, and a wealth of outdoor activities in its deserts, mountains, rivers, and lakes often come to mind—not unsafe roadways. Yet, over the past seven years, the county has experienced alarming crash trends, specifically people getting killed or seriously injured (KSI) on Mesa County roadways. In 2018, there were 56 people killed or seriously injured and in 2021 that number had spiked to 121 people. Recognizing the increasing severity of roadway crashes, the region has taken action by applying for a grant, developing this comprehensive safety action plan, and preparing to implement safety solutions.

About Mesa County

Mesa County is located in the sunny western portion of the Colorado River valley on Colorado's Western Slope and lies on the Western border of Colorado and Utah and covers 3,309 square miles. Five municipalities sit within its boundaries: City of Grand Junction, City of Fruita, Town of Palisade, Town of Collbran, and the Town of De Beque. The remainder of the county's (3,268 square miles) is unincorporated land, that is outside of the municipal boundaries. Approximately 71% of the county's total land mass is public land, managed by Federal and State agencies.

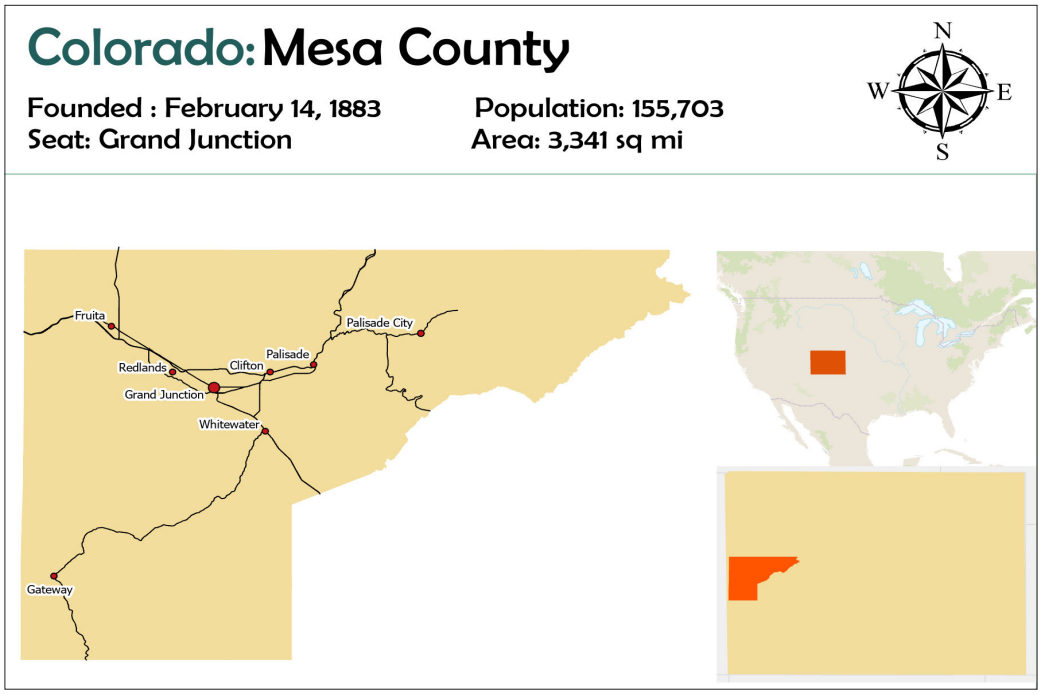


Figure 1: Mesa County Map

Mesa County had a population of 155,703 in 2020, most of which is concentrated in and around the City of Grand Junction. The city is home to 65,725 residents, more than a third of the Mesa County population. The remaining population is spread across the neighboring areas of Clifton (20,413), Redlands (9,061), Fruitvale (8,271), and Orchard Mesa (6,688), and nearby City of Fruita (13,395) and Town of Palisade (2,565). Smaller communities include Loma, Mesa, and Whitewater. The county's two main highways, Interstate 70 and US Route 50, and two major rivers, the Gunnison River and Colorado River, meet in Grand Junction. Additionally, the Grand Mesa Scenic Byway (State Highway 65) runs through the northeastern part of the county.

The Regional Transportation Planning Office

The Regional Transportation Planning Office (RTPO) is an umbrella organization that provides technical and administrative staff for:

- Grand Valley Transit
- Grand Valley Metropolitan Planning Organization (MPO)
- Grand Valley Transportation Planning Region (TPR)

The Grand Valley MPO, or GVMPO, provides regional transportation planning and programming services for all road users, including those who drive, walk, bike, roll, take transit, deliver freight, or travel by other modes. In compliance with federal law, the Grand Valley MPO works to ensure transportation projects and planning efforts are comprehensive, and are undertaken cooperatively and regularly with state and local governments.

Prioritizing Roadway Safety in the Region

The Mesa County Safety Action Plan aims to identify solutions to reduce the number of deaths and serious injuries on our roads across Mesa County. The plan covers the entirety of Mesa County, including the cities of Grand Junction and Fruita and the towns of Palisade, Collbran, and De Beque.

The Mesa County Safety Action Plan looked at local data and peer research and was ultimately built on a foundation of partnerships between a diverse group of stakeholders who strive to find solutions to make Mesa County roads safer for all users.

Funding

In 2023 the Mesa County RTPO announced $260,000 in funding from the Safe Streets and Roads for All (SS4A) grant program. Mesa County, the City of Grand Junction, City of Fruita, and Town of Palisade committed an additional $65,000 to develop the Safety Action Plan - bringing the project total to $325,000.

SS4A Funding	+	Local Funding	=	Total Funding
$260,000		$65,000		$325,000

The Mesa County Safety Action Plan kicked off in October 2023 and was developed throughout 2024. The final plan was published in November 2024.

Safe Street and Roads for All (SS4A) Grant Program

In 2021, the Bipartisan Infrastructure Law established the SS4A program with $5 billion in appropriated funds between 2022 and 2026. The program provides financial support for the planning, infrastructure, behavioral, and operational initiatives to prevent death and serious injuries on roads and streets involving all roadway users, **After completion of the Mesa County Safety Action Plan, additional funding is available and will be pursued to implement recommendations from the plan.**

Goals of the Safety Action Plan

- Meet the federal SS4A Safety Action Plan requirements.
- Develop a Comprehensive Roadway Safety Action Plan.
- Mesa County Lens: Recognize the different areas, transportation networks, and diverse community voices in Mesa County: rural, urban, and downtown.
- Establish a vision and actions in pursuit of a Safe System Approach.
- Inform stakeholders and the public to create awareness about SS4A and the safety action plan.
- Engage the public and collect meaningful feedback to inform the action plan.

Source: FHWA.

Figure 2: Federal Highway Administration safe systems approach

- Conduct data-driven safety analyses focusing on:
  - Crashes.
  - Key demographics.
  - Health.
  - Areas of concern.
- Develop a design "solutions toolbox" and strategies to:
  - Address how our community can create a safety culture.
  - Identify countermeasures for project design, construction, and operations and maintenance.
- Foster a collaborative and transparent process through stakeholder coordination meetings.

Guiding Principles

During this planning process, the following set of guiding principles was established to direct project development:

- **Leverage national resources such as United States Dept. of Transportation (USDOT), Federal Highway Administration (FHWA), Federal Transit Administration (FTA), and National Highway Traffic Safety Administration (NHTSA) to enrich the planning process and inform strategy development.**
- **Ensure transparency and accessibility throughout all phases of the planning process.**
- **Conclude the planning effort with a clear and actionable implementation plan that includes measurable outcomes.**
- **Address the unique needs of both rural and urban transportation networks in Mesa County.**
- **Define and prioritize equity within Mesa County, aligning efforts with the Federal 40 Initiative to promote inclusive access.**
- **Prioritize data-driven insights to guide decision-making and project prioritization.**

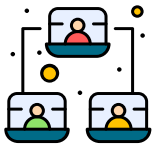
Scope and Schedule

Developing the Mesa County Safety Action Plan took 12 months and included project management and coordination, outreach and engagement, data analysis, and strategies and solutions. Figure 3 outlines major tasks, timeline, and occurrences developed throughout 2024, and identifies the associated project deliverables that guided the planning process and the development of this plan, which will be further explained in subsequent sections of this document. The plan kicked off in November 2023 and was finalized in October 2024.

Task 1: Project Management

Nov 2023 - Oct 2024

- Continuous Project Management Team Meetings



Task 2: Stakeholder Outreach & Public Engagement

Dec 2023 - Oct 2024

- Four Stakeholder Working Group Meetings
- Two online public events
- One Safety Workshop
- One Safety Symposium

Task 3: Safety & Data Analysis

Nov 2023 - July 2024

- Equity Analysis
- Comprehensive Crash Analysis
- High Injury Network
- Risk Assessment/ High Risk Network

Task 4: Solution Toolbox & Dashboard

May 2024 - Oct 2024

- Strategies & Countermeasures
- Solutions Toolbox
- Prioritization Methodology
- Development of 10 Projects
- Safety data dashboard
- Final report

Figure 3: Project Tasks and Deliverables

Stakeholder Working Group

A key component of this planning effort was the ongoing collaboration of the Stakeholder Working Group (SWG). Members of this group served as vital partners, contributing their expertise to deepen the understanding of crashes in Mesa County. Their insights were instrumental in shaping an implementable and supported safety action plan that aligns with current initiatives.

The SWG consisted of representatives from local governments, the school district, advocacy groups, enforcement agencies, universities, and hospitals.

Each agency involved in the SWG has active roadway safety efforts underway that span engineering, education, enforcement, evaluation, equity, and engagement. Highlights of these efforts are integrated throughout the plan in callout boxes and are additionally recognized in the safety strategies. An important aspect of this plan is to keep investing in activities that are working and are effective for Mesa County.

Figure 4: Stakeholder Working Group (not all in attendance) from September 2024

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FRUITA COLORADO
CITY OF Grand Junction COLORADO
Community HOSPITAL
Intermountain Health
MESA COUNTY SHERIFF'S OFFICE COLORADO
TOWN OF PALISADE COLORADO
MESA COUNTY PUBLIC HEALTH
D51
MESA COUNTY
madd NO MORE VICTIMS
STATE PATROL COLORADO

ONGOING SAFETY EFFORT

Prioritizing Partnerships for Surge Enforcement Operations

In 2022, Colorado State Patrol (CSP) in Mesa County reported 22 fatal crashes within its jurisdiction. Acknowledging the rise in these fatal crashes, CSP recognized several key strengths that existed: strong partnerships with other enforcement agencies, a receptive media market, and supportive communities. These opportunities paved the way to address staffing challenges and improve data collection, enabling the launch of a Surge Enforcement Operation that focused on specific locations with a history of serious crashes.

- **Agency Partnerships:** Grand Junction Police Department, Mesa County Sheriff's Office, Palisade Police Department, Fruita Police Department, CSP Port of Entry, CSP Smuggling and Trafficking Unit, Colorado Parks and Wildlife and communications centers
- **Using All Available Data Sources:** CSP, Grand Junction Police Deptartment, Mesa County Real Time Crime Center, traffic cameras, and dispatch centers for road-rage, DUIs, and aggressive driving reports.
- **Community Partnerships:** Local media, social media, tow carriers, schools, and universities.
- **Comprehensive Planning that Included:** Individual event action plan, pre operation/post operation press release, secure communications, secure real-time crime center (RTCC), safety briefing, 5-hour operation, debrief/after action, and follow-up plan for next month.

Results:

- 1615 Traffic Contacts
- 12 DUI Arrests
- 257 Distracted Driving Citations
- 67% Reduction in 5-Year Fatal and Serious Injury (KSI) Crashes (Grand Junction Police Department having similar outcomes)
- Auto Theft Task Force using same roadmap – highest reduction in auto theft in Colorado
- Using RTCC and portable traffic cameras for special events
- Utilized Surge Enforcement Operation to proactively combat street racing

02 Establishing the Safety Action Plan's Purpose and Focus

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

Development of the Mesa County Safety Action Plan Objectives

The first step in crafting a plan that responds to the safety needs of Mesa County is developing focus areas that guide the plan, alongside a series of actionable objectives to measure success.

This plan builds on existing planning efforts, studies, and other safety initiatives completed in Mesa County. Reviewing these previous documents allowed the project management team to understand and synthesize the goals already established by the communities within Mesa County. For relevant information and best practices addressing transportation safety, several documents were reviewed, including 12 local and regional transportation plans, Colorado's Strategic Transportation Safety Plan, and six national safety programs and initiatives. The previous planning work reviewed is visualized in Figure 5.

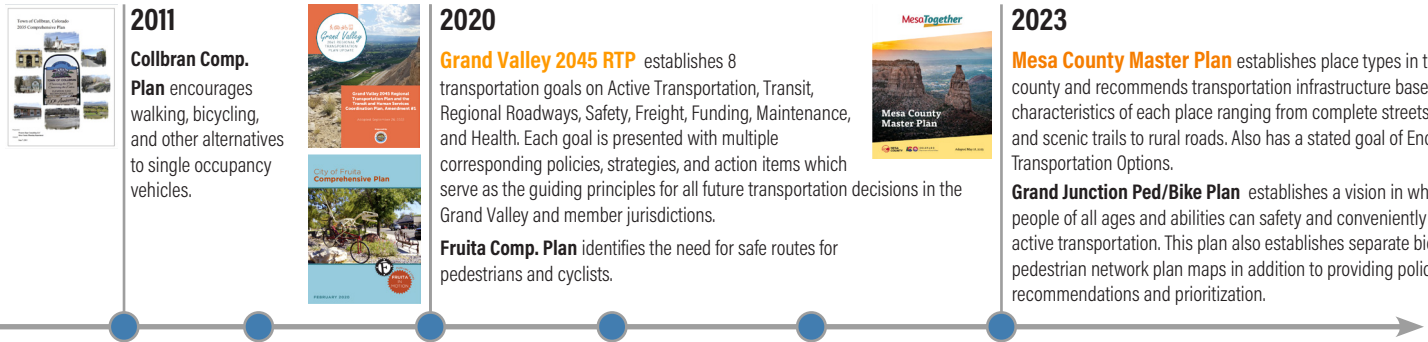


Figure 5: Previous Planning Documents Timeline

Through review of the plans and studies previously mentioned, and in coordination with the Stakeholder Working Group (SWG), several key themes emerged as objectives for the Mesa County Safety Action Plan. These themes are displayed in Figure 6. These objectives were used in identifying strategies and implementation recommendations.

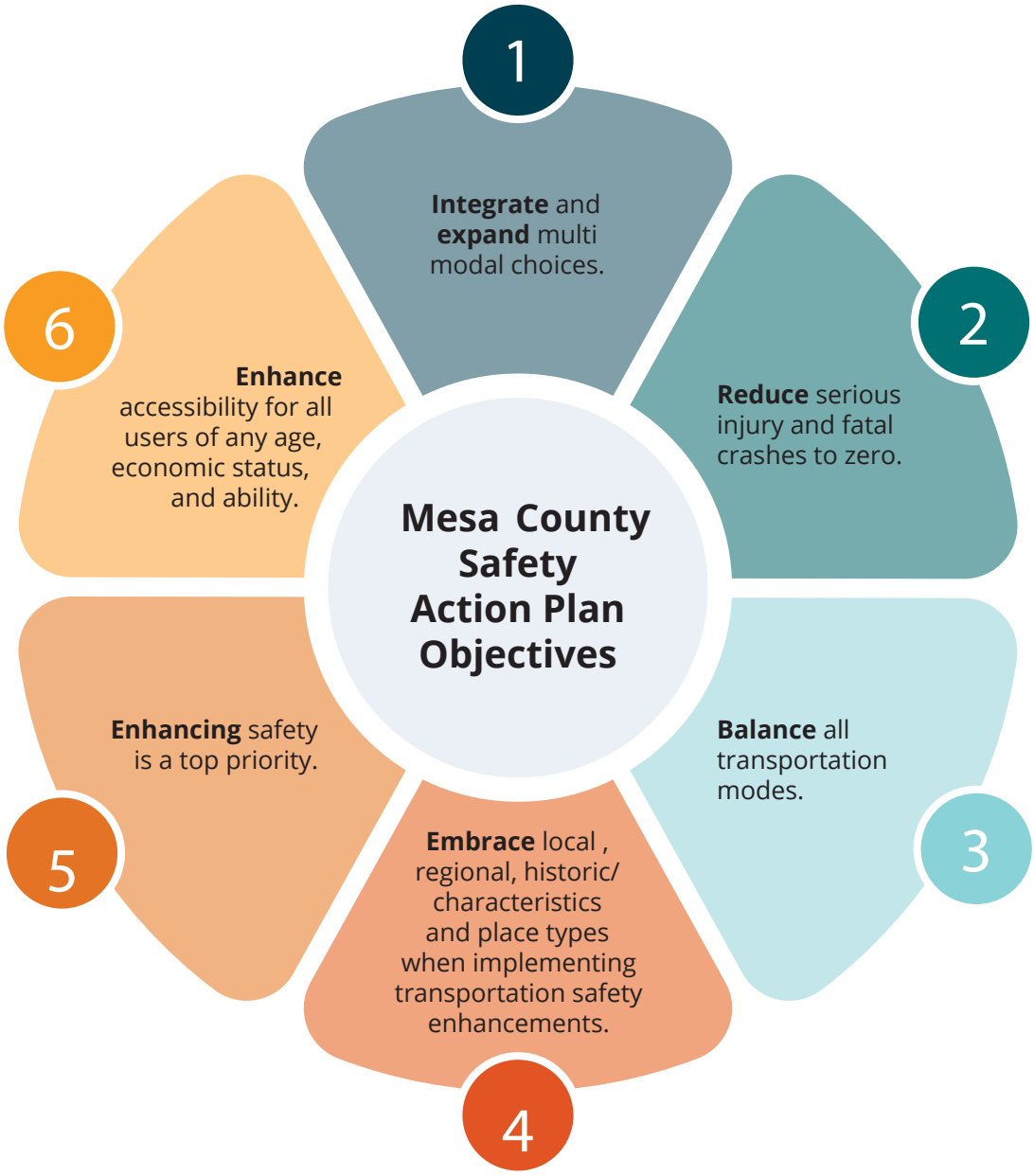


Figure 6: Safety Action Plan Objectives

Including Equity into the Process

One of the guiding principles of this planning effort was to conduct data-driven safety analyses using an equity lens on: crashes, key demographics, health, and areas of concern. Supporting this intention, one of the federal Safe Streets and Roads for All (SS4A) Action Plan requirements is to include an equity approach into the planning process. With these goals, the plan analyzed two different approaches to understand inequities in Mesa County. This information was used in the prioritization and implementation of the recommended strategies.

Colorado EnviroScreen

The Colorado Department of Public Health & Environment (CDPHE) first developed the Colorado EnviroScreen in 2022 and has since been written into Colorado law as a key tool to support statewide environmental justice action. The Colorado EnviroScreen aggregates data from 35 different sources, known as "indicators." The final score is used to identify communities experiencing greater environmental health burdens and/or facing more environmental health risks compared to other communities in Colorado (source – CDPHE). Figure 7 illustrates the process, indicators, and components of calculating the EnviroScreen score.

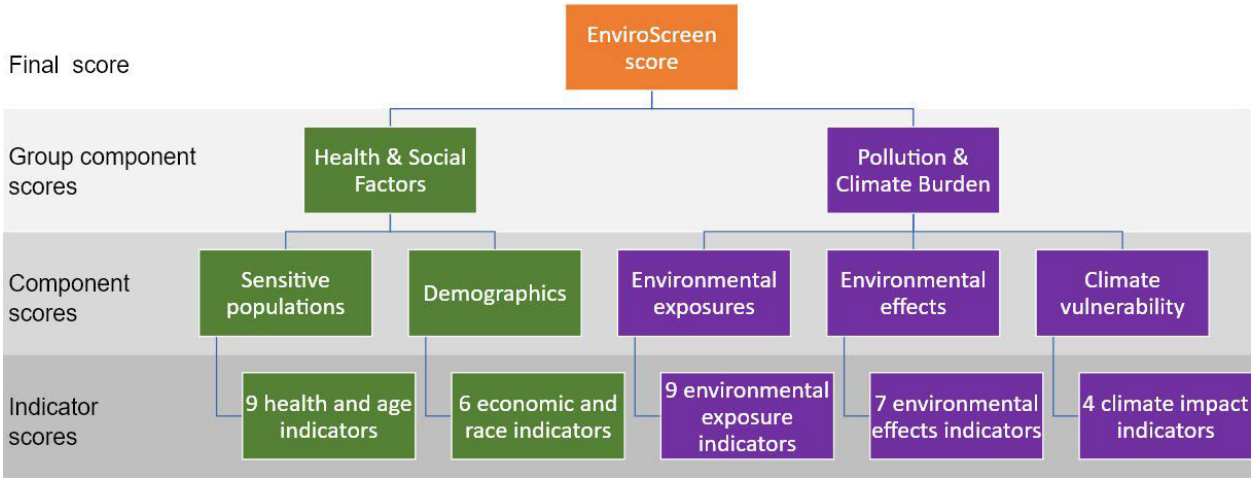


Figure 7: EnviroScreen Score Process. Source: CDPHE

Cumulative impacts refer to the combined effects of multiple burdens and stressors on communities over time. These burdens can include exposure to various pollutants, as well as social and economic stressors, all of which impact the health of communities. **A higher EnviroScreen Score means the area is more likely to be affected by environmental health injustices**. Figure 8 provides a county view of the EnviroScreen scores in Mesa County.

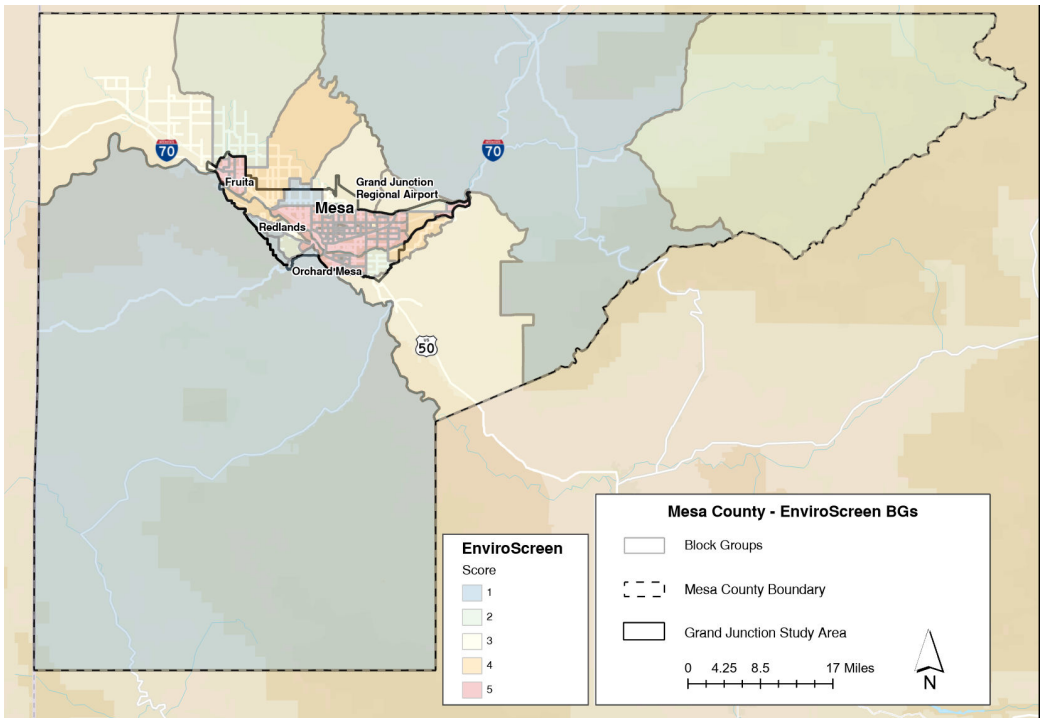


Figure 8: EnviroScreen Score Results – Mesa County

There is a concentration of census tracts in/near Grand Junction that have a high EnviroScreen score, indicating a high environmental health injustice shown in Figure 9. Of the 82 census block groups that are in (whole or partially) the urban area of Mesa County, 67 have an EnviroScreen score of 5, 5 have a score of 4, and 10 tracts have a score between 1 and 3.

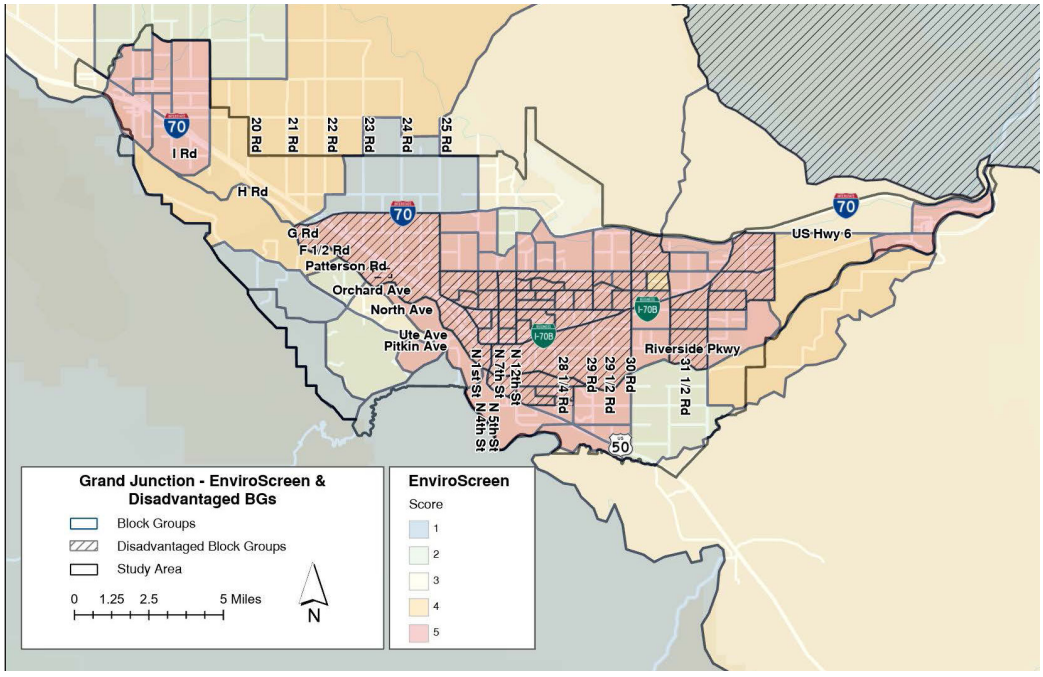


Figure 9: EnviroScreen Score Results – Mesa County Urban Area

Justice40 Initiative – Disadvantaged Communities

In 2021, President Joe Biden signed Executive Order 14008 outlining an investment initiative by the federal government, known as the Justice40 Initiative. A goal of investing 40 percent of certain funding opportunities and other investments to disadvantaged communities that are marginalized by previous underinvestment and overburdened by pollution was established. Related the transportation, the U.S. Department of Transportation (USDOT), Justice40 is an opportunity to address gaps in transportation infrastructure and public services by working toward the goal that at least 40% of the benefits from many of our grants, programs, and initiatives flow to disadvantaged communities. These grant programs SS4A.

Recognizing this initiative and the SS4A safety action plan requirements, an analysis of identifying disadvantaged communities in Mesa County was done through the USDOT Equitable Transportation Community (ETC) explorer. This interactive tool and its analysis results are required to be used for SS4A Implementation Grant Applications, specifically to identify disadvantaged communities for proposed funding, and to calculate rate of fatalities for disadvantaged communities. This evaluation tool provides the USDOT consistent data analysis across the nation to evaluate and compare grant requests. This evaluation tool relies on 56 factors that are analyzed through 5 Indices: Climate & Disaster Risk Burden, Environmental Burden, Health Vulnerability, Social Vulnerability, and Transportation Insecurity. Using the ETC tool to understand inequities, it determined that **45% of Mesa County's population is disadvantaged**. Figures 10 and 11 highlight this information at the county level, and at the urban area.

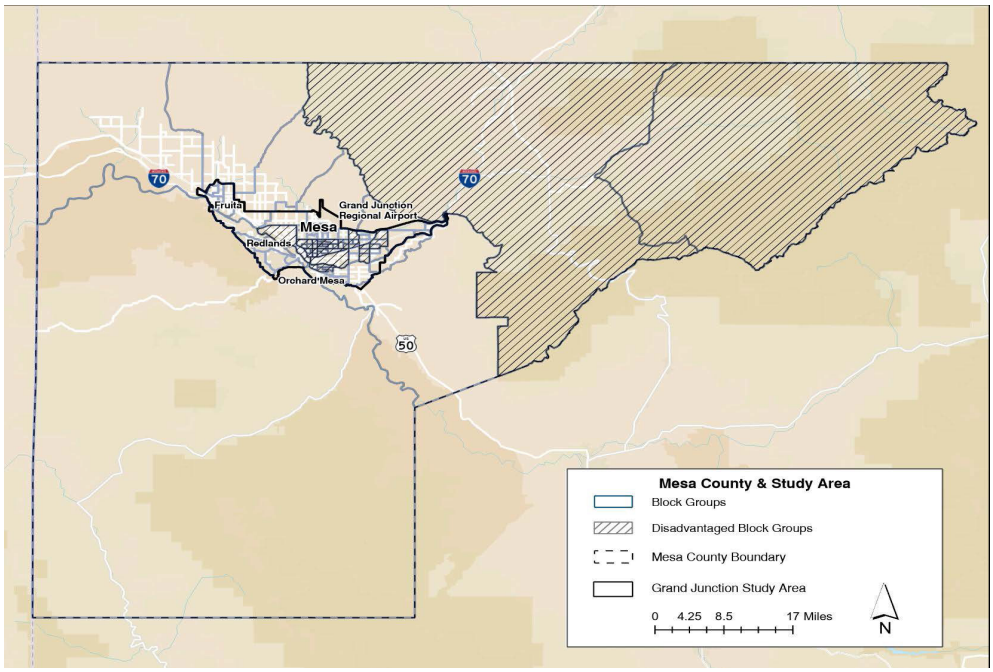


Figure 10: ETC Disadvantage Community Results – Mesa County

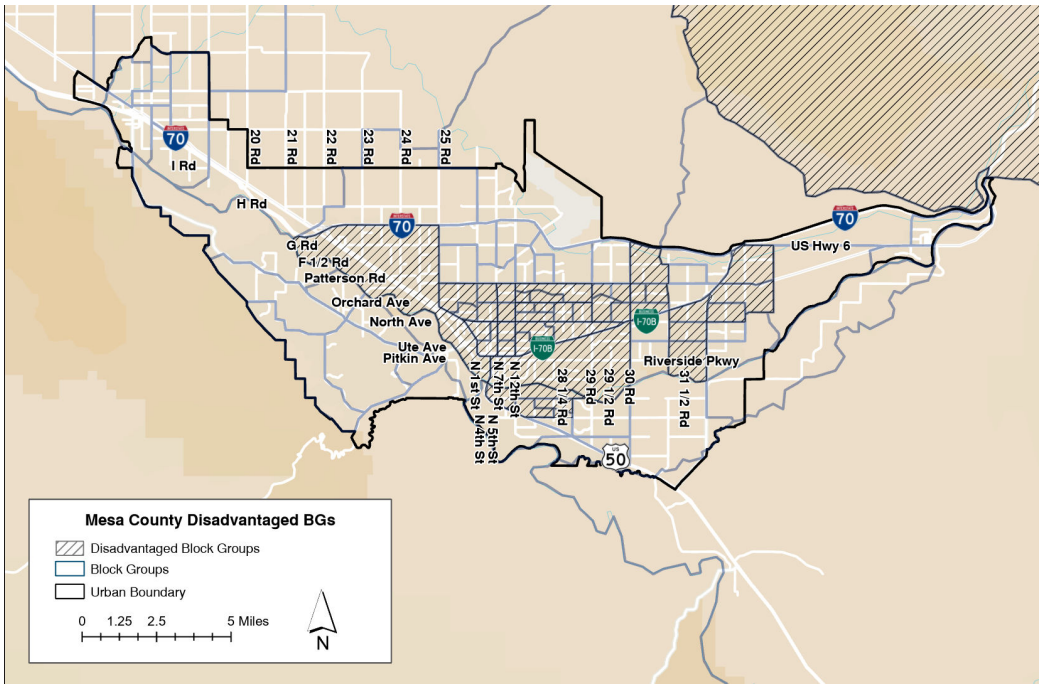


Figure 11: ETC Disadvantage Community Results – Mesa County Urban Area

Evaluating the data from both the EnviroScreen tool and the ETC Disadvantage Community, the majority of census tracts that scored a level 5 from the EnviroScreen are also noted as a Disadvantaged Community through the ETC tool as shown in Figure 12.

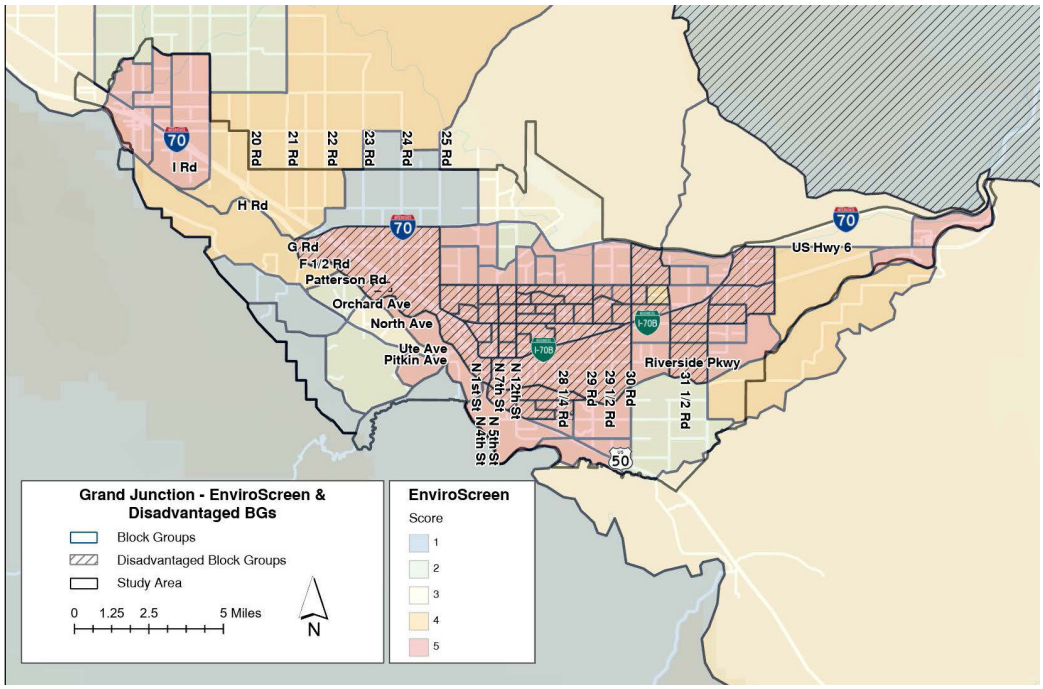


Figure 12: - EnviroScreen and ETC Disadvantage Community Results – Mesa County Urban Area

Comprehensive Crash Analysis

This section presents key findings from a comprehensive crash analysis for seven years of data from 2016 and 2022 (the most recent available data)to identify how, why, where, and when crashes occur in Mesa County. Understanding this crucial data will allow Mesa County to direct resources where they are needed most, and best address the root causes of crashes. **Appendix A** provides more information about the crash history in this time period.

Since 2016, the total number of crashes within the Mesa County has been relatively steady, with a slight decrease in recent years. A total of 17,086 crashes were reported in Mesa County over the seven-year period evaluated (2016-2022). Most crashes occurred in 2019 with 2,718 crashes while the lowest number of crashes occurred in both 2020 and 2022 with 2,230 crashes each year.

	Total Crashes	Fatal or Serious Injury Crashes	Fatal Crashes	Pedestrian Crashes	Bicycle Crashes	Motorcycle Crashes
Average Per Year	2,458	85	17	31	36	64
2016-2022	17,208	594	117	217	249	451

Figure 13: Overview of Crash Trends in Mesa County

How Are Crashes Reported & Data Collected? Crash reports are filed by police officers from local jurisdictions (Grand Junction Police Department, Colorado State Patrol, etc.). The Colorado Department of Revenue is the owner of this dataset. Reports are shared and compiled annually by CDOT. The data used in this analysis was obtained by Mesa County for use in this study directly from CDOT and from a third-party vendor contracted to geocode crashes with missing coordinates. Reportable crashes included in this database represent crashes with injuries or fatalities, uninsured drivers, more than $1,000 in damages, alcohol or drugs involved, or by driver request.

How Was Data Analyzed?
The consulting team utilized Microsoft Power BI to gather and analyze data. They also developed a customized platform for Mesa County to facilitate efficient data management and derive valuable insights. This platform enabled a thorough evaluation of crash data, helping to identify overall trends and assess various factors, including the timing, locations, causes, involved individuals, and types of crashes.

An increase in the percentage of serious injury crashes occurred from 2020 to 2021. The percentage of minor injury crashes has increased in recent years (2020-2022) with a high of 15.7% in 2022. The minor injury crash percentage varied between 4.9% and 6.4% from 2016 to 2019. There was no apparent trend in the percentage of crashes that resulted in possible injury(s) with a low of 6.5% occurring in 2018 and a high of 18.4% occurring in 2020. The percentage of crashes that resulted in property damage only (no injuries) increased from 2016 to 2018 reaching a peak of 86.5% in 2018 before decreasing in the years after to a low of 64.7% in the latest year (2022).

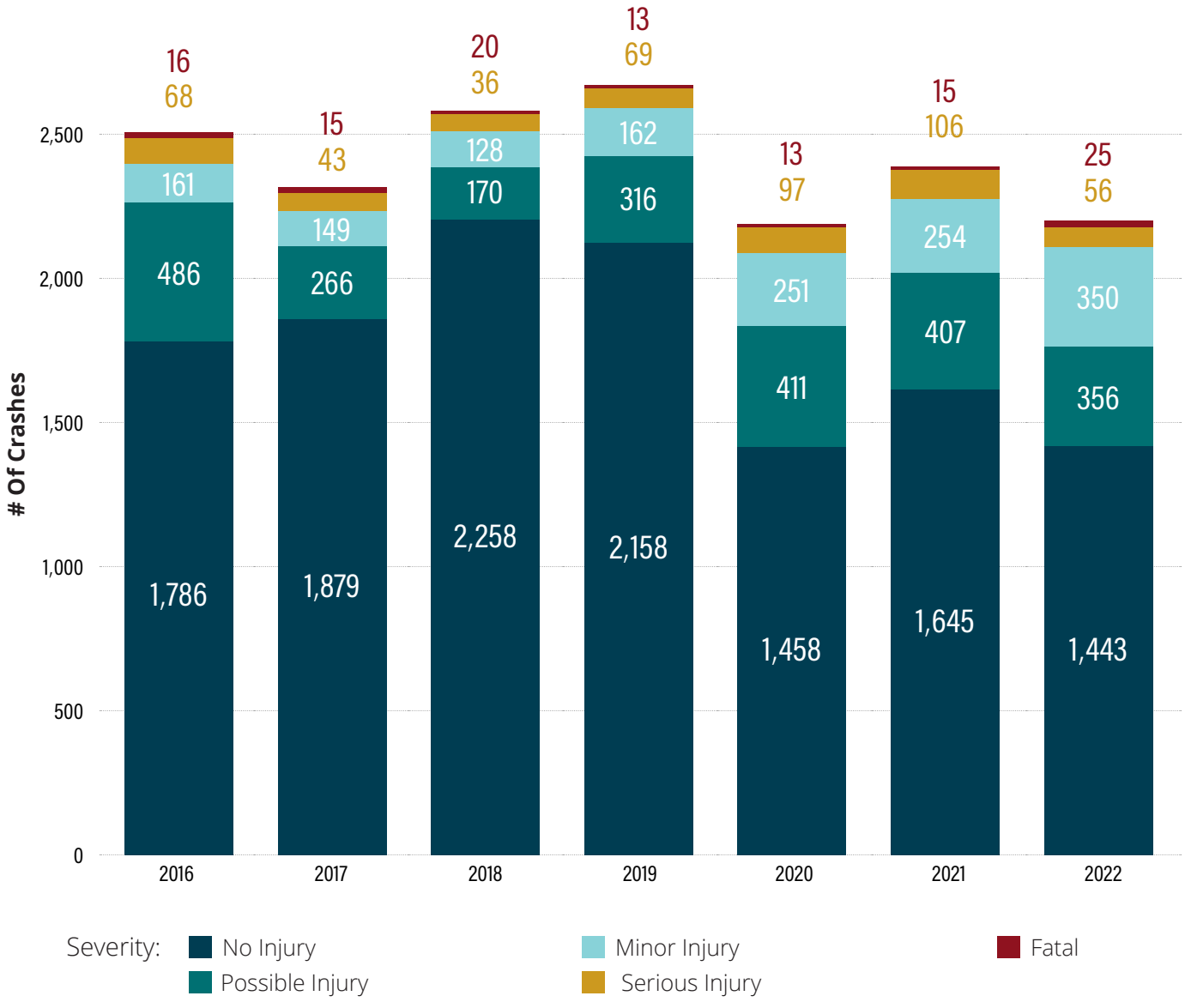


Figure 14: Total Number of Crashes per Year and Injury Severity, Mesa County, 2016-2022

Where

A heatmap of all crashes in Mesa County from 2016 to 2022 is shown in Figure 15. A majority of crashes are concentrated in Grand Junction and along Interstate 70 (I-70). This map also indicates the lack of concentration of crashes in the rural areas. Recognizing the difference of the crash picture between urban, freeway/interstate, and rural areas, the approach to further analyze crashes are separated into urban and rural areas.

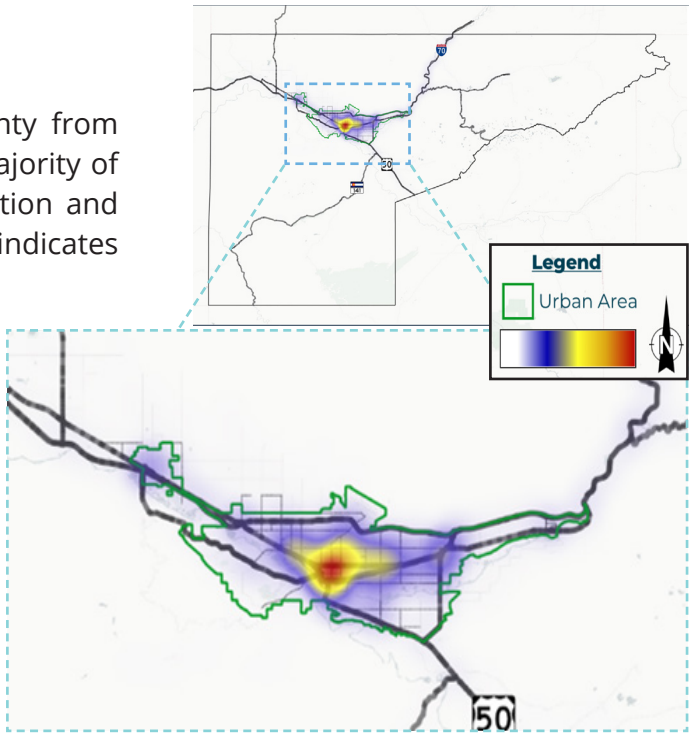


Figure 15: Heatmap of All Crashes in Mesa County, 2016-2022

Who

For this analysis, the user types are separated into four categories depending on who was involved in the crash: driver, motorcyclist, bicyclist, and pedestrian. Figure 16 shows the distribution of user types by injury severity for crashes in Mesa County within the study period. For crashes only involving drivers, the injury and fatal percentage is the lowest among all user types. Motorcyclists see the highest injury percentage of any user type and the second-highest percentage of fatal crashes. Crashes involving bicyclists had a high injury percentage but a low fatality percentage. Pedestrian crashes had the second-highest injury percentage and the highest fatality percentage of any user type.

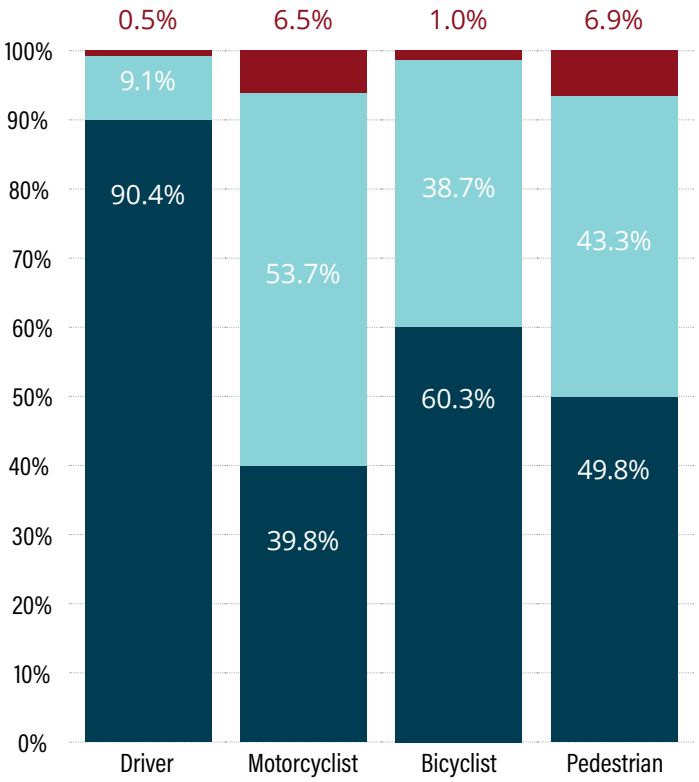


Figure 16: # of Crashes by User Type & Injury Severity, 2016-2022

Urban vs. Rural Crashes

Approximately 88% of all crashes in Mesa County were reported in urban areas (15,014 crashes) and the remaining 12% of crashes occurred in rural areas (2,072 crashes). Despite the lower number of total crashes, rural crashes accounted for 23% of all serious injury crashes (475 crashes) and 35% of all fatal crashes (41 crashes). A comparison between urban and rural crashes organized by injury severity is shown in Figure 17.

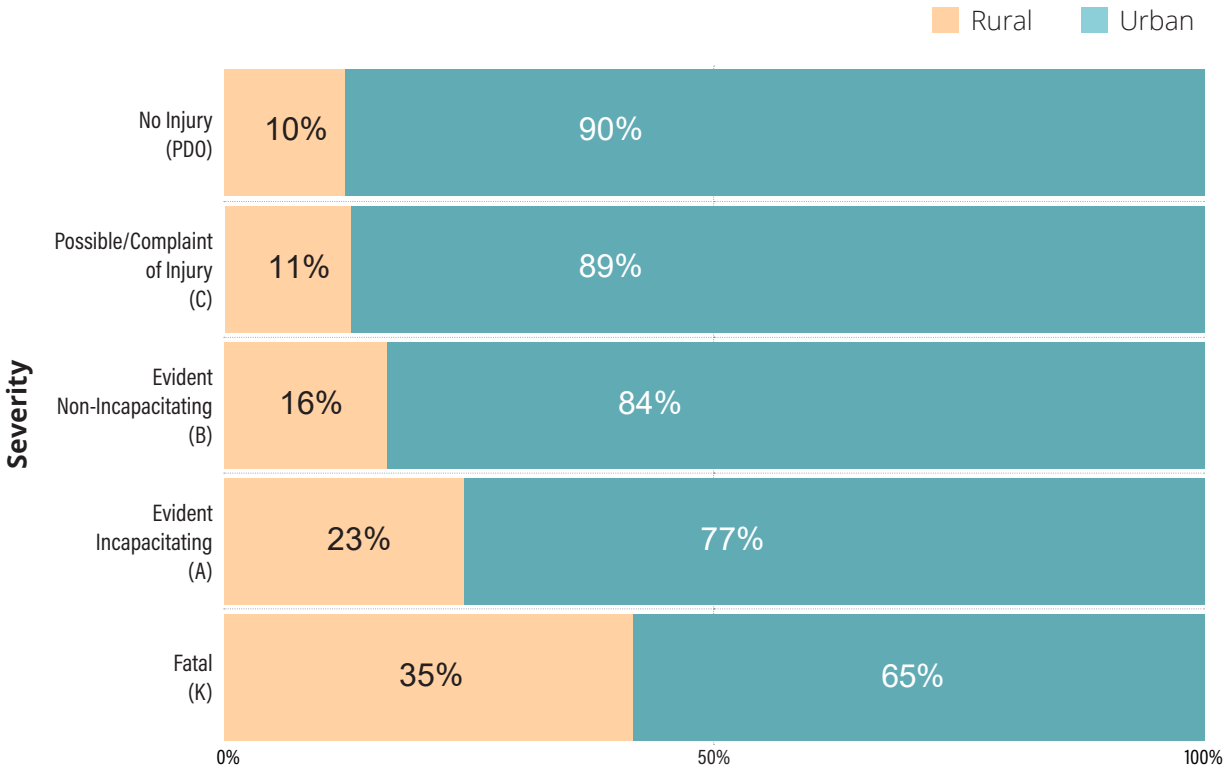


Figure 17: Urban vs. Rural Crashes by Injury Severity, 2016-2022 (N = 17,086)

Approximately 75% of KSI crashes occur within the designated urban area of Mesa County. KSI crashes steadily decreased from 2016 to 2018 before increasing steadily until 2021. The most recent year of analysis, 2022, saw a dip in the number of KSI crashes compared to previous years. Rural KSI crashes were relatively low in 2016 and 2017 before increasing to a relatively constant value from 2018 to 2022. There was no apparent effect on the amount of KSI crashes for rural crashes as a result of the pandemic in 2020. The number of urban KSI crashes increased in 2020 and 2021 before dropping in 2022.

Urban Crashes

Urban Crash Location

60% of urban crashes were intersection related.

56% of these crashes were at unsignalized intersections.

24% of Motorcycle crashes in urban areas resulted in death or serious injury.

97% of Pedestrian and Bicyclist KSI crashes occur in urban areas.

Contributing Factors to Urban Crashes

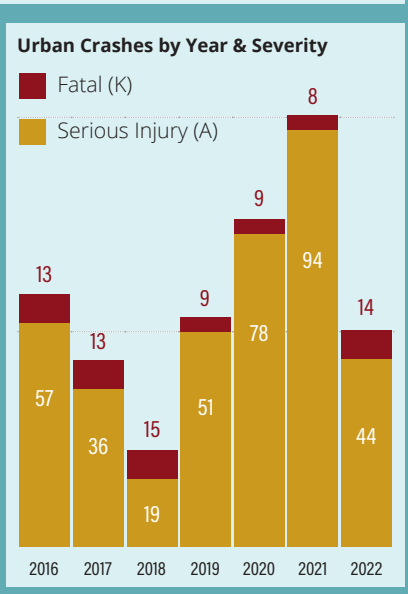
Impairment is a factor in **23%** of urban KSI crashes.

Speeding is a factor in **22%** of urban KSI crashes. Aggressive driving is the most common contribution factor.

Vulnerable road users (such as pedestrians, bicyclists, and motorcyclists) are involved in **16%** of urban KSI crashes.

31% of urban crashes involved **drivers under the age of 25**.

67% of KSI Approach Turn Crashes occurred at **Signalized intersections**



Rural Crashes

Rural Crash Location

87% of rural crashes were non-intersection crashes.

The majority, **77%** occurred on state highways.

49% of Motorcycle crashes in rural areas resulted in death or serious injury.

3% of Pedestrian and Bicyclist KSI crashes occur in rural areas.

Contributing Factors to Rural Crashes

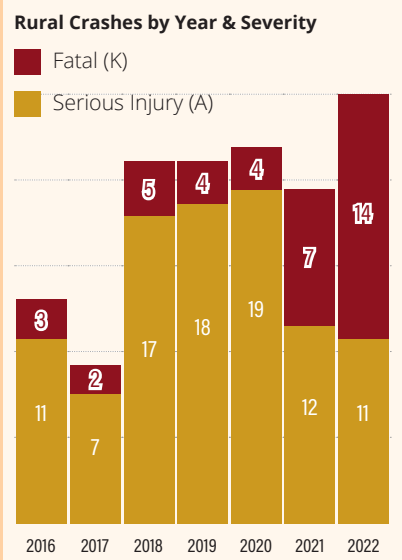
Impairment is a factor in **21%** of rural KSI crashes.

Speeding is a factor in **42%** of rural KSI crashes. Aggressive driving is the most common contribution factor.

Overturning accounts of **35%** of rural KSI crashes.

Wild animals contribute to **12%** of rural crashes

65% of rural crashes involved male drivers.



Identifying Focus Areas

Based on the crash analysis, seven focus areas were determined that guided the identification and creation of strategies that directly connect to addressing these types of crashes. As shown in Figure 22, there are five focus areas related to the urban area: signalized intersections, driving under the influence/impairment, people walking/pedestrians, people biking/bicyclists, and speeding. And three priorities for the rural area: speeding, overturning vehicles, and motorcyclists.

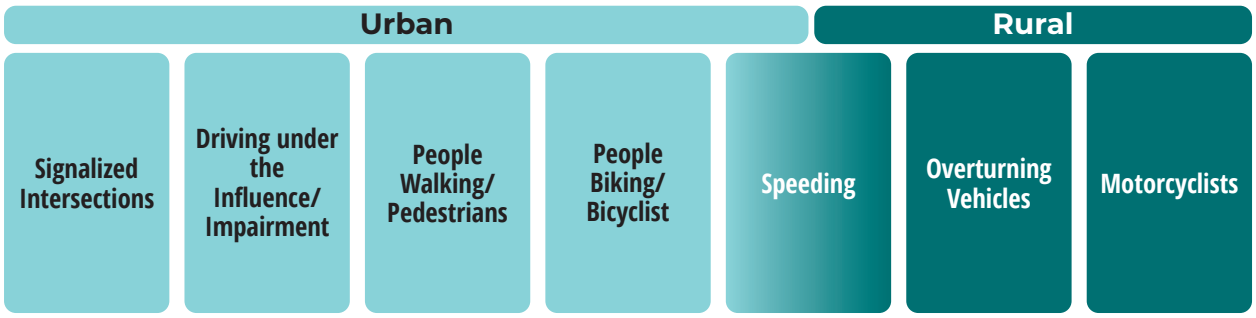


Figure 22: Initial Urban and Rural Focus Areas for Mesa County Safety Action Plan

As work advanced in selecting strategies and countermeasures to respond to the crash trends, further refinement of focus areas occurred. Building Safe Streets grouped signalized intersections and overturning vehicles together, Addressing Dangerous Behaviors became the umbrella category for driving under the influence/impairment and speeding, Protecting Vulnerable Road Users consolidated people walking/pedestrians, people biking/bicyclists and motorcyclists, and Creating a Culture of Safety transpired from the need to address policy and systemic changes.

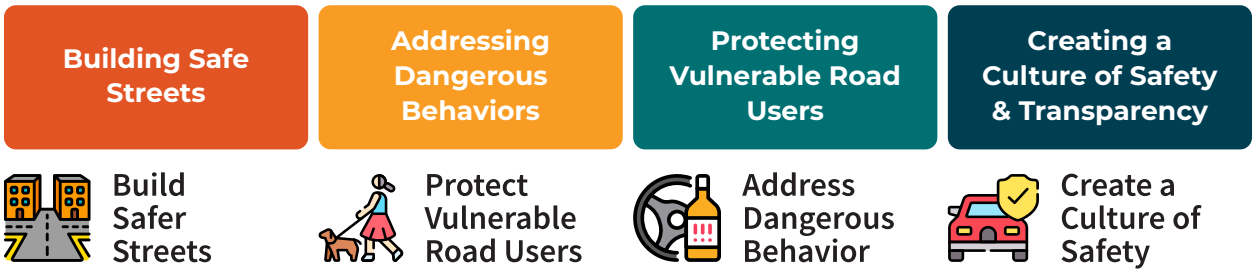


Figure 23: Focus Areas for Mesa County Safety Action Plan

High Injury Network

Mesa County developed a High Injury Network (HIN) to identify priority locations where a high number of people have been killed and severely injured in traffic crashes. The HIN is a useful framework that helps governments focus their limited resources on what's needed at these dangerous roads and intersections, including appropriate design solutions. The HIN will change over time as safety trends change.

Figure 24 provides a visual representation of the Mesa County HIN for traffic crashes between 2016 and 2022. Of the 594 fatal and serious injury crashes in Mesa County overall, 458 (77%) occurred in urban areas. Of the urban crashes, 280 (61%) occurred on road segments and 178 (39%) were at intersections. **The HIN accounts for 31% of all fatal and serious injury crashes in Mesa County** even though HIN locations account for only a fraction of the overall transportation network. Tables 1 and 2 display HIN Intersection and HIN Segment locations respectively.

Table 1: Intersections on the HIN

Intersection	KSI Count 7-Years
S 4th St & Ute Ave	7
29 Rd : D Rd & Riverside Pkwy	5
29 Rd & Teller Ave 5	5
25 Rd & Patterson Rd 5	5
29 Rd & Patterson Rd 5	5
28 1/4 Rd & Patterson Rd	4
N 10th St & North Ave	3
N 7th St & Elm Ave	3
N 1st St & Rood Ave	3
N 5th St & Grand Ave	3
N 12th St & Grand Ave	3
N 1st St & North Ave	3
N 12th St & North Ave	3
28 1/4 Rd & North Ave	3
29 Rd & North Ave	3
I70-B & North Ave	3
31 1/2 Rd & I-70B	3
24 1/2 Rd & Patterson Rd	3
29 1/2 Rd & Patterson Rd	3
30 Rd & Patterson Rd	3

The HIN looks at the urban areas of Mesa County and a detailed technical memorandum provides more in-depth information on the HIN analysis (see **Appendix B**). The project management team aimed to develop a High Risk Network (HRN) for the rural areas where there were fewer crashes. **However, after analyzing current data, it was determined that more data needs to be collected and analyzed to determine a HRN.**

Whats the Difference Between an "Arterial" and "Collector"?

Arterial Streets include freeways, multi-lane highways, and other major high-capacity roadways. Arterials typically do not directly connect to local/ neighborhoods streets. Collectors are major and minor roads that connect local/neighborhood streets with Arterial Streets. Collectors also typically have lower speeds than Arterials.

Source: US Dept. of Transportation

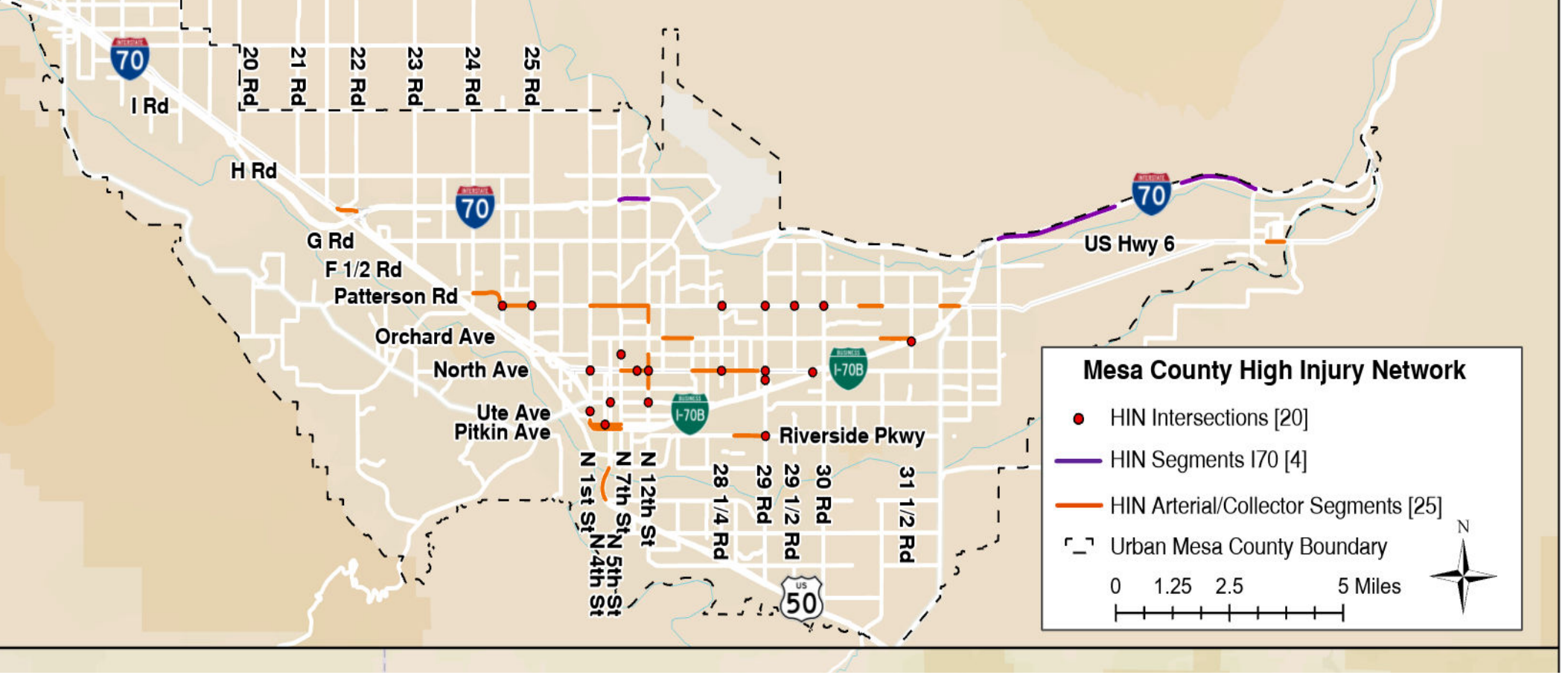


Figure 24: Mesa County High Injury Network (HIN)

The Mesa County HIN includes:

20 intersections, 21 Arterial/Collector Segments, & 4 I-70 segments.

As roadway improvement projects are implemented and new crash data becomes available, the transportation network will be re-evaluated on a regular basis to identify changes to the HIN.

Table 2: Collector/Arterial Roadway Segments on the HIN

Segment Name	From	To	Length (Miles)	KSI Crashes	KSI Crash/ Mile	Evaluation
North Ave	23rd St	28 1/4 Rd	0.5	5	10.0	Collector/Arterial
North Ave	7th St	12th St	0.5	4	8.5	Collector/Arterial
N 12th St	North Ave	Elm Ave	0.3	3	12.0	Collector/Arterial
North Ave	28 1/2 Rd	Melody Ln	0.4	3	8.0	Collector/Arterial
Patterson Rd	Cottage Meadows Ct	31 Rd	0.4	3	7.5	Collector/Arterial
Patterson Rd	7th St	12th St	0.5	3	6.0	Collector/Arterial
Patterson Rd	1st St	7th St	0.5	3	6.0	Collector/Arterial
Orchard Ave	15th St	23rd St	0.5	3	6.0	Collector/Arterial
Patterson Rd	24 1/2 Rd	25 Rd	0.5	3	5.9	Collector/Arterial
Hwy 50	Riverside Pkwy Ramp	Unaweep Ave	0.5	3	5.8	Collector/Arterial
E 1/2 Rd	31 Rd	31 1/2 Rd	0.5	3	5.7	Collector/Arterial
Riverside Pkwy	Evergreen Rd	29 Rd	0.5	3	5.6	Collector/Arterial
Ute Ave	1st St	7th St	0.6	3	5.1	Collector/Arterial
Pitkin Ave	1st St	7th St	0.6	3	4.8	Collector/Arterial
Patterson Rd	24 Rd	24 1/2 Rd	0.6	3	4.8	Collector/Arterial
I-70	EB, Mile Marker 38	EB, Mile Marker 39	1.0	3	2.9	Interstate
I-70	EB, 33 Rd	EB, Mile Marker 38	1.0	3	2.9	Interstate
I-70	WB, Mile Marker 40.3	WB, Elberta Ave	1.3	3	2.3	Interstate
North Ave	28 1/4 Rd	28 1/2 Rd	0.2	2	8.0	Collector/Arterial
N 12th St	Bookcliff Ave	Patterson Rd	0.2	2	8.0	Collector/Arterial
N 12th St	Gunnison Ave	North Ave	0.3	2	7.4	Collector/Arterial
N 8th St	Iowa Ave	Main St	0.3	2	7.0	Collector/Arterial
Patterson Rd	32 Rd	I-70B	0.3	2	6.2	Collector/Arterial
Hwy 6 & 50	Valley Ct	I-70 Wb Ramp	0.3	2	6.0	Collector/Arterial
I-70	EB, 26 1/2 Rd	EB, 27 Rd	0.5	2	4.0	Interstate

Integrating Direction from the Community

Stakeholder Working Group (SWG)

In March 2024, the project management team hosted a four-hour workshop with the SWG to inform, engage, and establish partnership with the variety of agencies and organizations that are invested in creating a safe place for Mesa County residents and visitors. With the goals outlined for the workshop, the project team created interactive sessions and activities that focused on: learning from others, crash data trends, focus areas, initial strategy development, and discuss how roadway safety efforts are currently administered.

Activity 1 - Focus Area Discussion

- Rural & Urban Focus Areas
- What's Missing?
- What Stands Out?
- What will the Community Think?
- Are there any current tools – programs are in place that directly connect to these issues?

Activity 2 - Connecting Strategy Ideas to the E's

Attendees were asked to write out ideas/ solutions/ thoughts/ strategies on how to address the focus areas within the seven E's: Enforcement, Evaluation, Engagement, Education/ Encouragement, Engineering, Equity, and Emergency Responder.

Activity 3 - Identification of Constraints & Opportunities

- Processes
- Structure & Programs
- Mesa County Residents
- Funding

Results

The SWG members provided detailed feedback from each activity that led to the:

- Refinements of focus areas and addition of Creating a Culture of Safety.
- Draft of initial Safety Action Plan strategies.
- Identification of issues to address in implementation.

What We Heard from the Community – Phase 1

The first public engagement touchpoint for this project took place in the Spring of 2024. A self-guided online meeting was open from March 13 to April 28, 2024, and included an interactive comment map and survey. In addition, Mesa County attended community events with a comment map and directed visitors to the online meeting. Between the online meeting and events there were a total of 1,160 participants.

The overarching goals of Phase 1 engagement were to have the community:

Learn about:

- The purpose of the plan, including funding and schedule.
- Community safety concerns, including existing conditions and crash trends
- Next steps and how to stay involved.

Provide feedback on:

- Areas where they have safety concerns.
- Goals of the plan.
- Safety areas to prioritize.

Online Meeting

754 Recorded Users

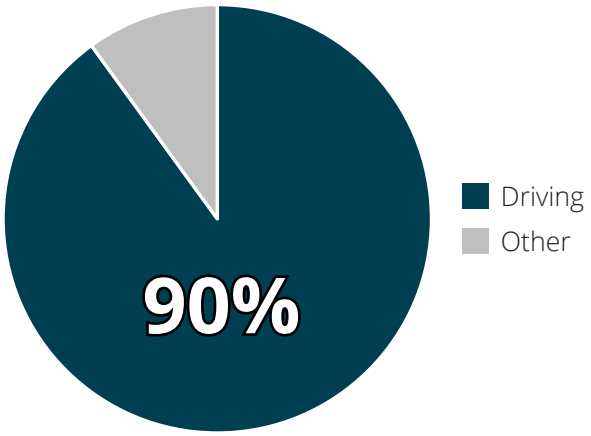
275 Survey Responses

245 Map Comments

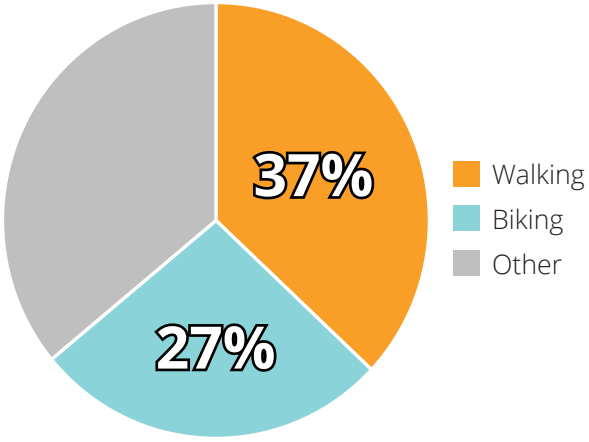
Community Events

- **Cesar Chavez Celebration.**
- **Sustainability and Adaptation Open House.**
- **Arbor Fest**

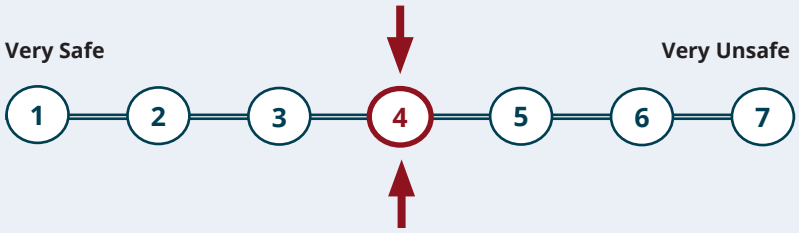
Key Takeaways from Engagement Phase 1



PRIMARY Mode of Transportation Around Mesa County



SECONDARY Mode of Transportation Around Mesa County



Respondents rated Mesa County roadways on a scale of 1 (very unsafe) to 7 (very safe). **The average rating was 4.**

Distracted Driving (16%) and **Speeding Vehicles** (15%) were identified by respondents as top safety topics.

81% of respondents agree or strongly agree that their **Personal Choices and Driving Behaviors** play a role in safer roadways in Mesa County.

Top 3 **safety concerns** were:

1. **distracted Driving**
2. **Speeding Vehicles**
3. **Reckless / Careless Driving**

Top 3 **desired safety improvements:**

1. **Design of Roads & Intersections**
2. **Traffic Signal Operations**
3. **Enforcement**

Additional Themes from Community Feedback

Traffic Signal Timing and Red-Light Runners

- Several intersections are highlighted for frequent red-light violations.
- Reports of issues with traffic signal timing, leading to frustration and red light running.
- Witnessing frequent instances of drivers running red lights, which poses a significant safety hazard.

Enforcement and Education

- Calls for stricter enforcement of traffic laws, including texting while driving, expired registrations, speeding, and red-light violations.
- Suggestions for community education in addressing road safety issues and increasing awareness of traffic laws.

Bicycle and Pedestrian Infrastructure

- Issues with pedestrian and cyclist safety due to inadequate sidewalks, bike lanes, and crossings, particularly in areas with high-density housing, schools, and parks.
- Concerns about pedestrian safety, including the need for more crosswalks, improved visibility, and better education for drivers and pedestrians on rules of the road.

Speeding and Aggressive Driving

- Concerns about speeding, tailgating, and road rage, with suggestions for increased enforcement, higher penalties, and better education on traffic laws.
- Reports of street racing, dangerous driving habits, and crashes.
- Reports of many drivers exceeding the speed limit by 10 mph or more.

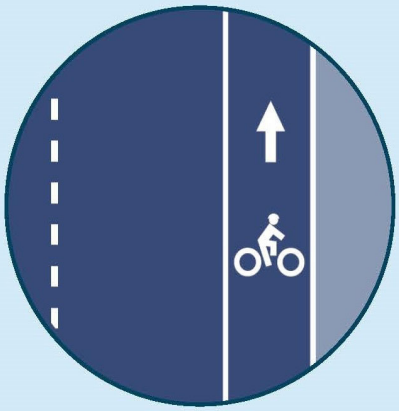
Bold Changes to Create Safer Streets for People Walking, Biking, and Driving

In summer 2024, the City of Grand Junction launched a pilot project designed to reduce speeds on 4th and 5th Streets between North Ave. and Ute Ave., that will increase safety for motorists, cyclists, and pedestrians. Both streets were one-direction, with two vehicle lanes and on-street parking on both sides.

During the pilot, vehicle traffic was narrowed to one way, one lane on each street (4th and 5th). A protected bike lane, with vertical elements and parked cars was constructed on the right-hand side and diagonal parking remains on the left-hand side of both roadways.

This project was identified in the City of Grand Junction's Pedestrian & Bicycle Plan, and by the 1981 Downtown Plan of Development and the 2019 Vibrant Together Master Plan for improvements.

U.S. Department of Transportation
Federal Highway Administration



Safety Benefits:

Converting traditional or flush buffered bicycle lanes to a separated bicycle lane with flexible delineator posts can reduce crashes up to:

53%

for bicycle/vehicle crashes.[3]

Bicycle Lane Additions can reduce crashes up to:

49%

for total crashes on urban 4-lane undivided collectors and local roads.[7]

30%

for total crashes on urban 2-lane undivided collectors and local roads.[7]

Bicycle lane in Washington, DC. Source: Alex Baca, Washington Area Bicyclist Association.

03 Establishing Strategies and Actionizing the Plan

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

Strategy Development

A key component of the Safety Action Plan is the creation of strategies - a variety of work efforts that function as a collective effort - to reduce Killed and Serious Injury (KSI) crashes in Mesa County. Mesa County used a six-month continuous process to develop the final list of strategies that included a comprehensive identification of an unconstrained list of known, effective strategies related to the focus areas, a stakeholder assessment and removal of low value strategies, and refinement of remaining strategies based on applicability and anticipated results.

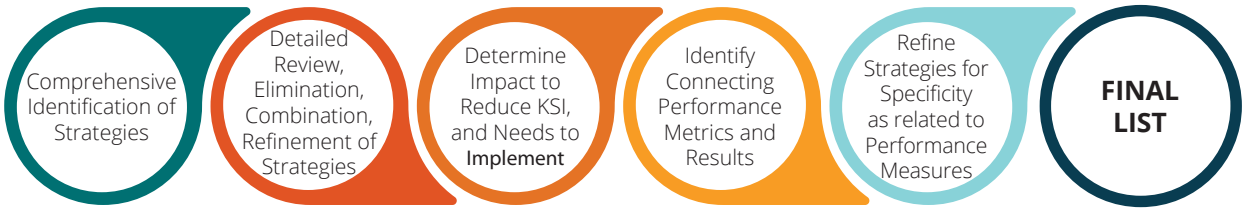


Figure 25: Strategy List Creation Process

In identifying and finalizing the strategy list, six principles were identified and integrated into the process:

Figure 26: Strategy List Creation Principles

Proven Results and Effectiveness

Highway safety has been an integral part of federal initiatives since the 1960's, when the Highway Safety Act of 1966 was enacted. As this was the first national initiative, it then progressed through the decades becoming more intentional, and relative to the local roadway systems through formalized funding sources like the Highway Safety Improvement Program (HSIP) in 2005. Highway safety was furthered by research and analysis with the launch of the crash modification factors clearing house (CMFC) in 2010, the Safe Systems Approach, and the launch of the SS4A program in 2021. There are many additional milestones in the history of transportation safety, which now provide technicians with a variety of proven strategies to reverse the trend of KSI crashes. Each one of these resources offers a wide range of countermeasures that have proven results and effectiveness in reducing KSI crashes.

For this planning effort, the main resources that were used to identify and evaluate strategies were:

United States Department Of Transportation (USDOT): Federal Highway Administration (FHWA) & National Highway Traffic Safety Administration (NHTSA)

- Proven Safety Countermeasures
- Safe System Roadway Design Hierarchy
- Behavioral Safety Strategies for Drivers on Rural Roads
- Manual for Selecting Safety Improvements on High Risk Rural Roads
- Low-Cost Safety Improvements for Rural Intersections
- The Crash Modification Factors Clearinghouse
- National Highway Traffic Safety Administration Countermeasures That Work
- PedBikeSafe – Pedestrian & Bicycle Safety Guide and Countermeasure Selection System
- Systemic Safety User Guide

Colorado Department of Transportation

- Strategic Transportation Safety Plan

Figure 27: Example of USDOT 'Proven Safety Countermeasure'

Each of these resources provide information about the background, application, evaluation process/methodology, and effectiveness of different countermeasures (strategies). While each resource measures effectiveness outcomes slightly different, each one is based on a research based methodology.

Holistic Approach

Another principle that was used in strategy development was using the Safe Systems approach, and the "Swiss Cheese Model", show in Figure 28, that recognizes one type of action will not solve the KSI crash problem, but building redundancy into the action plan will create layers of protection to keep people safe on Mesa County roadways. This principle helped the project management team and SWG review and include strategies that are not just focused on one type of solution, but holistically considered: engineering, enforcement, education and encouragement, equity, and evaluation work efforts.

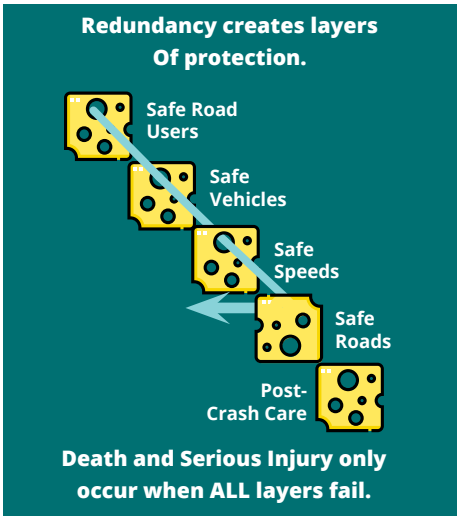


Figure 28: Swiss Cheese Model of Traffic Safety

Application

Another important factor that was considered in the strategy development process is the application of a strategy. For this plan, strategies were evaluated on where and how they could be applied. A strategy can have more than one application. Depending on the application type, it could have a higher impact on reducing KSI crashes.

- **Site Specific**
  - **High Injury Network (Urban**) – Roadway locations in Mesa County's urban area that have the highest amount of KSI's crashes.
  - **High Risk Network (Rural)** – Roadway locations in Mesa County's rural area that have similar characteristics of roadways of KSI crashes.
  - **Location Specific** – While many transportation projects are not on a HIN or HRN, local agencies can review crash trends from data analysis, look at context sensitive countermeasures, and integrate them into project development or a non-engineering effort like enforcement or an education campaign. Additionally, improving safety is integrated into roadway maintenance projects such as road overlays, ADA improvements, etc.
- **Systemic** - The Federal Highway Administration (FHWA) promotes the systemic approach as a complementary technique to the traditional, site-based "hot spot" approach. *'A systematic approach to safety involves the installation of a safety countermeasure at all sites system-wide that meet specific criteria. This is also sometimes described as a policy-based approach, in which all sites that meet criteria will eventually receive a certain treatment. It is also exclusionary in some ways, working from the assumption that a countermeasure should be installed everywhere except for those sites that do not meet certain criteria."* FHWA - Systemic Safety User Guide
- **Programmatic/Systematic** – Deploying strategies, typically low-cost, proven safety countermeasures, that can be integrated in existing transportation programs or into design or maintenance projects.

Resources

Another fundamental part of finalizing the safety strategies for this plan was consideration of funding and staffing resources, and availability. With finite and limited resources throughout Mesa County and within different types of work efforts (engineering, enforcement, education, etc.) decisions have to be made on what to fund and support. Part of this balancing is the impact of reducing traffic fatalities and improving safety and cost.

Keep it Local

The first step in the strategy development process was to develop a comprehensive list of strategies. Utilizing the resources mentioned previously in this section and connecting them to the results of the crash analysis. While it's important to initially be inclusive to all relevant strategies, a guiding principle to determine if it's actionable in Mesa County, was understanding if it can be implemented and both community leaders and residents will be accepting.

The Stakeholder Working Group (SWG) and the public involvement played a key role in finalizing the strategies from a local perspective. Specifically, questions that were addressed and inquired about included:

What work is being done now?

What has been tried before?

Who are leaders and partners?

Are resources available?

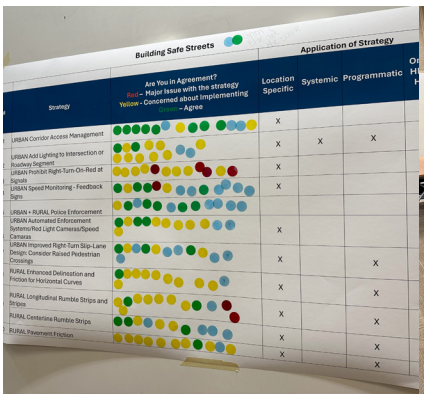
Is there community and political support?

Is there a legal framework in place to administer?

Phase 2 Stakeholder and Community Input

Related to the development of strategies, the SWG met twice in May and September 2024. The May 2024 work session focused on removing strategies from the comprehensive list, revising strategies for better alignment with existing work efforts, and initial prioritization. This was done through small working groups that discussed strategies grouped by the plan's focus areas. This work effort eliminated over a dozen strategies and provided more focused direction on others.

The SWG work session in September 2024, the fourth and final meeting, was focused on finalizing the strategies with specific actions, identifying the agencies responsible for implementation, and committing resources. This work is included in the final list of strategies.



Community engagement activities provided an update on the plan and gathered feedback on the strategies and prioritization. A self-guided online meeting was held between August 12 and September 8, 2024 attended by 103 people. In addition, Mesa County participated in seven existing community events between August 6 and September 5, 2024, and hosted the Western Colorado Transportation Safety Symposium on August 28, 2024. During these efforts, a total of approximately 450 participants were engaged. The engagement opportunities were promoted via social media, e-blasts, and a press release.

Engagement Results

450 Community Participants

35 Safety Pledges

60 Priority Board Responses

50 Strategy Board Responses

Key Takeaways from Engagement Phase 2

Key takeaways from the combined survey responses of the online meeting and in-person events that influenced the prioritization and implementation of the strategies are highlighted below.

Of the four focus areas, which would be your FIRST priority?

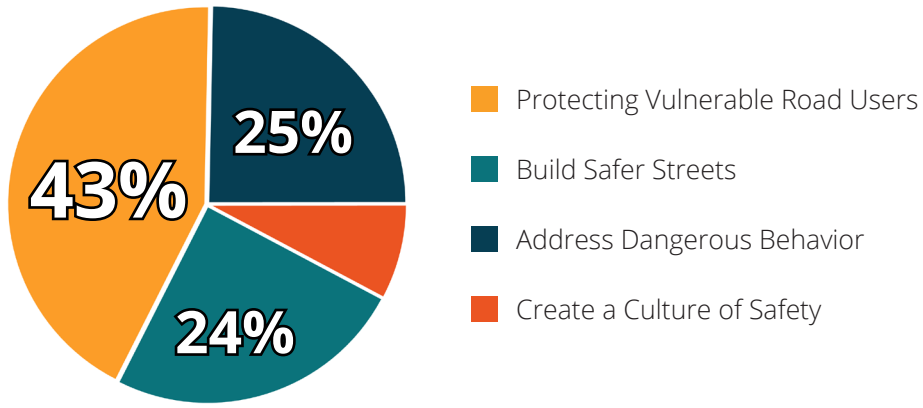


Figure 29 displays the average responses to the strategies presented to the community by focus area.

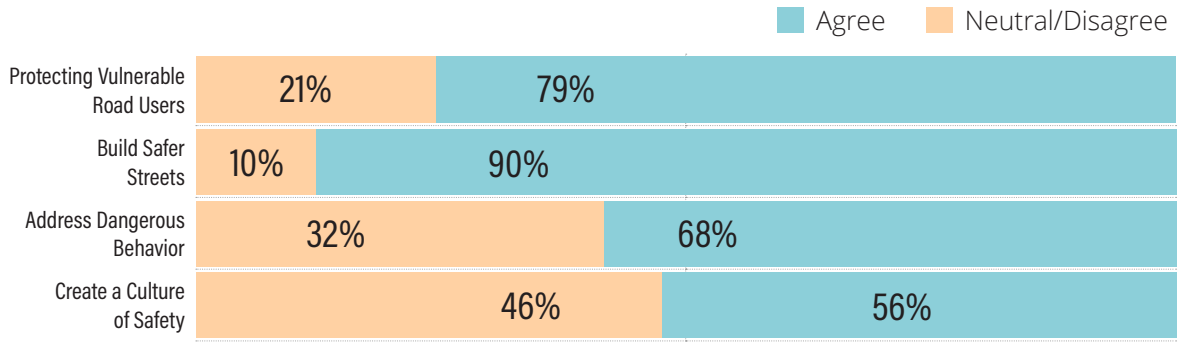


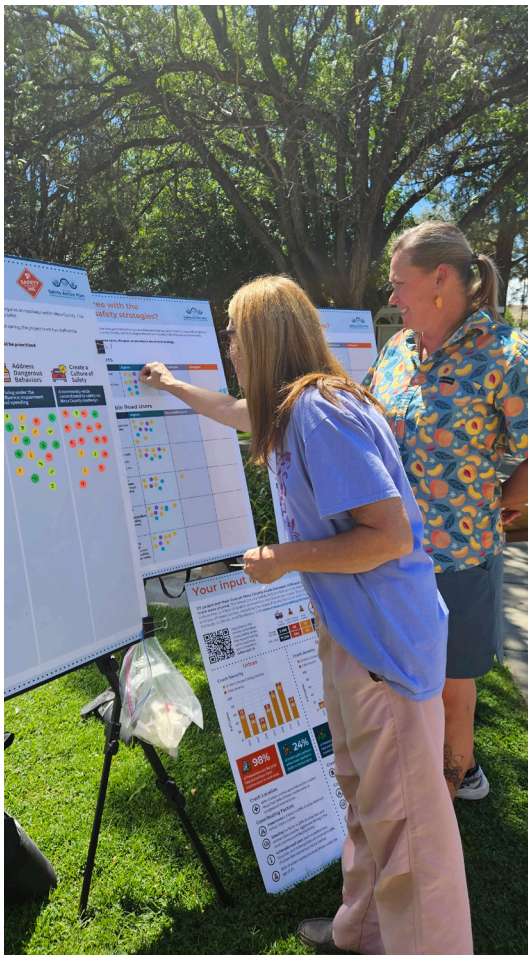
Figure 29: Average Response to Strategies Presented to the Community by Focus Area

The open-ended comments from the online meeting indicate the need for improved education and awareness campaigns for both drivers and cyclists, stricter enforcement of traffic laws, better road design including separated bike lanes and pedestrian paths, and a focus on reducing speeding and improving safety at intersections to address the systemic causes of dangerous roads and hostility toward cyclists.


OZARK TRAIL
Safe Routes to School
MESA COUNTY


Your input is critical


My Safety Pledge...


Your input

Safety Action Plan Strategies

The Mesa County Safety Action Plan is committing to 30 strategies that will support its goal of achieving zero fatalities and serious injuries on the transportation network in the future. The strategies are organized by the 4 focus areas and 10 objectives:

Building Safe Streets

Actions in this area will influence the physical design of urban and rural intersections and roadways.

Objective 1: Enhance intersection operations and visibility where conditions have been or could be a crash factor

Objective 2: Focus on proactively reducing severe crashes based on contextual factors

Objective 3: Ensure funding aligns with safety improvement projects

Protect Vulnerable Road Users

Actions in this area will protect people walking, people biking, people rolling, and motorcyclists.

Objective 1: Host targeted events and education campaigns for the general public that promote safe behaviors and increase awareness of traffic laws

Objective 2: Prioritize vulnerable road user improvements on High Injury Network (HIN) segments

Objective 3: Build upon Safe Routes to School (SRTS) efforts

Address Dangerous Behaviors

Actions in this area focus on influencing the behavior and attitudes of people traveling throughout Mesa County. These actions address driving under the influence and speeding.

Objective 1: Reduce speeding and red-light running

Objective 2: Host targeted events and education campaigns for the public that promote safe behaviors and increase awareness of traffic laws

Create a Culture of Safety

Actions in this area focus on creating a community-wide commitment to the Mesa County Safety Action Plan.

Objective 1: Unite, equip, and empower multi-disciplinary leaders to actively work together in pursuit of implementing the Mesa County Safety Action Plan

Objective 2: Support a transparent and data driven safety crash analysis

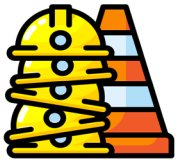
The following four tables list the strategies, actionable steps, type of strategy (engineering, evaluation, education and engagement, and enforcement), leaders and partners, effectiveness of strategy, range of costs, the schedule for implementation, and recommended performance measures.

Table 3: Build Safe Streets Strategy List

Build Safe Streets

Actions in this area will influence the physical design of urban and rural intersections and roadways.

#	Strategy	Actionable Steps
Objective 1: Enhance intersection operations and visibility where conditions have been or could be a crash factor		
BSS 1.1	Improve lighting at dangerous intersections	Evaluate High Injury Network (HIN) locations, prioritize locations for lighting improvements through local agency processes, upgrade or install lighting, and maintain infrastructure.
BSS 1.2	Make improvements at dangerous intersections	Evaluate HIN intersection locations, use the toolbox, seek funding and grants when applicable, improve or modify infrastructure, monitor and evaluate effectiveness, and maintain infrastructure.
Objective 2: Focus on proactively reducing severe crashes based on contextual factors		
BSS 2.1	Develop a High Risk Network (HRN) for rural areas of Mesa County	Identify data gaps and needs for contextual factors most associated with severe crash types, collect data, map corridors and intersections with the highest risk for severe crashes, and evaluate data.
BSS 2.2	Prioritize capital improvements on the High Injury Network (HIN)	Analyze one location on the HIN per year, use the toolbox to analyze and identify improvements, seek funding and grants when applicable.
BSS 2.3	Develop a road safety audit (RSA) program, and engage with relevant agencies to understand implementation	Conduct one RSA per year, seek funding to implement recommendations. Ensure the RSA includes assessment for context sensitive corridor access management improvements and use of speed setting tools to review and evaluate roadway segment speed limits.
BSS 2.4	Prioritize capital improvements on the High Risk Network (HRN)	After the HRN is complete, evaluate one HRN location per year, and use the Rural Road Engineering Toolbox to analyze and identify improvements. Seek funding for implementation/construction.
Objective 3: Ensure funding aligns with safety improvement projects		
BSS 3.1	Prioritize improvement projects on the HIN in regional and local budgets	Prioritize HIN roadway segments upgrades - proven engineering safety countermeasure improvements - into regional and local budgets, CIP, TIP, and RTP for funding.



Type	Leader(s)	Partner(s)	Effectiveness	Cost	Schedule	Performance Monitoring
Engineering	Local Gov.	CDOT	4 stars	Varies	Ongoing	Number of projects receiving lighting improvements compared to prior years.
Engineering	Local Gov.	CDOT	1 to 4 stars	Varies	Ongoing	Number of intersections receiving improvements compared to prior years.
Evaluation	RTPO	Local Gov.	2 stars	Low: $10,000 to $100,000	Annually	Number of segments/intersections receiving improvements compared to prior years.
Engineering	CDOT; Local Gov.	RTPO	1 to 5 stars	Varies	Annually	Launch program and complete 1 audit/year
Engineering & Evaluation	Local Gov.	RTPO; CDOT	5 stars	Varies	Annually	Number of segments/intersections receiving improvements compared to prior years.
Engineering	Mesa County; CDOT	Local Agencies	1 to 5 stars	Varies	One-Time	Complete HRN analysis process.
Engineering	RTPO; Local Gov.	CDOT	1 to 5 stars	Varies	Varies	Number of segments/intersections receiving improvements compared to prior years.

1 Star: 1 star from NHTSA or CMF Clearinghouse, or 10% reduction from FHWA resource
2 Stars: 2 stars from NHTSA or CMFC, or 20 - 30% reduction from FHWA resource
3 Stars: 3 stars from NHTSA or CMFC, or 30 - 40% reduction from FHWA resource
4 Stars: 4 stars from NHTSA or CMFC, or 40 - 50% reduction from FHWA resource
5 Stars: 5 stars from NHTSA or CMFC, or 50% or more reduction from FHWA resource

Low Cost: $10,000 to $100,000
Medium Cost: $100,000 to $500,000
High Cost: $500,000 to $1,000,000
Major Cost: $1 million +

Table 4: Protect Vulnerable Road Users Strategy List

Protect Vulnerable Road Users

Actions in this area will protect people walking, people biking, people rolling, and motorcyclists.

#	Strategy	Actionable Steps	
Objective 1: Host targeted events and education campaigns for the general public that promote safe behaviors and incr			
VRU 1.1	Host a Cycle (both Motorcycle and Bicycle) - Safety Summit(s)	Work with a variety of partners to organize and promote a Cycle (both Motorcycle and Bicycle) - Safety Summit event for new and experienced bicyclists and motorcyclists.	E Er
VRU 1.2	Implement targeted education campaigns for drivers, pedestrians, and bicyclists	Study various safety messaging and approaches. Determine methods of outreach. Develop and implement education campaigns: -for DRIVERS to learn about vulnerable road user awareness -for PEDESTRIAN/BICYCLISTS to learn about basic riding skills, safety practices, and road rules Collect input on campaigns, refine, and ensure efforts are ongoing.	E Er
Objective 2: Prioritize vulnerable road user improvements on High Injury Network (HIN) segments			
VRU 2.1	Compliment local transportation plans for vulnerable road users	Evaluate the HIN for locations that are identified for bicycle infrastructure improvements in regional and local agency plans. Seek funding and grants when applicable.	E
VRU 2.2	Prioritize sidewalk infill, inspection, and maintenance	Continue to implement sidewalk upgrades into capital improvement projects and prioritize completing sidewalk gap projects through implementation of the Grand Junction Pedestrian and Bicycle Plan, and other regional and local agency plans.	E
VRU 2.3	Enhance bus stop access and amenities	Evaluate HIN segments for transit routes and current transit stop conditions for safe and convenient access to transit and ADA compliance. Ensure new capital improvement projects, developments and redevelopments include bus stop upgrades. Seek funding and grants when applicable.	Ev E
VRU 2.4	Upgrade or install mid-block crossings	Analyze one location on the HIN segments per year for applicable mid-block crossings. Seek funding and grants when applicable.	E
VRU 2.5	Identify locations of right-turn slip-lane design that are on the HIN and evaluate for pedestrian improvements	Analyze one location of a right-turn slip-lane that is on the HIN, and evaluate for pedestrian improvements (narrow, convert, shorten turning radii, or install raised pedestrian crossings).	E
Objective 3: Build upon Safe Routes to School (SRTS) efforts			
VRU 3.1	Prioritize improvement projects on the HIN in regional and local budgets	Prioritize HIN roadway segment upgrades - proven engineering safety countermeasure improvements - into regional and local budgets, CIP, TIP, and RTP for funding.	E
VRU 3.2	Update Safe Routes to School (SRTS) Walking and Bicycling Audits and develop improvement plans for infrastructure and non-infrastructure projects	Update SRTS Walking and Bicycling Audits and develop a capital improvement plan to consider for implementation. Prioritize locations that are within a 1/4 mile of the HIN. Integrate HIN locations into SRTS project evaluation and selection process as appropriate.	E Er E

Type	Leader(s)	Partner(s)	Effectiveness	Cost	Schedule	Performance Monitoring
ease awareness of traffic laws						
ducation & ngagement	RTPO; CSP	CSP; Law Enforcement; Local Gov; Hospitals	2 to 3 stars	Low: $10,000 to $100,000	Annually	Plan and conduct a Cycle Safety Symposium on an annual basis and evaluate by post event survey, and track # of attendees, # of safety message touchpoints.
ducation & ngagement	RTPO	Hospitals; CSP; Law Enforcement; Local Gov; School Districts; Non-Profits	1 star	Low: $10,000 to $100,000	Ongoing	Launch campaign and evaluate depending on type of campaign
ngineering	Local Gov.	RTPO	4 stars	Varies	Ongoing	Number of segments/intersections receiving bicycle improvements compared to prior years.
ngineering	Local Gov.	RTPO	5 stars	Varies	Varies	Number of segments/intersections receiving new/ improved sidewalks compared to prior years.
valuation & ngineering	RTPO	Local Gov.	2 stars	Varies	Varies	Number of bus stops with new/improved access and/or amenities compared to prior years.
ngineering	Local Gov.	CDOT	5 stars	Varies	Annually	Number of mid-block improvements compared to prior years.
ngineering	CDOT	RTPO; Local Gov.	3 stars	Varies	Varies	1st year - create a list/inventory right-turn slip lane locations on CDOT roads. Future years - establish evaluation and improvement cadence.
ngineering	Local Gov; School Districts	CDOT	1 to 5 stars	Varies	Varies	Number of segments/intersections receiving bicycle improvements compared to prior years.
Evaluation, ngagement, ngineering	RTPO	Local Gov; School Districts	5 stars	Low: $10,000 to $100,000	Varies	Number of SRTS programs (non-infrastructure) updated/implemented and projects (infrastructure) compared to prior years.

1 Star: 1 star from NHTSA or CMF Clearinghouse, or 10% reduction from FHWA resource
2 Stars: 2 stars from NHTSA or CMFC, or 20 - 30% reduction from FHWA resource
3 Stars: 3 stars from NHTSA or CMFC, or 30 - 40% reduction from FHWA resource
4 Stars: 4 stars from NHTSA or CMFC, or 40 - 50% reduction from FHWA resource
5 Stars: 5 stars from NHTSA or CMFC, or 50% or more reduction from FHWA resource

Low Cost: $10,000 to $100,000
Medium Cost: $100,000 to $500,000
High Cost: $500,000 to $1,000,000
Major Cost: $1 million +

Table 5: Address Dangerous Behaviors Strategy List

Address Dangerous Behaviors

Actions in this area focus on influencing the behavior and attitudes of people traveling throughout Mesa County. These actions addre

#	Strategy	Actionable Steps
Objective 1: Reduce speeding and red-light running		
ADB 1.1	Pilot speed feedback signs	Install fixed or temporary equipment, conduct pilot, study pilot results, and consider moving forward with permanent installation or expansion.
ADB 1.2	Pilot automated enforcement, such as red-light cameras and speed cameras	Begin legal and administrative modifications to support pilot testing, install equipment, conduct pilot, study the pilot results, and consider moving forward with permanent installation or expansion.
ADB 1.3	Install and enhance video monitoring systems	Install and enhance video monitoring systems at 1 to 2 HIN locations on CDOT roadways to monitor near-miss conflicts.
Objective 2: Host targeted events and education campaigns for the general public that promote safe behaviors and incr		
ADB 2.1	"Continue Surge Enforcement Operations on a monthly basis at key locations connected to the High Injury Network (HIN) and High Risk Network (HRN)"	Create an individual event action plan, release information to partners and media, execute operation, ensure clear communication during Surge Enforcement Operations, debrief, refine, and ensure efforts are ongoing.
ADB 2.2	Continue support of saturation patrols	Use data-driven methods to prepare for patrols, coordinate with other agencies, execute patrol, debrief, refine, and ensure efforts are ongoing. Continue funding for law enforcement officer training on the latest BAC enforcement techniques including field sobriety tests, the use of breathalyzer devices, and purchase of equipment that supports saturation patrols.
ADB 2.3	Implement targeted education campaigns to drivers for dangerous behaviors (speeding, tailgating, distracted driving, seatbelt use, etc.)	Study various safety messaging and approaches. Determine methods of outreach. Develop and implement education campaigns. Collect input on campaigns, refine, and ensure efforts are ongoing.
ADB 2.4	Implement targeted education campaigns for driving under the influence	Study various safety messaging and approaches. Determine methods of outreach. Develop and implement education campaigns by working with enforcement, public schools, and pharmacies on alcohol, drugs, cannabis, and RX medications. Collect input on campaigns, refine, and ensure efforts are ongoing.
ADB 2.5	Implement targeted education campaigns for teens and young adults	Study various safety messaging and approaches. Determine methods of outreach. Develop and implement education campaigns. Collect input on campaigns, refine, and ensure efforts are ongoing.

ss driving under the influence and speeding.

Type	Leader(s)	Partner(s)	Effectiveness	Cost	Schedule	Performance Monitoring
Engineering	Local Gov.	CDOT	4 stars	Low: $10,000 to $100,000	Annually	Launch pilot and measure results
Enforcement	Local Gov.	CDOT	5 stars	Varies	Varies	1st year, work with CDOT, local law enforcement and judicial system to understand and establish administrative requirements.
Engineering & Evaluation	CDOT	Local Gov.	-	Low: $10,000 to $100,000	Annually	1 location/year and evaluate results to determine future frequency of installation
rease awareness of traffic laws						
Enforcement	CSP	Law Enforcement	4 stars	Low: $10,000 to $100,000	Ongoing/ Monthly	Complete monthly Surge Operations and measure results related to traffic stops, citations, and other trends
Enforcement	CSP; Law Enforcement	Local Gov.	3 stars	Low: $10,000 to $100,000	Ongoing	Complete ongoing Surge Operations and measure results related to traffic stops, citations, and other trends
Education	CSP; Law Enforcement; RTPO	Local Gov; Hospitals; School Districts; Non-Profits	1 to 2 stars	Low: $10,000 to $100,000	Ongoing	Launch campaign and evaluate depending on type of campaign
Education	Hospitals; RTPO	CSP; Law Enforcement; Local Gov; Non-Profits	1 to 2 stars	Low: $10,000 to $100,000	Ongoing	Launch campaign and evaluate depending on type of campaign
Education	School Districts; RTPO	Hospitals; CSP; Law Enforcement; Local Gov; Non-Profits	1 to 2 stars	Low: $10,000 to $100,000	Ongoing	Launch campaign and evaluate depending on type of campaign

1 Star: 1 star from NHTSA or CMF Clearinghouse, or 10% reduction from FHWA resource
2 Stars: 2 stars from NHTSA or CMFC, or 20 - 30% reduction from FHWA resource
3 Stars: 3 stars from NHTSA or CMFC, or 30 - 40% reduction from FHWA resource
4 Stars: 4 stars from NHTSA or CMFC, or 40 - 50% reduction from FHWA resource
5 Stars: 5 stars from NHTSA or CMFC, or 50% or more reduction from FHWA resource

Low Cost: $10,000 to $100,000
Medium Cost: $100,000 to $500,000
High Cost: $500,000 to $1,000,000
Major Cost: $1 million +

Table 6: Create a Culture of Safety Strategy List

Create a Culture of Safety

Actions in this area focus on creating a community-wide commitment to the Mesa County Safety Action Plan.

#	Strategy	Actionable Steps
Objective 1: Unite, equip, and empower multi-disciplinary leaders to actively work together in pursuit of implementing t		
CCS 1.1	Fund a Safety Action Plan Coordinator position	Determine position need, role, and responsibilities. Seek funding for a full- or part-time position.
CCS 1.2	Create a multi-agency Transportation Safety Task Force	Continue partnerships with Stakeholder Working Group members, identify additional stakeholders, develop a charter, review crash data, funding and resources, action plan progress, and safety performance. Monitor and evaluate task force progress.
CCS 1.3	Prioritize collaboration with CDOT	Create a working partnership with CDOT, Mesa County and Local Agencies, and meet regularly for programmatic, systemic, location specific safety improvements based on the HIN, HRN, and crash analysis.
CCS 1.4	Continue the Transportation Safety Symposium	Evaluate the 2024 Western Colorado Transportation Safety Symposium, identify goals and objectives for the next event, plan logistics, organize a planning committee, market to past attendees and potential new attendees, host and evaluate event.
Objective 2: Support a transparent and data driven safety crash analysis		
CCS 2.1	Using the crash analysis dashboard, clean and update crash data	Continue monitoring and utilizing the crash data dashboard, update data annually, and ensure the data is accessible to safety partners.
CCS 2.2	Create public-facing annual reports about the Mesa County Safety Action Plan	Define performance indicators, collect and analyze data, develop a clear narrative for the public, develop and distribute the report.

Type	Leader(s)	Partner(s)	Effectiveness	Cost	Schedule	Performance Monitoring
the Mesa County Safety Action Plan						
-	RTPO	Local Gov.	-	Low: $10,000 to $100,000	Ongoing	Fund and hire new position.
Evaluation; Engagement; Engineering; Education	RTPO	Safety Task Force Members	2 stars	Low: $10,000 to $100,000	Quarterly	Continue and expand Stakeholder Working Group, set cadence of meetings, hold meetings, and track progress of strategies.
Evaluation; Engagement; Engineering; Education	RTPO	CDOT; Mesa County; Local Gov.	1 to 5 stars	Low: $10,000 to $100,000	Quarterly	Meet quarterly and track outcomes related to data evaluation, project development, and funding.
Evaluation; Engagement; Education	RTPO	Hospitals; CSP; Law Enforcement; Local Gov; Non Profits	2 stars	Low: $10,000 to $100,000	Annually	Plan and conduct the Western Slope Transportation Safety Symposium on an annual basis and evaluate by post conference survey
Evaluation	RTPO	CDOT; Local Gov; CSP; Law Enforcement	4 stars	Low: $10,000 to $100,000	Annually	Report to the Grand Valley Regional Transportation Committee on an annual basis, related to implementation of strategies, crash trends, and reduction in KSI crashes.
Evaluation & Education	RTPO	Safety Task Force Members	-	Low: $10,000 to $100,000	Bi-Annually	Report to the public and the Grand Valley Regional Transportation Committee on an bi-annual basis, related to implementation of strategies, crash trends, and reduction in KSI crashes.

1 Star: 1 star from NHTSA or CMF Clearinghouse, or 10% reduction from FHWA resource
2 Stars: 2 stars from NHTSA or CMFC, or 20 - 30% reduction from FHWA resource
3 Stars: 3 stars from NHTSA or CMFC, or 30 - 40% reduction from FHWA resource
4 Stars: 4 stars from NHTSA or CMFC, or 40 - 50% reduction from FHWA resource
5 Stars: 5 stars from NHTSA or CMFC, or 50% or more reduction from FHWA resource

Low Cost: $10,000 to $100,000
Medium Cost: $100,000 to $500,000
High Cost: $500,000 to $1,000,000
Major Cost: $1 million +

Actionizing the Plan and Monitoring Progress

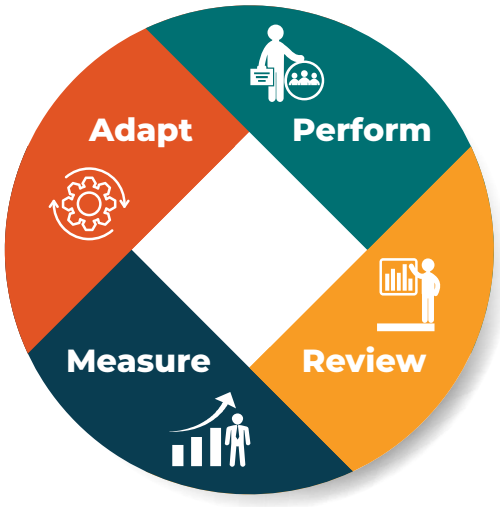
To reach the goal of zero deaths and serious injuries on roadways in Mesa County, a collaborative partnership between organizations and within agencies is needed. The RTPO, as the umbrella organization for transportation planning in the region, is the essential organization to foster cooperation amongst local governments, various agencies, and supporting organizations for implementation and monitoring progress of the Mesa County Safety Action Plan.

Recognizing that there are many different leaders responsible for implementation, a significant portion of the first five years monitoring progress will be gathering information on how/if strategies are being implemented and to what extent. This will support a future effort to set specific targets for implementation (example: 1 location/year, 1 education campaign effort/quarter). Once all actions in the plan have established targets, anticipated outcomes (based on effectiveness information), can be calculated and a date to reach zero deaths on Mesa County roadways can be committed to.

The Performance Review Cycle

The progress and future establishment of targets, will be centered around reviewing the outcomes of the strategies, adjusting measures and/or action items, consistently reporting on a bi-annual basis, and continuously worked on by the Regional Transportation Safety Task Force.

The performance review cycle provides a framework to support actionizing the plan, and providing flexibility for adjustments based on measuring and monitoring impact to reduce deaths on roadways in Mesa County.



The RTPO and the Regional Transportation Safety Task Force will utilize it's forum to track, monitor, and analyze progress of strategies.

Implement and Perform

As noted in the strategy tables, there are a variety of leaders and partners responsible to implement strategies, which also have different time frames: ongoing, annually or quarterly, one time, and varies.

While the strategies are committed to, the implementation of them remains to be more fully

understood in the future. With each strategy a suggested implementation/performance indicator is noted. Outlining performance, will help understand if progress is being made by responsible agencies, and to establish targets in the future (ex. 1 location/year, 1 education campaign effort/quarter).

For strategies that have ongoing or varies noted for their schedule to implement, progress will be monitored if the strategy was implemented, and how often. It is recommended that this is done over a five-year period to then establish an understanding of what the leaders are able to do. From there, a clearer time-frame can be established, and then progress to reaching zero KSI crashes in Mesa County can be established. As noted in the strategy tables, there are a variety of leaders and partners responsible to implement strategies, which also have different time frames: ongoing, annually or quarterly, one time, and varies.

Review - Measure - Adapt

As Key work efforts of the performance review cycle are outlined in Table 7. This schedule drafts a proposed schedule of when and what activities should be completed. Part of this work effort will be establishing targets for strategies, that can result in identifying a year and appropriate milestones to reach zero deaths on Mesa County roadways.

Table 7: Key Work Efforts of the Performance Review Cycle

Schedule	Review	Measure	Adapt & Set Targets
Monthly	Track performance metrics for strategies that are one-time efforts until strategy is launched and complete.		N/A
Twice a Year	Track performance metrics for strategies that are ongoing efforts.		N/A
Annually	Track performance metrics for strategies that are annual & varies strategies.		N/A
	Update crash dashboard with new data.	Measure progress to reducing KSI trends in focus areas.	Review crash trends, modify focus areas, and document notable trends
	Produce annual Mesa County Crash Analysis Report		
Every Two Years	Produce the Safety Action Plan Progress Report	Measure performance metrics for ongoing, annual, and varies to understand implementation patterns.	Establish targets (example - 1 location/year, 1 education campaign/quarter) for 50% of strategies, and analyze and document proposed KSI reduction.
	Update the HIN and HRN based on the previous 5-years of crash data.	Use new data to refresh HIN and HRN analysis.	Modify HIN and HRN as appropriate
Third - Fifth Year	Complete setting targets for all strategies.	Measure performance metrics for ongoing, annual, and varies to understand implementation patterns.	Complete setting targets for all strategies, analyze proposed KSI reduction, and determine year and milestones to reach zero deaths.

Blending the HIN and Equity Into Existing Programs

Many strategies that are led by local agencies and organizations, include a focus on the HIN and/or HRN. Considering the HIN and/or HRN into existing programs and processes requires a necessary shift to change the KSI trend.

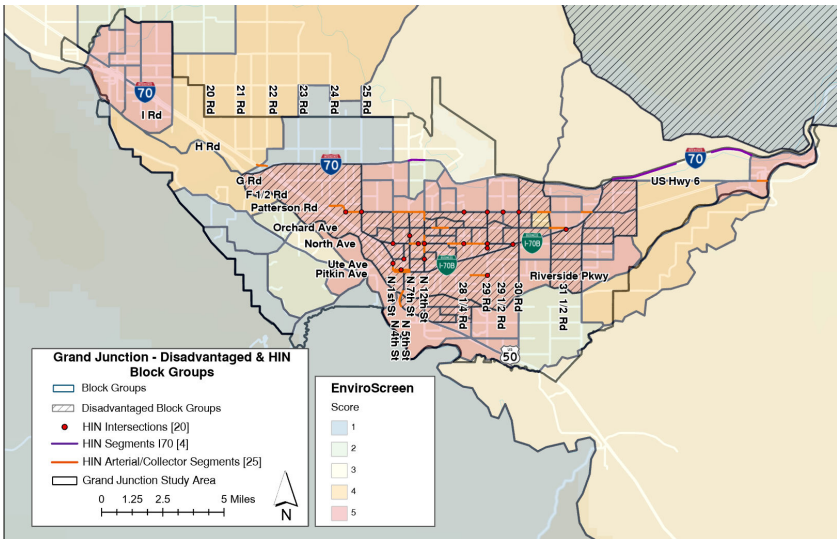


Figure 30 - Disadvantage Community EnviroScore HIN Urban Area

Additionally of note, **41 of the 45 HIN locations (intersections and individual segments) are located within areas of need, identified as Disadvantaged Communities through the ETC explorer, AND as Level 5 through the Colorado EnviroScreen** as shown in Figure 30. Prioritizing locations on the HIN, will not only provide safety benefits, but it will make neighborhoods in Mesa County more equitable.

Continuing to Value Partnerships – Creating a Regional Transportation Safety Task Force

The members of the stakeholder working group for this project demonstrated their clear commitment to working together, exploring new ideas and partnerships, and committing to change the trend of KSI crashes in the region. Once the plan is adopted, a Regional Transportation Safety Task Force will be created and hosted by the RTPO. This task force will include all leaders and partners identified in this action plan and the task force will be opened to other interested agencies and organizations using the attendee list from the Western Slope Safety Symposium as a starting point.

Western Colorado Transportation Safety Symposium

The Western Colorado Transportation Safety Symposium was hosted by the RTPO to educate and connect participants to the transportation safety community. The event was held on August 28, 2024 from 8:30 a.m. to 4:00 p.m. and had eight breakout sessions and two keynote speakers. **120 people attended** from a diverse group of professionals, first responders, advocates, and interested members of the community seeking to acquire new knowledge in transportation safety, engage in dialogue, and establish connections with like-minded people. Attendees included representatives from 48 organizations/agencies.

31% **Engineering, Maintenance, & Consulting**

22% **Law Enforcement & Judicial**

19% **Planning & Policy**

12% **Education**

10% **Vulnerable Road User Advocates**

6% **Hospitals & Non-Profits**

Supplemental Resources for the Action Plan

In support of two engineering strategies: BSS 1.2 and BSS 2.4, an ***engineering countermeasure toolbox*** was created to support local governments with options for improving roadway safety. The toolbox is meant to be used as a resource for signalized intersections and rural roads, and offers 24 proven engineering based solutions that can be used in a context sensitive, programmatic, and/or systemic approach. Please see **Appendix C** for the Toolbox.

With an emphasis on action, the project team identified ten priority locations to create a series of *'project cards,'* which include information about: existing conditions, severe crashes, draft ideas of improvements, and a high level cost estimate. These project cards have initial ideas that need to be further studied, engineered, designed, and funding identified for implementation.

To align with the strategies, HIN locations were utilized, followed by a five-factor analysis to reduce the list to ten sites. This analysis considered the percentage of KSI crashes at each location, the total number of KSI crashes, an equivalent property damage only (EDPO) calculation that assesses the cost of various crash types relative to property damage, the total number of pedestrian and bicycle crashes, and the inclusion of neighboring HIN locations. After further coordination with the Project Management Team, one location (US 6/8th Street) was removed from the project card development due to recent roadway improvements and future planned enhancements.

The 9 HIN locations that are advancing into projects cards are:

- S 4th Street & Ute Avenue
- 25 Road & Patterson Road
- 29 Road & Patterson Road
- 29 Road & Teller Avenue
- 29 Road & Riverside Parkway/ D Road
- Elm Avenue & N 7th Street
- North Avenue: 23rd Street to 28 1/4 Road
- North Ave: 7th Street to 12th Street
- N 12th Street: North Avenue to Elm Avenue

A Safer Future for All Roadway Users

The effectiveness of a roadway safety action plan is measured not only by data but also by the collective community changes that emphasize the principle that deaths and serious injuries on our roads are unacceptable. The analysis, resources, and partnerships developed through this planning initiative are steering Mesa County toward the ambitious goal of zero roadway fatalities and serious injuries.

In the near future, we will implement pilot projects, long-term strategies, and sustained efforts focused on engineering, education and encouragement, enforcement, and evaluation activities. These initiatives will address high-injury networks (HIN) and high-risk networks (HRN), fostering a culture of safety.

Recognizing that reaching this goal depends on collaboration among government agencies, the public, non-profit organizations, educational institutions, local businesses, and visitors to the Grand Valley, it is important to acknowledge that this journey is just beginning. We will continue to work together and pledge for safer Mesa County.

ONGOING SAFETY EFFORT

Slow Down and Move Over When Lights Are Flashing

Every day, law enforcement officers, emergency responders, tow truck operators, maintainers and construction crews risk their lives to keep us safe. Tragically, many have been killed in the line of duty. Recently on September 4, 2024, two dedicated Colorado Department of Transportation roadway maintenance teammates, Trent Umberger and Nate Jones, lost their lives from a vehicle crash near Palisade while conducting roadside repairs. Unfortunately, an additional community member lost their life in the same crash.

In 2023, Colorado strengthened its Move Over Law to provide greater protection for roadside workers and motorists. The law requires drivers to move over a lane when encountering any stopped vehicle on a highway with its hazards or safety lights flashing. If moving over isn't possible, drivers must slow down to at least 20 mph below the posted speed limit. No one should lose their life while responding to emergencies, crashes, or maintaining our roads. Being more attentive and following the law might just save a life.


My Safety Pledge...
A commitment to roadway safety ensures the well-being of ourselves, our loved ones, and everyone around us. By making responsible choices, we create a safer community.
Let's pledge to enhance roadway safety in our community, together!
I pledge to:
Be alert and avoid distractions
Always wear a seatbelt or helmet
Obey speed limits, traffic lights, and traffic signs
Travel sober or have a sober ride home
Share the road
Safety Action Plan
Jessi Spencer
Grand Junction
Doing my part to be safe on our roadways matters to me because:
My Kids and friends/ family matter
My Safety Pledge...
Michael Killen
FRUITA
SAFETY FIRST!
My Safety Pledge...
Laura Richardson
Grand Junction
I value my life and the lives of those around me.
My Safety Pledge...
ELIJAH SWANK
FRUITA
I DONT WANT PEOPLE TO DIE
My Safety Pledge...
Iliana M.-L
Clifton
It's the right thing to do.
My Safety Pledge...
THERESE P.
GRAND JUNCTION
it's great to be alive!
My Safety Pledge...
Leila Schoenstein
Grand Junction
I want to keep myself & others safe.
My Safety Pledge...
Erin Allard
GJ
I care about my neighbors & community
My Safety Pledge...
Josiah Kinsthaver
Grand Junction
I want everyone to get home safe

Appendix A

Mesa County Crash Safety Review

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

MEMORANDUM

TO: Rachel Peterson

FROM: Denise Baker, PE(AZ), PhD, RSP1, dbaker@y2keng.com
Kurt Larson, EIT, klarson@y2keng.com
Eileen Yazzie, AICP, eyazzie@y2keng.com

DATE: May 7, 2024

SUBJECT: Mesa County Crash Safety Review - *Revised*

INTRODUCTION

Mesa County is currently in the process of developing a Comprehensive Roadway Safety Action Plan, which will help in refining the County's strategic approach to enhancing roadway safety. This project involves a review of current safety trends, existing programs and processes, and public/stakeholder involvement to create a vision and plan for the future. This memorandum is intended to provide an overview of historical crash trends within Mesa County over the study period of 2016 to 2022 through the development of a dynamic crash dashboard. Crash data within Mesa County was obtained from January 1, 2016, to December 31, 2022. At the time of the analysis, 2023 crash data was not available. While the present memorandum reflects the most recent data made available to the consultant team, these results are subject to further refinement.

METHODOLOGY

Crash reports are filed by police officers from local jurisdictions (Grand Junction Police Department, Colorado State Patrol, etc.) for specific crashes. The Colorado Department of Revenue is the owner of this dataset. The reports are shared and compiled annually by the Colorado Department of Transportation (CDOT). The data used in this analysis was obtained by Mesa County for use in this study directly from CDOT and from a third-party vendor contracted to geocode crashes with missing coordinates. Reportable crashes included in this database represent crashes with injuries or fatalities, uninsured drivers, more than 1,000 dollars in damages as a result of the crash, alcohol or drugs involved, or by driver request.

The data used in this report includes exported crash data from 2016-2022 DiExSys VZS (third-party vendor licensed by Mesa County), complemented by additional CDOT data in 2021 and 2022 to add extra fields not available from DiExSys Road Safety Analytics. Power BI software was used to

compile all crashes provided and clean the data that was provided. That allows for a streamlined way to manage the existing data and draw meaningful insights. The data presented here is the latest available data, however, it is subject to change as new information is obtained and more refinements are performed.

HELPFUL DEFINITIONS

Throughout this memorandum, a few specific terms will be used. They are defined below.

Urban and Rural Crashes – crashes were separated into urban and rural classifications based on whether the crash occurred inside or outside a designated urban area. The urban area was defined using a provided shapefile that was based on 2020 decennial census urban area boundaries. The urban definition used in this report is not yet approved by FHWA and is subject to change.

KSI - Killed and Serious Injury Crashes – killed and serious Injury (KSI) crashes were crashes that resulted in one or more fatalities or serious injuries. Serious injuries are defined as broken extremities, severe lacerations, paralysis, etc. Fatal crashes are defined when one or more people die within 30 days of the crash as a result of the injuries sustained in the collision. These collisions correspond to “K” and “A” injuries in the KABCO scale.

Crash Type – crash types were defined by the State of Colorado Crash Reporting Manual.

First Harmful Event – the first harmful event is the first point of injury or damage in the sequence of events in a crash.

OVERALL CRASH TRENDS

Since 2016, the total number of crashes within the Mesa County has been relatively steady, with a slight decrease in recent years. A total of 17,086 crashes were reported in Mesa County over the seven-year period evaluated (2016-2022). The most crashes occurred in 2019 with 2,718 crashes while the lowest number of crashes occurred in both 2020 and 2022 with 2,230 crashes each year.

The average percentage of fatal crashes was 0.7% for the study period, with a low of 0.5% in 2019 and a high of 1.1% in 2022. An increase in the percentage of serious injury crashes occurred from 2020 to 2021 with an average of 4.4% compared to the other analysis years which saw a high of 2.7% (2016). The percentage of minor injury crashes has increased in recent years (2020-2022) with a high of 15.7% in 2022. The minor injury crash percentage varied between 4.9% and 6.4% from 2016 to 2019. There was no apparent trend in the percentage of crashes that resulted in possible injury(s) with a low of 6.5% occurring in 2018 and a high of 18.4% occurring in 2020. The percentage of crashes that resulted in property damage only (no injuries) increased from 2016 to 2018 reaching a peak of 86.5% in 2018 before decreasing in the years after to a low of 64.7% in the latest year (2022). **Figure 1** shows the number of crashes by injury severity for each year in the analysis period. **Figure 2** shows the number of fatal and serious injury crashes from 2016 to 2022.

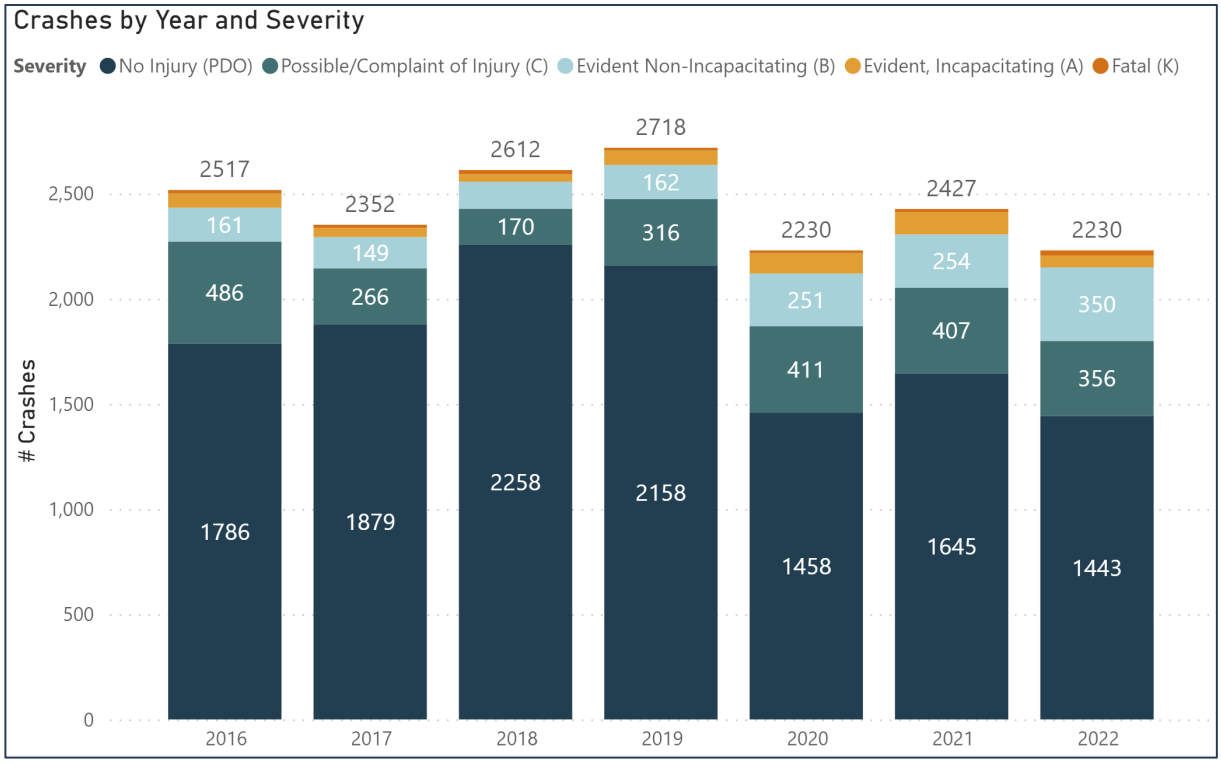


Figure 1: Total Number of Crashes per Year and Injury Severity, Mesa County, 2016-2022

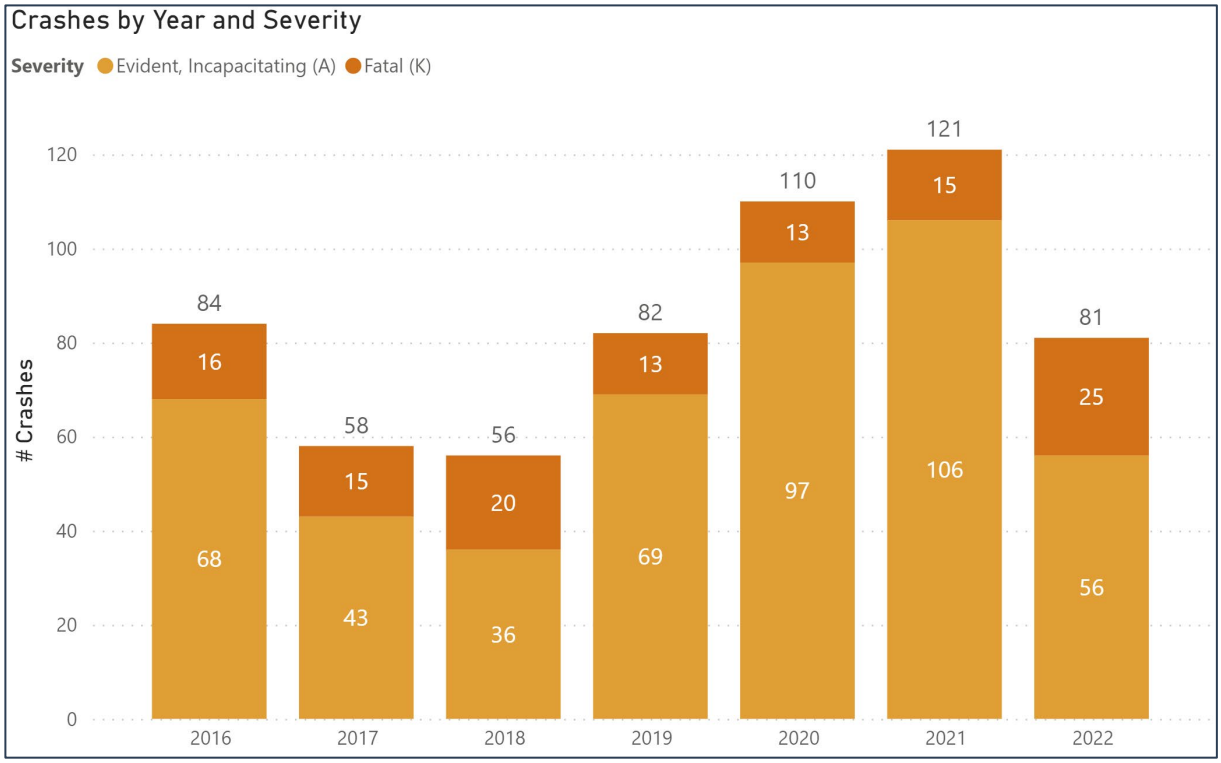


Figure 2: Total Number of KSI Crashes per Year, Mesa County, 2016-2022

CRASH TYPE

Table 1 shows the distribution of crashes in Mesa County by crash type from 2016 to 2022. The most frequently reported crash types were rear-end crashes (27.0% of all reported crashes) followed by broadside crashes (18.6% of all crashes) and fixed object crashes (13.0% of all crashes). Together, these three crash types make up over half of all crashes. Pedestrian and bicyclist crashes made up 3.1% of all crashes.

Table 1: Number of Crashes by Year and Crash Type, Mesa County, 2016-2022

	2016	2017	2018	2019	2020	2021	2022	Total	%
Animal	116	52	110	99	87	75	67	**606**	**3.6%**
Approach Turn	163	148	148	186	147	176	176	**1144**	**6.7%**
Bike	40	71	51	49	35	32	34	**312**	**1.8%**
Broadside	464	424	508	502	420	485	382	**3185**	**18.6%**
Curb/Embankment	89	75	75	110	110	102	104	**665**	**3.9%**
Fixed Object	323	294	364	364	325	311	241	**2222**	**13.0%**
Non-Fixed Object	178	154	141	173	138	162	123	**1069**	**6.3%**
Overturning/Rollover	121	134	137	167	142	181	112	**994**	**5.8%**
Pedestrian	30	33	39	37	26	28	27	**220**	**1.3%**
Rear End	739	719	752	760	579	608	449	**4606**	**27.0%**
Sideswipe	233	220	264	243	188	230	224	**1602**	**9.4%**
Other	21	28	23	30	34	37	291	**461**	**2.7%**
Total	**2,517**	**2,352**	**2,612**	**2,718**	**2,230**	**2,427**	**2,230**	**17086**	**100%**

Table 2 shows the number of pedestrian and bicyclist crashes per year, as well as the injury severity. Both pedestrian and bicyclist crashes have seen a decrease in recent years (2020-2022). Over the seven-year period, pedestrians were involved in an average of 31 crashes per year, and bicyclists were involved in an average of 45 crashes per year. Together, pedestrian and bicyclist crashes accounted for 14.7% of all KSI crashes (87 crashes).

Table 2: Number of Pedestrian/Bicyclist Crashes by Year and Injury Severity, Mesa County, 2016-2022

	2016	2017	2018	2019	2020	2021	2022	Total
Bicyclists	**40**	**71**	**51**	**49**	**35**	**32**	**34**	**312**
No Injury (O)	6	39	37	23	4	9	11	**129**
Possible Injury (C)	17	9	4	9	7	7	6	**59**
Minor injuries (B)	9	18	6	11	19	10	13	**86**
Serious Injury (A)	8	5	3	6	5	6	2	**35**
Fatal (K)	0	0	1	0	0	0	2	**3**
Pedestrians	**30**	**33**	**39**	**37**	**26**	**28**	**27**	**220**
No Injury (O)	6	14	16	14	6	4	6	**66**
Possible Injury (C)	9	5	4	7	8	5	4	**42**
Minor injuries (B)	8	7	13	9	6	10	10	**63**
Serious Injury (A)	5	3	3	6	6	7	4	**34**
Fatal (K)	2	4	3	1	0	2	3	**15**
Combined	**70**	**104**	**90**	**86**	**61**	**60**	**61**	**532**

WHERE

A heatmap of all crashes in Mesa County from 2016 to 2022 is shown in **Figure 3**. A majority of crashes are concentrated in Grand Junction and along Interstate 70 (I-70).

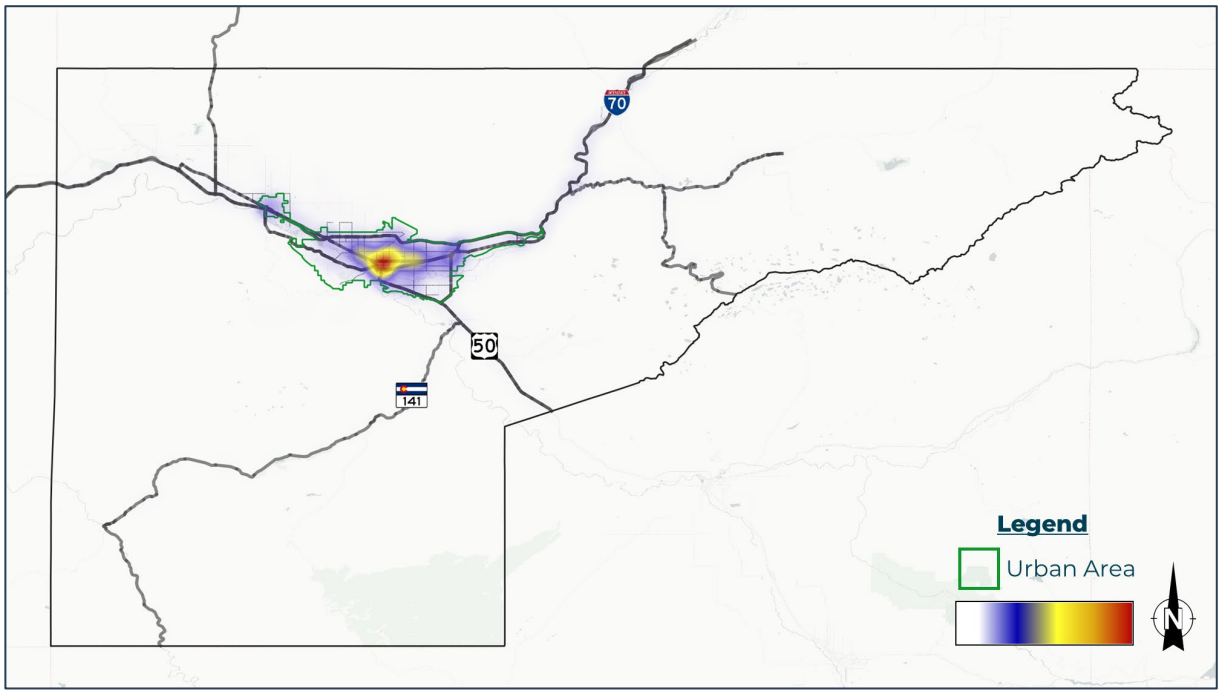


Figure 3: Heatmap of All Crashes in Mesa County, 2016-2022

WHEN

Figure 4 shows the frequency of crashes in Mesa County by month. The month with the greatest number of crashes was December with 1,638 crashes, while February saw the lowest number of crashes with 1,217 crashes. From February to April, there was a decrease in the frequency of crashes before increasing in May. An increase in crashes occurred from August to October and then decreased to a local minimum in November. December and January saw a peak in the crash frequency before decreasing in the subsequent months, as previously described. The months with the highest number of crashes (January and December) coincided with the lowest average temperatures[1] in Mesa County. Increased crashes in January and December coincide with increased snow and ice on roadways.

The frequency of serious injury and fatal crashes by month is shown in **Figure 5**. The greatest frequency of serious injury crashes happened in September (49 crashes) followed by October (48 crashes). Despite the high number of total crashes, December and January experienced the lowest number of serious injuries with 28 and 31 crashes, respectively. The highest number of fatal crashes occurred in June (19 crashes) followed by July (17 crashes). A noticeable decrease in fatal crash frequency happened from November to April before increasing during the summer months.

[1] Source of temperature data: NOAA: National Centers for Environmental Information

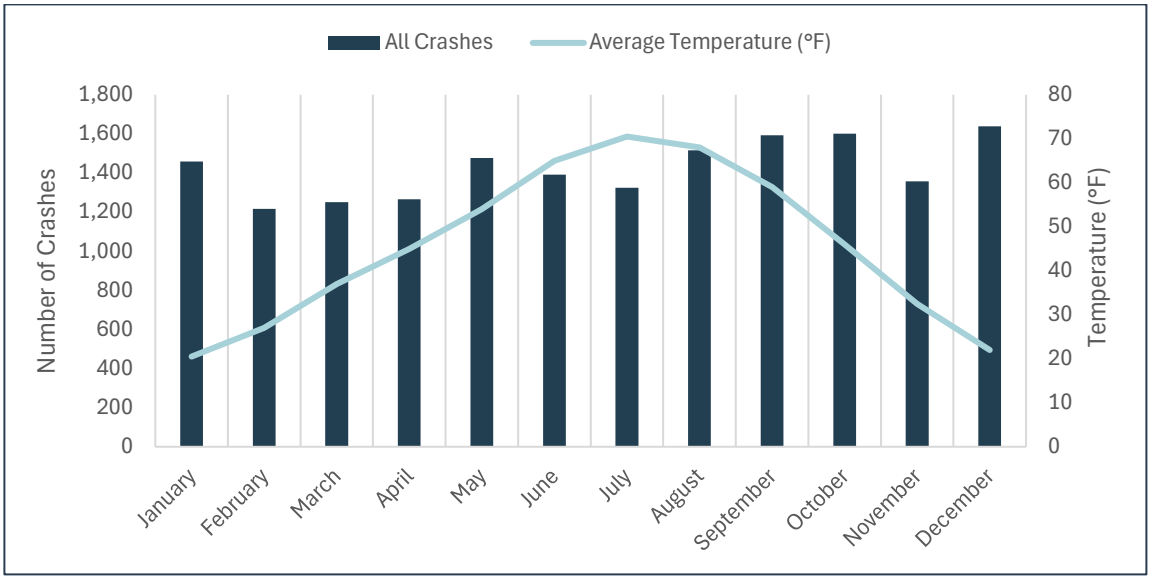


Figure 4: Number of Crashes by Month in Mesa County, 2016-2022

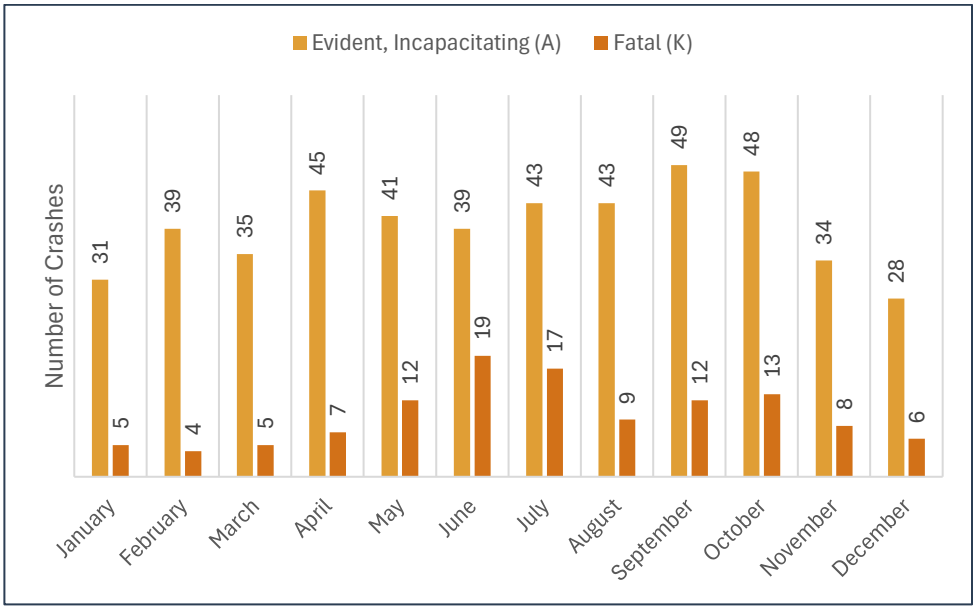


Figure 5: Number of Serious Injury and Fatal Crashes by Month in Mesa County, 2016-2022

The distribution of crashes by weekday is shown in **Figure 6**. Crashes occurred most frequently on Fridays, while the fewest crashes happened on Sundays. Serious injury crashes occurred most on Fridays and least on Mondays and Tuesdays. Fatal crashes remained relatively the same throughout the week with a peak on Saturdays and Sundays.

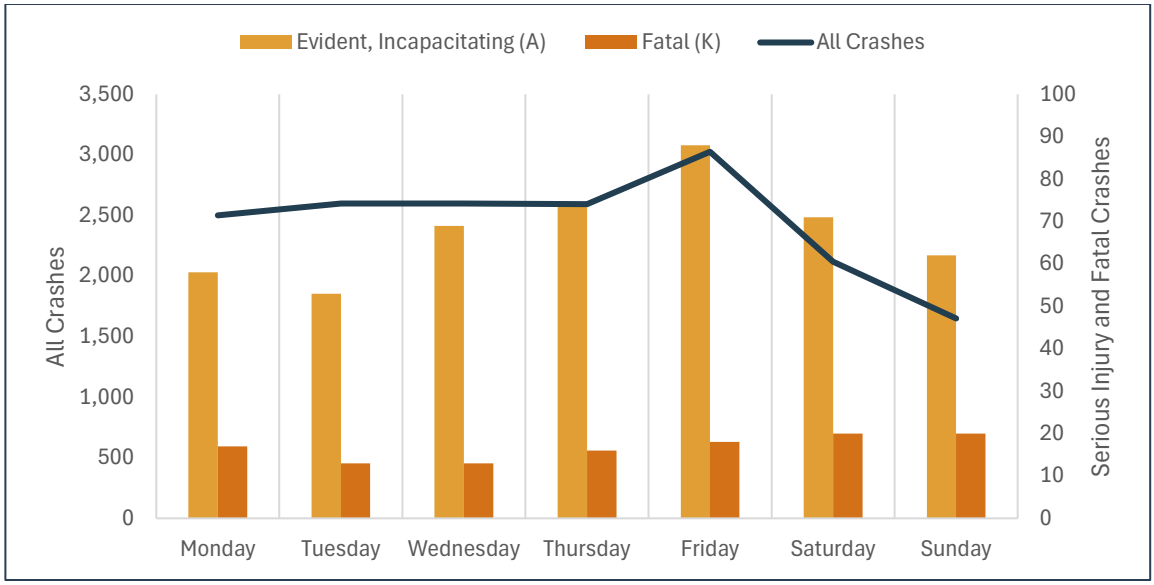


Figure 6: Number of Crashes by Day of the Week in Mesa County, 2016-2022

Crashes on Fridays had an AM peak hour from 8:00 to 9:00 AM and a PM peak hour from 5:00 to 6:00 PM, similar to the distribution throughout the day for other days of the week. Considering crashes that involved impairment, Friday was the day with the third highest number of crashes, with Saturday and Sunday having the most. Impairment crashes occurred most frequently from 6:00 PM to 3:00 AM during the night and early morning.

Figure 7 shows that the majority of crashes (72.0%) occurred during daylight, with 28.0% of crashes occurring during dawn, dusk, or dark conditions.

Figure 8 shows how the crashes are distributed by lighting conditions over the course of the day. In addition to the AM peak around 7:00 to 8:00 AM, a large number of crashes occur at noon and during the PM peak from 3:00 to 6:00 PM.

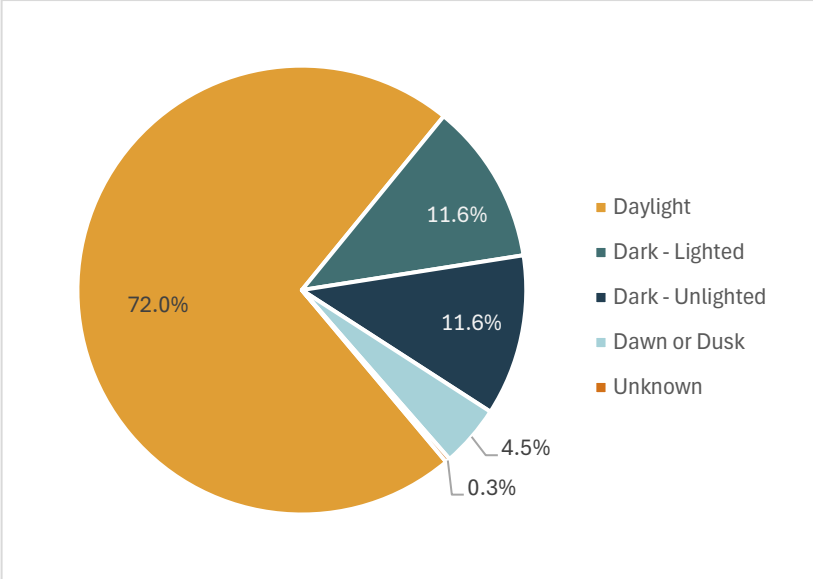


Figure 7: Share of Crashes by Light Condition in Mesa County, 2016-2022 (N = 17,086)

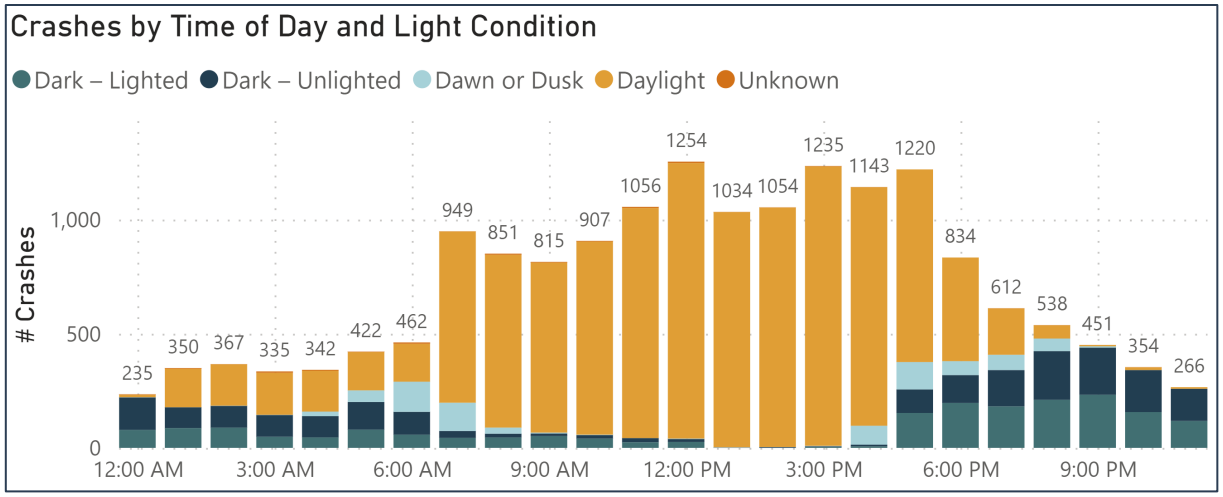


Figure 8: Number of Crashes by Hour and Lighting Condition, Mesa County, 2016-2022

URBAN VS RURAL CRASHES

Approximately 87.8% of all crashes in Mesa County were reported in urban areas (15,014 crashes) and the remaining 12.2% of crashes occurred in rural areas (2,072 crashes). Despite the lower number of total crashes, rural crashes accounted for 22.7% of all serious injury crashes (475 crashes) and 35.0% of all fatal crashes (41 crashes). A comparison between urban and rural crashes organized by injury severity is shown in **Figure 9**.

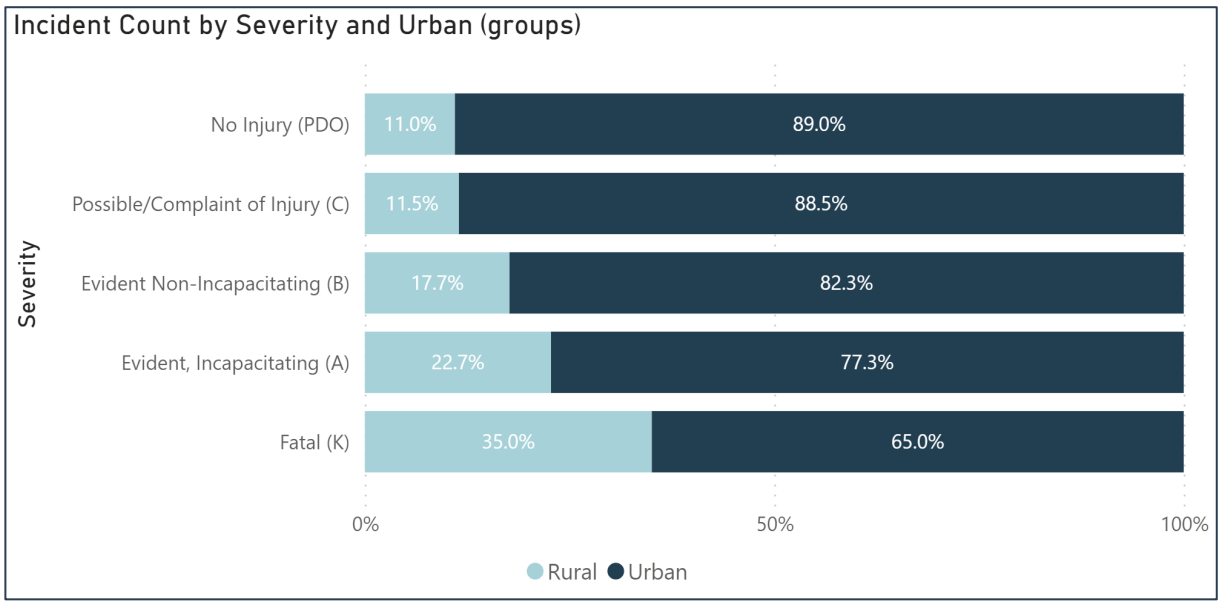


Figure 9: Urban vs. Rural Crashes by Injury Severity, Mesa County, 2016-2022 (N = 17,086)

Pedestrian and bicyclist crashes occurred at a higher frequency for urban crashes compared to rural crashes. Pedestrian and bicyclist crashes made up 1.4% and 2.1% of urban crashes compared to 0.2% and 0.2% of rural crashes, respectively. However, motorcyclists were involved in a higher share of rural crashes than urban crashes. Although rural motorcyclist crashes make up a higher percentage of rural crashes when compared to urban motorcycle crashes, the number of

motorcyclist crashes in the urban area is approximately four times the number in the rural area. Motorcyclist crashes made up 4.2% of rural crashes compared to 2.4% of urban crashes. The comparison of user types for urban and rural crashes is shown in **Figure 10**.

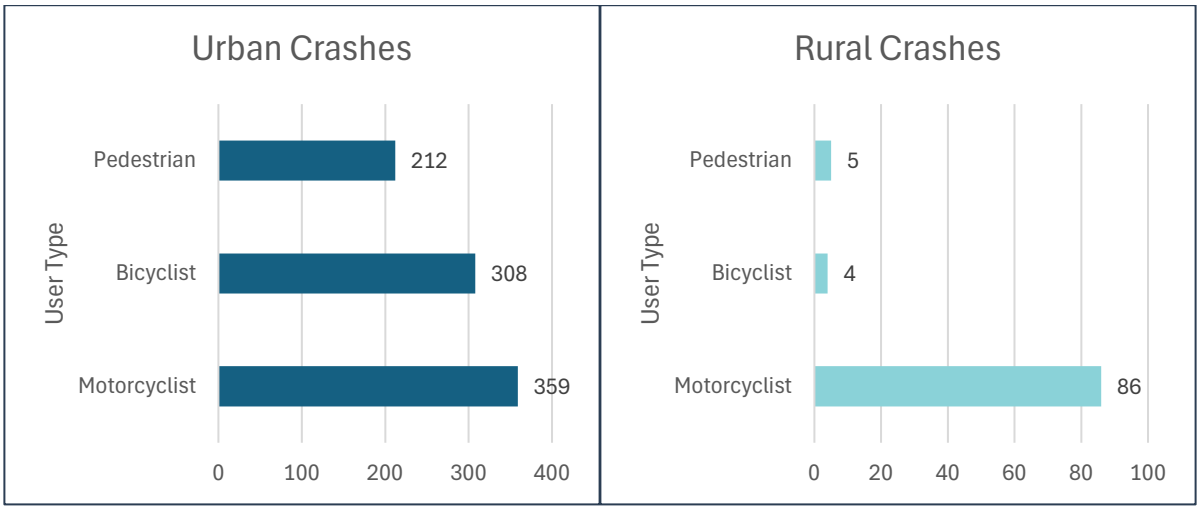


Figure 10: User Type of Urban vs Rural Crashes, Mesa County, 2016-2022

The top three crash types present in rural crashes are fixed object, overturning/rollover, and animal crashes. For urban crashes, the most common crash types are rear-end, broadside, and fixed object crashes. Fixed object crashes make up nearly a third of all rural crashes (31.9%) compared to only 10.9% of urban crashes. The crash types of urban and rural crashes are displayed in **Figure 11**.

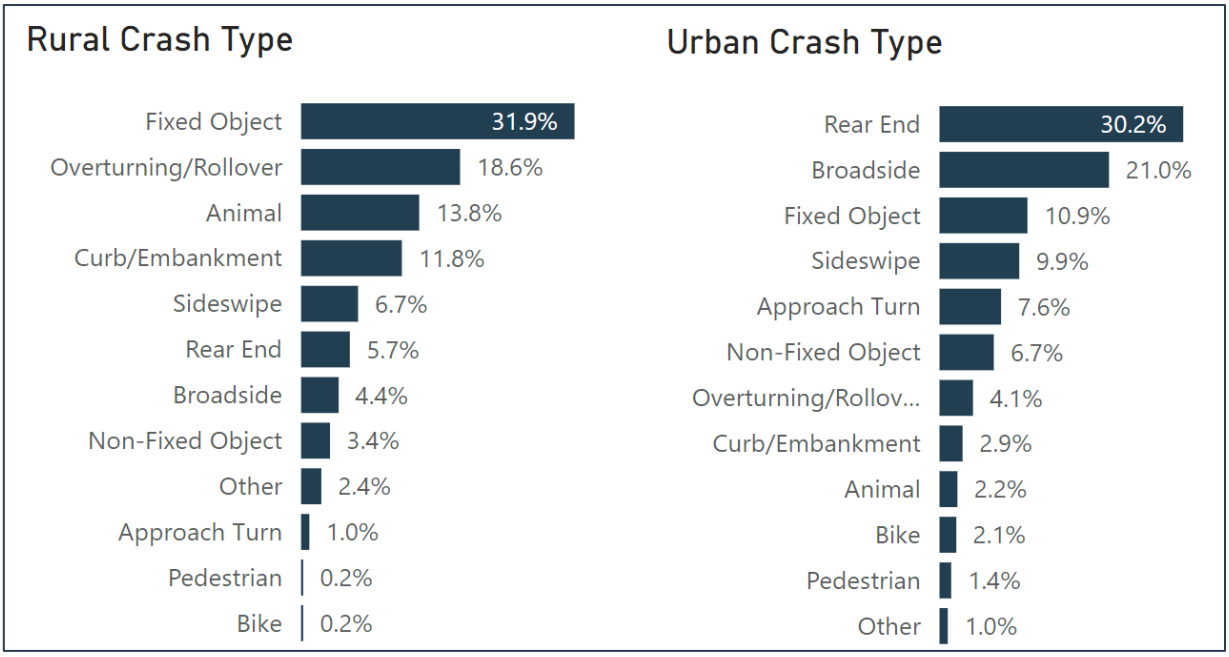


Figure 11: Crash Type (All Severities), Urban vs. Rural, 2016-2022

FATAL AND SERIOUS INJURY (KSI) CRASH TRENDS

This analysis uses the KABCO scale of crash severity, where “K” denotes a fatal crash, “A” is a serious injury crash, “B” is a minor injury crash, “C” is a possible injury crash, and “O” is a property damage-only (PDO) crash. This subsection of the report further details crashes that resulted in at least one serious injury or fatality, and this sub-set of crashes is referred to as “KA” or “KSI” Crashes. A review of critical crashes can identify key trends for further investigation. Compared to reviewing fatal crashes only, reviewing the combination of fatal and serious injury crashes provides a greater sample size and reduces the volatility between years. Additionally, the Vision Zero model aims to reduce fatalities and serious injuries on roadways, aligning this evaluation with Vision Zero goals.

A total of 592 KSI crashes were reported in Mesa County from 2016 to 2022. These crashes consisted of 475 serious injury crashes and 117 fatal crashes. The greatest number of KSI crashes occurred in 2021 (121 crashes) followed by 2020 (110 crashes). 2017 and 2018 saw a great decrease in KSI crashes with 58 and 56 crashes, respectively. Fatal crashes were most frequent in 2022 (25 crashes) and least frequent in 2019 and 2020 (13 crashes each year).

Figure 12 compares the crash type of KSI crashes with crashes that resulted in no injury, possible injury, or minor injuries (non-KSI crashes). The most common crash type of non-KSI crashes was rear-end crashes, while the most common crash type for KSI crashes was broadside crashes. The second and third most common crash types for KSI crashes were overturning/rollover and fixed object crashes, respectively.

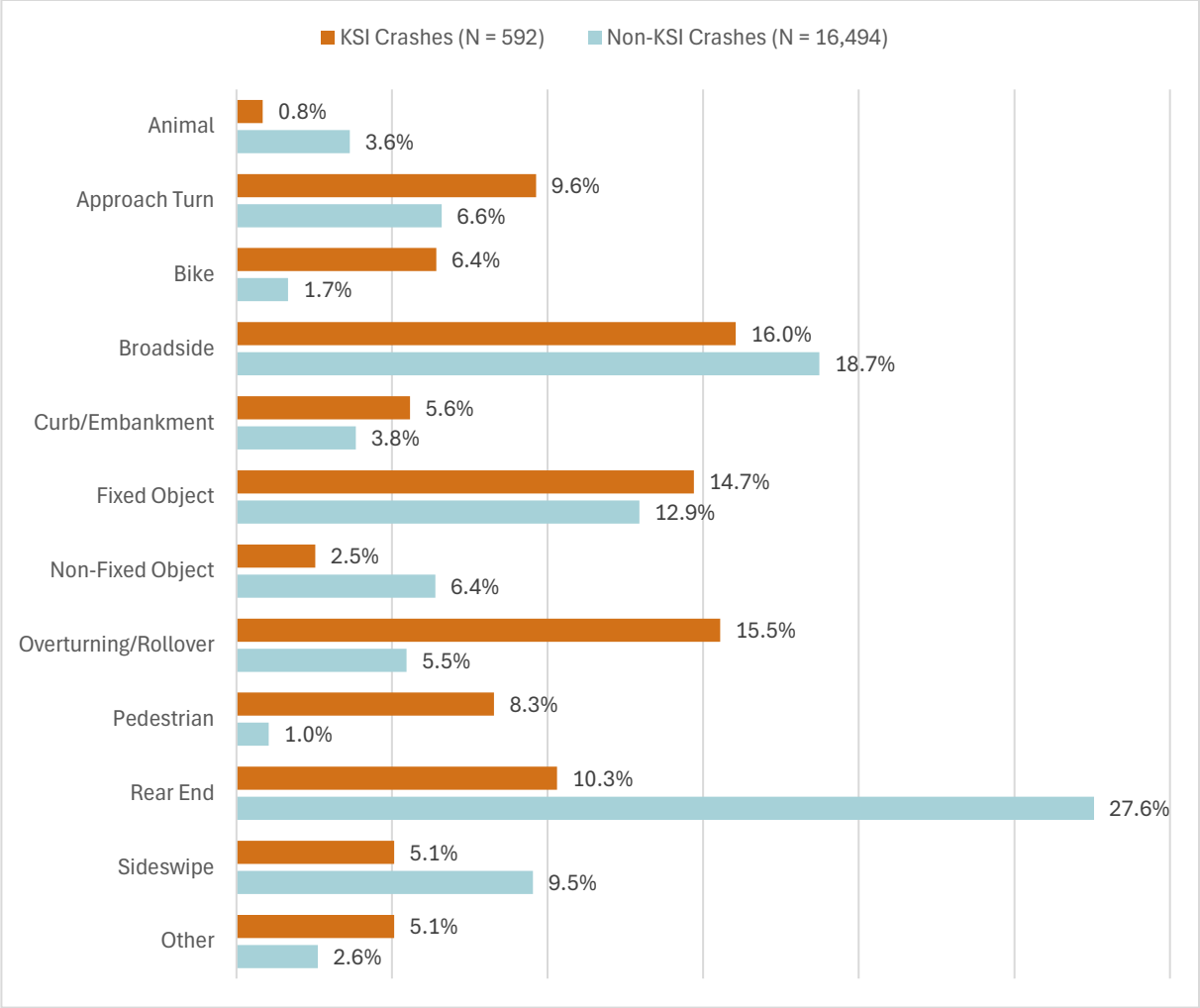


Figure 12: Crashes by Crash Type and Injury Severity, Mesa County, 2016-2022

WHO

For this analysis, the user types are separated into four categories depending on who was involved in the crash: driver, motorcyclist, bicyclist, and pedestrian. **Figure 13** shows the distribution of user types by injury severity for crashes in Mesa County within the study period. For crashes only involving drivers, the injury and fatal percentage is the lowest among all user types. Motorcyclists see the highest injury percentage of any user type and the second-highest percentage of fatal crashes. Crashes involving bicyclists had a high injury percentage but a low fatality percentage. Pedestrian crashes had the second-highest injury percentage and the highest fatality percentage of any user type.

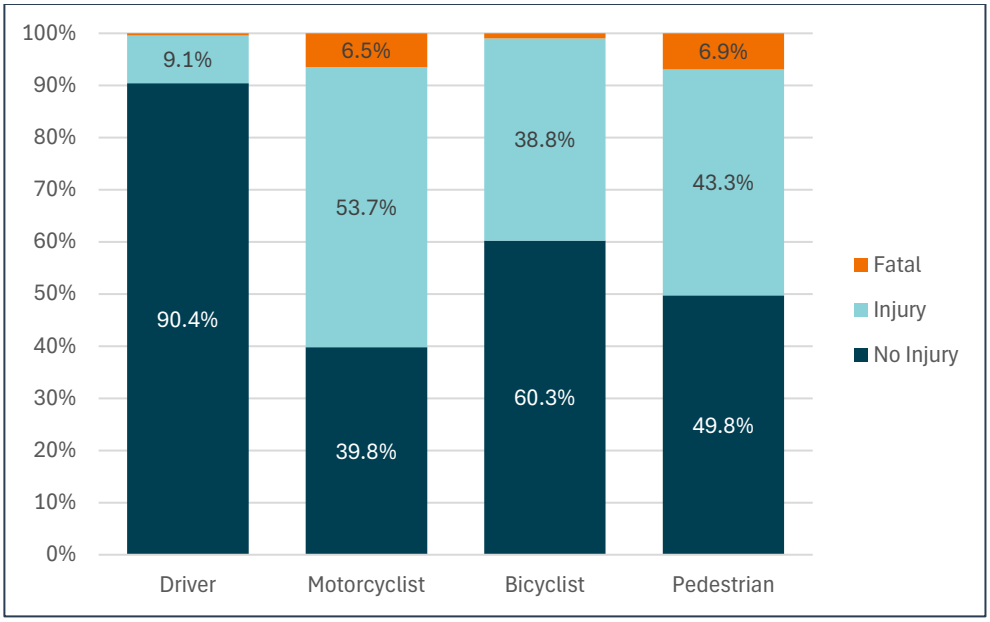


Figure 13: Number of Crashes by User Type and Injury Severity, Mesa County, 2016-2022

WHEN

The distribution of KSI crashes by month in the period of 2016 to 2022 is shown in **Figure 14**. The months with the highest number of KSI crashes were September and October with 61 crashes each. Right behind those months was July with 60 KSI crashes. The lowest number of KSI crashes occurred in the period from November to March.

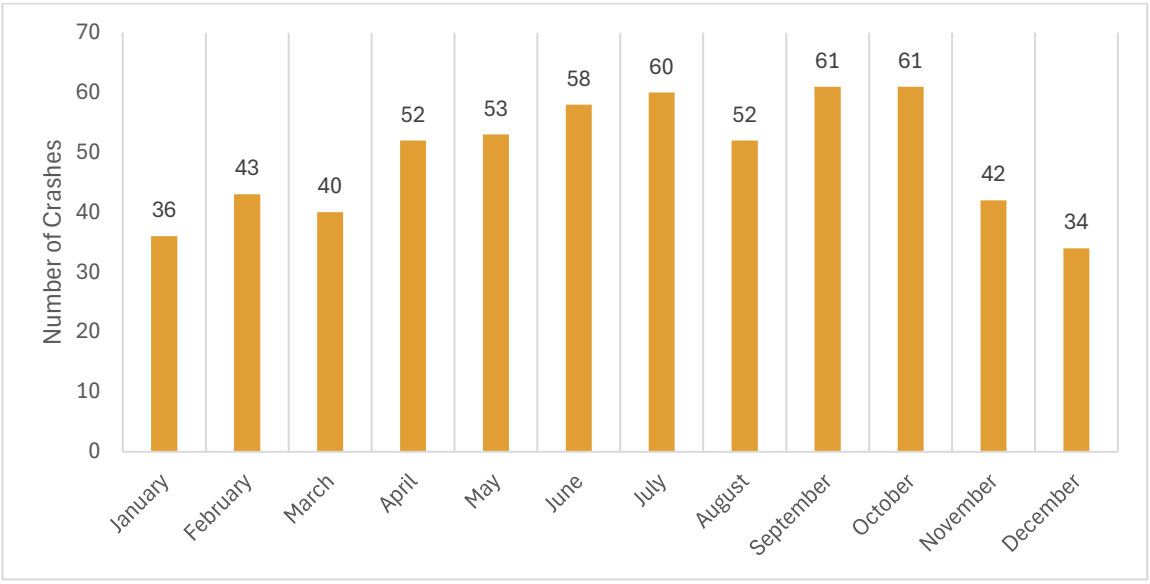


Figure 14: Number of KSI Crashes by Month, Mesa County, 2016-2022

Figure 15 shows the distribution of KSI crashes by day of the week. Similar to all crashes, the day with the highest frequency of KSI crashes was Friday, while Tuesday was the day that saw the lowest frequency of KSI crashes.

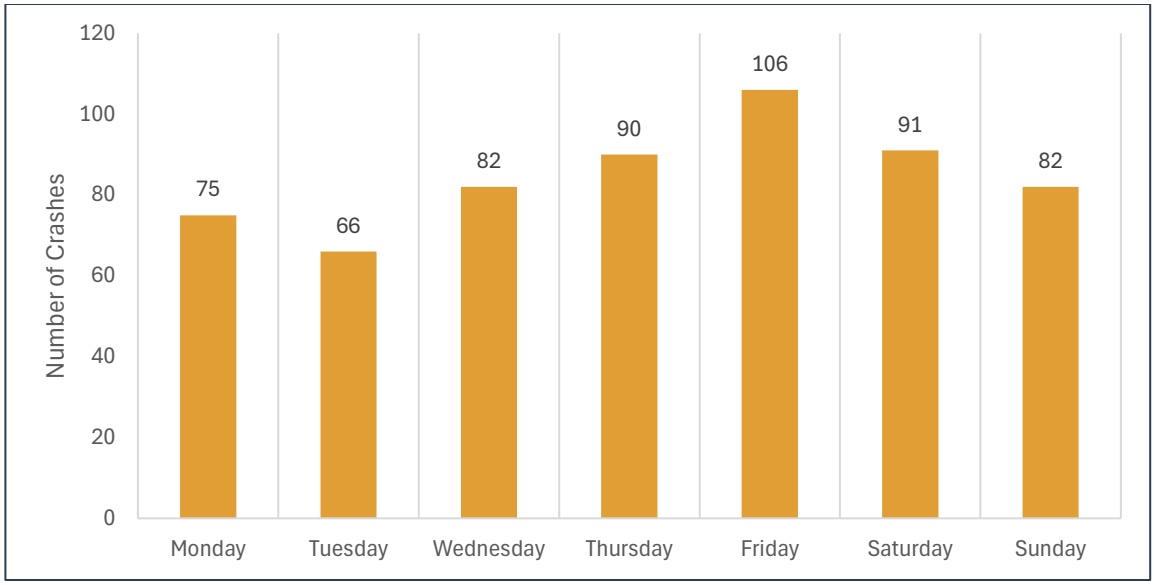


Figure 15: Number of KSI Crashes by Day of the Week, Mesa County, 2016-2022

URBAN VS RURAL KSI CRASHES

Approximately 74.8% of KSI crashes occur within the designated urban area of Mesa County. KSI crashes steadily decreased from 2016 to 2018 before increasing steadily until 2021. The most recent year of analysis, 2022, saw a dip in the number of KSI crashes compared to previous years. Rural KSI crashes were relatively low in 2016 and 2017 before increasing to a relatively constant value from 2018 to 2022. There was no apparent effect on the amount of KSI crashes for rural crashes as a result of the pandemic in 2020. The number of urban KSI crashes increased in 2020 and 2021 before dropping in 2022. The trends of urban and rural KSI crashes are displayed in **Figure 16**.

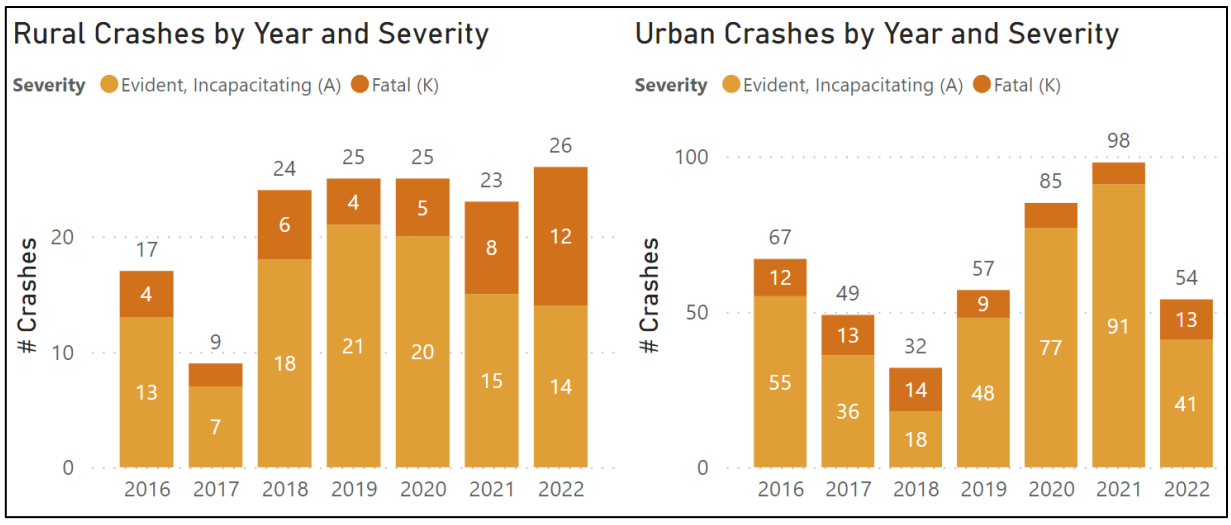


Figure 16: KSI Crashes per Year, Urban vs. Rural, 2016-2022

The most common crash type among urban KSI crashes was broadside crashes, followed by approach turn and rear-end crashes. For rural KSI crashes, overturning/rollover, fixed object, and curb/embankment crashes were the most common occurring crash types. KSI crashes involving

vulnerable road users were much more common among urban crashes in comparison to rural crashes. Animal KSI crashes were notable for rural crashes while being nearly non-existent for urban crashes. **Figure 17** shows the crash types of urban and rural KSI crashes.

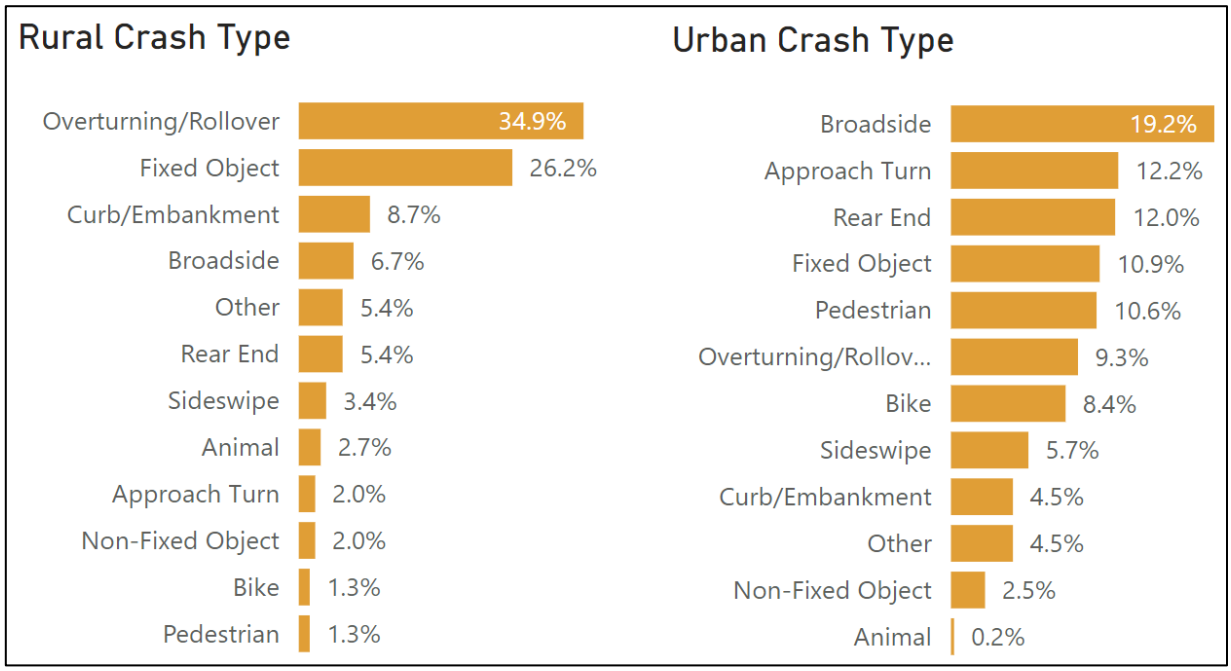


Figure 17: Crash Type of KSI Collision, Urban vs Rural, 2016-2022

The peak months of April and October experienced the greatest number of urban KSI crashes. The summer period from July to September also saw a high number of KSI crashes in the urban area. During wintertime, there was a low number of urban KSI crashes. Among rural KSI crashes, June had the greatest number of crashes followed by July and September. The lowest number of rural KSI crashes occurred in the middle of spring and the beginning of winter. **Figure 18** shows the distribution of crashes throughout the year by month.

The day of the week that experienced the highest number of urban KSI crashes was Friday. Thursday and Wednesday were the next highest days, while Tuesday and Monday were the lowest. Saturday and Sunday are when the greatest number of rural KSI crashes occurred. Monday and Thursday were the next highest days, and Tuesday and Wednesday consisted of the lowest number of crashes. **Figure 18** shows the distribution of urban and rural KSI crashes by day of the week.

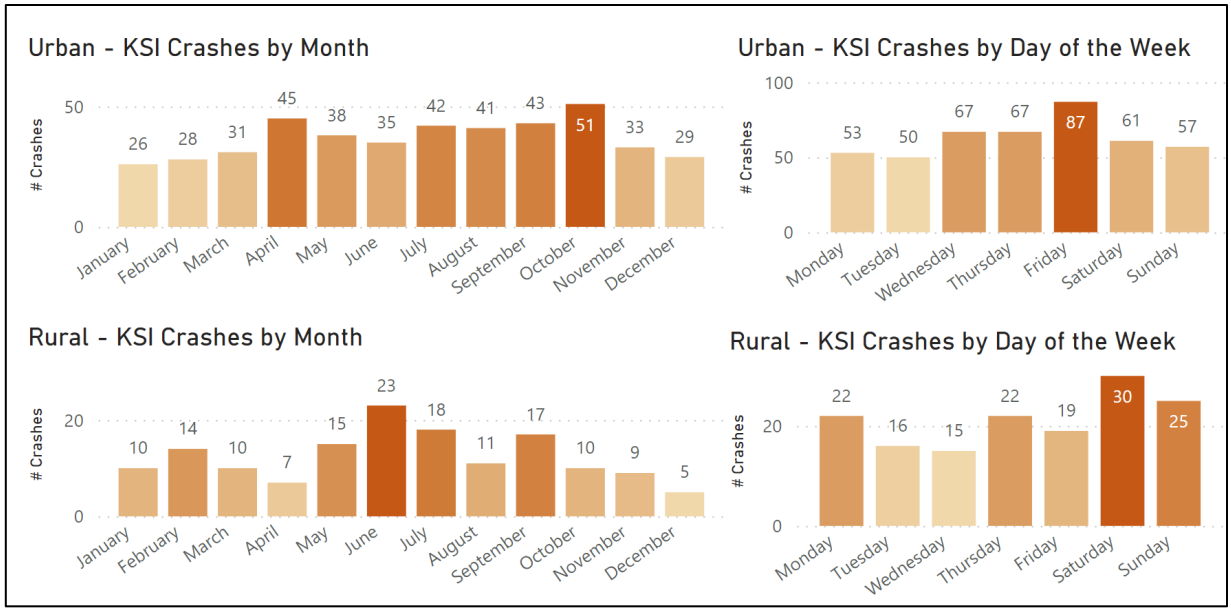


Figure 18: KSI Crashes by Month and Day of the Week, Urban vs. Rural, 2016-2022

The percentage of urban and rural KSI crashes that involved speeding or impairment is shown in **Figure 19**. KSI crashes that involved speeding were more common in rural crashes in comparison to urban crashes. Almost half of rural KSI crashes had speeding as a factor while speeding was only involved in just over one-fifth of urban KSI crashes. The proportion of KSI crashes that involved impairment was very similar between urban and rural crashes.

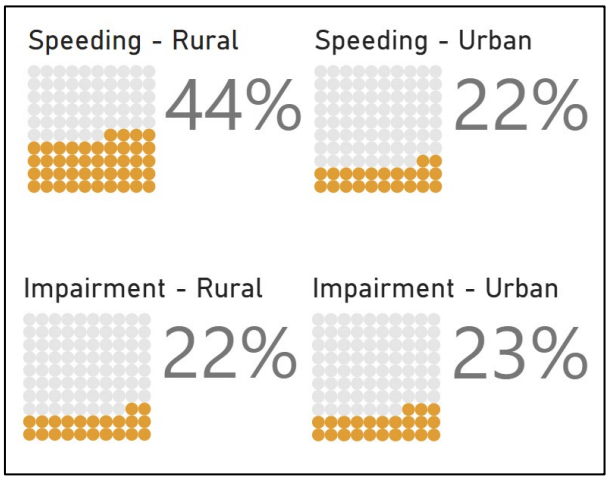


Figure 19: Impairment and Speeding-Related KSI Crashes, Urban vs. Rural, 2016-2022

URBAN CRASH TRENDS

The majority (87.8%) of crashes reported in Mesa County from 2016 to 2022 were located within the designated urban area with a total of 15,014 crashes. The number of urban crashes has decreased in the most recent analysis years from 2020 to 2022. After 2018, the number of urban KSI crashes steadily increased before a steep drop in 2022. **Figure 20** shows the distribution of urban crashes by year and severity and the distribution of urban KSI crashes is shown in **Figure 21**.

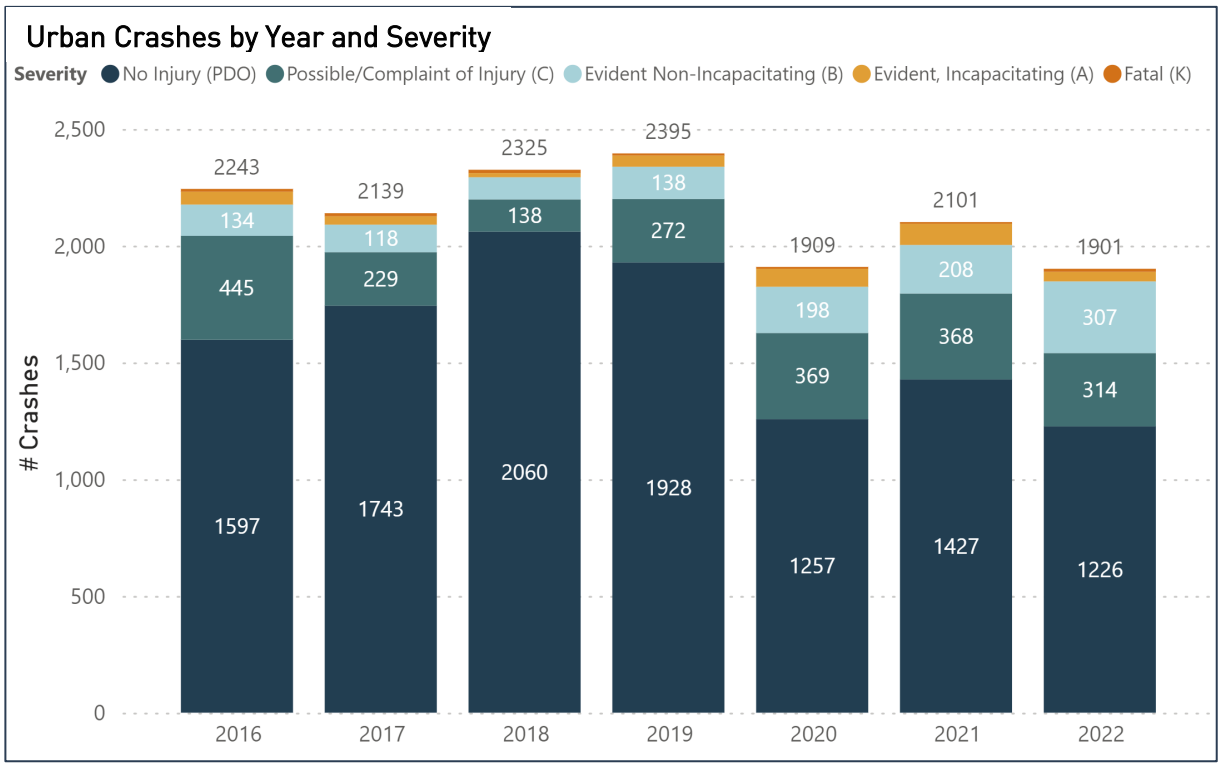


Figure 20: Number of Urban Crashes by Year and Injury Severity, Mesa County, 2016-2022

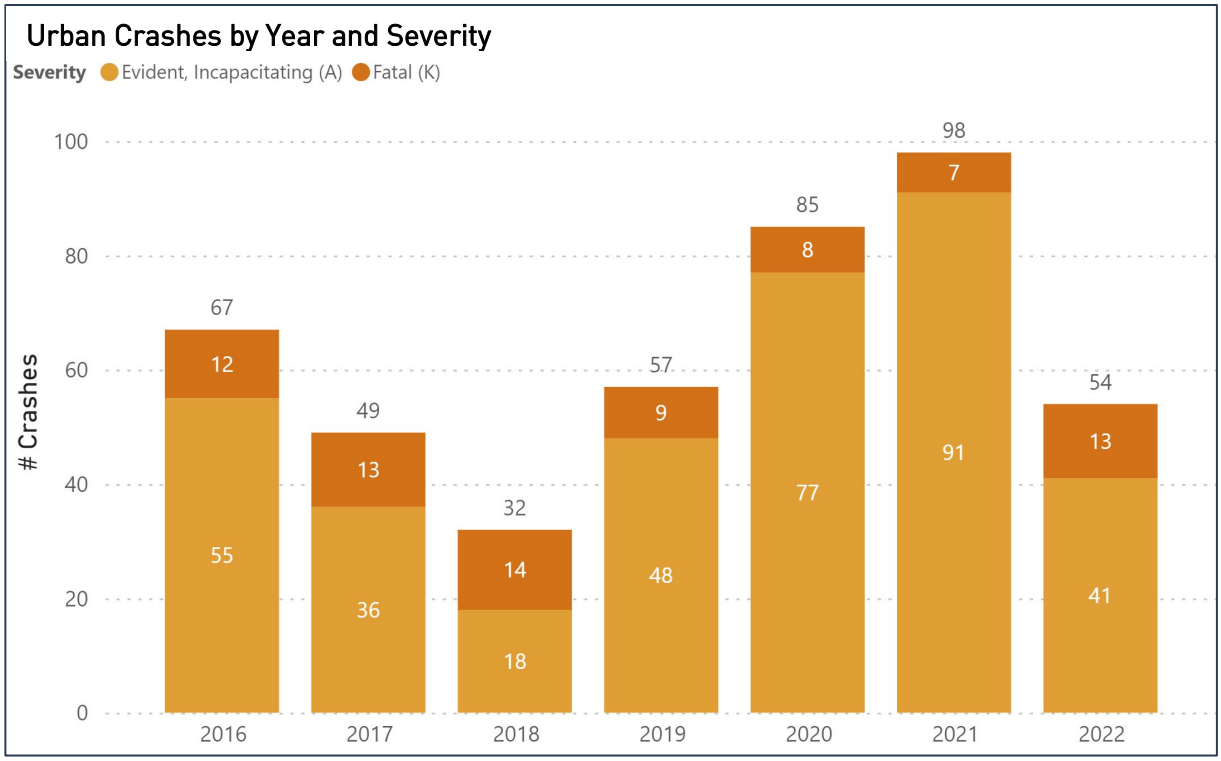


Figure 21: Number of Urban KSI Crashes by Year and Injury Severity, Mesa County, 2016-2022

Figure 22 shows the distribution of crash types among urban crashes within Mesa County from 2016 to 2022. The most common crash type among non-KSI urban crashes was rear-end crashes, while the most common crash type among KSI urban crashes was broadside crashes. For KSI urban crashes, the next highest crash types were approach turn and rear-end crashes.

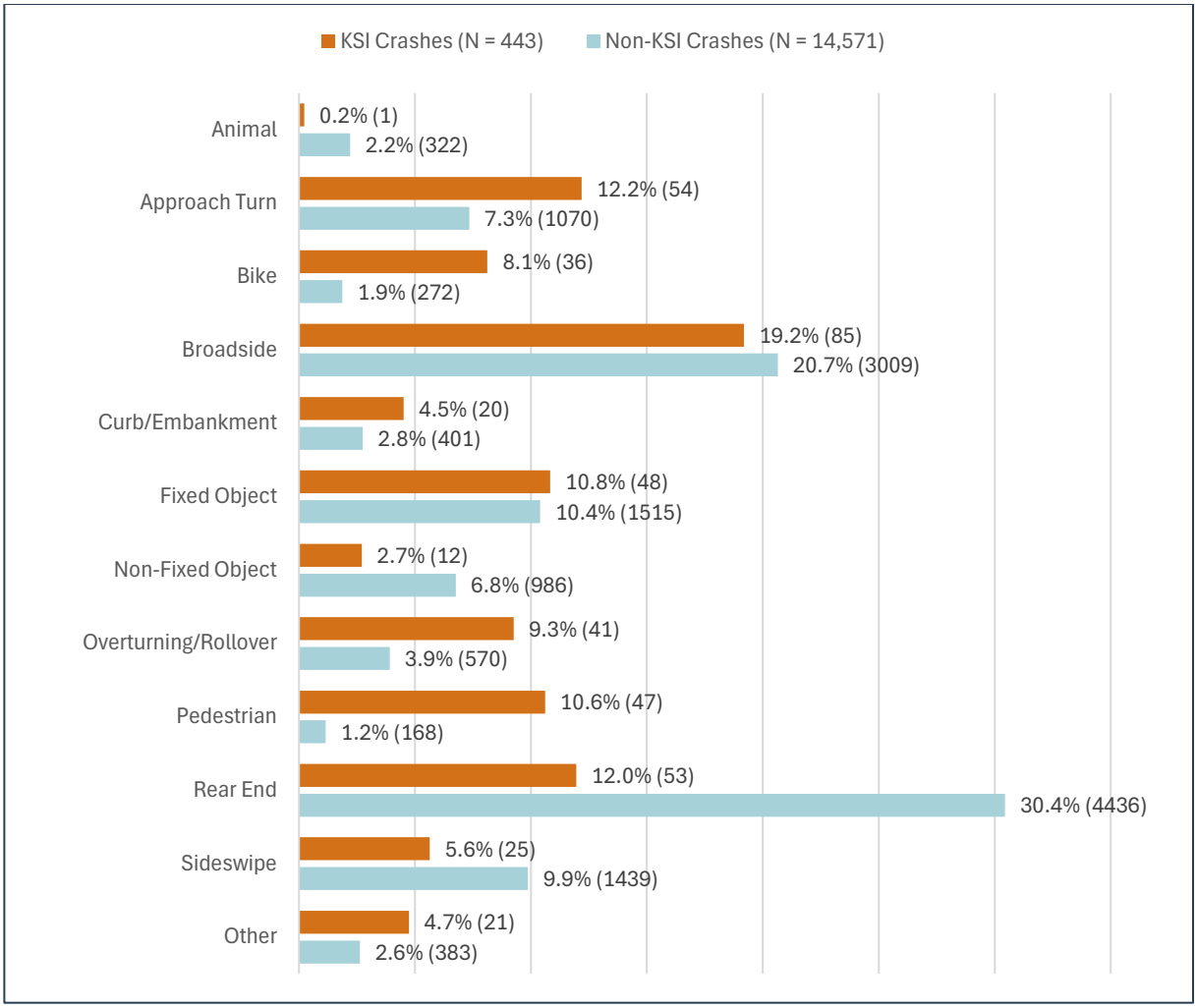


Figure 22: Urban Crashes by Crash Type and Injury Severity, Mesa County, 2016-2022

WHERE

The majority of urban crashes were located at intersections or were intersection-related (60.6%). Of the urban intersection crashes, approximately 55.9% were at unsignalized intersections. The greatest number of crashes, on city and county roads, occurred on Patterson Road. On state roadways, the highest frequency of crashes occurred on I-70. The intersection of 12th Street and North Avenue had the greatest number of crashes for any urban intersection within Mesa County. Segment crashes and intersection crashes within the Mesa County urban area are shown in **Figure 22** and **Figure 23**, respectively. **Figure 24** shows a heatmap of the urban crashes within Mesa County.

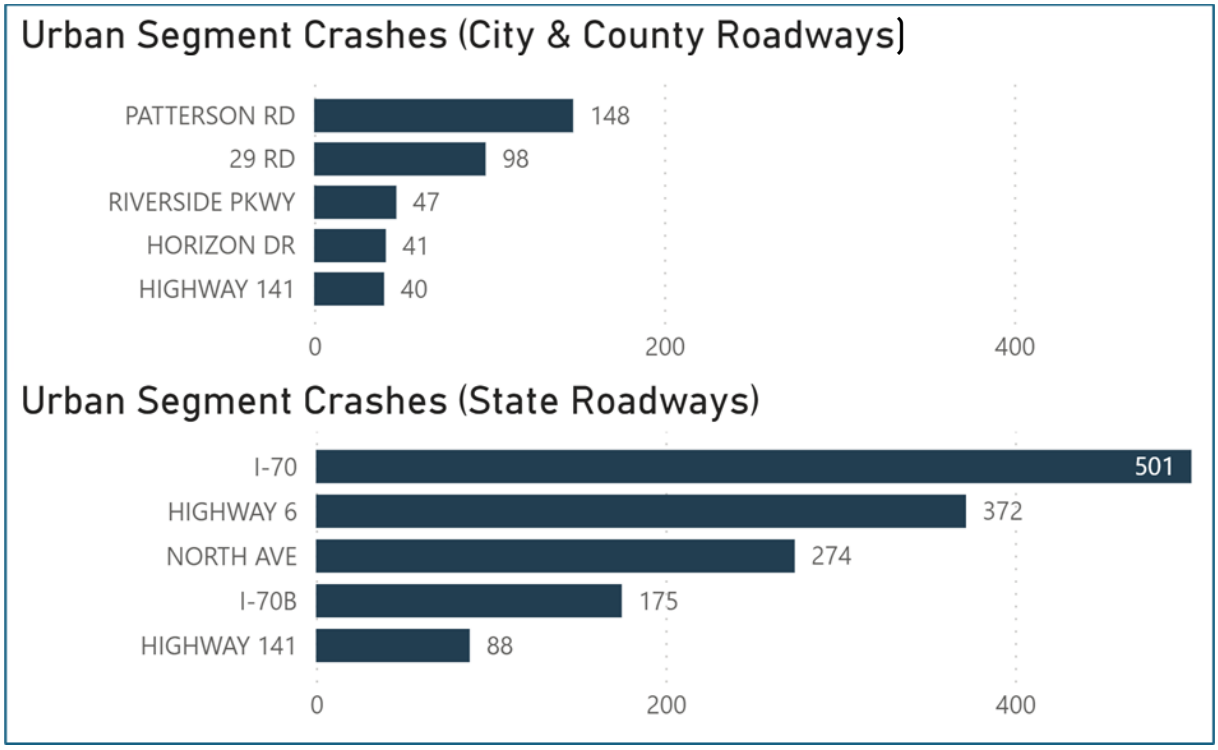


Figure 23: Top Segment Crashes for City & County Roadways (Top) and State Roadways (Bottom) in the Mesa County Urban Area, 2016-2022

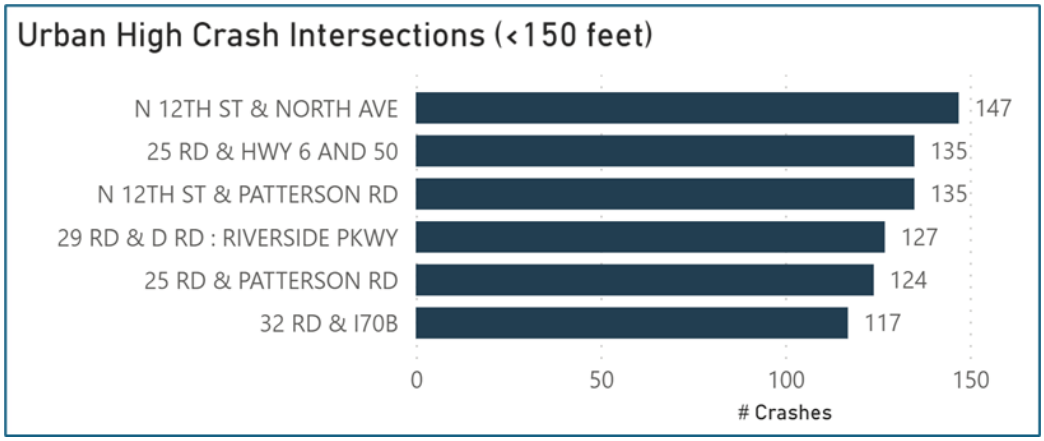


Figure 24: Top Intersection Crashes in the Mesa County Urban Area, 2016-2022

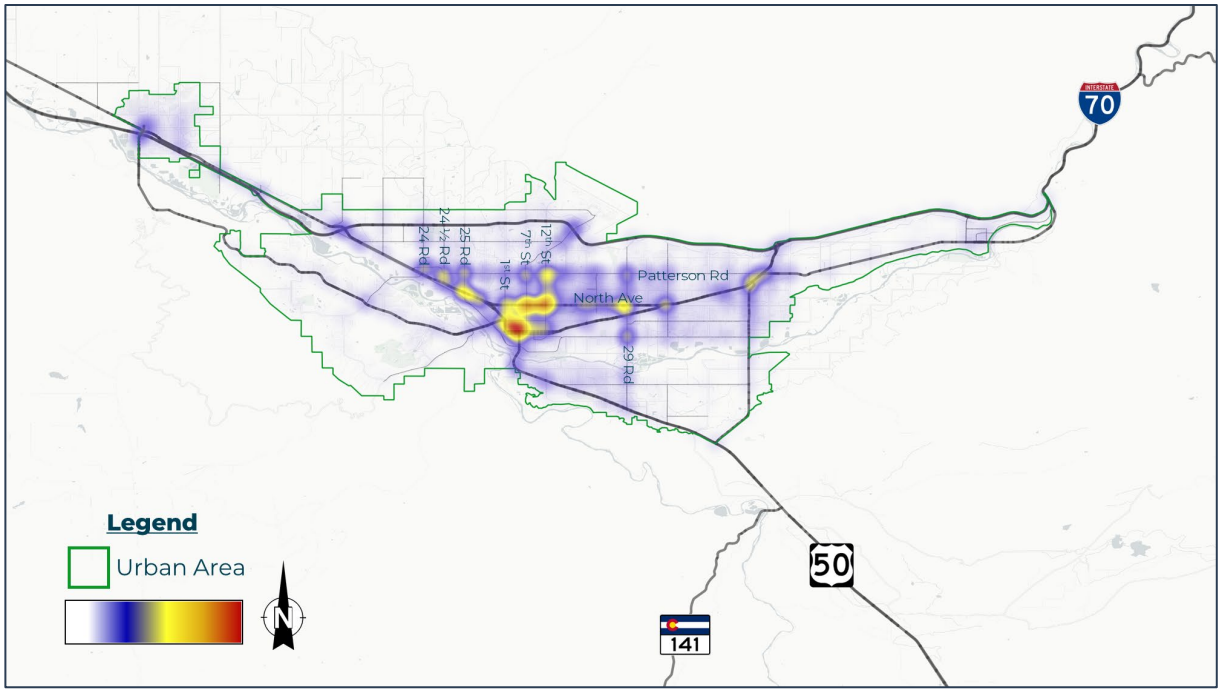


Figure 25: Heatmap of Urban Crashes in Mesa County, 2016-2022

URBAN KSI CRASHES BY LOCATION

Approximately 57.7% of urban KSI crashes were at intersections or intersection-related. 50.6% of urban KSI crashes at intersections were reported at unsignalized intersections. The segments that saw the greatest number of urban KSI crashes occur were Patterson Road and I-70 for city/county roadways and state roadways, respectively. North Avenue (US 6) experienced the next highest number of KSI crashes for state roadways, however, it is very similar in roadway configuration to Patterson Road. The intersection that had the most urban KSI crashes was 4th Street and Ute Avenue with seven (7) crashes recorded. The top segment and intersection crashes are shown in **Figure 25** and **Figure 26**, respectively.

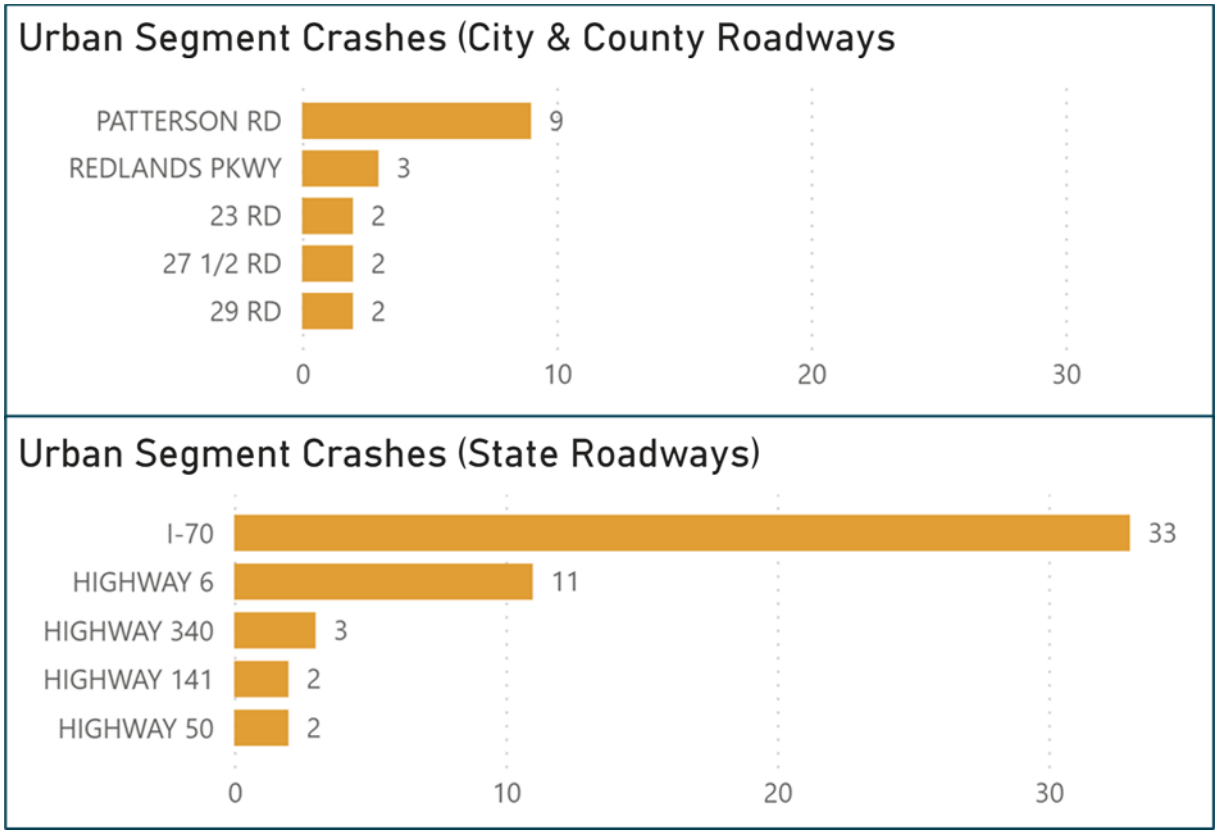


Figure 26: Top KSI Segment Crashes for City & County Roadways (Top) and State Roadways (Bottom) in the Mesa County Urban Area, 2016-2022

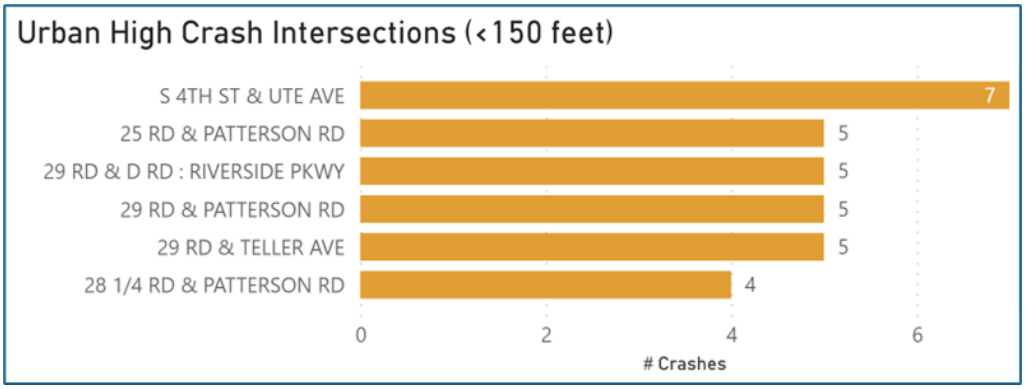


Figure 27: Top KSI Intersection Crashes in the Mesa County Urban Area, 2016-2022

WHO

The age and gender of urban drivers are shown in **Figure 27**. The age and gender of the driver of Unit 1 are shown, in which Unit 1 is the driver that is at fault for the crash, generally.

For female drivers, the most common age of drivers in urban crashes was 15-19 years old and the next highest was 20-24 years old. After that age group, the number of crashes generally decreases until the age of 85 years or older, with a slight spike in the 55-59 age group. For male drivers, the most numerous age of drivers in crashes is 20-24 years old followed by 15-19 years old. The number of crashes generally decreases among male drivers as age increases until reaching the age of 85

years or older, except for a few small spikes in the number of crashes seen for the ages of 55-59 years and 60-64 years. Overall, male drivers were more common making up approximately 55% of urban crashes from 2016 to 2022.

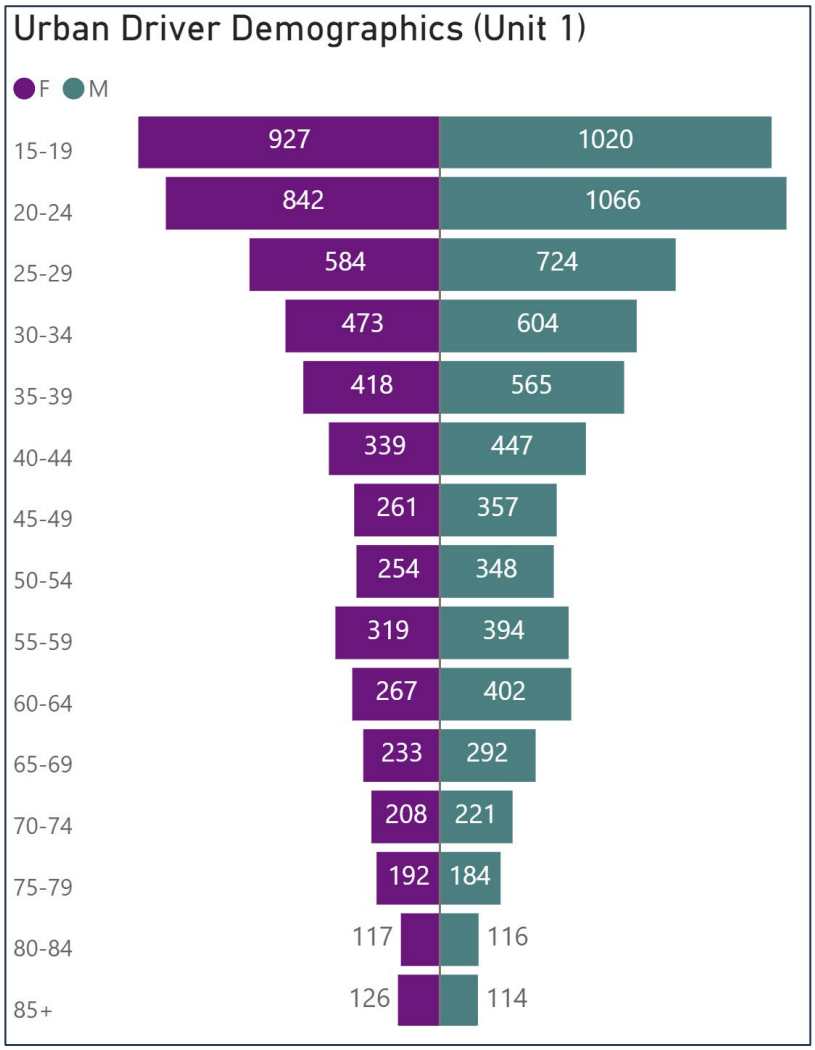


Figure 28: Age and Gender of Drivers of Unit 1 for Urban Crashes, Mesa County, 2016-2022

PEDESTRIANS AND BICYCLISTS

Pedestrian and bicyclist crashes were most common within the urban area of Mesa County when compared to Rural Mesa County. 15.8% of urban pedestrian and bicyclist crashes resulted in a fatality or serious injury. **Figure 28** shows the distribution of urban vulnerable road user crashes within Mesa County from 2016 to 2022. The number of urban pedestrian crashes increased slightly from 2016 to 2018 before decreasing to a constant value in the most recent analysis years. For urban bicyclist crashes, there was a large spike in 2017, after which there was a sharp decline before leveling out in the most recent years.

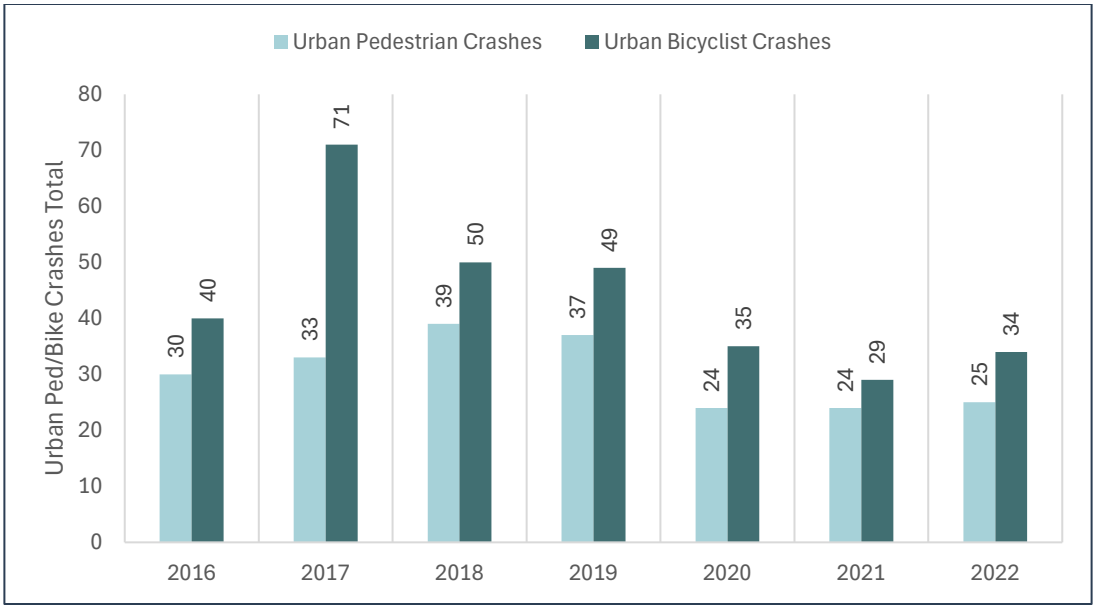


Figure 29: Urban Pedestrian and Bicyclist Crashes by Year, Mesa County, 2016-2022

Of urban pedestrian and bicyclist crashes, 59.9% happened at intersections and 6.4% were intersection-related. Of intersection and intersection-related crashes, 60.9% occurred at unsignalized intersections. The intersection of 12th Street and North Avenue experienced the greatest number of crashes that involved bicyclists with eight (8) crashes. The most pedestrian crashes happened at 10th Street and North Avenue with five (5) crashes. The intersection that saw the most amount of pedestrian and bicyclist crashes was also 12th Street and North Avenue with 10 combined crashes. A list of intersections with the greatest number of urban pedestrian and bicyclist crashes is displayed in **Figure 29**. A map of urban KSI crashes involving pedestrians and bicyclists is shown in **Figure 30**.

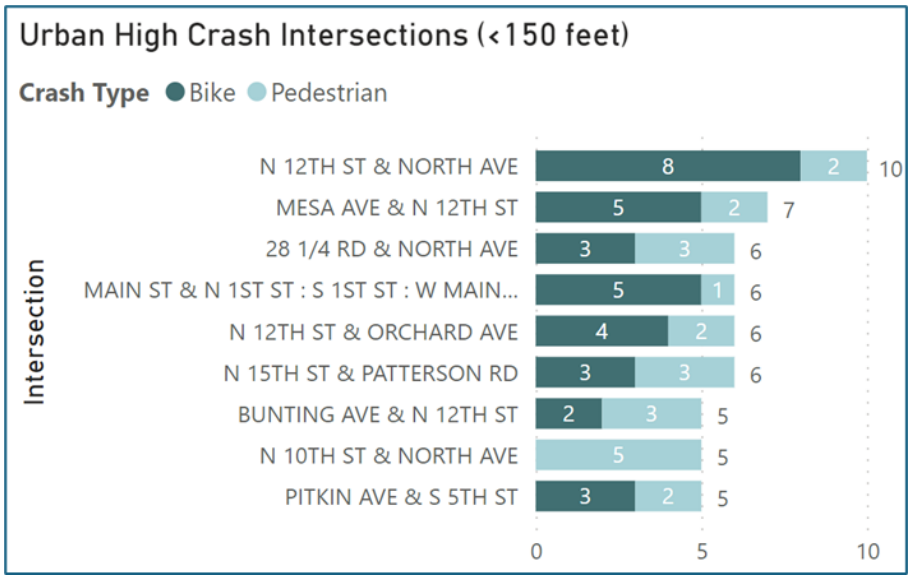


Figure 30: Urban Ped and Bike, All Severities, 2016-2022

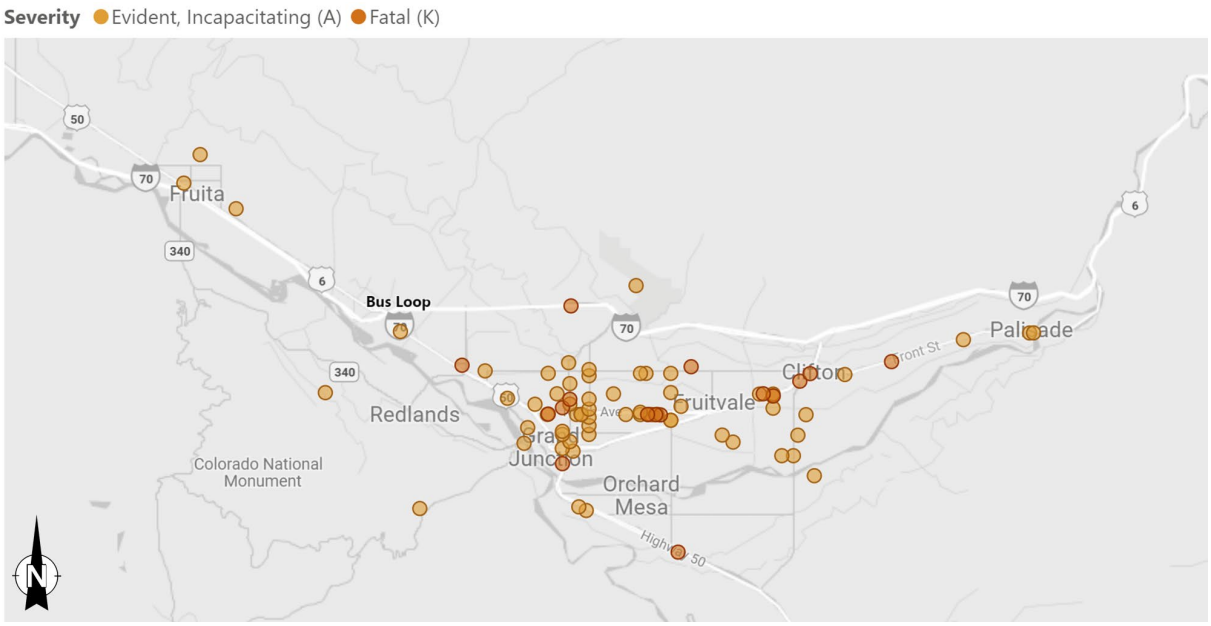


Figure 31: Location of Urban KSI Crashes involving Pedestrians and Bicyclists, 2016-2022

WHY

The top contributing factors for urban crashes are shown in **Figure 31**. The top contributing factors for urban KSI crashes were found to be aggressive driving, driving under the influence, and "other". Impairment of some kind was present in 7.5% of all urban crashes and 22.6% of urban KSI crashes. Speeding was present in 8.0% of all urban crashes and 22.3% of urban KSI crashes. 66.7% of urban KSI approach turn crashes occurred at signalized intersections.

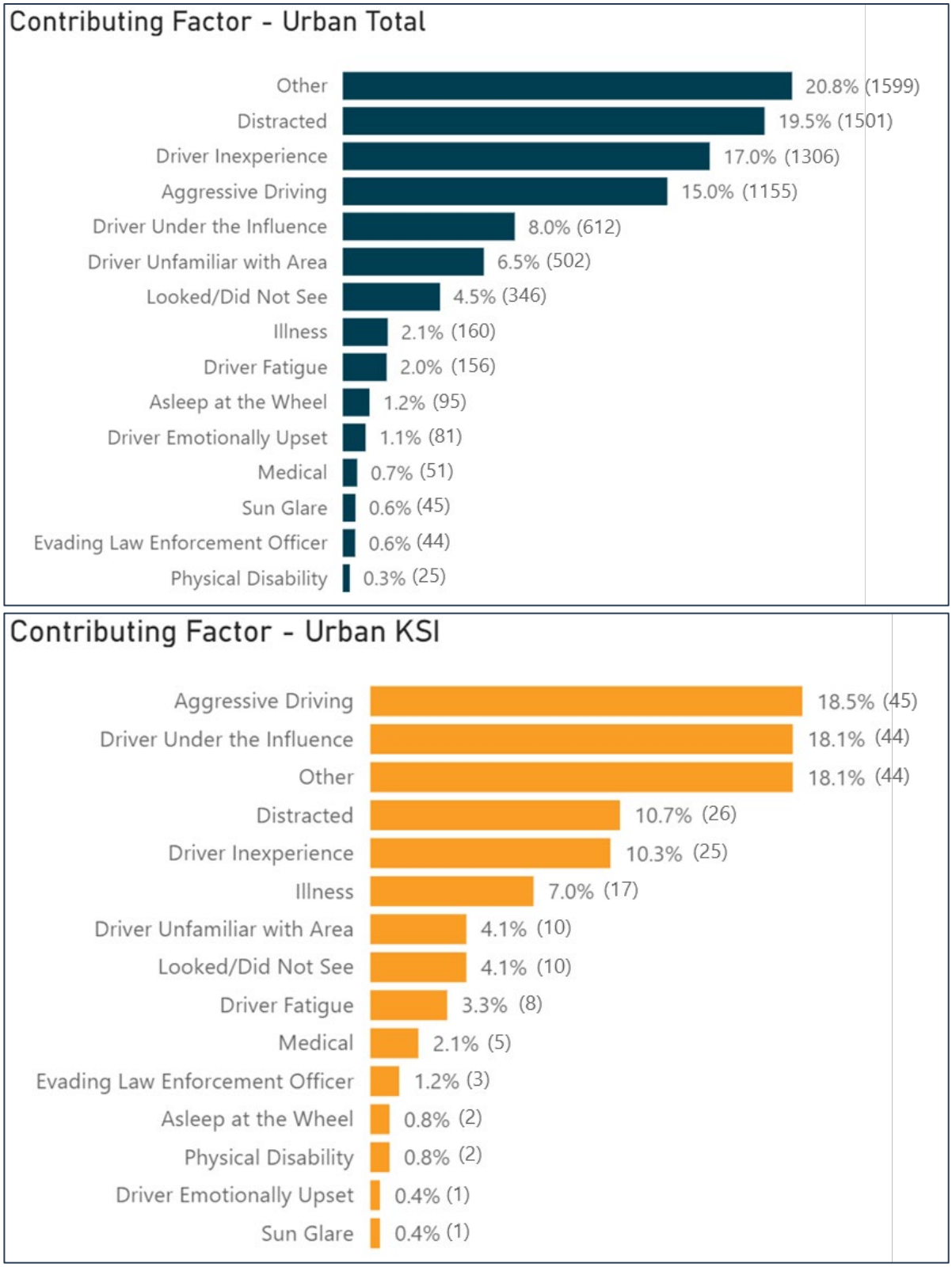


Figure 32: Top Contributing Factors for Urban Crashes (Top) and Urban KSI Crashes (Bottom), Mesa County, 2016-2022

RURAL CRASH TRENDS

A total of 2,072 rural crashes were reported which makes up approximately 12.2% of all crashes within Mesa County from 2016 to 2022. The number of rural crashes has been constant for the past four analysis years (2019-2022). The number of rural crashes was less from 2016 to 2018, with a minimum reported in 2017. The number of rural KSI crashes in 2017 is lower than in the other analysis years as well. The crash distribution of rural crashes is shown in **Figure 33** for all rural crashes and in **Figure 34** for rural KSI crashes.

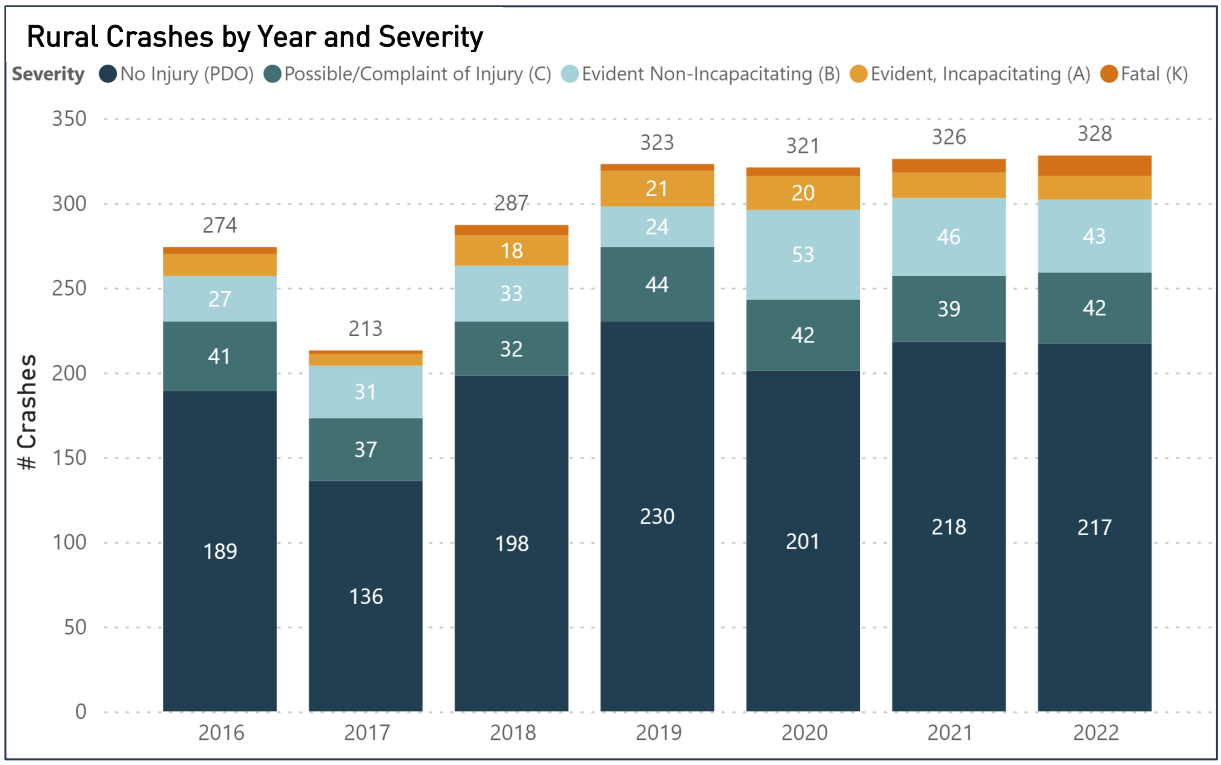


Figure 33: Number of Rural Crashes by Year and Injury Severity, Mesa County, 2016-2022

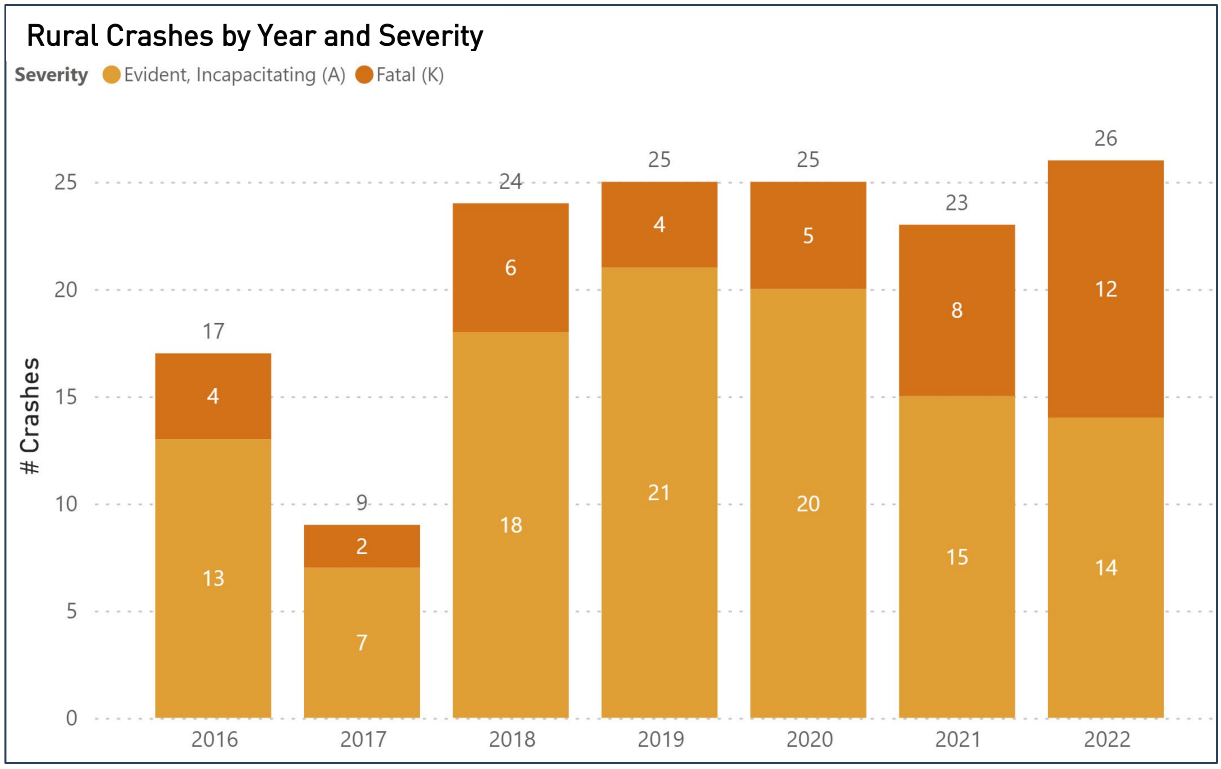


Figure 34: Number of Rural KSI Crashes by Year and Injury Severity, Mesa County, 2016-2022

The distribution of crash type for rural crashes is displayed in **Figure 33**. Fixed object crashes were the most common crash type for rural crashes in Mesa County from 2016 to 2022. The most common crash type for rural KSI crashes was overturning/rollover crashes, followed by fixed object and curb/embankment crashes. Overturning/rollover crashes account for 34.2% of rural KSI crashes as opposed to 17.4% in non-KSI rural crashes.

Fixed object crashes made up the largest percentage of rural crashes. **Figure 34** shows the distribution of fixed object rural crashes categorized by the first harmful event. The most common fixed objects that were involved in a collision were guardrails/barriers with the next most common being fences.

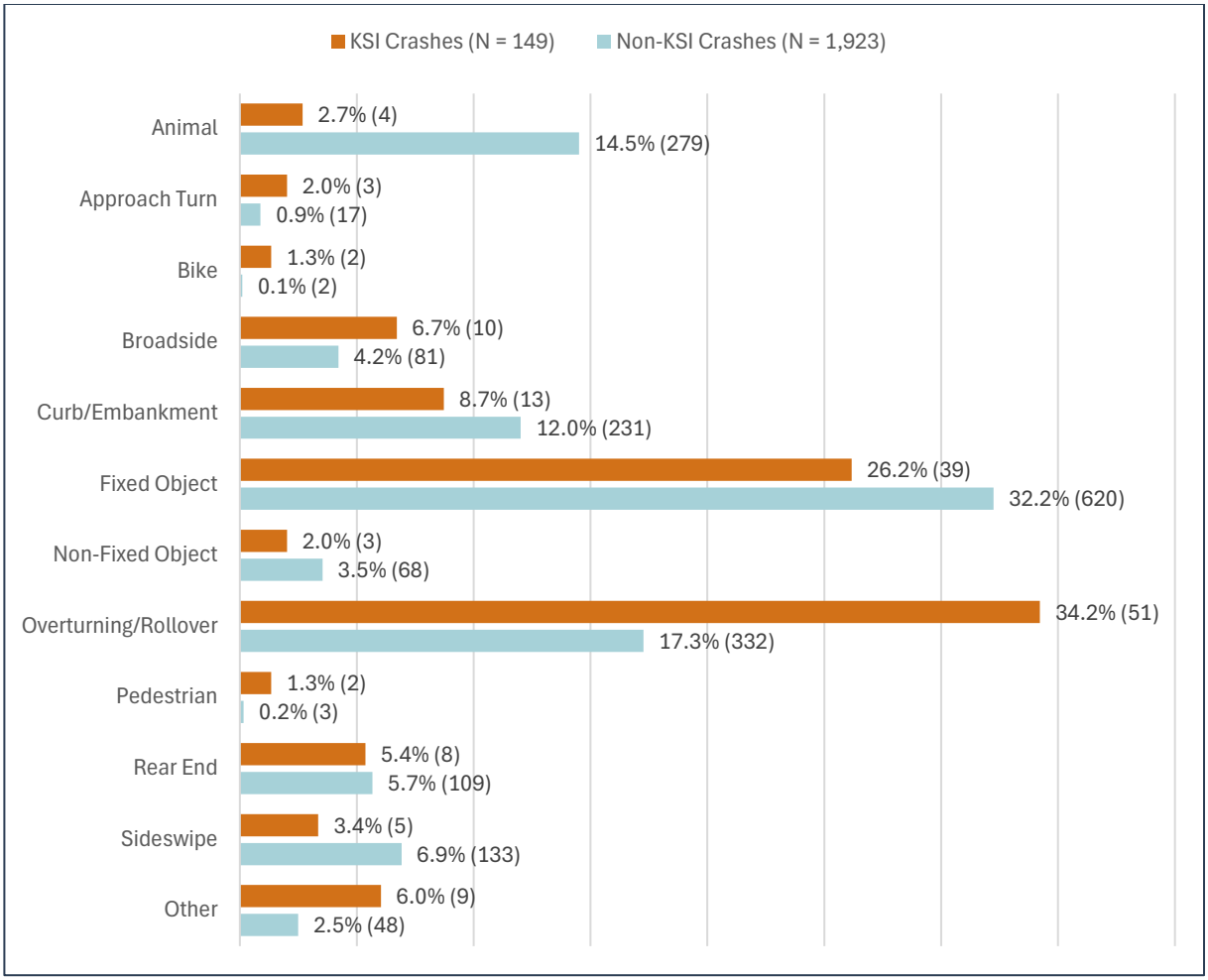


Figure 35: Rural Crashes by Crash Type and Injury Severity, Mesa County, 2016-2022

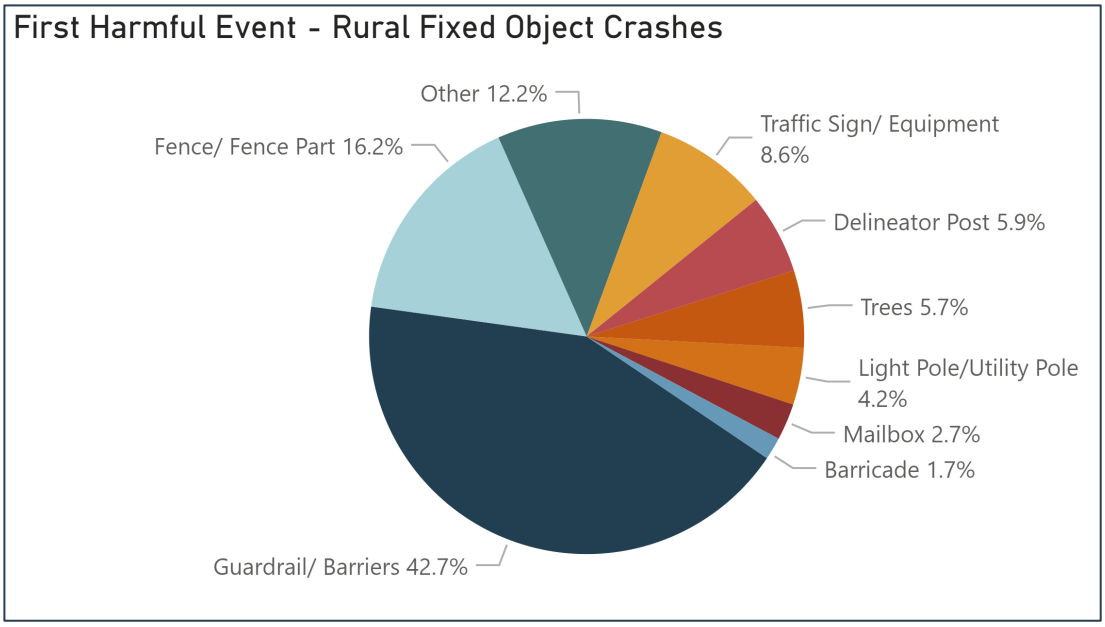


Figure 36: First Harmful Event of Rural Fixed Object Crashes, Mesa County, 2016-2022

WHERE

Approximately 85.2% of rural crashes were non-intersection related and the majority, 72.8%, occurred on state highways. The segment that had the most rural crashes among city and country roadways was 45 ½ Road with 19 crashes followed by Little Park Road with 18 crashes. On state roadways, the segment with the highest number of rural crashes was I-70. **Figure 35** shows the top segments for rural crashes on city/county roadways and state roadways. A total of 30 Rural intersection crashes are spread throughout Mesa County without clear concentration on any specific intersection. The location of rural crashes that occurred at intersections is displayed in **Figure 36**.

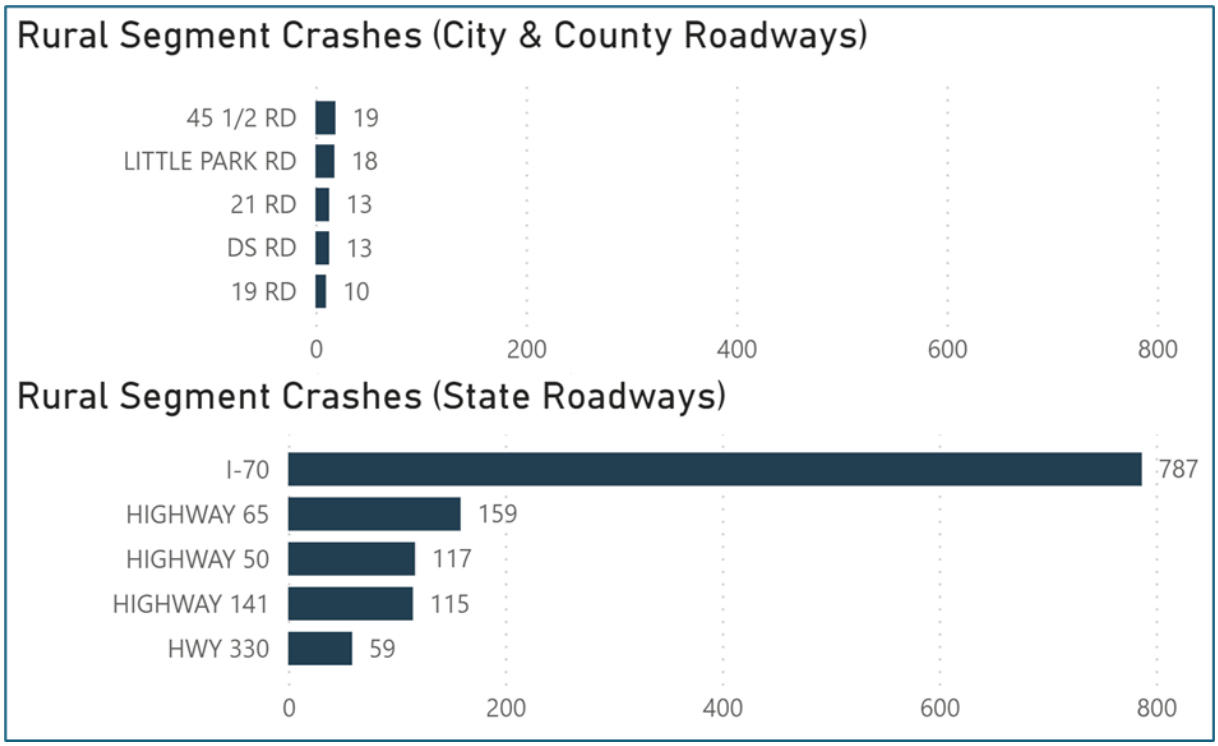


Figure 37: Top Segment Crashes for City & County Roadways (Top) and State Roadways (Bottom) in the Mesa County Rural Area, 2016-2022

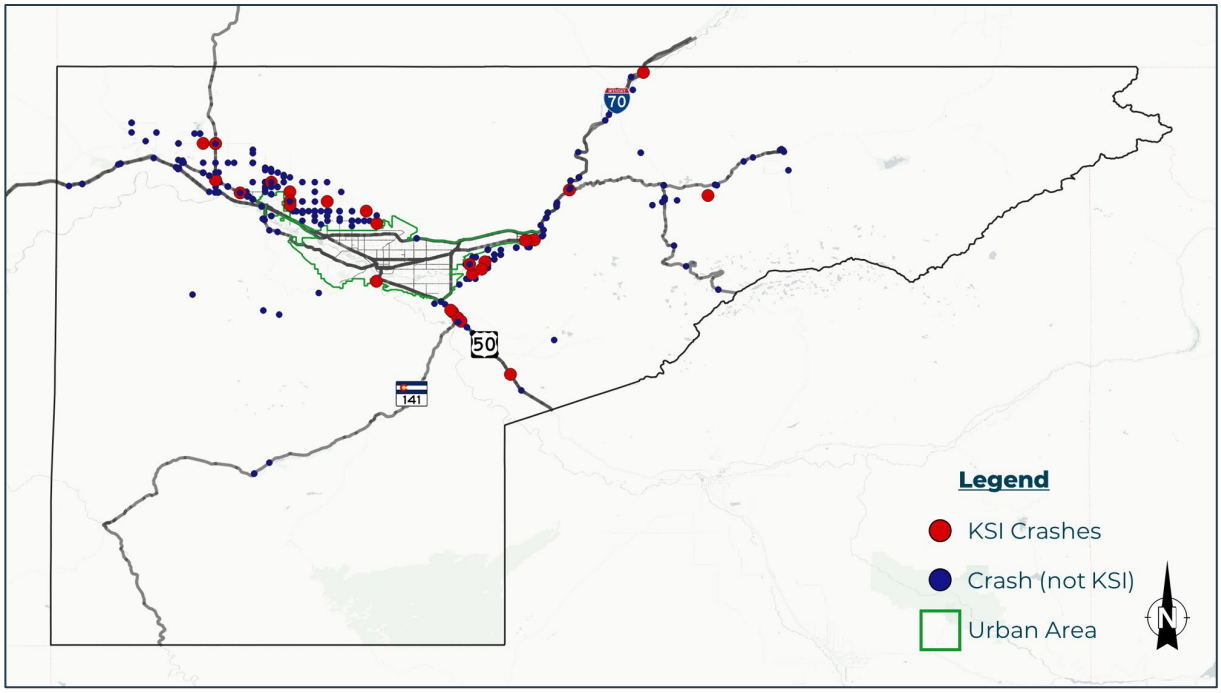


Figure 38: Map of Rural Intersection Crashes in Mesa County, 2016-2022

RURAL KSI CRASHES BY LOCATION

149 rural KSI crashes occurred throughout Mesa County from 2016 to 2022. Most of these crashes did not occur at intersections (85.2%) and most of them happened on state highways (69.8%). The number of segment rural KSI crashes on city/county roadways was too low to provide any meaningful observations or trends. Rural KSI crashes that occurred on state roadways were most prevalent on I-70 followed by Highway 141. The rural KSI segment crashes are shown in **Figure 37**.

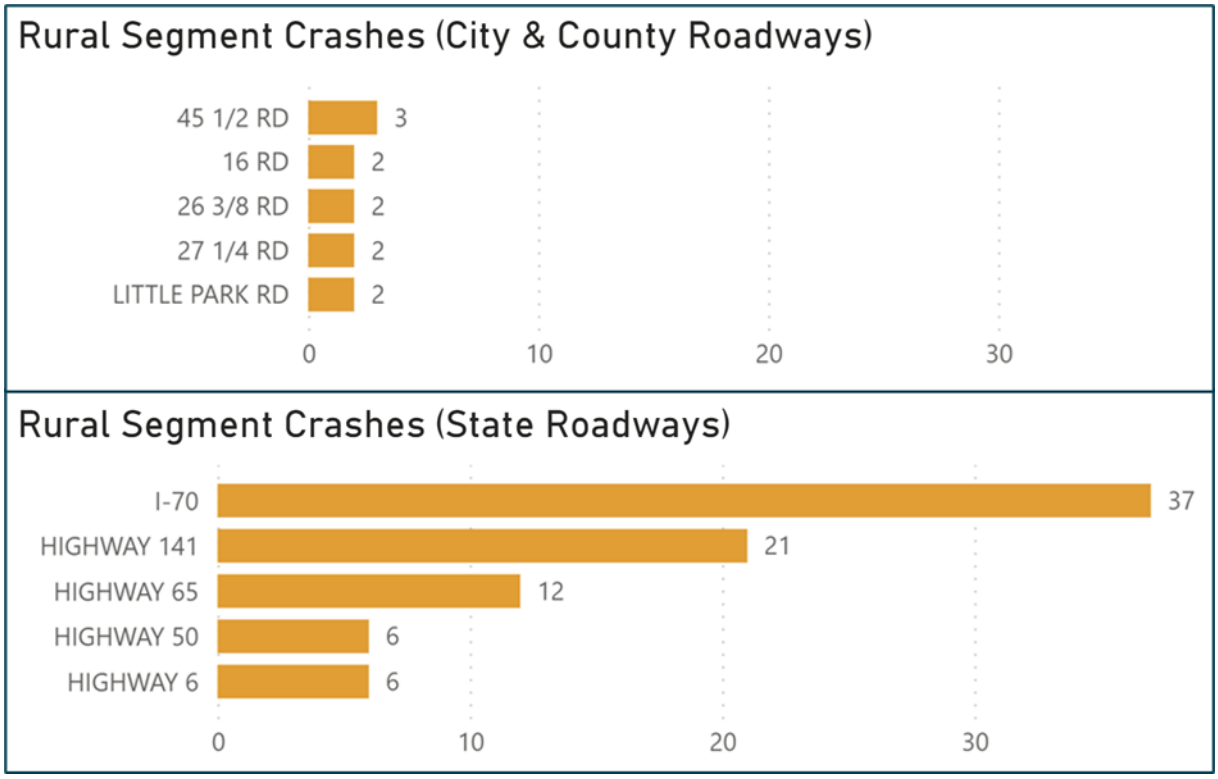


Figure 39: Top KSI Segment Crashes for City & County Roadways (Top) and State Roadways (Bottom) in the Mesa County Rural Area, 2016-2022

WHO

Figure 38 shows the age and gender of drivers involved in Rural Crashes in Mesa County from 2016 to 2022. The driver of Unit 1, which is most at fault for the crash, was analyzed.

The most common age of female drivers involved in rural crashes was 25-29 years old, followed by 15-19 and 20-24 years. The number of crashes is relatively low among other female age groups with small spikes in the ages 30-34 and 55-59 years. Among male drivers, the most common age group was recorded as 20-24 years old, with 15-19 and 25-29 years as the next highest groups. For male drivers, there was a spike in drivers aged 60-64. The data shows that younger drivers are more likely to be involved in rural crashes. Overall, male drivers were more common in rural crashes, accounting for 69% of rural crashes in Mesa County from 2016 to 2022.

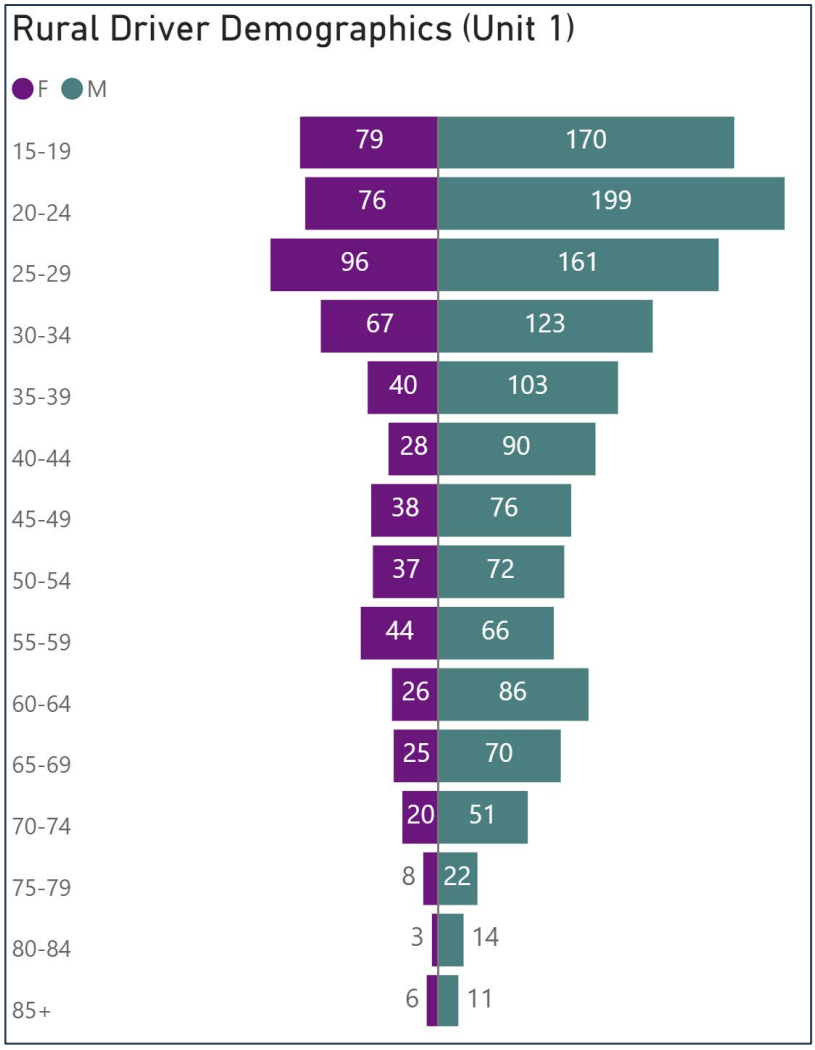


Figure 40: Age and Gender of Drivers of Unit 1 for Rural Crashes, Mesa County, 2016-2022

VULNERABLE ROAD USERS – PEDESTRIANS, BICYCLISTS, AND MOTORCYCLISTS

The user type of rural crashes is shown in **Figure 39**. Pedestrian crashes have the highest frequency of fatal crashes, however, a small sample size of five (5) crashes is observed in Rural Mesa County. Similarly, a sample size of four (4) crashes represents rural bicyclist crashes, which makes the injury frequency high among these crashes. Rural crashes that involved motorcyclists have a sample size of 86 crashes, and it is clear that injury and fatality frequencies are high compared to the majority of crashes. 48.8% of rural crashes involving a motorcyclist resulted in a KSI. A map of the rural motorcyclist crashes is displayed in **Figure 40**.

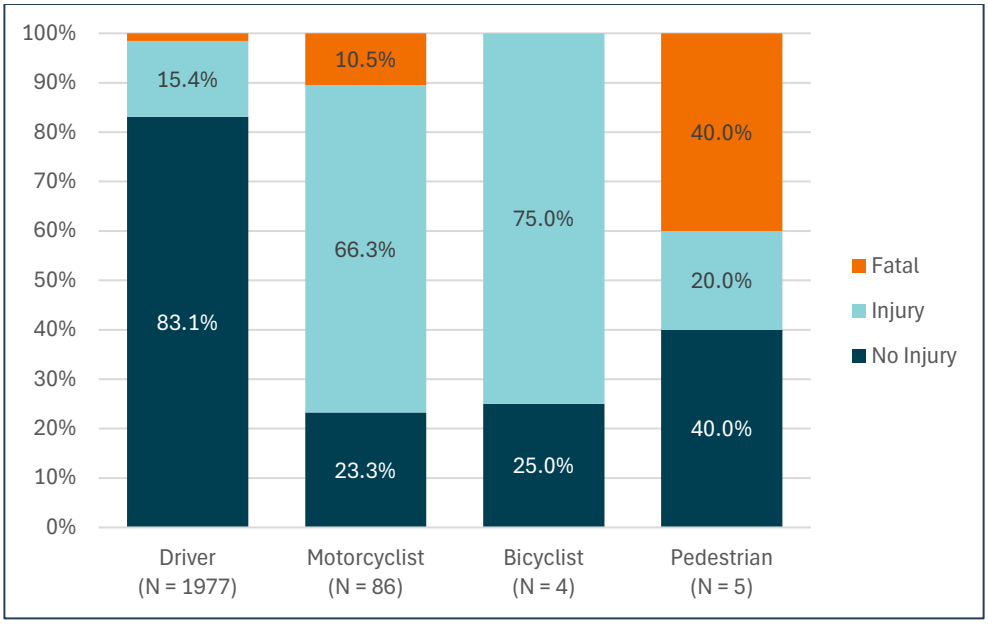


Figure 41: Number of Rural Crashes by User Type and Severity, Mesa County, 2016-2022

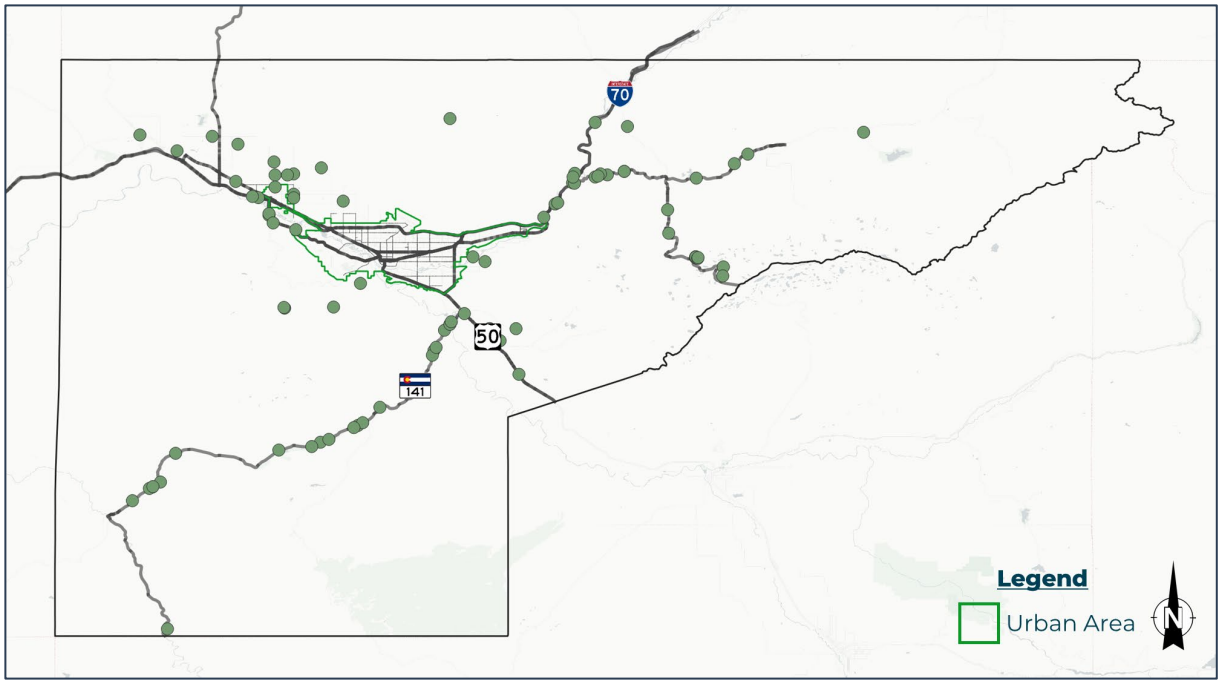


Figure 42: Location of Motorcycle Crashes in Rural Mesa County (All Severities), 2016-2022

WHY

The top contributing factors for rural crashes are shown in **Figure 41**. In rural KSI crashes, the top contributing factors were recorded as aggressive driving, driving under the influence, and "other". 10.9% of all rural crashes included impairment of some kind, while 22.1% of rural KSI crashes involved impairment. Speeding was present in 20.9% of all rural crashes and 43.6% of rural KSI crashes.

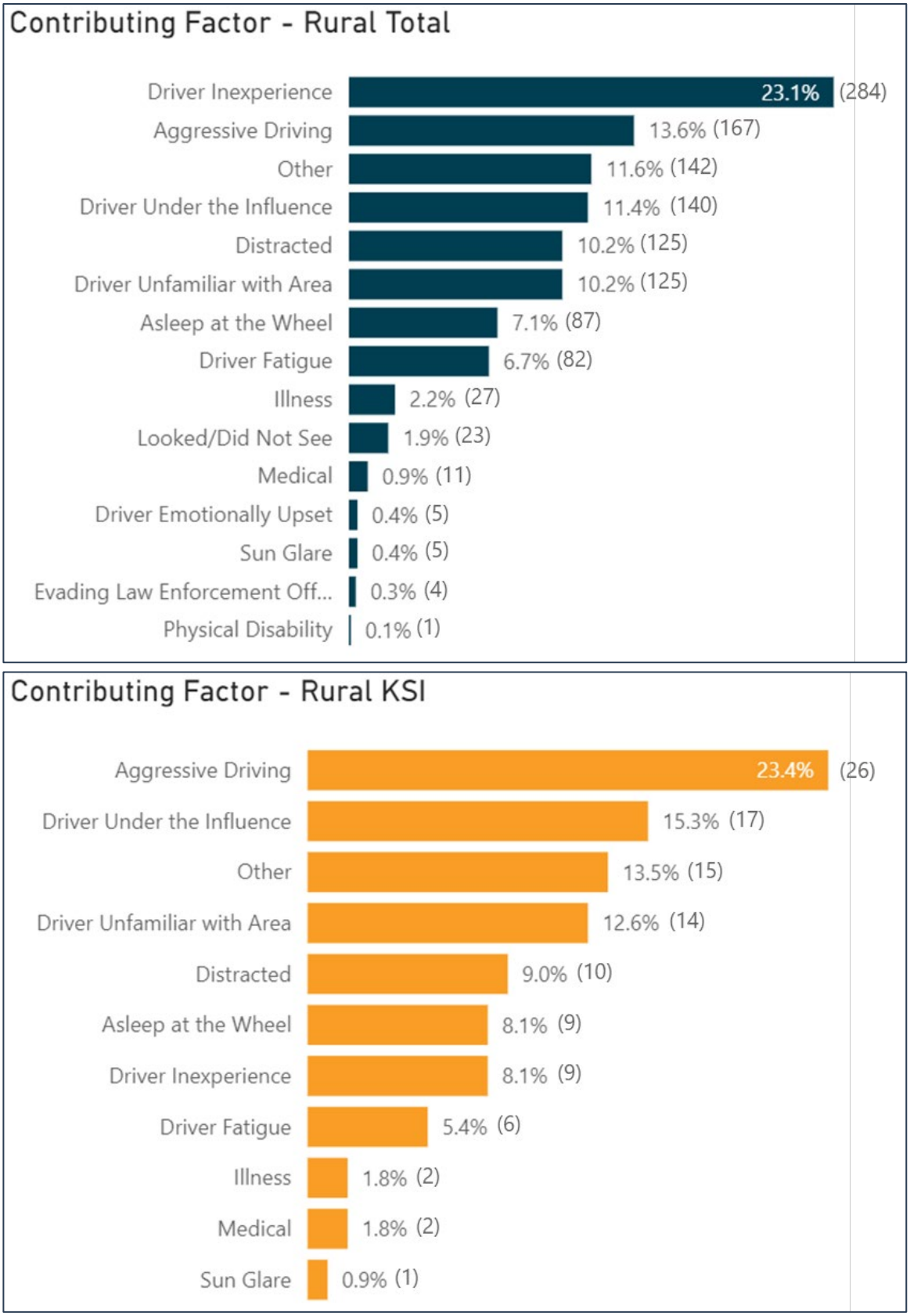


Figure 43: Top Contributing Factors for Rural Crashes (Top) and Rural KSI Crashes (Bottom), Mesa County, 2016-2022

NATIONAL AND REGIONAL ROAD SAFETY CONTEXT

The Colorado Crash Data Dashboard developed by the Colorado Department of Transportation (CDOT) summarizes statewide crash data from 2010 to 2024[2]. National crash data was obtained from the National Highway Traffic Safety Administration's annual crash reports which contain crash data from 1988 to 2021[3]. The total amount of crashes for each analysis year was compared between Mesa County, Colorado statewide, and national data. The growth rate between successive years was calculated as shown in **Figure 42**.

The growth rate between all sets of data follows the same trends. The growth rate increased from 2017 to 2018 and then decreased until a minimum was reached in 2020. After 2020, the growth rate increased again before decreasing again in 2022. It should be noted that national crash data was not available in 2022.

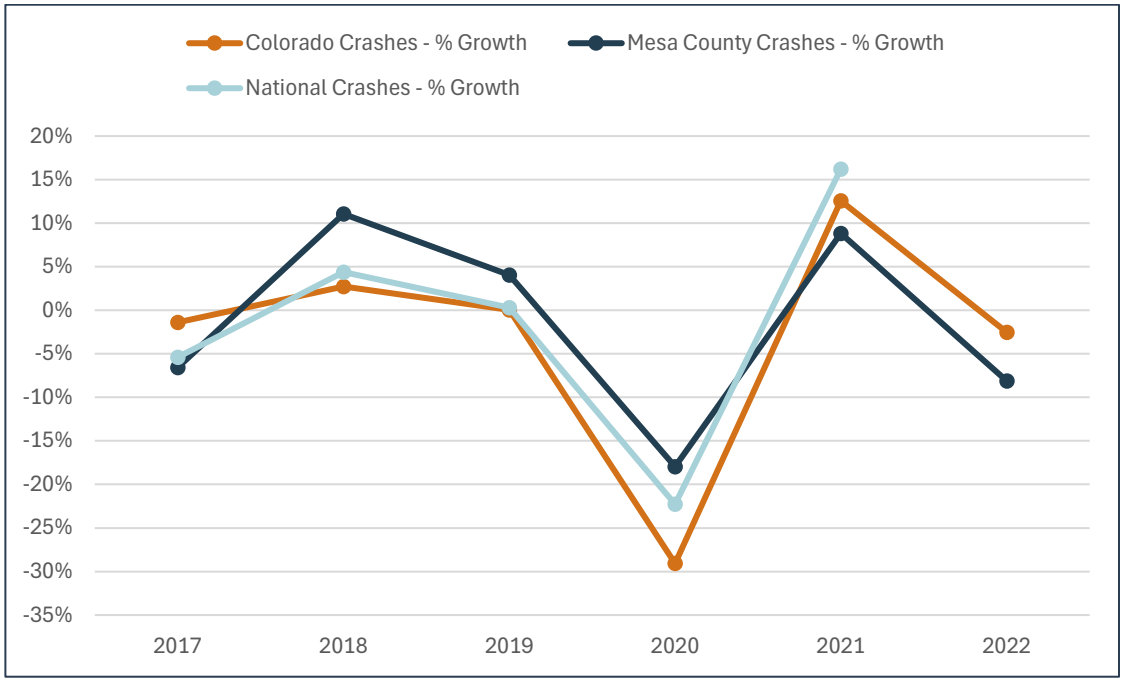


Figure 44: Growth Rate of Mesa County, Statewide, and National Crashes, 2016-2021

[2] Colorado Department of Transportation – Colorado Crash Data Dashboard
[3] National Highway Traffic Safety Administration – Traffic Safety Facts Annual Report Tables

The severity of crashes for all three sets of data is displayed in **Figure 43**. The county and state data classifies injury severity into five categories, while the national data separates it into three categories: no injury, injury, and fatal. The fatality rate (at the crash level) is rather similar among the collected data with an average value of 0.6%. The rate of KSI crashes in Mesa County is slightly higher than the statewide rate at a value of 3.5% compared to 3.0%. The national rate is 29.2% while the rate in Mesa County is a combined 25.4%.

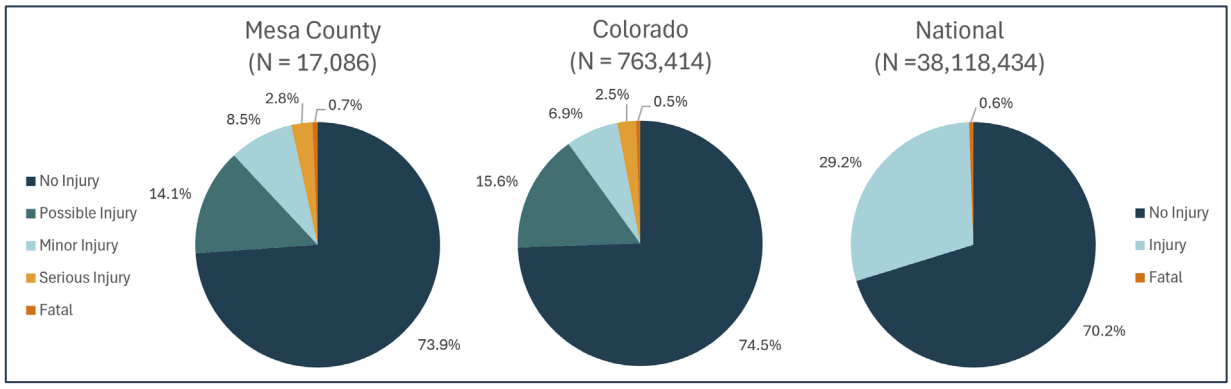


Figure 45: Crash Severity Comparison of Mesa County, State of Colorado, and National Crashes, 2016-2022

The fatality rates of Mesa County, statewide, and national crashes are shown in **Figure 44**. Note that 2022 data is not available for national crash data. Mesa County consistently had a higher fatality rate than statewide and national rates, except for 2020 and 2021 where it was slightly less. 2022 sticks out in particular with a high fatality rate of 1.12%.

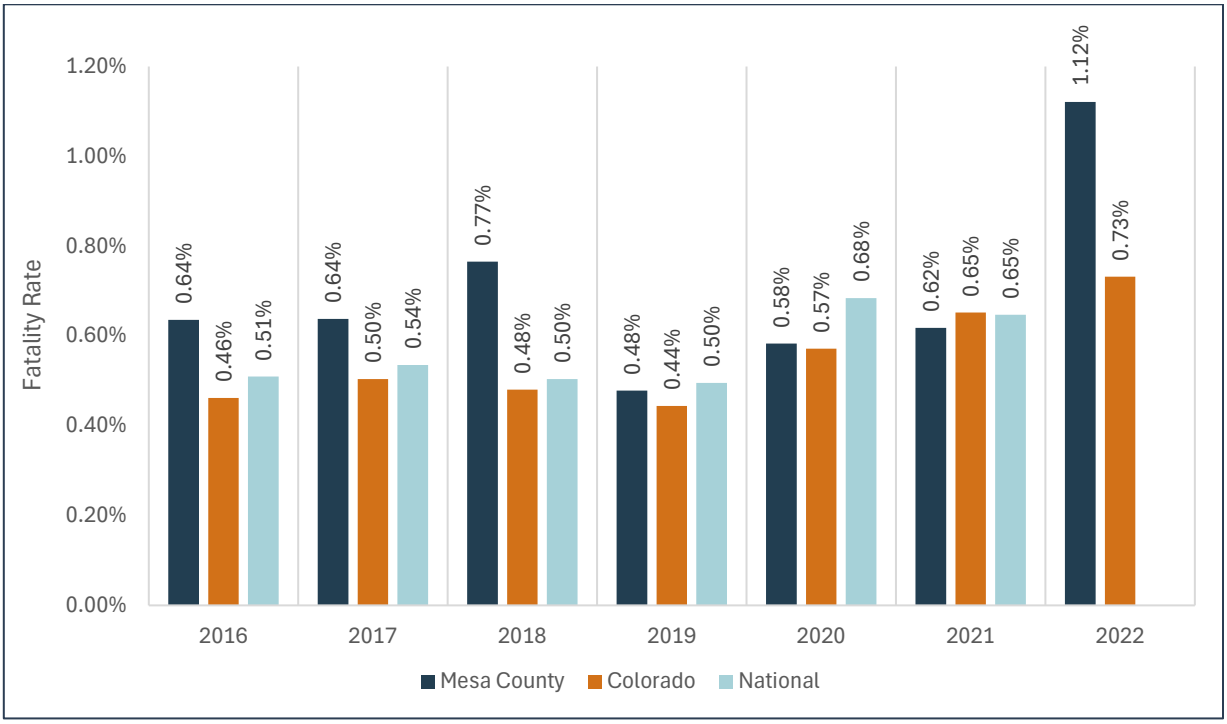


Figure 46: Fatality Rate of Mesa County, State of Colorado, and National Crashes by Year, 2016-2022

From 2020 to 2021, the number of fatalities in Colorado increased from 496 to 637, a percent change of 28.4%. Fatalities in Mesa County increased by 15.4% from 2020 to 2021; however, the year-to-year fluctuation in this data does not indicate a clear trend. National statistics on 2021 fatalities and percent change trends from 2020 are shown in **Figure 45**.

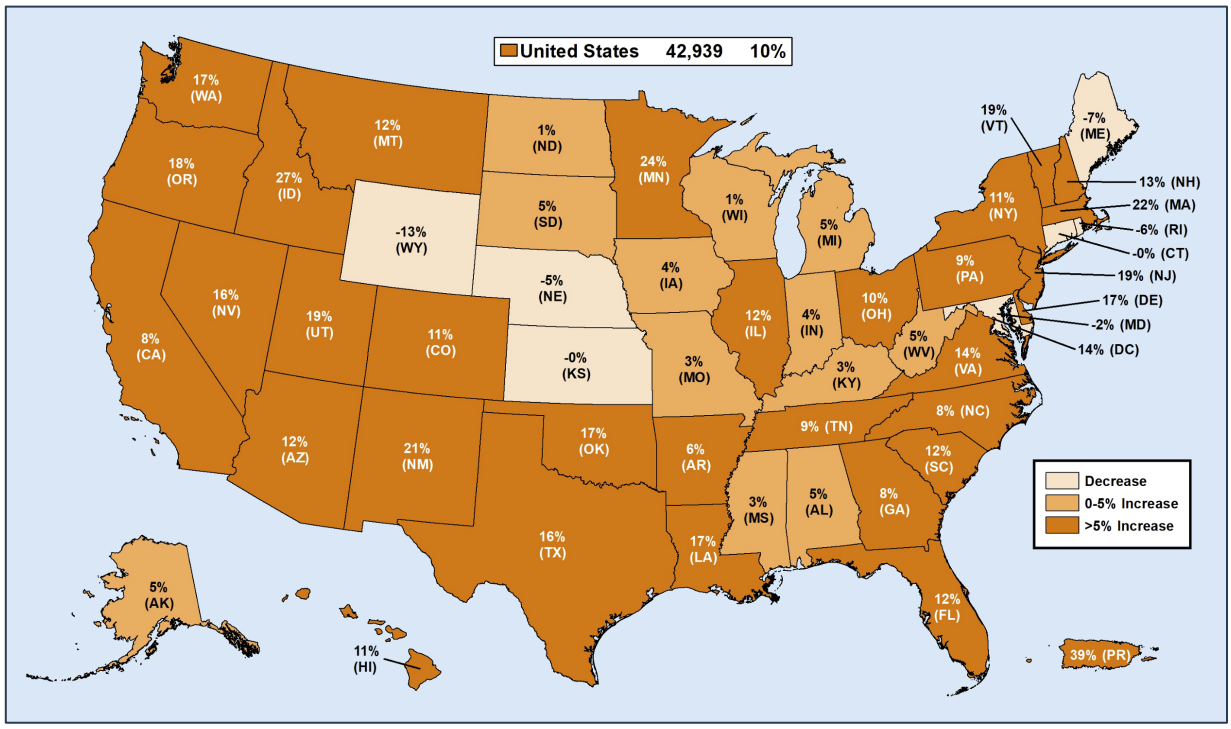


**Figure Source: NHTSA Traffic Safety Facts 2021 – State Traffic Data*

Figure 47: 2021 Fatalities and Percent Changes from 2020, by State (Person-Level)

PEDESTRIANS

A large share of traffic fatalities involves pedestrians. **Figure 46** shows that the state of Colorado was below the national average, with pedestrians accounting for approximately 13.3% of 2021 fatalities. In Mesa County, the share of fatalities that is represented by pedestrians peaked in 2017 at approximately 27% before leveling out in recent analysis years around 12% to 13%. In 2020, no pedestrian fatalities were recorded in Mesa County. In most analysis years, the share of pedestrian fatalities is lower than that of statewide and national shares. The share of pedestrian fatalities for all data sets can be seen in **Figure 47**.

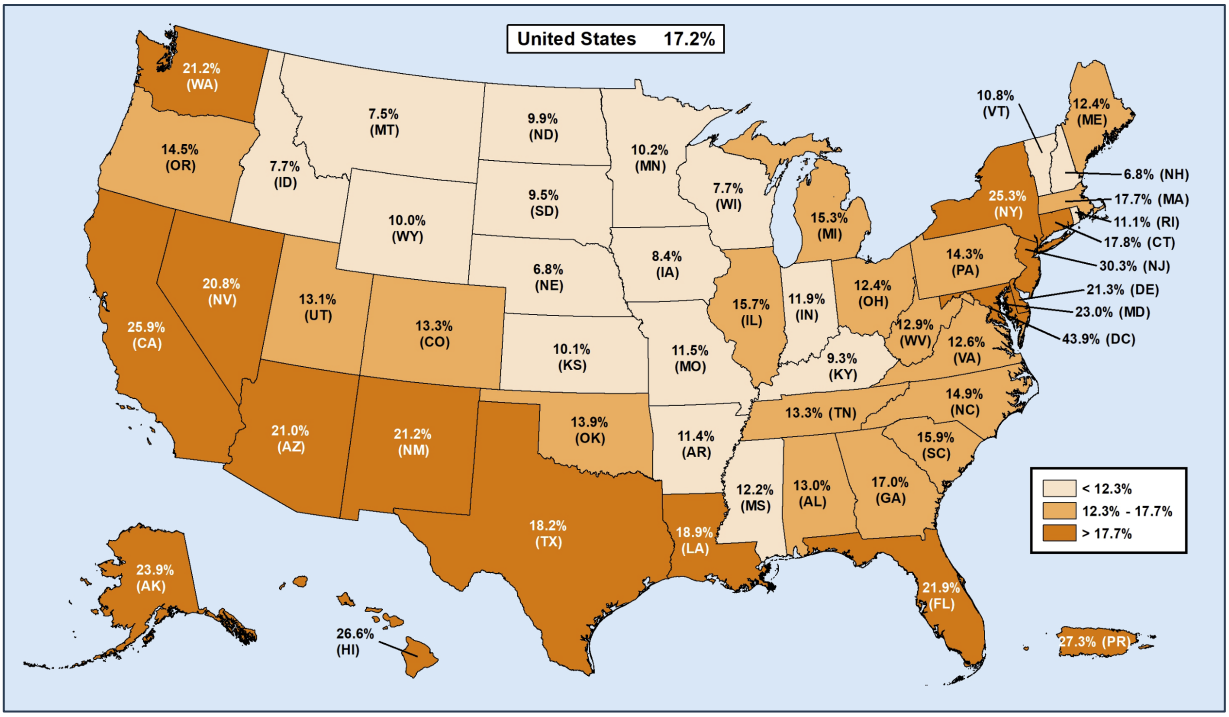


**Figure Source: NHTSA Traffic Safety Facts 2021 - Pedestrians*

Figure 48: Percentage of Total Fatalities Involving Pedestrians, by State (Persons), 2021

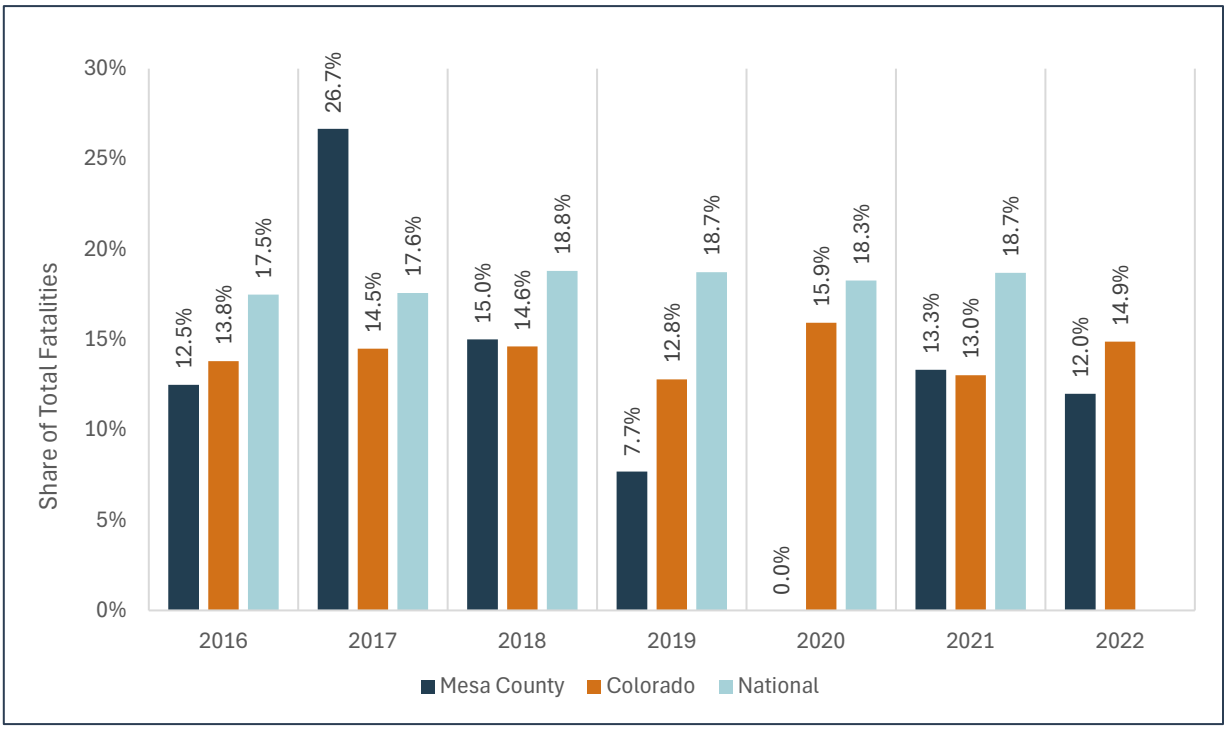


Figure 49: Share of Total Fatalities Who Were Pedestrians, Comparison between Mesa County, Statewide, and National Crash Data, 2016-2022

The percentage of pedestrian crashes in Mesa County stayed between 1.2% and 1.5% from 2016 to 2022. Statewide crash data saw lower pedestrian crash rates between 1.1% and 1.4%. National

crash data was, again, slightly lower with a range of 1.0% to 1.3% from 2016 to 2021. The comparison of pedestrian crashes between data sets is shown in **Figure 48**.

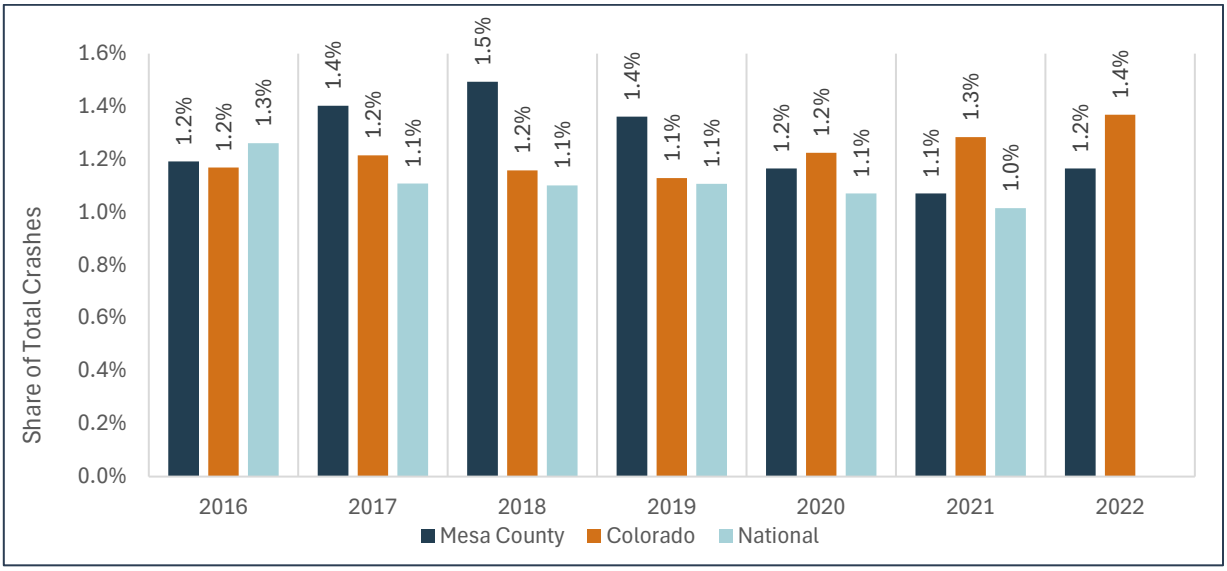


Figure 50: Pedestrian Crashes by Year for Mesa County, Statewide, and National Crashes, 2016-2022

BICYCLISTS

As shown in **Figure 49**, the percentage of crashes involving bicyclists was higher in Mesa County than in both Colorado and the United States from 2016 to 2022. The lowest percentage of bicyclist crashes in Mesa County was 1.3% in 2021 which is a higher percentage when compared to statewide and national data for all analysis years. A peak occurred in 2017 in Mesa County, where the percentage of bicyclist crashes reached 3.0%. Overall, bicyclist crashes happened at a more frequent rate in Mesa County compared to statewide and national rates.

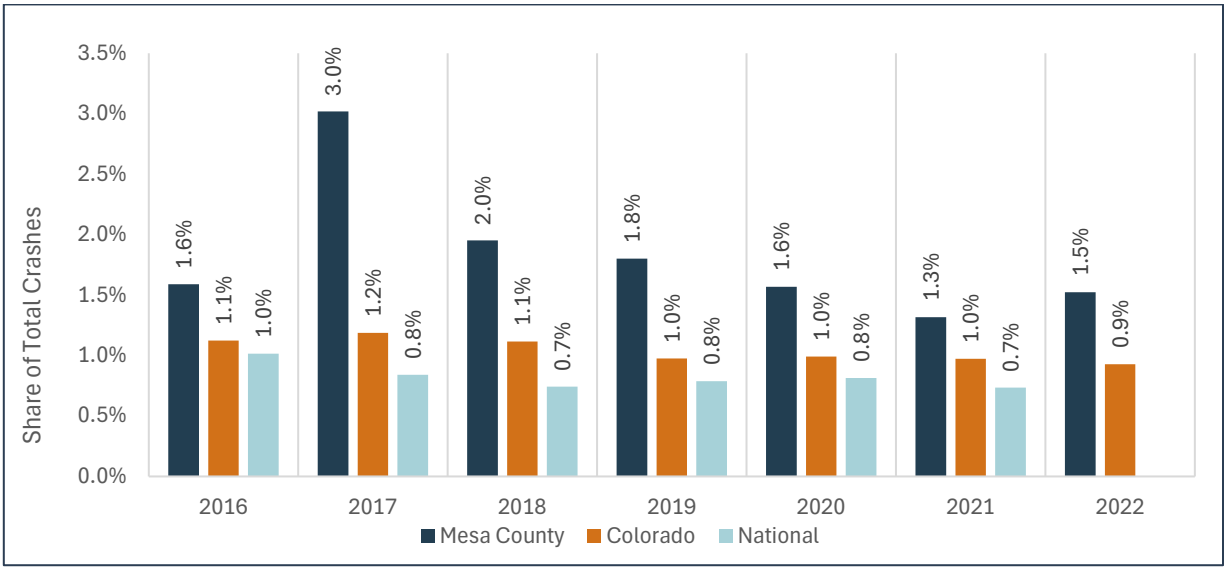


Figure 51: Bicycles Crashes per Year for Mesa County, Statewide, and National Crashes, 2016-2022

OLDER DRIVERS (65 AND OLDER)

Other vulnerable user groups were also analyzed, including older drivers and younger drivers. **Figure 50** compares the number of crashes involving older drivers in Mesa County to statewide and national crash data. The severity of those crashes is shown in **Figure 51** for both Mesa County and the state of Colorado. Note that national crash data is not available for the year 2022.

Older drivers involved in crashes were more common in Mesa County than in the state of Colorado as well as compared to national data from 2016 to 2019. From 2020 onwards, Mesa County data was more in line with that of statewide and national data. The severity of older driver crashes in Mesa County deviated from the statewide data. In Mesa County, the fatality rate is 1.5% compared to 0.5% for the state of Colorado. The percentage of no-injury crashes for crashes involving older drivers was lower than the statewide percentage (63.3% vs 82.6%).

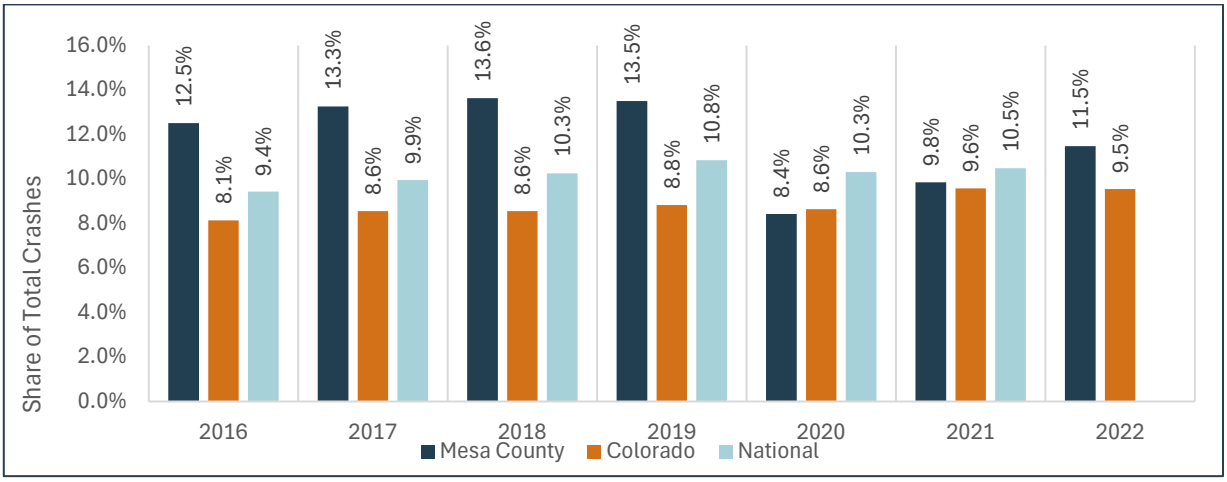


Figure 52: Older Driver Crashes per Year for Mesa County, Statewide, and National Crashes, 2021-2022[4]

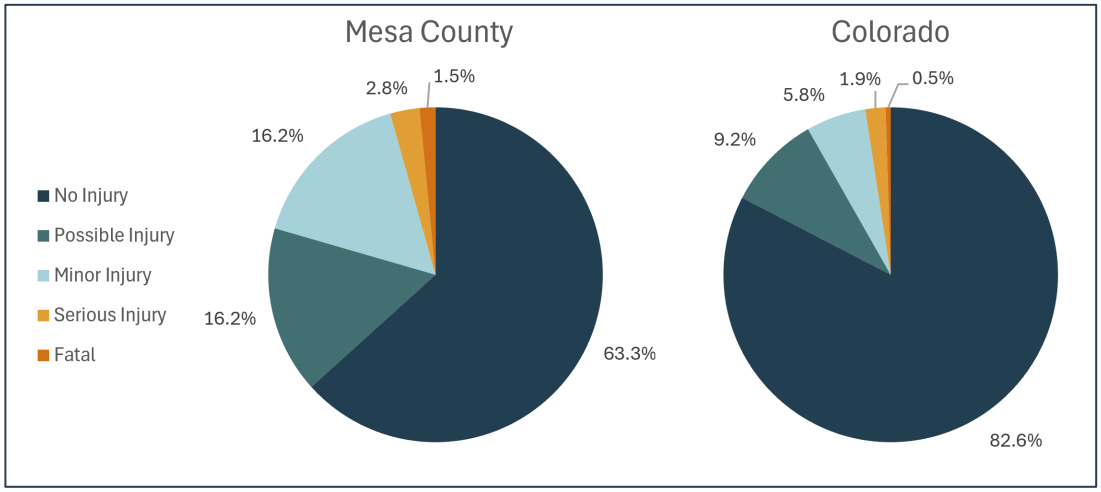


Figure 53: Severity of Older Driver Crashes, Mesa County and Statewide Crashes, 2021-2022

[4] Note: the different reporting systems before and after 2020 can contribute for the different trends in age-related crashes.

YOUNGER DRIVERS (24 AND YOUNGER)

Figure 52 compares the number of crashes involving younger drivers in Mesa County, the state of Colorado, and the United States from 2016 to 2022. The percentage of younger driver crashes is considerably higher for Mesa County in comparison to statewide and national data from 2016 to 2019. From 2020 and onwards, the Mesa County percentage of younger drivers drops and becomes similar to that of statewide and national data. The severity of younger driver crashes is displayed in **Figure 53**. The fatality rate of younger driver crashes does not differ much between Mesa County crashes and statewide crashes (0.2% vs 0.3%). The percentage of no-injury crashes greatly differs between the two data sets, however, with 65.8% in Mesa County and 84.7% in the State of Colorado.

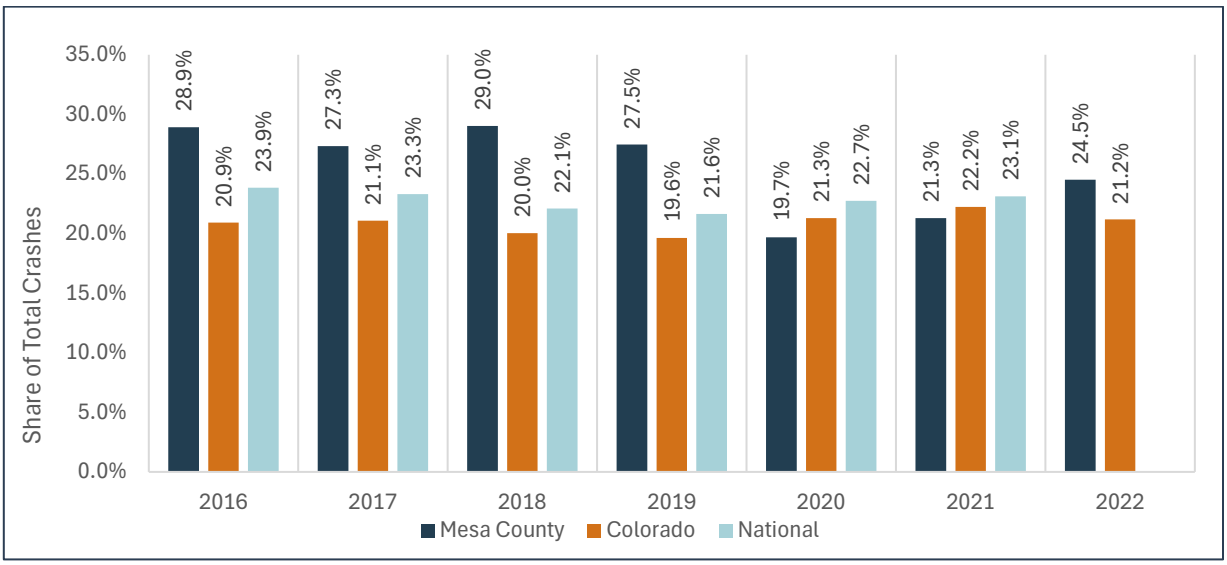


Figure 54: Younger Driver Crashes per Year for Mesa County, Statewide, and National Crashes, 2016-2022[5]

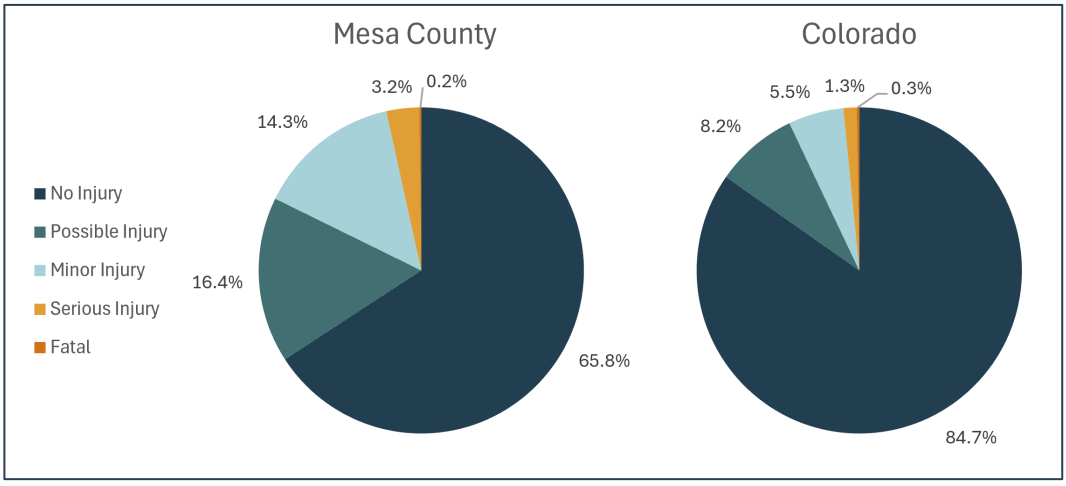


Figure 55: Severity of Younger Driver Crashes, Mesa County and Statewide Crashes, 2021-2022

[5] Note: the different reporting systems before and after 2020 can contribute for the different trends in age-related crashes.

FINAL CONSIDERATIONS

Crash queries were obtained from DiExSys Road Safety Analytics and the Colorado Department of Transportation. This report used existing tools to conduct a safety analysis of seven years from 2016 to 2022 and compared trends to statewide and national data. The following key findings are based on a review of crash data from 2016 to 2022:

- An annual average of 2,441 crashes per year were reported during the seven-year study period. This equates to approximately seven (7) crashes per day.
- Most crashes result in no injury (73.9%), just under one-quarter result in possible or minor injury (22.6%), 2.8% result in serious injury, and 0.7% result in fatality. This equates to one serious injury crash occurring approximately every five days and one fatal crash happening approximately every 21 days.
- The percentage of KSI crashes has increased in the most recent three years and no injury crashes have decreased in that same time span.
- Rear-end crashes were the most common crash type, followed by broadside crashes. These two crash types account for nearly half of all crashes (45.6%).
- For KSI crashes, the most common crash types were broadside crashes (16.1%), followed by overturning/rollover crashes (15.7%) and fixed object crashes (14.7%).
- Urban crashes make up a majority (87.9%) of the crashes in Mesa County, however, KSI crashes make up a larger percentage of total crashes among rural crashes (7.2% for rural vs 3.0% for urban).
- A majority of urban KSI approach turn crashes occurred at a signalized intersection (66.7%, 36 crashes). Impairment was a factor in 22.6% of urban KSI crashes while speeding was a factor in 22.3%. 15.8% of urban pedestrian/bicyclist crashes resulted in a KSI (83 crashes).
- The most common crash types for rural KSI crashes were overturning/rollover crashes (34.2%) followed by fixed object crashes (26.2%). Among fixed object crashes, guardrails/barriers were the most common object that vehicles collided with (42.6%).
- Speeding was a factor in 43.6% of rural KSI crashes. Aggressive driving was cited as the most common contributing factor in rural KSI collisions.
- For rural crashes, motorcycle crashes are overrepresented among crashes that result in injury or fatality. Crashes that involve motorcyclists resulted in injury 66.3% of the time and fatality 10.5% of the time. Specifically, nearly half of rural crashes involving a motorcyclist resulted in a KSI (48.8%, 42 crashes).
- For most analysis years, pedestrian crashes occurred at a higher frequency in Mesa County compared to statewide and national rates. Bicycle crashes occurred at a greater frequency in Mesa County than both statewide and national rates.
- In Mesa County, both younger and older drivers were involved in crashes at a higher frequency when compared to statewide and national data for most analysis years.

Appendix B

Development of The Mesa County High Injury Network

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

HIN MEMORANDUM

TO:	Rachel Peterson – Transportation Planner – Grand Valley MPO/TPR Dana Brosig, PE – RTPO/ GVMPO Director – Grand Valley MPO/TPR Daniel Larkin, PE – Transportation Engineer – Mesa County Engineering Eric Mocko, PE – Transportation Engineer – City of Grand Junction
FROM:	Denise Baker, PhD, PE, RSP1 – Project Engineer – Y2K Engineering
DATE:	July 31, 2024
SUBJECT:	Methodology documentation of the development of the Mesa County High Injury Network

Development of the High Injury Network (HIN), or the mapping of corridors where high numbers of people have been killed and severely injured in traffic crashes, is a tool for road safety initiatives. This approach will help county staff focus limited resources on what's needed. Funds can be invested in areas that are most impacted by crashes that result in death and injury. Further data analysis of roadway characteristics along the HIN will allow for the identification and assignment of appropriate design solutions. Due to the high concentration of KSI crashes within the urban area, it was recommended that HIN be conducted for that region.

The HIN is planned to be reviewed and updated regularly as new data becomes available and new trends might be identified.

DATA

CRASHES

The data used in this report includes exported crash data from 2016-2022 DiExSys VZS (third-party vendor licensed by Mesa County), complemented by additional CDOT data in 2021 and 2022 to add extra fields not available from DiExSys Road Safety Analytics. Power BI software was used to compile all crashes provided and clean the data that was provided. That allows for a streamlined way to manage the existing data and draw meaningful insights. The data presented here is the latest available data, however, it is subject to change as new information is obtained and more refinements are performed. The 2024 County of Mesa's HIN used a 7-year historical data set (2016-2022) from the Colorado Department of Transportation (CDOT) statewide crash database and a third-party vendor contracted to geocode crashes with missing coordinates. A total of 592 crashes that resulted in serious injury or death (KSI) were identified within Mesa County, 548 of which were reported within the urban boundary. This data was separated into two non-overlapping categories based on whether crashes were located within the designated urban or rural areas of Mesa County.

Of the 592 KSI crashes in Mesa County, 458 were located in the urban area. Of the 458 urban KSI crashes, 178 (38.9%) were considered for the intersection evaluation, 247 (53.9%) were considered in the segment evaluation, and 33 (7.2%) were not considered due to being located on local roadways.

URBAN AREA

The area provided shown in **Figure 1** is defined based on 2020 census data. That area has been approved as the urban boundary by CDOT and FHWA.

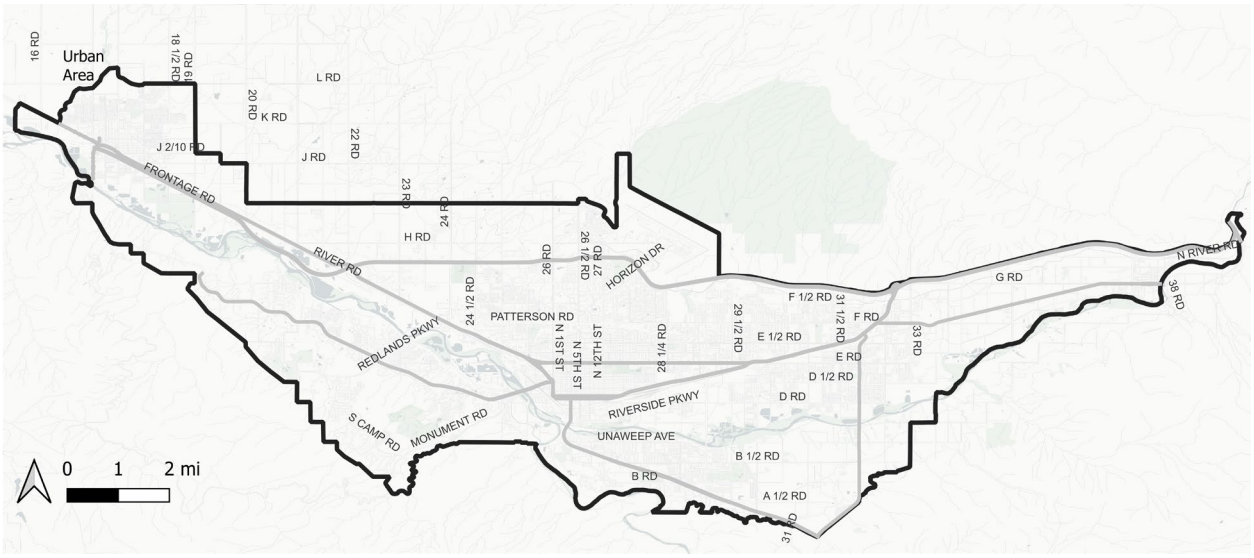


Figure 1: Urban Area Considered in the HIN Evaluated

CENTERLINES

The centerline file was obtained from the street centerline from the Open Data catalog. For the purposes of this study, only principal arterials, minor arterials, major collectors and minor collectors were considered. A total of 370.5 miles were evaluated. Consistent segment length is an important piece of a sound HIN method. To segment the roadways evaluated, roads were separated at major intersections (arterial/arterial or arterial/collector). Segments that were smaller than 0.3 miles were consolidated and segments that were longer than 0.7 miles were further separated, as possible by the existing road layout of the region. **Figure 2** shows the final segmentation used on the centerlines evaluated.

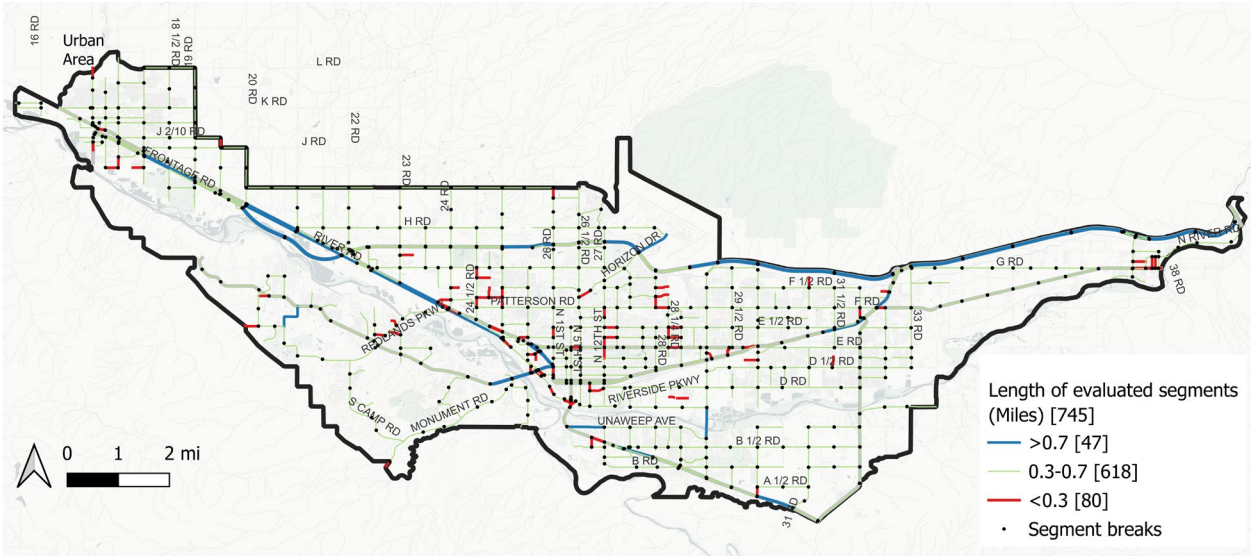


Figure 2: Length of Evaluated Segments

INTERSECTIONS

For the intersection analysis of the HIN evaluation, only 404 major intersections were considered. Major intersections (arterial/arterial, arterial/collector, and collector/collector) were selected for evaluation. Additional intersections were included in the evaluation due to high crash frequency or selected by County/City staff. Crashes within a 150-foot radius from the center of the intersection were considered as part of the intersection evaluation and excluded from the segment evaluation. Signalized and unsignalized intersections were considered together. **Figure 3** shows the evaluated intersections in relation to the evaluated segments.

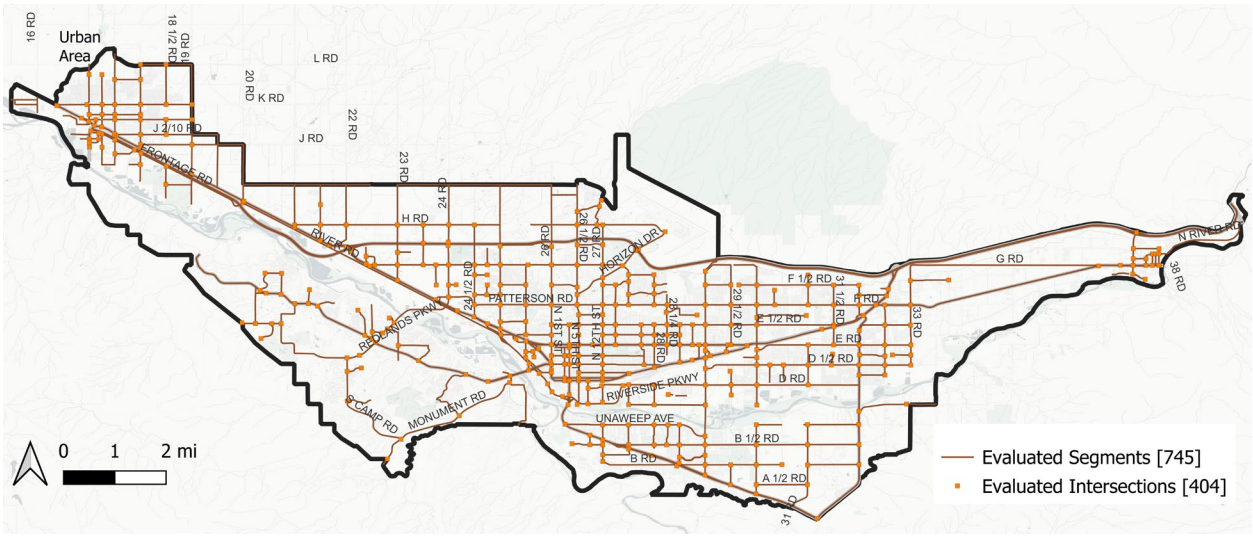


Figure 3: Evaluated Intersections and Segments

Table 1: Crash Frequency at Evaluated Intersections

	KSI/7 years	# Intersections
	0	297
	1	69
	2	18
Proposed HIN	3	14
	4	1
	5	4
	7	1
	Grand Total	404

The average KSI per intersection was 0.44 crashes (178 crashes / 404 intersections) with a standard deviation of 0.94 crashes. The recommended threshold for considered intersections in the HIN was determined to be 3 KSI crashes (approximately equal to the average + three standard deviations). The number of intersections with 3 or more KSI crashes was observed to be 20 within the seven-year period (2016-2022) as shown in **Table 1**. A list of the intersections with 2 KSI crashes is included in Attachment A for monitoring.

HIN Intersection Inclusion Criteria
3 Crashes in a 7-year period

20 of the 404 (4.9%) evaluated intersections were added to the HIN. Of the 178 crashes at the evaluated intersections, 73 (41.0%) happened at an HIN intersection. The HIN intersections are listed in **Table 2** and shown in **Figure 1**.

Table 2: Intersections on the High Injury Network

Intersections	KSI Count 7-Years
S 4th St & Ute Ave	7
29 Rd : D Rd & Riverside Pkwy	5
29 Rd & Teller Ave	5
25 Rd & Patterson Rd	5
29 Rd & Patterson Rd	5
28 1/4 Rd & Patterson Rd	4
N 10th St & North Ave	3
Elm Ave & N 7th St	3
N 1st St : Rood Ave & W Rood Ave	3
Grand Ave & N 5th St	3
Grand Ave & N 12th St	3
Hwy 6 : N 1st St & North Ave	3
N 12th St & North Ave	3
28 1/4 Rd & North Ave	3
29 Rd & North Ave	3
I70b & North Ave	3
31 1/2 Rd & I70B	3
24 1/2 Rd & Patterson Rd	3
29 1/2 Rd & Patterson Rd	3
30 Rd & Patterson Rd	3

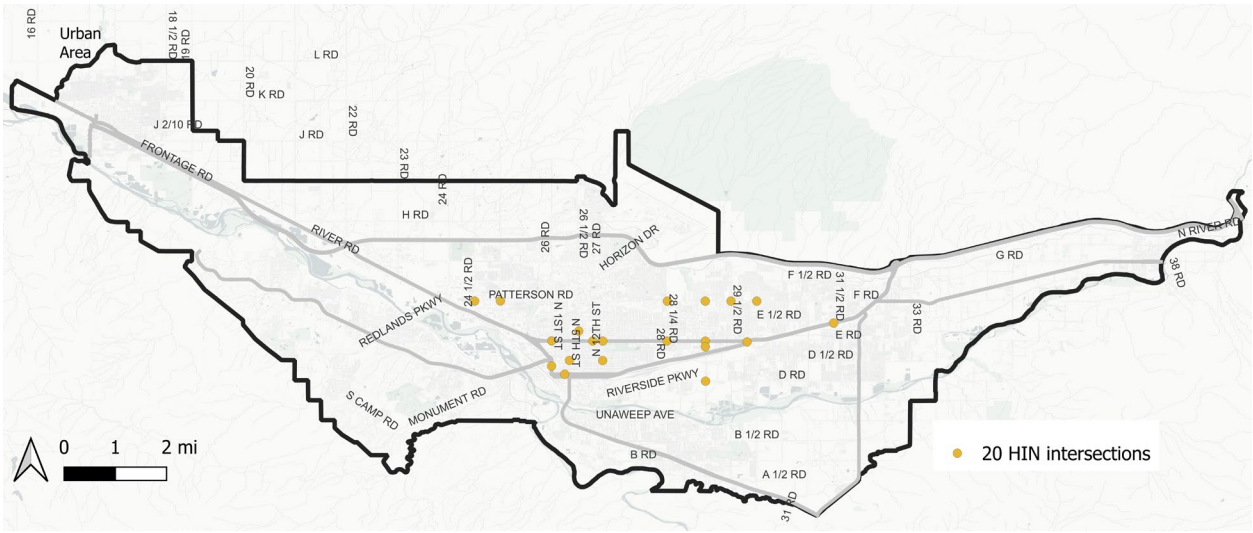


Figure 4: 2024 High Injury Network – Location of Intersections

SEGMENTS

Segments within the urban area of Mesa County were separated into two groups: arterials/collectors and I-70. The street centerlines of segments were merged by name and split at arterials and collectors. Each street name represents a continuous line, but these lines are segmented at key intersections with major roads to facilitate a more detailed and accurate analysis of the transportation network. Crashes were considered segment crashes if they were at least 150 feet away from an evaluated intersection. The average length of the 745 identified segments was calculated as 0.50 miles long. A total of 370.5 miles were evaluated and separated into 623 segments.

A total of 60 segments were identified on I-70 and 685 segments were identified on arterial and collector roadways. The average KSI per mile for I-70 and arterial/collector segments was 0.69 and 0.73 crashes per mile, respectively. A minimum of 2 KSI crashes was also required for inclusion on the HIN for both the arterials/collector's group and the I-70 group. The statistical details of the samples evaluated on groups are displayed in **Table 4 and Table 5**.

Table 3: Segment Statistics

	# Segments	Average	Standard Deviation (std)	Average+2std	Average+3std
Arterial/Collector	685	0.69	1.59	3.87	5.46
Interstate 70	60	0.73	1.03	2.79	3.81
Grand Total	745	0.69	1.55	3.79	5.34

Table 4: Crash Frequency at the Evaluated Segments

	# Crashes	# Segments	Length (miles)	Average of Crash/Mile	Minimum of Crash/Mile	Maximum of Crash/Mile
Collector/ Arterial	0	537	246.7	0.0		
	1	102	52.3	2.2	0.6	5.7
	2	31	14.7	4.6	2.2	8.0
	3	13	6.5	6.4	4.8	12.0
	4	1	0.5	8.5		
	5	1	0.5	10.0		
	All Collector/Arterials	685	321.1	0.7	0.0	12.0
	# Crashes	# Segments	Length (miles)	Average of Crash/Mile	Min of Crash/Mile	Max of Crash/Mile
I70	0	35	27.0	0.0		
	1	18	15.6	1.4	0.7	2.5
	2	4	3.4	2.6	1.7	4.0
	3	3	3.4	2.7	2.3	2.9
	All I70	60	49.4	0.7	0.0	4.0
ALL	**All Segments**	**745**	**370.5**	**0.7**	**0.0**	**12.0**

HIN Segment Inclusion Criteria
3 Crashes in a 7-year period OR
2 Crashes in a 7-Year period and 6 or more crashes per mile on Collector or Arterial OR
2 Crashes in a 7-Year period and 3.8 or more crashes per mile on I70

For the arterial/collector group, 20 segments had 3 KSI crashes or 2 or more KSI crashes while also possessing more than 6 crashes per mile. 4 segments were identified in the I-70 group that featured 3 KSI crashes or 2 or more KSI crashes and more than 3.8 KSI crashes per mile. Overall, a total of 25 segments were identified between both groups that met the recommended thresholds for inclusion in the HIN. The identified HIN segments that were arterials/collectors had a total length of 9.1 miles, while the I-70 segments had a total length of 3.9 miles. Altogether, the length of the identified HIN segments totaled 13 miles.

The list of HIN segments is shown in **Table 7** and the location of the segments is displayed in **Figure 5**. **Attachment B** shows segments that were close to the HIN threshold but not included in the final network, for collision pattern monitoring.

Table 5: HIN Segments

Segment Name	From	To	Length (Miles)	Crashes	Crash/Mile	Evaluation
941-North Ave	23rd St	28 1/4 Rd	0.5	5	10.0	Collector/Arterial
447-North Ave	7th St	12th St	0.5	4	8.5	Collector/Arterial
1041-N 12th St	North Ave	Elm Ave	0.3	3	12.0	Collector/Arterial
484-North Ave	28 1/2 Rd	Melody Ln	0.4	3	8.0	Collector/Arterial
989-Patterson Rd	Cottage Meadows Ct	31 Rd	0.4	3	7.5	Collector/Arterial
529-Patterson Rd	26 1/2 Rd: 7th St	12th St	0.5	3	6.0	Collector/Arterial
170-Patterson Rd	26 Rd: 1st St	26 1/2 Rd: 7th St	0.5	3	6.0	Collector/Arterial
534-Orchard Ave	15th St	23rd St	0.5	3	6.0	Collector/Arterial
171-Patterson Rd	24 1/2 Rd	25 Rd	0.5	3	5.9	Collector/Arterial
1053-Hwy 50	Riverside Pkwy Ramp	Unaweep Ave	0.5	3	5.8	Collector/Arterial
994-E 1/2 Rd	31 Rd	31 1/2 Rd	0.5	3	5.7	Collector/Arterial
1027-Riverside Pkwy	Evergreen Rd	29 Rd	0.5	3	5.6	Collector/Arterial
422-Ute Ave	1st St	7th St	0.6	3	5.1	Collector/Arterial
423-Pitkin Ave	1st St	7th St	0.6	3	4.8	Collector/Arterial
577-Patterson Rd	24 Rd	24 1/2 Rd	0.6	3	4.8	Collector/Arterial
332-I70	EB, MM 38	EB, MM 39	1.0	3	2.9	I70
228-I70	EB, 33 Rd	EB, MM 38	1.0	3	2.9	I70
398-I70	WB, MM 40.3	WB, Elberta Ave	1.3	3	2.3	I70
220-North Ave	28 1/4 Rd	28 1/2 Rd	0.2	2	8.0	Collector/Arterial
542-N 12th St	Bookcliff Ave	Patterson Rd	0.2	2	8.0	Collector/Arterial
501-N 12th St	Gunnison Ave	North Ave	0.3	2	7.4	Collector/Arterial
621-E Eighth St	Fifth St	Main St	0.3	2	7.0	Collector/Arterial
294-Patterson Rd	32 Rd	I70b	0.3	2	6.2	Collector/Arterial
430-Hwy 6 And 50	Valley Ct	I70 Wb Ramp	0.3	2	6.0	Collector/Arterial
268-I70	EB, 26 1/2 Rd	EB, 27 Rd	0.5	2	4.0	I70

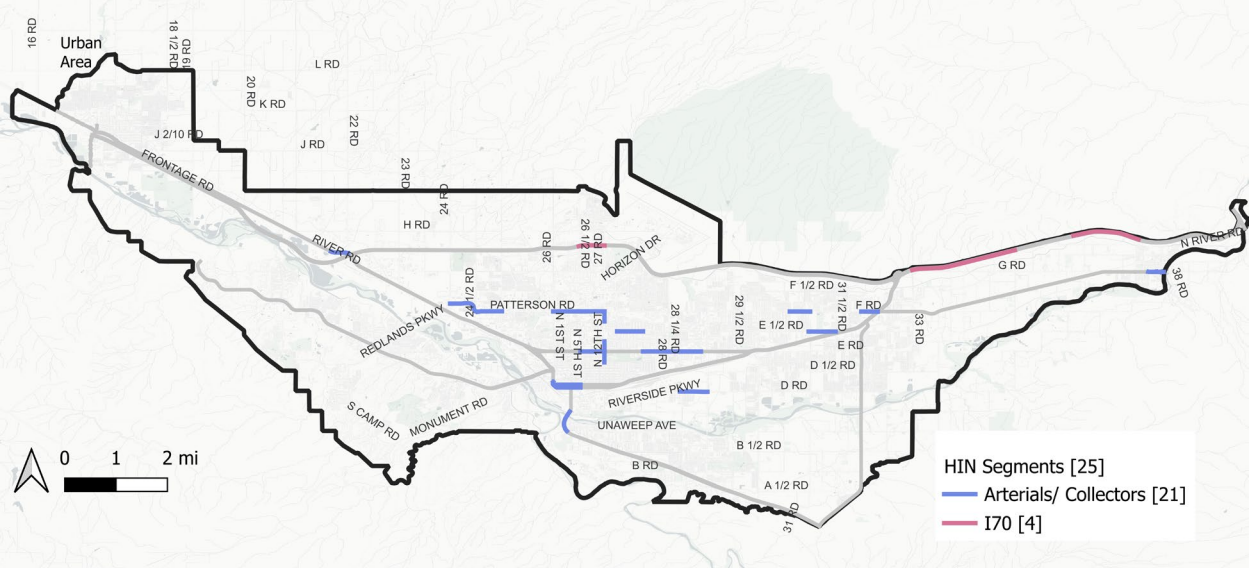


Figure 5: 2024 High Injury Network – Location of Segments

13.0 of the 370.5 (3.5%) miles of evaluated segments were added to the HIN. Of the 247 crashes considered in the segment evaluation, 71 (28.8%) happened at a HIN segment (more than 150 feet from an evaluated intersection). A detailed comparison of the HIN with the other segments is shown in **Table 6**.

Table 6: Comparison of HIN with Other Segments

	#Segments	Length (Miles)	Share of Miles	Crashes	Share of Crashes	Average of Crash/ Mile
Not on HIN	720	357.5	96.5%	176	71.3%	0.5
HIN Arterial/Collectors	21	9.1	2.5%	60	24.3%	6.9
HIN I70	4	3.9	1.0%	11	4.5%	3.0
All Segments	745	370.5	100.0%	247	100.0%	0.7

FINAL CONSIDERATIONS AND NEXT STEPS

The Mesa County Urban Area High Injury Network is shown in Figure 6. It includes 20 intersections, 21 arterial/collector segments, and 4 I-70 segments.

As new projects are implemented and new crash data becomes available, segments within the urban area of Mesa County should be re-evaluated to identify the locations that should be prioritized.

Additional locations which crash history did not meet the threshold for inclusion on the HIN, but were close to it are listed in the Appendices of this memorandum. Those locations should be monitored for their crash trends as they evolve.

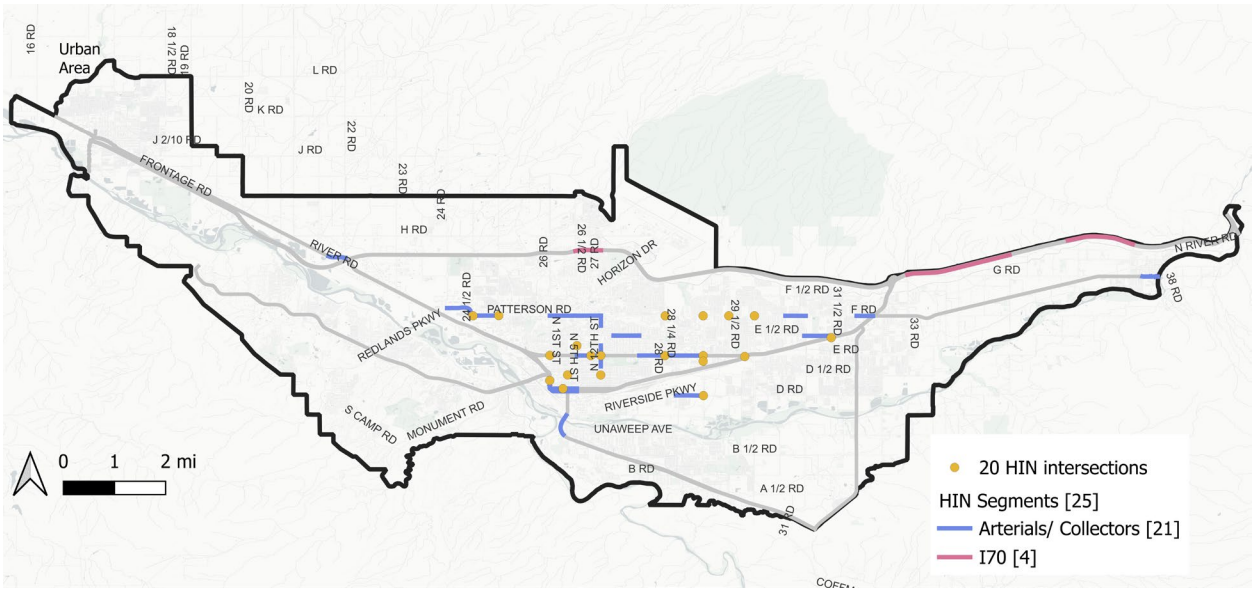


Figure 6: Final HIN for Mesa County Urban Area

ATTACHMENT A

LIST OF INTERSECTIONS CLOSE TO THE THRESHOLD FOR INCLUSION ON THE HIN – LOCATIONS TO BE MONITORED

Intersection	Crashes
28 3/4 Rd & North Ave	2
27 Rd & Hwy 50	2
32 Rd & B 1/2 Rd	2
Pitkin Ave & S 5th St	2
Gunnison Ave & N 5th St	2
N 7th St & North Ave	2
28 1/2 Rd & North Ave	2
Melody Ln & North Ave	2
32 Rd & Mesa Ave	2
I70b & Warrior Way	2
26 Rd : N 1st St & Patterson Rd	2
B 3/4 Rd & Hwy 50 : Linden Ave	2
Hwy 6 And 50 : N 1st St : W Grand Ave	2
Hwy 6 And 50 & N 1st St	2
25 Rd & Hwy 6 And 50	2
19 Rd & K Rd	2
J 6/10 & 19 Rd	2
I70B & F Rd	2

ATTACHMENT B

LIST OF SEGMENTS CLOSE TO THE THRESHOLD FOR INCLUSION ON THE HIN – LOCATIONS TO BE MONITORED

Segment Name	From	To	Length (Miles)	Crashes	Crash/Mile	Evaluation
1050-B 1/2 Rd	Allyce Ave	28 Rd	0.3	2	5.8	Collector/Arterial
1021-D Rd	31 5/8 Rd	32 Rd	0.4	2	5.4	Collector/Arterial
1033-North Ave	17th St	N 23rd St	0.4	2	5.3	Collector/Arterial
571-Patterson Rd	28 1/4 Rd	28 3/4 Rd	0.4	2	4.8	Collector/Arterial
1071-Riverside Pkwy	S 5th St	S 9th St	0.4	2	4.6	Collector/Arterial
417-Ute Ave	S 7th St	S 12th St	0.5	2	4.3	Collector/Arterial
617-Hwy 6 And 50	21 Rd	MM 25.4	0.5	2	4.3	Collector/Arterial
914-23 Rd	I70	H Rd	0.5	2	4.3	Collector/Arterial
841-N 5th St	Grand Ave	North Ave	0.5	2	4.1	Collector/Arterial
407-Riverside Pkwy	S 9th St	15th St Alignment	0.5	2	4.1	Collector/Arterial
596-E Rd	31 Rd	31 1/2 Rd	0.5	2	4.0	Collector/Arterial
505-29 Rd	Orchard Ave	Patterson Rd	0.5	2	4.0	Collector/Arterial
838-N 5th St	North Ave	Orchard Ave	0.5	2	4.0	Collector/Arterial
583-Horizon Dr	G Rd: 27 1/2 Rd	I70	0.5	2	4.0	Collector/Arterial
165-N 12th St	Patterson Rd	Ridge Dr	0.5	2	4.0	Collector/Arterial
55-W Independent Ave	25 1/2 Rd	1st St	0.5	2	4.0	Collector/Arterial
931-Redlands Pkwy	Colorado River	23 1/2 Rd	0.5	2	3.9	Collector/Arterial
979-Horizon Dr	Grand Valley Canal	12th St	0.5	2	3.8	Collector/Arterial
939-Orchard Ave	1st St	N 7th St	0.5	2	3.8	Collector/Arterial
981-27 1/2 Rd	Patterson Rd	Ridge Dr	0.6	2	3.4	Collector/Arterial
436-Hwy 6 And 50	19 Rd	19 1/2 Rd	0.6	2	3.4	Collector/Arterial
1019-32 Rd	C 1/2 Rd	D Rd	0.7	2	3.0	Collector/Arterial
1006-Front St	36 Rd	G Rd	0.7	2	3.0	Collector/Arterial
270-I70	EB, MM 32	EB, MM 32.5	0.7	2	2.9	I70
428-Hwy 6 And 50	I70 Wb Ramp	G Rd	0.7	2	2.9	Collector/Arterial
394-I70b	Warrior Way	32 Rd	0.9	2	2.2	Collector/Arterial
216-I70	EB, 33 Rd	EB, MM 38	1.0	2	1.9	I70
326-I70	EB, MM 35.5	I70B Access Rd	1.2	2	1.7	I70

Appendix C

Signalized Intersection and Rural Road Safety Countermeasure Toolbox

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

Mesa County

Safety Action Plan

Enhancing Roadway Safety in Our Community

Strategy Toolbox

October 2024 Version

Introduction

As part of the Safety Action Plan deliverables and commitment to the SS4A grant requirements, an engineering toolbox was created to support two engineering strategies: BSS 1.2 and BSS 2.4. The toolbox is to be used as a resource for signalized intersections and rural roads, and offers a variety of proven engineering based solutions that can be used in a context sensitive, programmatic, and/or systemic approach.

The two linked strategies are:

Strategy BSS 1.2: Make improvements at dangerous intersections.

Action: Evaluate HIN intersection locations, ***use the signalized intersections toolbox,*** seek funding and grants when applicable, improve or modify infrastructure, monitor and evaluate effectiveness, and maintain infrastructure.

Strategy BSS 2.4: Prioritize capital improvements on the High Risk Network (HRN)

Action: After the HRN is complete, evaluate one HRN location per year, and ***use the rural road engineering toolbox*** to analyze and identify improvements. Seek funding for implementation/construction.

Contents

SIGNALIZED INTERSECTIONS 05

RURAL ROADS 19

Mesa County
Safety Action Plan
Enhancing Roadway Safety in Our Community

Description of Toolbox Elements

Name of Application

Description of Application

Description of when and where to apply this particular application and things to consider when deciding on an application

List of crash types an application can impact

Roundabouts

Description:

Install roundabouts at appropriate intersections to slow traffic, reduce conflict points, and therefore reduce the frequency and severity of crashes.

When/Where to Use:

Roundabouts address angle, broadside, and left turn crashes at intersections. This tool can be used at complex intersections to reduce conflict points as roundabouts have fewer conflict points than traditional intersections.

Considerations: Available right-of-way, traffic volumes/operations, community acceptance, and designing for all users, including large vehicles and pedestrians.

Associated Crash Type: Angle, Broadside, Left-Turn Crashes

Image Source: City of Tempe, AZ

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

Converting a signalized intersection to a roundabout is associated with 78% reduction in fatal and serious injuries.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=226

Description of Toolbox Elements

Roundabouts

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Install roundabouts at appropriate intersections to slow traffic, reduce conflict points, and therefore reduce the frequency and severity of crashes.

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Roundabouts address angle, broadside, and left turn crashes at intersections. This tool can be used at complex intersections to reduce conflict points as roundabouts have fewer conflict points than traditional intersections.

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Associated Crash Type: Angle, Broadside, Left-Turn Crashes

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

Converting a signalized intersection to a roundabout is associated with 78% reduction in fatal and serious injuries.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=226

Example Picture

Estimated Cost of Application
$ = $0 to $5,000
$$ = $5,001 to $20,000
$$$ = $20,001 to $50,000
$$$$ = $50,001 to $100,000
$$$$$ = $100,001 and above

Effectiveness Score of Application

Points are assigned based on crash modification factor (CMF) reductions for total or pedestrian type crashes:
0%-6% CMF = 10
7%-13% CMF = 20
14%-20% CMF = 30
21%-27% CMF = 40
28% CMF = 48
29% CMF = 49
30% CMF and above = 50

Points are assigned based on crash modification factor (CMF) reductions for specific type crashes:
0%-11% CMF = 10
12%-23% CMF = 20
24%-35% CMF = 30
36%-47% CMF = 40
48% CMF = 48
49% CMF = 49
50% CMF and above = 50

If based on Safe Systems Roadway Design Hierarchy:
Tier 1 = 50
Tier 2 = 40
Tier 3 = 30
Tier 4 = 20
Tier 5 = 10

01 Signalized Intersections

Signalized Intersection Section Contents

Roundabouts	07
Improved Left-Turn Movements at Signals	08
Reduced Turning Radius and Raised Corner Islands	09
Restricted Parking Near Intersections	10
Yellow Change and All Red Intervals	11
Intersection Lighting	12
Backplates with Retroreflective Borders	13
Improved Sight Visibility for Turning Vehicles	14
Crosswalk Visibility Enhancements	15
Pedestrian Signal Enhancements	16
Dedicated Bicycle Facilities	17
Emergency Vehicle Preemption	18

Roundabouts

Description:

Install roundabouts at appropriate intersections to slow traffic, reduce conflict points, and therefore reduce the frequency and severity of crashes.

When/Where to Use:

Roundabouts address angle, broadside, and left turn crashes at intersections. This tool can be used at complex intersections to reduce conflict points as roundabouts have fewer conflict points than traditional intersections.

Considerations: Available right-of-way, traffic volumes/operations, community acceptance, and designing for all users, including large vehicles and pedestrians.

Associated Crash Type: Angle, Broadside, Left-Turn Crashes

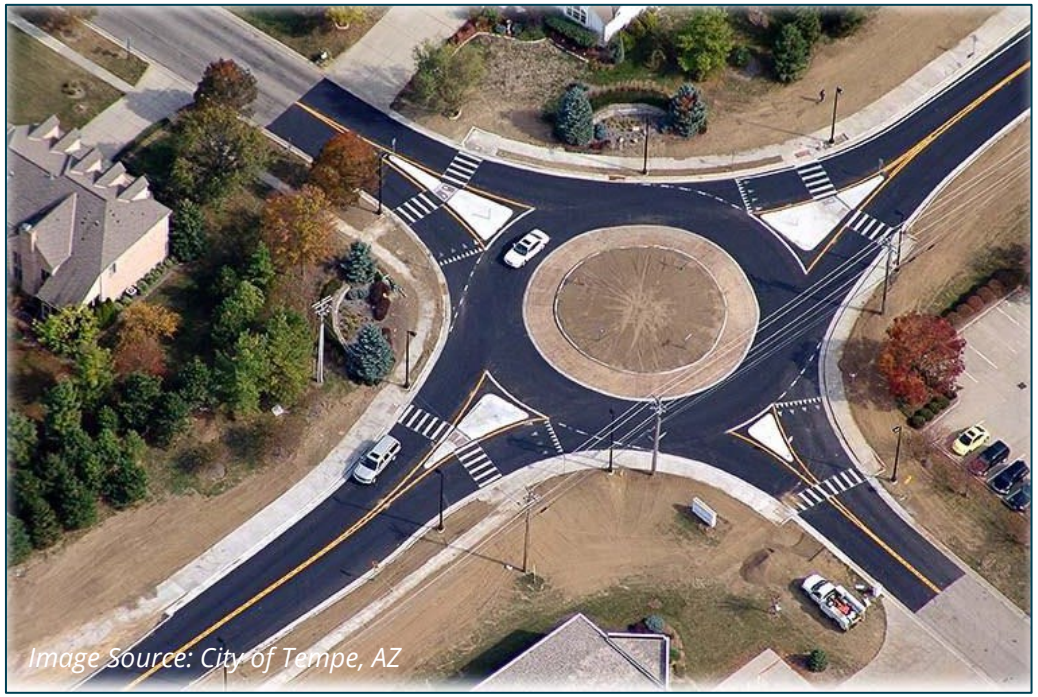


Image Source: City of Tempe, AZ

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

Converting a signalized intersection to a roundabout is associated with **78%** reduction in fatal and serious injury crashes.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=226

Improved Left Turn Movements at Signals

Description:

Improve left-turn conflicts through signal timing, such as implementing protected left-turn signal phasing at high-risk intersections. This includes conversion of permissive or permissive/protected left-turn signal timing phases to a protected only left turn signal timing phase, reducing conflicts with through vehicles. Consideration could also be given to restricting left turns at designated locations. This could be coupled with hardened centerlines to tighten turn radius, and improved signing and striping, such as vehicle tracking pavement markings.

When/Where to Use:

This tool is proven to addresses left-turn crashes at signalized intersections, particularly those involving motorcycles, pedestrians, and bicyclists. Considerations: Evaluation to determine priority order of implementation; phasing may be by time of day or all day; longer queues may spill back into travel lanes requiring reconstruction to extend left turn lane or install dual left turn lanes; older signal mast arms may need to be reconstructed to install left turn signal in alignment with the left turn lane(s). Double service of left turn phase in a cycle may mitigate the need for dual left turn lanes, but will lengthen overall cycle lengths.

Associated Crash Type: Left-Turn Crashes

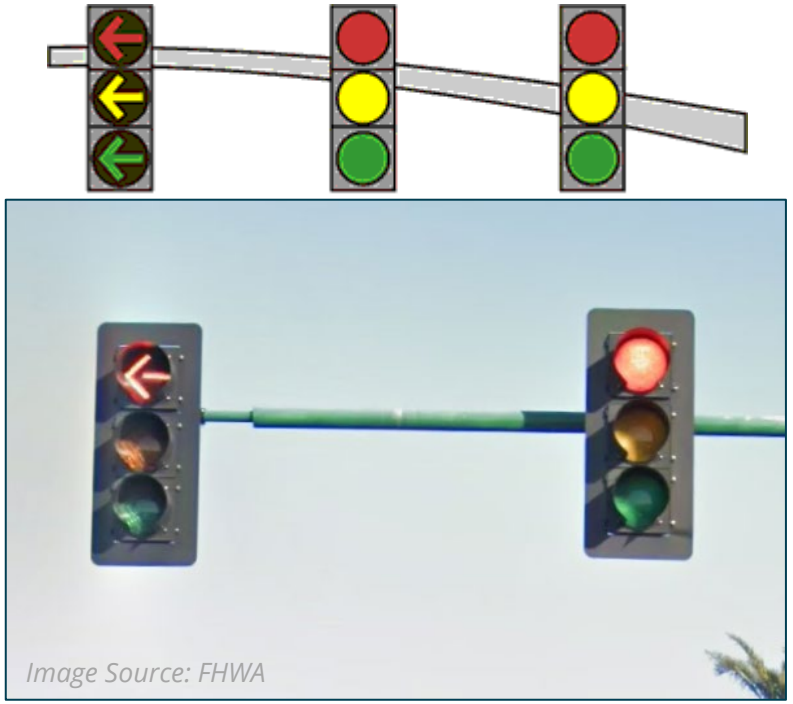


Image Source: FHWA

Cost:

$ - $$$

Effectiveness Prioritization Score :

50 / 50

Conversion to a fully protected left turn is associated with a **99%** reduction in left turn crashes.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=339

Reduced Turning Radius And Raised Corner Islands

Description:

Implement features like reduced turning radii, raised corner islands, and right-turn wedges to slow vehicles at intersections and reduce conflicts between vehicles and other road users. This can be accomplished through curb reconstruction, or by using temporary/quick build materials.

When/Where to Use:

This tool addresses crashes involving right turning vehicles, and improves safety for bicyclists and pedestrians by decreasing the speed of the vehicles and improving visibility of crossings. Considerations: material type, maintenance needs, ensuring compliance with design standards, and minimizing disruption during installation.

Associated Crash Type: Right-Turn

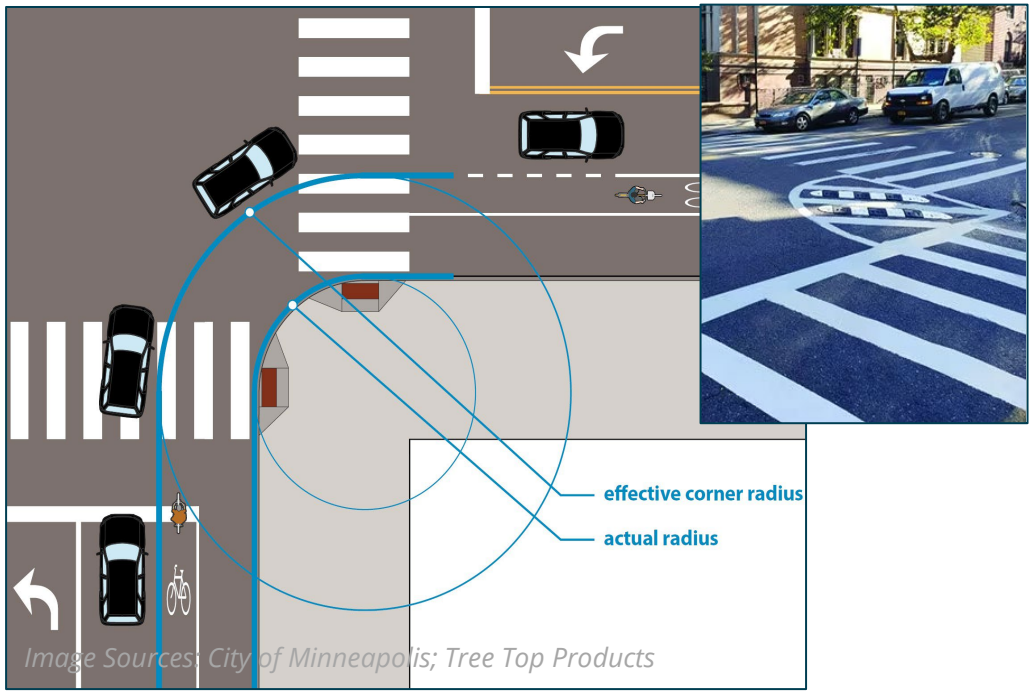


Image Sources: City of Minneapolis; Tree Top Products

Cost:

$$ - $$$

Effectiveness Prioritization Score :

50 / 50

Modifying the right turn lane design, including reduced turning radius, is associated with a **44%** reduction on all crashes.

Effectiveness Source: https://www.cmfclearinghouse.org/detail.php?facid=8496

Restricted Parking Near Intersections

Description:

Sightlines of pedestrians and motorists are limited when vehicles are parked too close to pedestrian crossings, which increases risk for pedestrians who intend to cross the road. Evaluate parking needs and restrict parking at locations where parking is permitted near the intersections to improve visibility. This could be accomplished through either signage and curb markings or curb extensions, which could be constructed with curb or quick build materials.

When/Where to Use:

This increases sight distance and improves visibility. It is applicable when parked vehicles restrict sight distance for turning movements. It responds to pedestrian and bicyclist collisions, right turn collisions, and angle crashes.

Associated Crash Type: Vehicle-Pedestrian, Bicyclists, Right-Turn, Angle

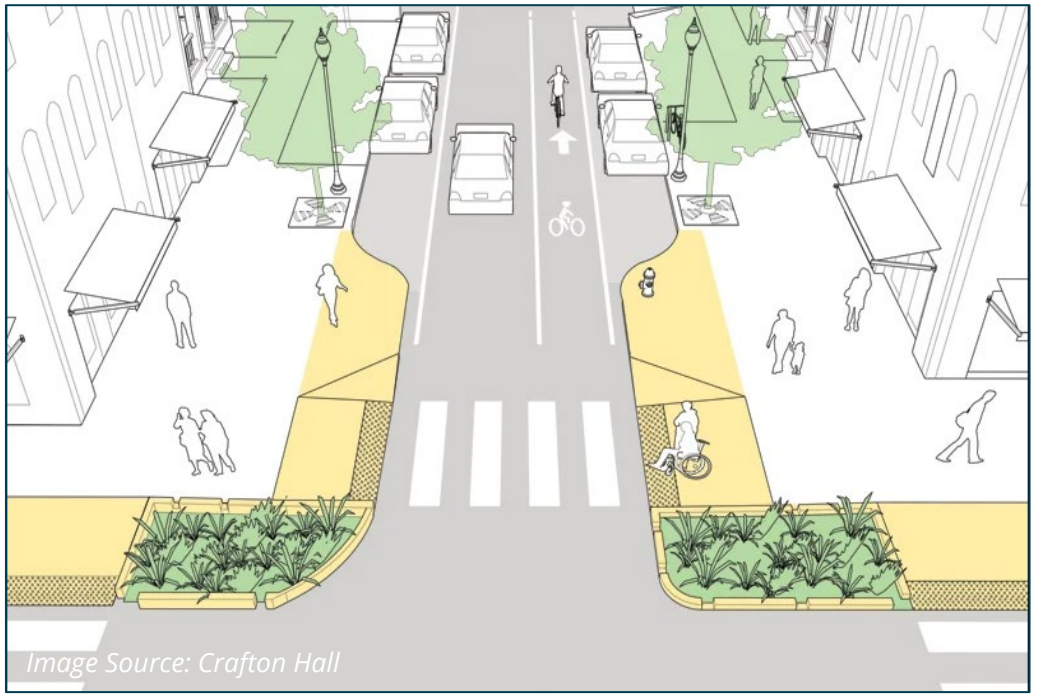


Image Source: Crafton Hall

Cost:

$ - $$$

Effectiveness Prioritization Score :

20 / 50

Removing a parking space on the approach into an intersection may help pedestrians to safely cross the street by providing them with a clearer view of oncoming vehicles and the driver with a clearer view of people walking.

Effectiveness Source: FHWA PedSafe - http://www.pedbikesafe.org/pedsafe/countermeasures_detail.cfm?CM_NUM=9

Yellow Change and All-Red Intervals

Description:

Evaluate and update the yellow change interval and all-red intervals, which is the length of time that the yellow signal indication is displayed following a green signal indication, and the length of time all traffic signals are displayed red during the cycle length. This interval should be reviewed and modified considering roadway speeds and crash patterns.

When/Where to Use:

This tool addresses red-light running crashes and improves overall safety at the intersection.

Associated Crash Type: Red-Light Running

Image Source: Stratford Crier

Cost:

$$$$$

Effectiveness Prioritization Score :

30 / 50

Yellow change intervals are associated with **36-50%** reduction in red-light running and **12%** reduction in injury crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/yellow-change-intervals

Intersection Lighting

Description:

Evaluate lighting conditions at intersection crosswalks and intersection approaches to ensure illumination standards are met, positive crosswalk lighting is provided and pedestrian level lighting is provided where appropriate. Actions to mitigate lighting deficiencies include installation of new light posts and enhancement/replacement of existing luminaries.

When/Where to Use:

This tool addresses night-time collisions, in particular involving vulnerable road users. It should be used when there is a lighting gap or insufficient lighting, and prioritized in areas of over-represented crashes during dark lighted conditions are identified at an intersection.

Associated Crash Type: Night-Time

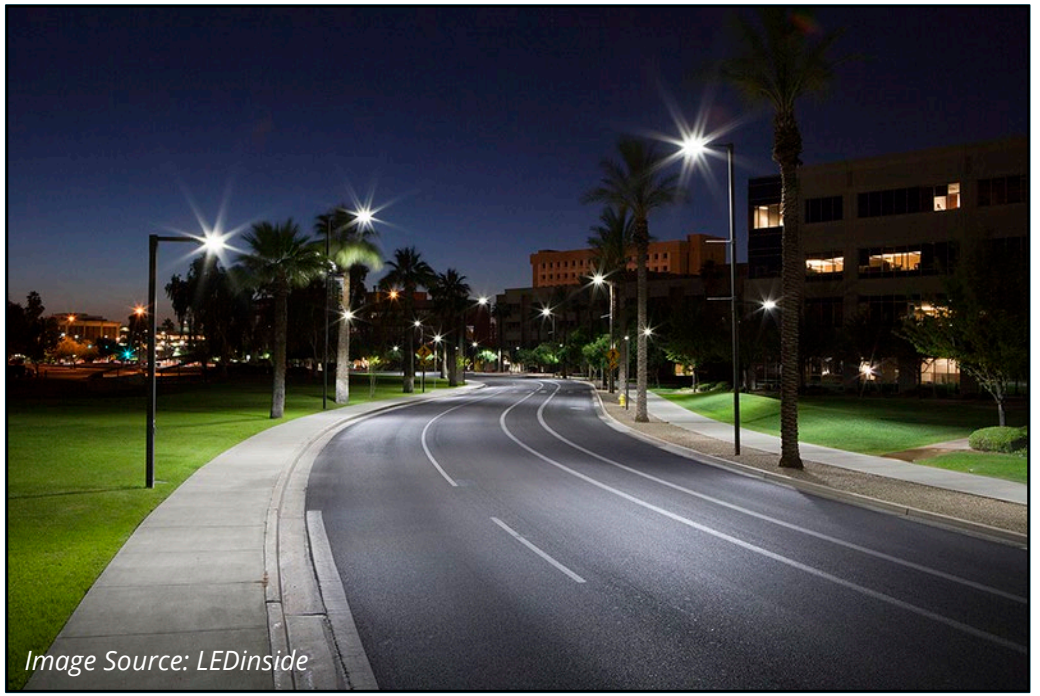


Image Source: LEDinside

Cost:

$$$$$

Effectiveness Prioritization Score :

40 / 50

Intersection lighting is associated with up to **42%** reduction in nighttime injury crashes involving pedestrians.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/lighting

Backplates with Retroreflective Borders

Description:

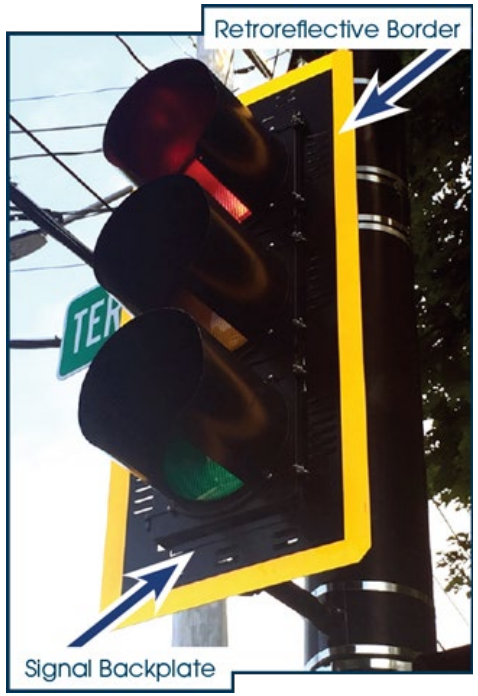
Install backplates with retroreflective borders (framing the signal head with a 1- to 3-inch yellow retroreflective border) at high crash locations and on high-speed roadways.

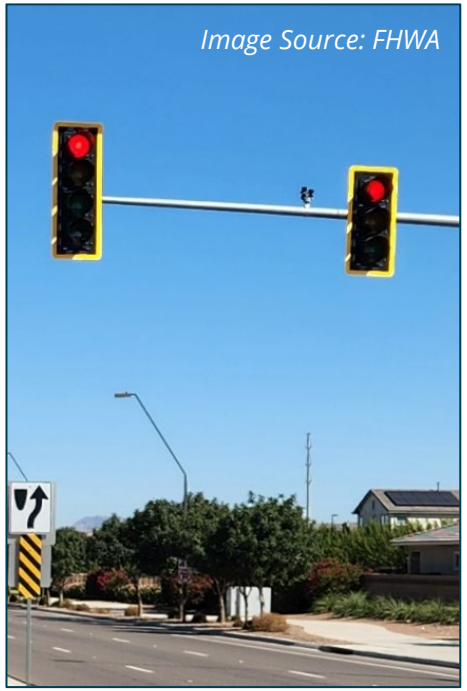
This tool enhances traffic signal visibility, conspicuity, and orientation for both older and color vision deficient drivers. It also helps during periods of power outages when the signals would otherwise be dark. Additionally, new guidance from the MUTCD recommends signal backplates to support automated vehicle integration.

When/Where to Use:

Backplates with retroreflective borders should be used at high-crash intersections, intersections where older drivers are a concern, areas where temporary power outages are a concern, and/or areas with low ambient lighting.

Associated Crash Type: Night-Time, Red-light Running





Cost:

$$$$$

Effectiveness Prioritization Score :

10 / 50

Backplates with retroreflective borders are associated with a **15%** reduction in all crashes.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=1410

Improved Sight Visibility For Right And Left Turning Vehicles

Description:

Measure and evaluate sight visibility for right turns and left turns ensuring that there are not obstructions in sight visibility triangles, such as vehicles from offset turn lanes, or vegetation. Adjust stop bar location, remove vegetation as necessary and correct offset turn lanes as necessary to provide unobstructed sight distance.

When/Where to Use:

This tool is implemented to enhance sight distance and improve visibility, which improves intersection safety for pedestrians and bicyclists. It responds to right-turn collisions and angle crashes.

Associated Crash Type: Vehicle-Pedestrian, Right-Turn, Angle Crashes

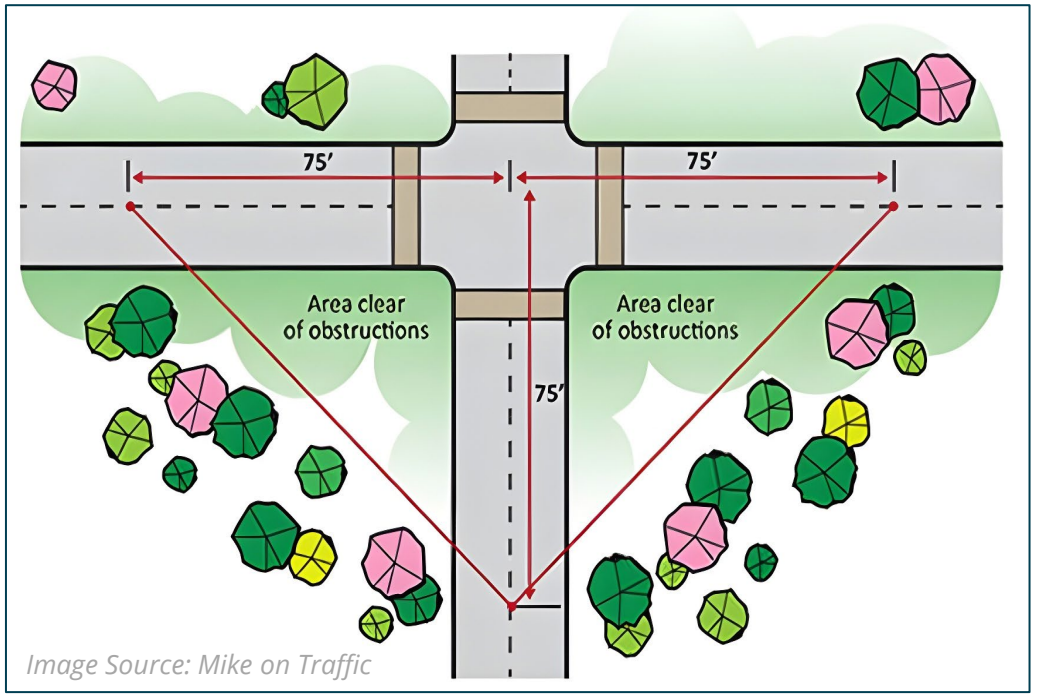


Image Source: Mike on Traffic

Cost:

$ - $$$

Effectiveness Prioritization Score :

50 / 50

Increasing triangle sight distance is associated with a **48%** reduction in injury crashes.

Effectiveness Source: https://www.cmfclearinghouse.org/detail.php?facid=307

Crosswalk Visibility Enhancements

Description:

Enhancements could include: Advanced stop bars at traffic signals, high-visibility crosswalk striping, positive lighting, and additional signage.

When/Where to Use:

These enhancements not only ensure that pedestrians are more visible to drivers but also help pedestrians identify safer crossings more easily. This tool addresses pedestrian visibility and vehicle-pedestrian collisions. Considerations: Selecting high-risk locations, coordinating with nearby traffic control devices, and educating the public on the changes.

Associated Crash Type: Vehicle-Pedestrian

Image Source: FHWA

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

High visibility crosswalks are associated with a **40%** reduction in pedestrian injury crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/crosswalk-visibility-enhancements

Pedestrian Signal Enhancements

Description:

Enhancements could include: Audible pedestrian signals, enhanced pedestrian detection, replacing existing WALK/DON'T WALK signals with pedestrian countdown signal heads, evaluate and re-time pedestrian clearance considering demographics, leading pedestrian intervals (which provide pedestrians a head start in crossing an intersection before vehicles can proceed), exclusive pedestrian phasing, split phasing, improved pedestrian push buttons. Smart signal systems that detect the presence of pedestrians could also be implemented, allowing signal timing to adjust for slower walkers and provide longer crossing times during peak pedestrian periods. Additionally, the installation of Accessible Pedestrian Signals (APS) would assist individuals with vision impairments by providing audible and tactile cues.

When/Where to Use:

These measures collectively address pedestrian collisions at busy intersections, particularly on roads with high pedestrian traffic. Considerations: Identifying priority intersections, coordinating with traffic signal timing as many of these timing considerations impact cycle length, and educating the public about new signal features. May require traffic signal upgrades and reconstruction.

Associated Crash Type: Vehicle-Pedestrian

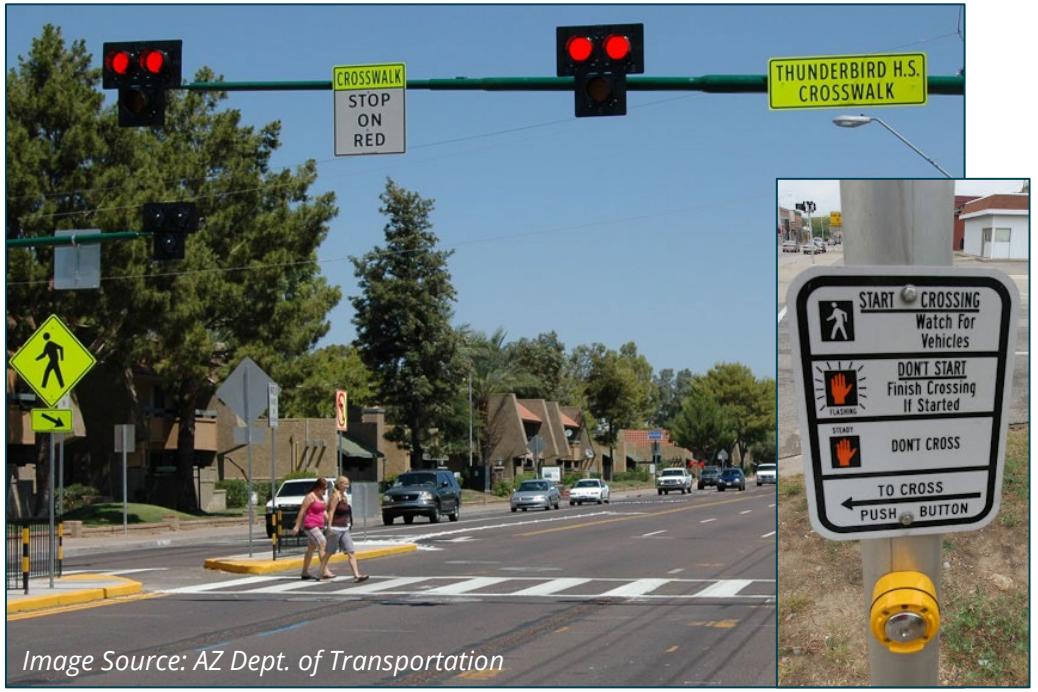


Image Source: AZ Dept. of Transportation

Cost:

$$ - $$$

Effectiveness Prioritization Score :

20 / 50

A Leading Pedestrian Interval (LPI), one of the potential pedestrian signal enhancements, is associated with a **13%** reduction in pedestrian-vehicle.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/leading-pedestrian-interval

Dedicated Bicycle Facilities At Signalized Intersections

Description:

Dedicated bicycle facilities at signalized intersections include bike lanes, raised bicycle crossings, exclusive right turn lanes, shared right lanes, color markings on bike facilities, and other pavement markings.

When/Where to Use:

This tool should be used at signalized intersections with high volumes of bicyclists and/or at locations with an over-representation of collisions involving bicyclists.

Associated Crash Type: Vehicle-Bicycle

Image Source: NACTO

Cost:

$$$$$

Effectiveness Prioritization Score :

20 / 50

Installation of bike lanes at signalized intersections is associated with a **20%** reduction in vehicle-bicycle crashes.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=3247

Emergency Vehicle Preemption

Description:

Implement emergency vehicle preemption at traffic signals to give emergency vehicles a green light at intersections, while giving red lights to other vehicles, to help emergency vehicles get through quickly and safely.

When/Where to Use:

This tool improves response time of emergency vehicles and addresses the Emergency Response of the Traffic Safety E's.

Associated Crash Type: All Signalized Intersection Crash Types

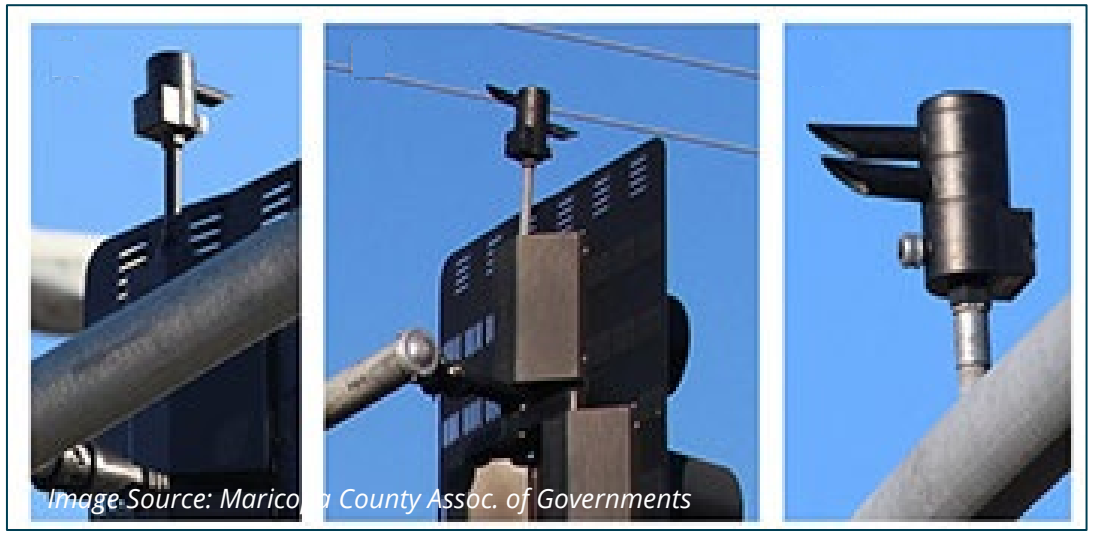


Image Source: Maricopa County Assoc. of Governments

Cost:

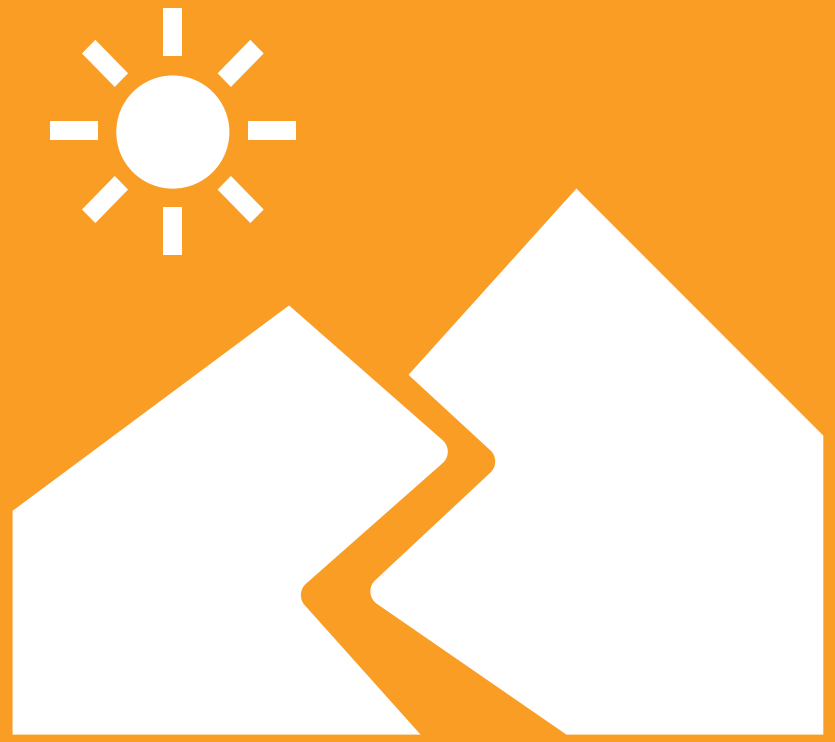
$$$ - $$$$

Effectiveness Prioritization Score :

30 / 50

Emergency vehicle preemption is associated with **43 to 51 percent reduction in emergency response times**, depending on traffic density.

Effectiveness Source: https://www.itskrs.its.dot.gov/2018-b01259



02 Rural Roads

Rural Roads Section Contents

Median Barriers	21	Safety Edge℠	27
Raised Pavement Markers	22	Pavement Friction Management	28
Wider Edge Lines (6 Inches)	23	Self Enforcing Roadways	29
Centerline Rumble Strips	24	Changeable Curve Speed Limit Signs	30
Longitudinal Rumble Strips And Stripes on 2 Lane Roads	25	Enhanced Delineation For Horizontal Curves	31
Roadside Design Improvements	26	Panels of Retroreflective Sheeting	32

Median Barriers

Description:

Installation of median barriers, which are longitudinal barriers designed to separate opposing traffic on divided highways, in selected high crash locations. They come in three main types: cable, metal-beam, and concrete barriers, each with different characteristics in terms of flexibility, deflection, and maintenance requirements.

When/Where to Use:

The tool is specifically designed to respond to **cross-median crashes**, particularly head-on collisions that occur when a vehicle crosses the median into oncoming traffic. The barriers help to redirect vehicles, reducing the severity and frequency of these types of crashes. This treatment may be used on divided highways with 20,000 ADT or greater that have a system-wide history of cross-median crashes.

Associated Crash Type: Cross-Median Crashes, Head on Crashes


Image Source: Gibraltar Global


Image Source: Vishal Pipes

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

Median Barriers Installed on Rural Four-Lane Freeways are associated with a **97%** reduction in cross-median crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/median-barriers

Raised Pavement Markers

Description:

Installation of raised pavement markers (RPM), which are designed to supplement the delineation provided by pavement markings. By installing raised pavement markers, they are much more prominent in adverse weather conditions, providing important information to the driver.

When/Where to Use:

Raised pavement markers should be installed on routes with sufficient pavement quality to hold the devices in place. The type of raised pavement marker to install is dependent on regional climate. For example, in areas that experience snowfall, snow plowable RPMs should be used.

Associated Crash Type: Run-off-the-Road Crashes

Image Source: Road Safe Traffic

Cost:

$ - $$

Effectiveness Prioritization Score :

30 / 50

Raised pavement markers are associated with a **24%** reduction in nighttime crashes.

Effectiveness Source: https://www.cmfclearinghouse.org/detail.php?facid=107

Wider Edge Lines (6 Inches)

Description:

Edge lines are considered ”wider“ when the marking width is increased from the minimum normal line width of 4 inches to the maximum normal line width of 6 inches.

When/Where to Use:

This tool addresses single-vehicle run off the road crashes on rural highways. It is used to clearly identify the edge of the travel lanes. It can be incorporated into system wide maintenance and updates.

Associated Crash Type: Run-off-the-Road Crashes

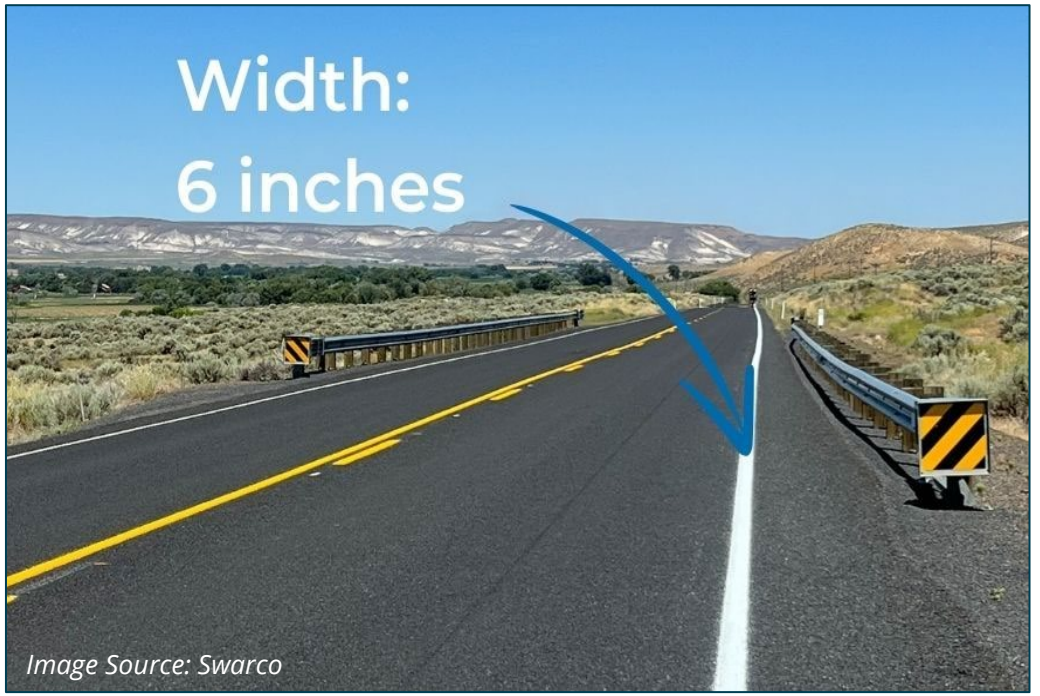


Image Source: Swarco

Cost:

$$$$$

Effectiveness Prioritization Score :

40 / 50

Six-inch edge lines are associated with a **22%** reduction in fatal and injury crashes on rural freeways.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/wider-edge-lines

Centerline Rumble Strips

Description:

Installation of centerline rumble strips on two-lane rural roads. Center rumble strips are milled or raised elements on the pavement designed to alert drivers through vibration and sound when they leave their travel lane. These strips can be installed on the shoulder, edge line, or center line of undivided roadways.

When/Where to Use:

This tool addresses run off road crashes towards the median (to the left).

Associated Crash Type: Run-off-the-Road Crashes

Image Source: The Joint Solution

Cost:

$$$$$

Effectiveness Prioritization Score :

40 / 50

Centerline Rumble Strips are associated with a **44-64%** reduction in head-on fatal and injury crashes on two-lane rural roads.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/longitudinal-rumble-strips-and-stripes-two-lane-roads

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Description:

Installation of shoulder rumble strips. Similar to center rumble strips, longitudinal rumble strips are milled or raised elements on the pavement designed to alert drivers through vibration and sound when they leave their travel lane.

When/Where to Use:

This tool addresses run off road crashes towards the shoulder (to the right).

Associated Crash Type: Run-off-the-Road Crashes

Image Source: The Hog

Cost:

$$$$$

Effectiveness Prioritization Score :

40 / 50

Shoulder Rumble Strips are associated with a **13-51%** reduction in single vehicle, run-off-road fatal and injury crashes on two-lane rural roads.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/longitudinal-rumble-strips-and-stripes-two-lane-roads

Roadside Design Improvements

Description:

This tool includes Recovery Zones, Clear Zones, and Breakaway Sign-Posts.

Evaluation and improvements on roadside areas to reduce the severity of run-off road crashes. Key elements of this tool include the creation and maintenance of clear zones, the addition or widening of shoulders, slope flattening, and the installation of barriers like cable, metal-beam, or concrete barriers. A clear zone is an unobstructed, traversable area alongside the roadway that provides drivers with the space needed to safely stop or regain control if they accidentally leave the road. The clear zone should be free of fixed objects, such as trees or utility poles, to minimize the risk of a collision if a vehicle departs the roadway.

When/Where to Use:

This tool minimizes the severity of road departure (run off road) crashes.

Associated Crash Type: Run-off-the-Road Crashes

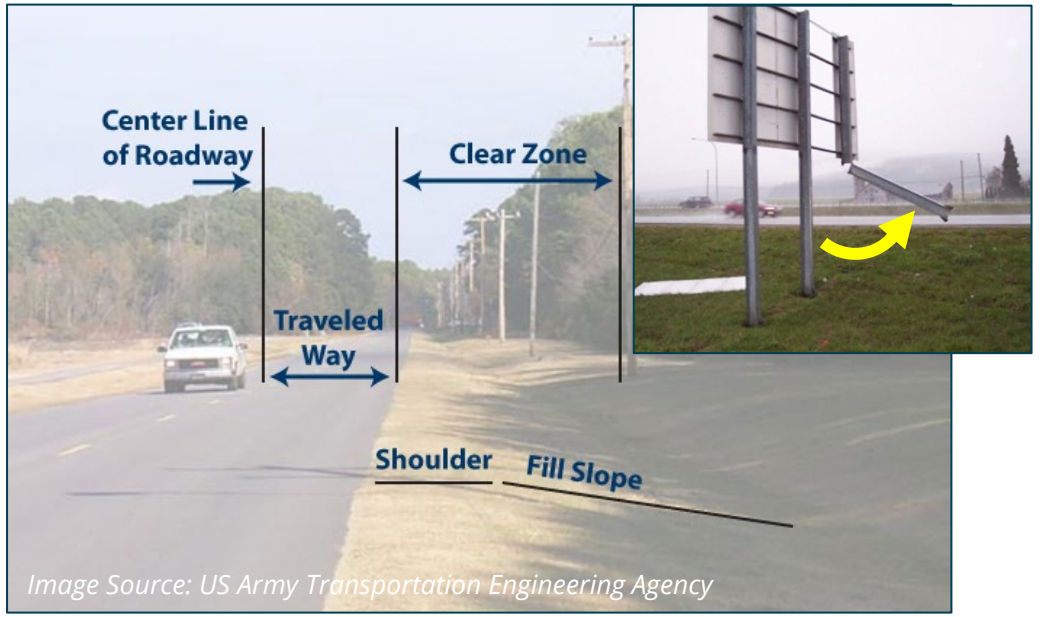


Image Source: US Army Transportation Engineering Agency

Cost:

$$$ - $$$$$

Effectiveness Prioritization Score :

40 / 50

Increasing the distance to roadside features from 3.3 ft to 16.7 ft is associated with a **22%** reduction in all crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/roadside-design-improvements-curves

Safety Edge SM

Description:

SafetyEdge℠ is a paving technology that shapes the edge of the pavement at a 30-degree angle during construction. This design helps eliminate dangerous vertical drop-offs at the pavement's edge and enhances pavement durability by reducing edge raveling. The technology is easy to implement with minimal cost, requiring only a specialized device attached to the paving equipment.

When/Where to Use:

This tool addresses single-vehicle run off the road crashes on rural highways. These incidents are often more severe when vertical pavement edges are present, as they can destabilize the vehicle. The SafetyEdge℠ mitigates this risk by providing a sloped edge that allows drivers to safely regain control and return to the road.

Associated Crash Type: Run-off-the-Road Crashes

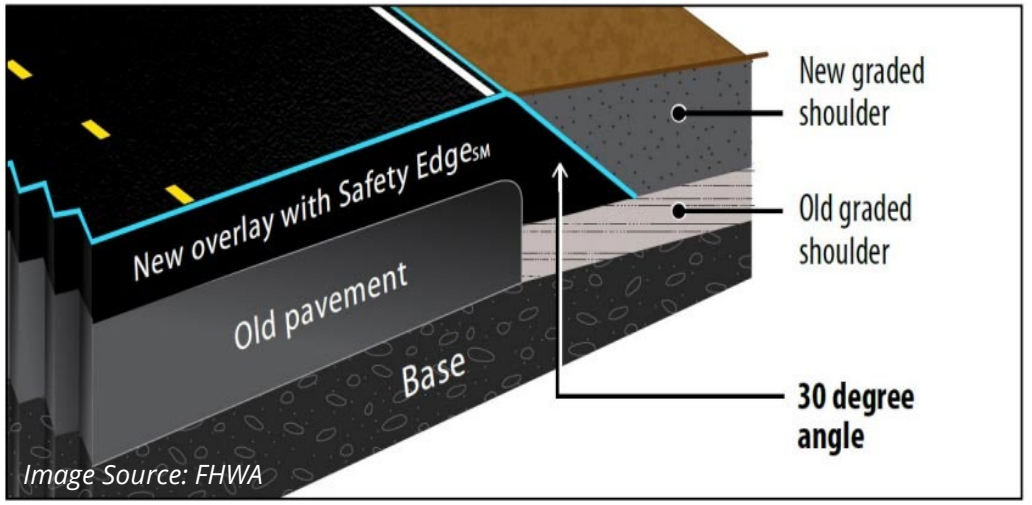


Image Source: FHWA

Cost:

$$$$$

Effectiveness Prioritization Score :

20 / 50

Safety edge is associated with a **11%** reduction in fatal and injury crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/safetyedgesm

Pavement Friction Management

Description:

Pavement Friction Management involves measuring, monitoring, and maintaining the friction of road surfaces to enhance vehicle safety. This process uses Continuous Pavement Friction Measurement (CPFM) technology to gather detailed friction data across road networks, allowing for targeted friction treatments. One such treatment is High Friction Surface Treatment (HFST), which involves applying a durable, high-friction material to critical areas like curves, intersections, and steep grades to improve skid resistance and reduce crashes.

When/Where to Use:

The tool primarily addresses friction-related crashes, including roadway departure, rear-end, failure-to-yield, wet-weather, and red-light-running crashes. By enhancing pavement friction in key areas, it helps to improve vehicle control and reduce the risk of accidents, particularly in challenging driving conditions.

Associated Crash Type: Friction-Related Crashes, Motorcycle Crashes

Image Source: FHWA

Cost:

$$$$$ VARIES

Effectiveness Prioritization Score :

48 / 50

Pavement friction improvements are associated with a **48%** reduction in injury crashes at horizontal curves.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/pavement-friction-management

Self Enforcing Roadways

Description:

This improvement encompasses: physical engineering infrastructure, high friction pavement, its systems, and speed feedback signs.

This tool involves the implementation of infrastructure features that naturally decrease speeds. Examples are optical speed bars and speed feedback signs.

When/Where to Use:

This tool addresses speed-related crashes. Optical speed bars are transverse stripes spaced at gradually decreasing distances. The rationale for using them is to increase drivers' perception of speed and cause them to reduce speed, which can be helpful near intersections or horizontal curves. This tool can also be used to address locations with history of speeding or speed-related crashes.

Associated Crash Type: Speed-Related Crashes

Image Source: ResearchGate

Cost:

$$$$$

Effectiveness Prioritization Score :

40 / 50

Speed feedback signs are associated with a **5%** reduction in all crashes.

Effectiveness Source: https://www.cmfclearinghouse.org/detail.php?facid=6885

Changeable Curve Speed Limit Signs

Description:

Changeable curve speed limit signs are dynamic traffic signs installed on horizontal curves. These signs display variable speed limits, which can be adjusted in real-time based on current road and environmental conditions such as weather, visibility, and traffic. They use sensors and communication systems to detect factors like rain, snow, fog, or high vehicle speeds, adjusting the speed limit to promote safe driving. These signs can also be integrated with flashing lights or message boards to further alert drivers of the recommended speed or additional warnings.

When/Where to Use:

Changeable curve speed limit signs are most effective on rural roads that have high-speed limits, sharp curves, and a history of crashes caused by drivers not adjusting their speed appropriately for road conditions.

Associated Crash Type: Curve-Related Crashes

Image Source: AASHTO

Cost:

$$$$$

Effectiveness Prioritization Score :

5 / 50

Changeable curve speed warning signs are associated with a **2%** reduction in crashes.

Effectiveness Source: https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=68

Enhanced Delineation For Horizontal Curves

Description:

Enhancement of delineation for horizontal curves through various strategies such as “curve ahead” and chevron signs to improve driver awareness of curves on the road. These strategies include pavement markings, retroreflective strips, delineators, chevron signs, enhanced conspicuity (such as larger or fluorescent signs), and dynamic warning signs. These treatments can be applied either in advance of or within the curve itself to better inform drivers of the curve's presence, direction, and appropriate speed.

When/Where to Use:

Curve warning signs should be applied to any horizontal curve or turn with a history of roadway departure crashes and curves or turns with similar geometry or traffic volumes yet to experience crashes. This tool addresses curve-related crashes on Rural Roads.

Associated Crash Type: Curve-Related Crashes

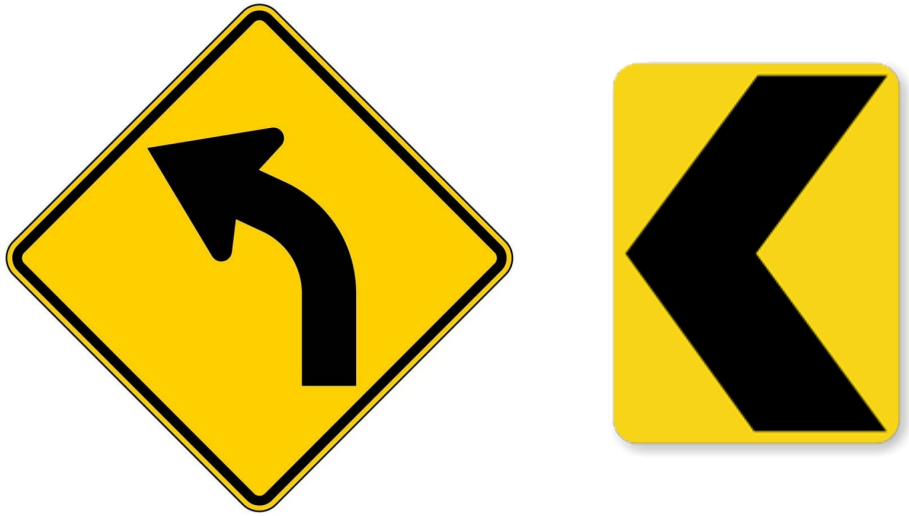


Image Source: Advanced Sign

Cost:

$$$$$

Effectiveness Prioritization Score :

50 / 50

Chevron signs are associated with a **25%** reduction in night-time crashes, and in-lane curve warning pavement markings are associated with a **35-38%** reduction in all crashes.

Effectiveness Source: https://highways.dot.gov/safety/proven-safety-countermeasures/enhanced-delineation-horizontal-curves

Panels of Retroreflective Sheeting

Description:

Installation of retroreflective strips on signposts to increase visibility at nighttime.

"The use of retroreflective strips on sign posts may be beneficial when there is a need to draw additional attention to the signs, especially at night. Reflective strips may be added to Stop signs, curve or intersection warning signs, regulatory or guidance signs, etc."

When/Where to Use:

The MUTCD provides guidance for the use of reflective strips on sign posts. This tool addresses night-time crashes and increases compliance with posted signs.

Associated Crash Type: Night-Time Crashes

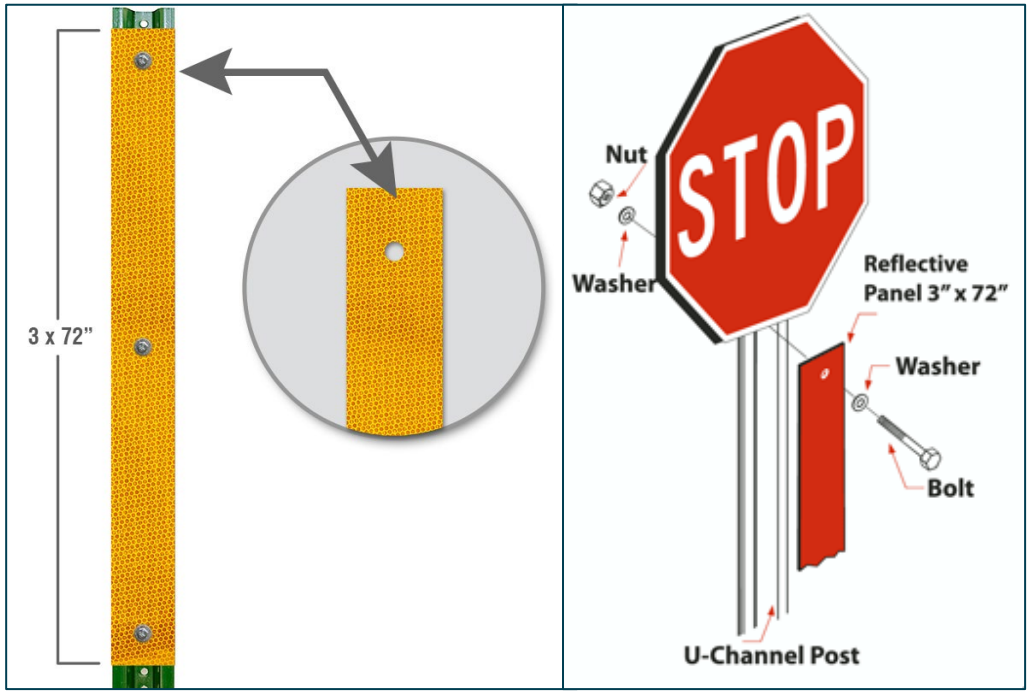


Image Source: TrafficSign

Cost:

$$$$$

Effectiveness Prioritization Score :

10 / 50

Retroreflective material has been tried on rural road applications, but has yet to be fully researched. FHWA still recommends this treatment through its High Risk Rural Road Manual.

Effectiveness Source: Manual for Selecting Safety Improvements on High Risk Rural Roads, https://safety.fhwa.dot.gov/hsip/hrrr/manual/