APPENDIX A. TECHNICAL MEMORANDUM #1 – SAFETY ANALYSIS RESULTS

SAFETY ACTION PLAN

FOR ALL IRON COUNTY

March 2025

Iron County Safety Action Plan

Technical Memorandum #1 – Safety Analysis

Iron County Safety Action Plan

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March 2025

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Statutory notice

23 U.S.C. § 407: US Code - Section 407: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144 and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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1. INTRODUCTION

Between 2019 and 2023 there were 44 fatalities and 243 serious injuries on roadways in Iron County. The number of fatalities more than doubled between 2019 and 2023, from 4 fatalities in 2019 to 9 fatalities in 2023, as shown in Figure 1. While the number of serious injuries in 2023 is lower than 2019, serious injury crashes in 2021 and 2022 were higher than serious injury crashes in 2023.

Recognizing these trends, Iron County is preparing a Safety Action Plan (SAP) to develop a holistic, well-defined strategy to reduce roadway fatalities and serious injuries on Iron County roadways. The SAP will analyze safety needs, identify high-risk locations and factors contributing to crashes, and prioritize strategies to address them.

The SAP will meet eligibility requirements that will allow Iron County and local jurisdictions in Iron County to apply for Implementation Grants from the United States Department of Transportation (USDOT) Safe Streets and Roads for All (SS4A) discretionary grant program[1]. The grant program was established by the Bipartisan Infrastructure Law (BIL) with $5 billion in appropriated funds. The SS4A grant program is in effect from 2022 to 2026.

Technical Memorandum #1 provides an overview of the safety analysis methodology and results, contributing to identification of a high-risk network. The high-risk network will inform high safety risk locations and strategies to address the present risks.

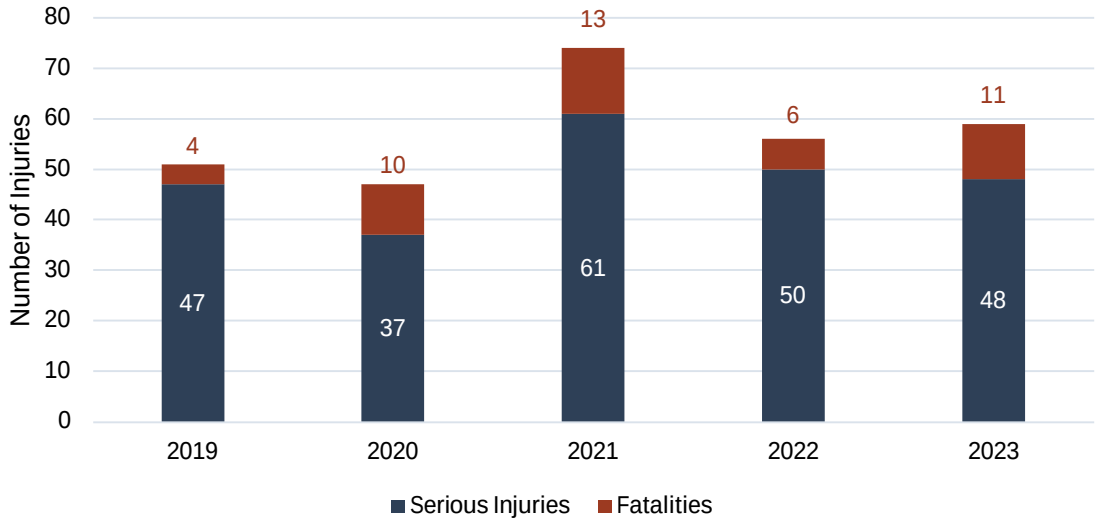

Figure 1. Fatalities and Serious Injuries in Iron County, 2019 to 2023

[1] https://www.transportation.gov/grants/SS4A

1.1. Safe Streets and Roads for All (SS4A) Grant Program

The purpose of the SS4A discretionary grant program is to fund regional and local initiatives to prevent roadway deaths and serious injuries of all users of roadways including pedestrians, bicyclists, public transportation users, motorists, and others. The program supports the goal of zero roadway deaths using the USDOT Safe System Approach[2].

The grant program provides funding for two types of grants: Planning and Demonstration Grants and Implementation Grants.

Planning and Demonstration Grants: These provide funding to prepare an Action Plan with the goal to prevent roadway fatalities and serious injuries in a region. The Action Plan identifies the most significant roadway safety concerns in a community, and implementation of projects and strategies to address roadway safety issues.

Implementation Grants: These provide funding to implement projects and strategies identified in an Action Plan aimed at addressing a roadway safety problem. Projects and strategies may include infrastructure, behavioral, or operational activities. To apply for an Implementation Grant, applicants must have a completed and qualifying Action Plan.

Iron County secured a Planning and Demonstration Grant to develop this SAP for all of Iron County including municipalities and agencies within Iron County.

1.2. Action Plan Components

An eligible Action Plan must include the following two elements:

- Safety analysis of:
  - Existing conditions and historical trends.
  - Crashes by location, severity and contributing factor.
  - Systemic and specific safety needs.
- Identify a comprehensive set of projects.

In addition, the Action Plan must include at least four of the remaining six elements:

- Public commitment to an eventual goal of zero fatalities and serious injuries, a date to reach zero, or setting targets to achieve significant declines in roadway fatalities and serious injuries.
- Oversight by a committee charged with plan development, implementation, and

[2] https://www.transportation.gov/safe-system-approach

monitoring.

- Engagement with the public and relevant stakeholders to inform plan development.
- Opportunities to improve, plans, guidelines, and standards.
- A process to measure and report progress over time.

The Iron County SAP will satisfy all requirements of an Action Plan.

1.3. SAP Development Process

The SAP will serve as a guide for jurisdictions to identify and prioritize solutions to improve safety. Development of the SAP includes the tasks as listed in Table 1.

Table 1. Iron County SAP Tasks

Safety Action Plan Task	Purpose
Task 1: Leadership and Goal Setting	A Safety Commitment Resolution will be presented to the Iron County Rural Planning Organization (RPO) for consideration for adoption. The Safety Commitment Resolution will be provided to each jurisdiction for consideration for adoption.
Task 2: Planning Structure	A SAP Sub-Committee of representatives from local jurisdictions, Iron County, and the Utah Department of Transportation (UDOT). The Sub-Committee oversees the SAP development and deliverables.
Task 3: Safety Analysis	An analysis of crash history, existing data and trends, identification of risk factors, high-risk locations, and a high-injury network.
Task 4: Engagement and Collaboration	Community engagement and outreach through stakeholder workshops, pop-up events, printed flyer distribution, online advertisements, and a project website. The project website includes an interactive map where stakeholders and members of the public may leave comments and identify locations of concern, review materials, and view upcoming events and deliverables.
Task 5: Policy and Process Changes	Existing policies, programs, and practices will be reviewed that may impact safety. Opportunities for change will be identified.

Safety Action Plan Task	Purpose
	Potential engineering, enforcement, education, and policies or practices will be recommended.
Task 6: Strategy and Project Type Recommendations	The SAP will recommend and prioritize countermeasures, strategies, and project types to help prevent fatal and serious injury crashes in the County.
Task 7: Final Report and Safety Resolution	A final report will summarize study findings and recommendations. The final report and safety commitment resolution will be presented to the Iron County RPO and local jurisdictions for review and adoption.

1.4. Safe System Approach

SAP recommendations will be based on the USDOT Safe System Approach, a guiding paradigm to address roadway safety and mitigate the risk inherent in complex transportation systems.

The Safe System Approach includes principles and elements to prevent crashes from happening and minimizing injury should a crash occur. The approach focuses on human mistakes and vulnerability to help design and operate a transportation system with redundancy in place to protect all users of the system. The Safe System Approach includes the principles as summarized in Figure 2.

Figure 2. Safe System Approach
Source: USDOT

The Safe System Approach considers five elements of a safe transportation system, summarized in Table 2. Achieving zero traffic fatalities and serious injuries requires strengthening each element, building upon the foundational principles as illustrated in Figure 2 and Table 3.

Table 2. Safe System Approach Elements

Safe System Approach Element		Description
	Safer people	Encourage safe, responsible driving and behavior including those who walk, bike, drive, ride transit or travel by other modes and create conditions that prioritize their ability to reach their destination unharmed.
	Safer vehicles	Expand the availability of vehicle systems and features that help to prevent crashes and minimize the impact of crashes on both occupants and non-occupants.
	Safer speeds	Humans are less likely to survive high-speed crashes. Promote safer speeds in all roadway environments through a combination of thoughtful, equitable, context-appropriate roadway design, appropriate speed-limit setting, targeted education, outreach campaigns and enforcement.
	Safer roads	Design streets to mitigate human mistakes and account for injury tolerances, encourage safer behaviors and facilitate safe travel by the most vulnerable users. An example includes physically separating people traveling at different speeds.
	Post-crash care	People who are injured in crashes rely on emergency first responders to quickly locate and stabilize their injuries and transport them to medical facilities. Post-crash care also includes forensic analysis at the crash site, traffic incident management and other activities.

Table 3. Safe System Approach Principles

Safe System Approach Principals	
Death and serious injuries are unacceptable The Safe System Approach prioritizes the elimination of crashes that result in deaths and serious injuries.	Responsibility is shared All stakeholders—including government at all levels, industry, non-profit and advocacy, researchers and the public—are vital to preventing fatalities and serious injuries on our roadways.

Safe System Approach Principals	
Humans make mistakes People will make mistakes and decisions that can lead or contribute to crashes, but the transportation system can be designed and operated to mitigate the outcomes of human mistakes and avoid deaths and serious injuries when a crash occurs.	Humans are vulnerable Human bodies have physical limits for tolerating crash forces before death or serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and recognizes physical human vulnerabilities.
Safety is proactive Proactive tools should be used to identify and address safety issues in the transportation system, rather than waiting for crashes to occur and reacting afterwards.	Redundancy is crucial Reducing risks requires that all parts of the transportation system be strengthened, so if one part fails, the other parts still protect people.

Implementing the Safe System Approach requires moving away from traditional safety paradigms, as summarized in Figure 3.

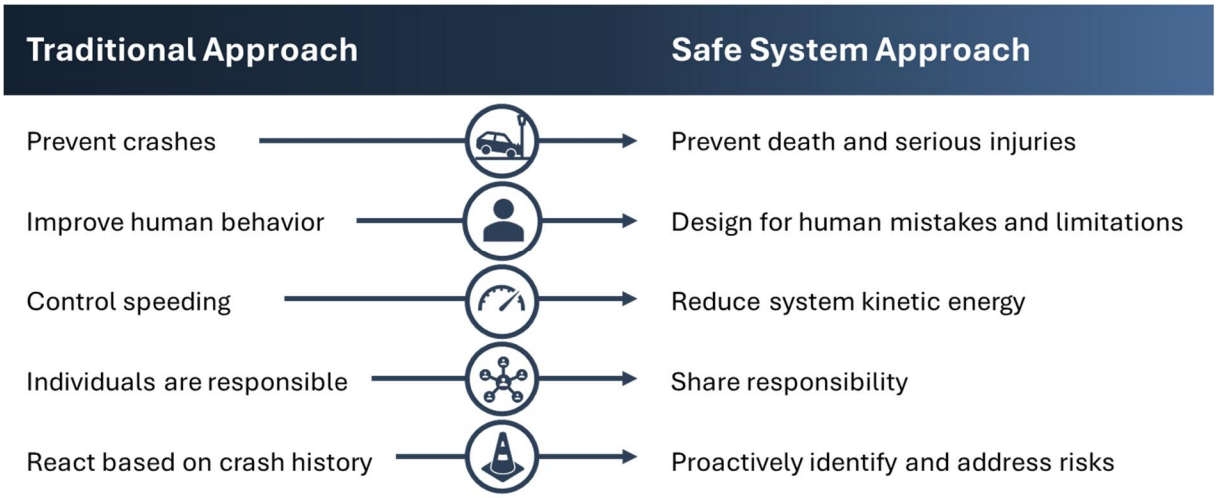

Figure 3. Safe System Approach Paradigm

1.5. Utah State Strategic Highway Safety Plan

Utah's goal is to achieve zero traffic-related fatalities as documented in the Utah Strategic Highway Safety Plan (SHSP). A SHSP is a requirement of the Highway Safety Improvement Program (HSIP) (23 U.S.C. § 148) and is a statewide-coordinated safety plan that provides a comprehensive framework for reducing fatalities and serious injuries on all public roads. The Utah SHSP identifies eleven different emphasis areas for safety to reach the Zero Fatalities goal. The SAP recommendations will build upon the identified emphasis areas in the Utah SHSP.

1.6. Document Organization

This technical memorandum is organized into the following sections:

- Section 1 introduces the SAP and provides background information on the SS4A grant program and Safe System Approach.
- Section 2 describes the study area.
- Section 3 details a crash analysis including a crash history overview and comparison to the Utah SHSP.
- Section 4 describes the safety analysis methodologies and results.
- Section 5 details next steps for the SAP.
- Section 6 introduces the Appendices including the individual Geographic Focus Area (GFA) safety analysis results.

2. STUDY AREA

The Iron County SAP study area includes all of Iron County, including jurisdictions within the County, as illustrated in Figure 4. To organize the jurisdictions and unincorporated areas of Iron County into manageable analysis areas, the county was divided into five Geographic Focus Areas (GFA). Table 4 lists jurisdictions/areas by GFA. The safety analyses presented in the appendices of this Technical Memorandum #1 are organized by GFA. Roadways within the study area are divided into two categories:

- State Routes: UDOT-maintained roads
- Non-State Routes: Local jurisdiction-maintained roads

Table 4. GFA and Jurisdictions

Geographic Focus Area (GFA)	Jurisdictions/Boundaries
Cedar City	Cedar City (excluding I-15)
Enoch City	Enoch City (excluding I-15)
East Iron County	Parowan City Paragonah Town Kanarraville Town The Paiute Tribe of Utah Unincorporated areas of Iron County, east of SR 130 and SR 56 (excluding Cedar City and Enoch City)
West Iron County	Unincorporated areas of Iron County, west of SR 130 and SR 56 (excluding Cedar City and Enoch City)
Interstate-15 (I-15)	From milepost 41 to milepost 101

The Interstate 15 (I-15) corridor is defined as a GFA. I-15 is managed and maintained by the Utah Department of Transportation. However, state departments of transportation are not eligible to apply for SS4A funds. As such, the SAP will review crash data for the I-15 corridor, but will not make recommendations for improvements to I-15.

For other state-owned and maintained routes, outside of I-15, UDOT may partner with local jurisdictions or agencies to complete or implement improvements or strategies identified in the SAP. Therefore, those roadways are included in the SAP process and analyses.

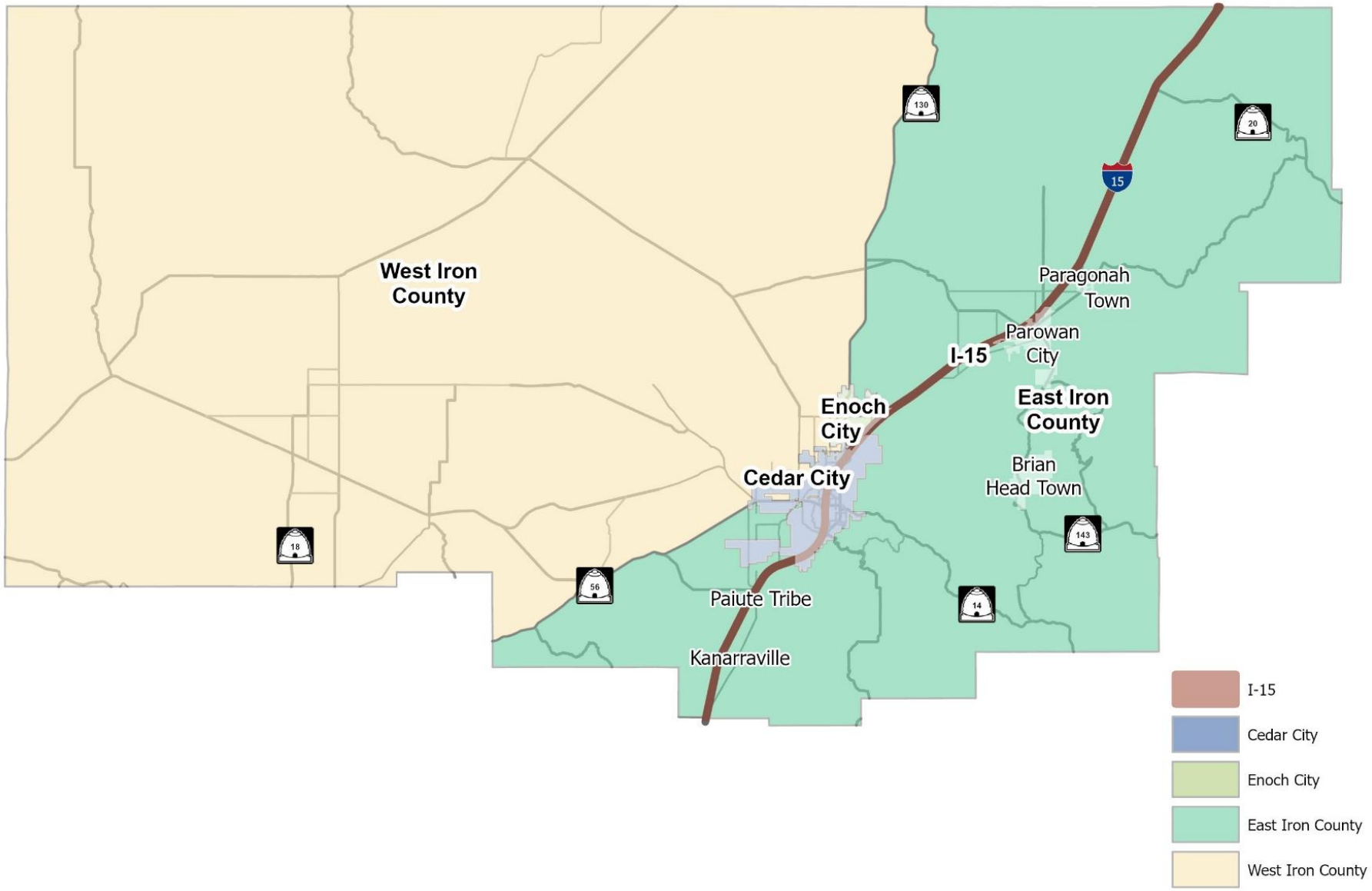

Figure 4. Iron County SAP Study Area and GFAs

3. HISTORICAL CRASHES

Crash data was obtained from the UDOT database for the most recent complete five-year period, 2019 to 2023. Crashes reported to UDOT are included in this analysis. The project team recognizes that some crashes occur that are not reported. The analysis uses crash description terminology as presented in the crash reports. Information from historical crashes will inform future phases of the SAP.

Two methods were applied to review the historical crash data, each informing the identification of safety strategies, locations, and potential countermeasures. Countermeasures refer to specific actions or infrastructure elements designed to improve safety. The goal of the identified safety strategies and proposed countermeasures in the SAP is to reduce traffic fatalities and serious injuries. The two methodologies for reviewing crash history include:

- Historic Crash Review: Provides an overview of the most frequent crash types and common contributing factors.
- Utah SHSP Emphasis Area Comparison: Crashes in Iron County are grouped based on the Utah SHSP Emphasis Areas and are compared to statewide crash data.

Each of these analyses informs future phases of the SAP development.

3.1. Historic Crash Review

A historic crash review was conducted for the most recent complete five-year period, 2019 to 2023, for crashes that occurred on Iron County roadways. The crash data was summarized for all of Iron County, and for each individual GFA, in the following categories:

- Crashes by Year
- Crashes by Severity and Route Type
- Fatal and Serious Injury Crashes by Year
- Fatal and Serious Injury Crashes by Manners of Collision
- Fatal and Serious Injury Crashes by Crash Types
- Fatal and Serious Injury Crashes by Driver Contributing Factors
- Vulnerable User Crashes by Year
- Fatal and Serious Injury Vulnerable User Crashes

3.1.1. All Crashes

A total of 5,185 crashes occurred in Iron County from 2019 to 2023. Figure 5 shows that the highest number of crashes (1,125) occurred in 2019. While crashes decreased in 2020 as compared to 2019, the number of crashes occurring each year has since increased.

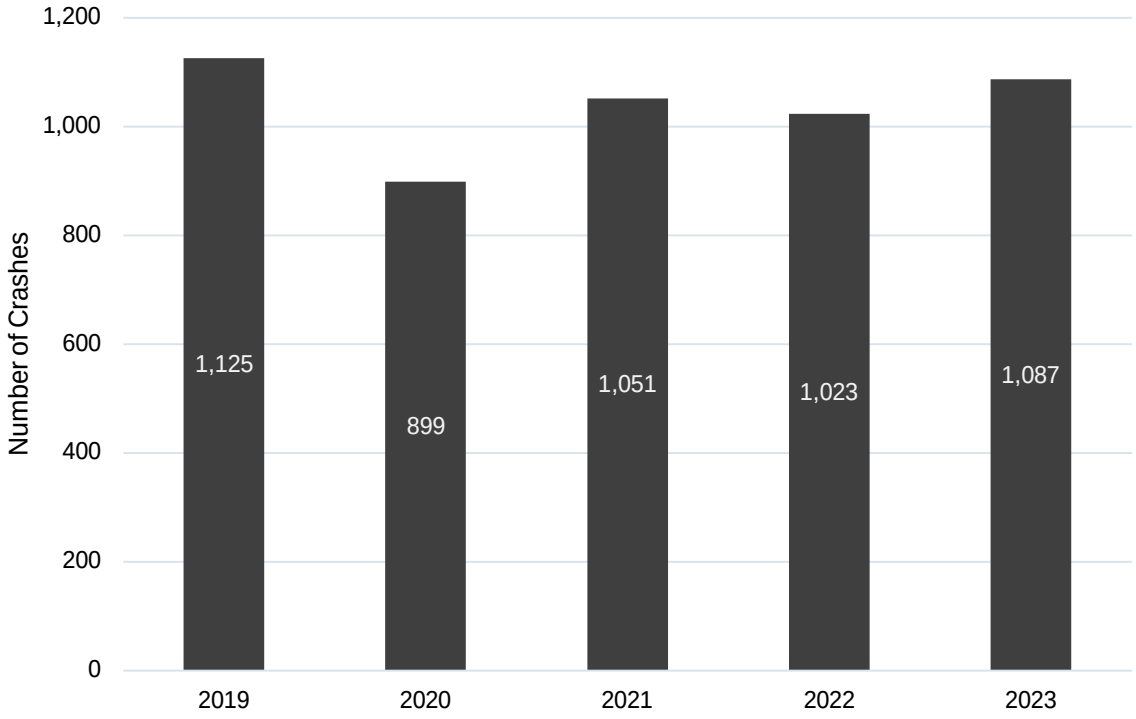

Figure 5. Crashes by Year in Iron County, 2019-2023

Table 5 summarizes crashes by severity and route type in Iron County for the five-year period (2019-2023). A review of the data shows:

- Approximately twice as many fatal crashes occurred on State Routes as compared to non-State Routes.
- The total number of crashes that occurred on State Routes is more than double that of non-State Routes.
- Approximately 5% of the crashes in Iron County were fatal or serious injury crashes.

Table 5. Crashes by Severity, 2019-2023

Route Type	State Route		Non-State Routes		Overall Total	
Crash Severity	Crashes		Crashes		Crashes	
	#	%	#	%	#	%
Fatal	27	0.8%	12	0.7%	39	0.8%
Suspected Serious Injury	109	3%	83	5%	192	3.7%
Suspected Minor Injury	428	12%	203	13%	631	12.2%
Possible injury	517	14%	202	13%	719	13.9%
No Injury / Property Damage Only	2,503	70%	1,101	69%	3,604	69.5%
Total	3,584	100%	1,601	100%	5,185	100%

3.1.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in Figure 6. The number of crashes resulting in fatalities or serious injuries increased from 2019 to 2022. The highest number of fatal and serious injury crashes in the five-year analysis period occurred in 2021 with 11 fatal crashes and 40 serious injury crashes.

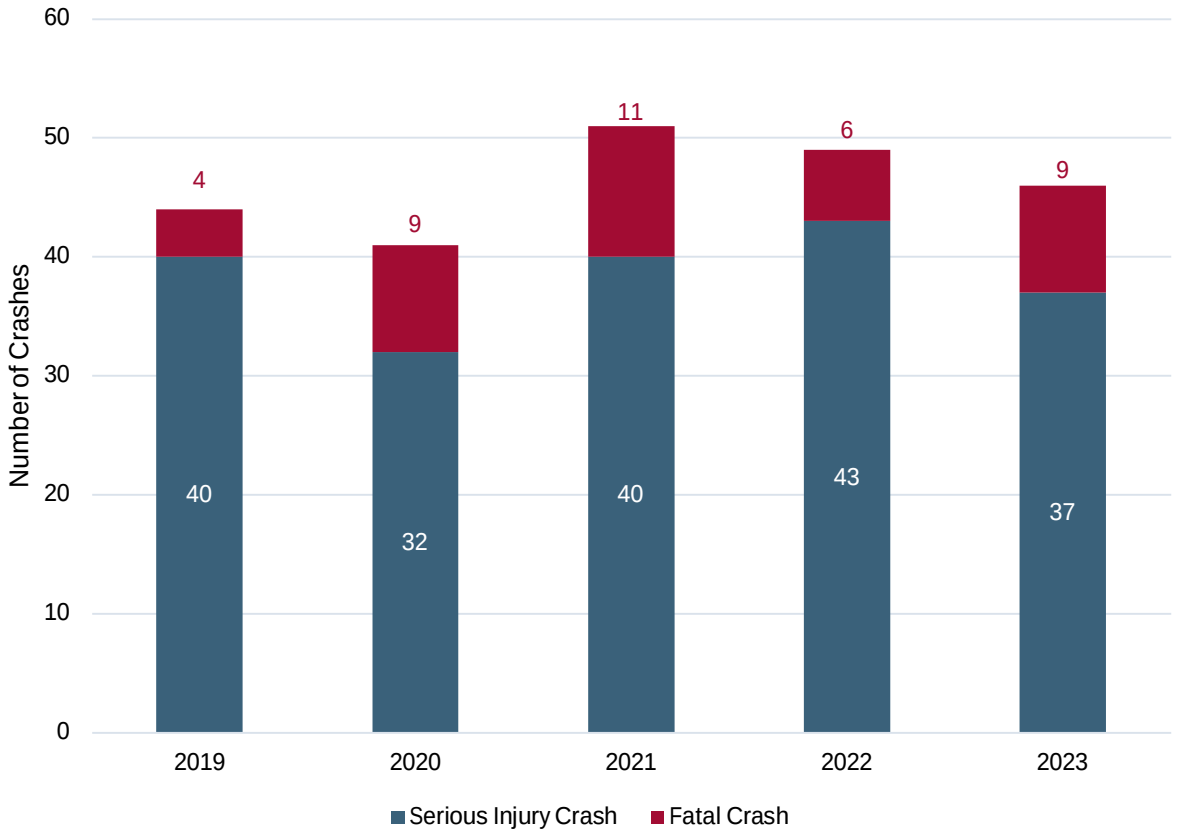

Figure 6. Number Of Fatal and Serious Injury Crashes by Year in Iron County, 2019-2023

The locations of the fatal and serious injury crashes are displayed in Figure 7 and show a prevalence along major roads such as I-15, SR-56, and SR-130.

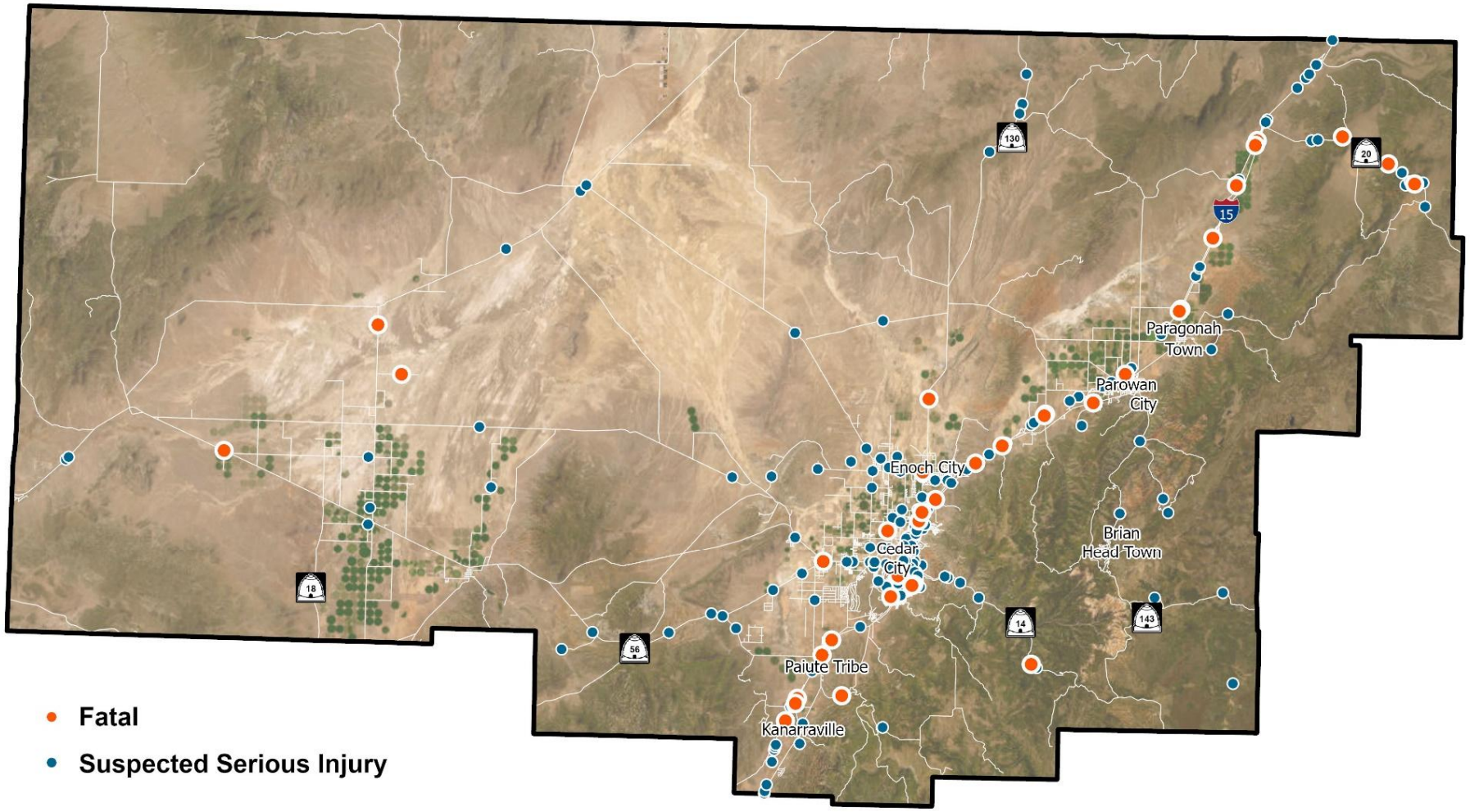

Figure 7. Fatal and Serious Injury Crashes in Iron County, 2019-2023

3.1.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collision categories is shown in Figure 8. The manner of collision represents how two vehicles initially collided.[3] The three most frequent manners of collision that resulted in a fatality or serious injury are single vehicle crashes, sideswipe crashes, and angle crashes.

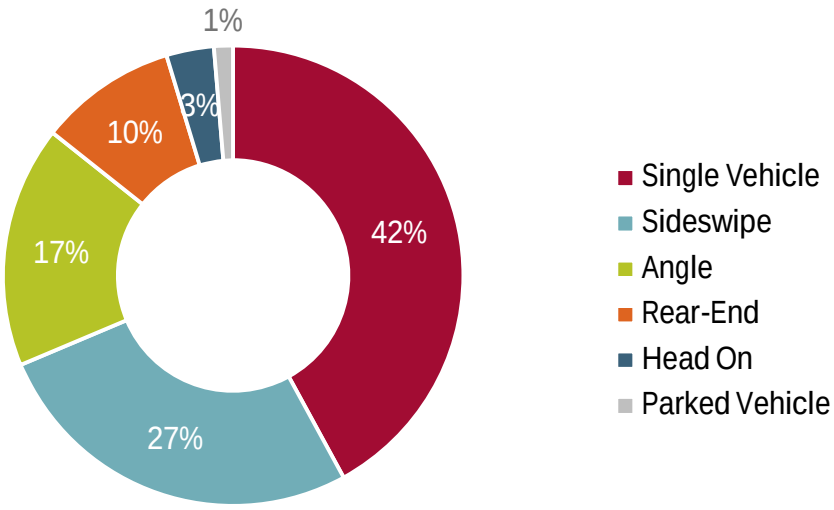

Figure 8. Most Common Fatal and Serious Injury Manners of Collision

3.1.2.2. Crash Types

The most common crash types for fatal and serious injury crashes are shown in Figure 9. Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type; examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The top 10 crash types for Iron County are summarized in Figure 9. The three most common crash types are roadway departure crashes, highway crossover crashes and "other" crashes. The crash type "other" may indicate a unique crash scenario or a gap in data.

[3] The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization as compared to crash type that is summarized in Section 3.1.2.2.

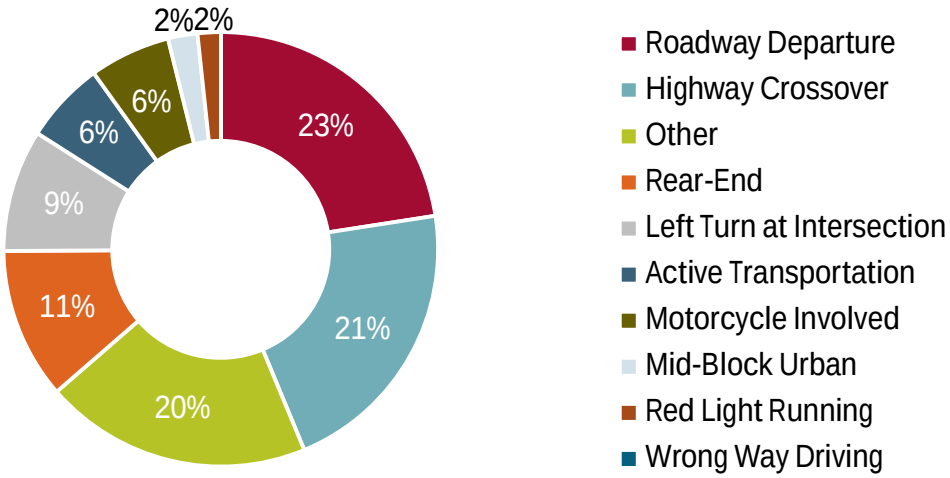

Figure 9. Most Common Fatal and Serious Injury Crash Types

3.1.2.3. Contributing Factors

Several factors may contribute to a single crash; however, the driver contributing factors shown in Figure 10 only represent the first driver-specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. A review of the data shows that the three most frequent driver contributing factors are failing to keep in proper lanes, failing to yield proper right-of-way, and speeding. The second most frequent driver contributing factor is "Other/Unknown," which may indicate a unique scenario or highlight a gap in data collection. The data shows that 19% of reported crashes from 2019 to 2023 did not have a reported driver contributing factor.

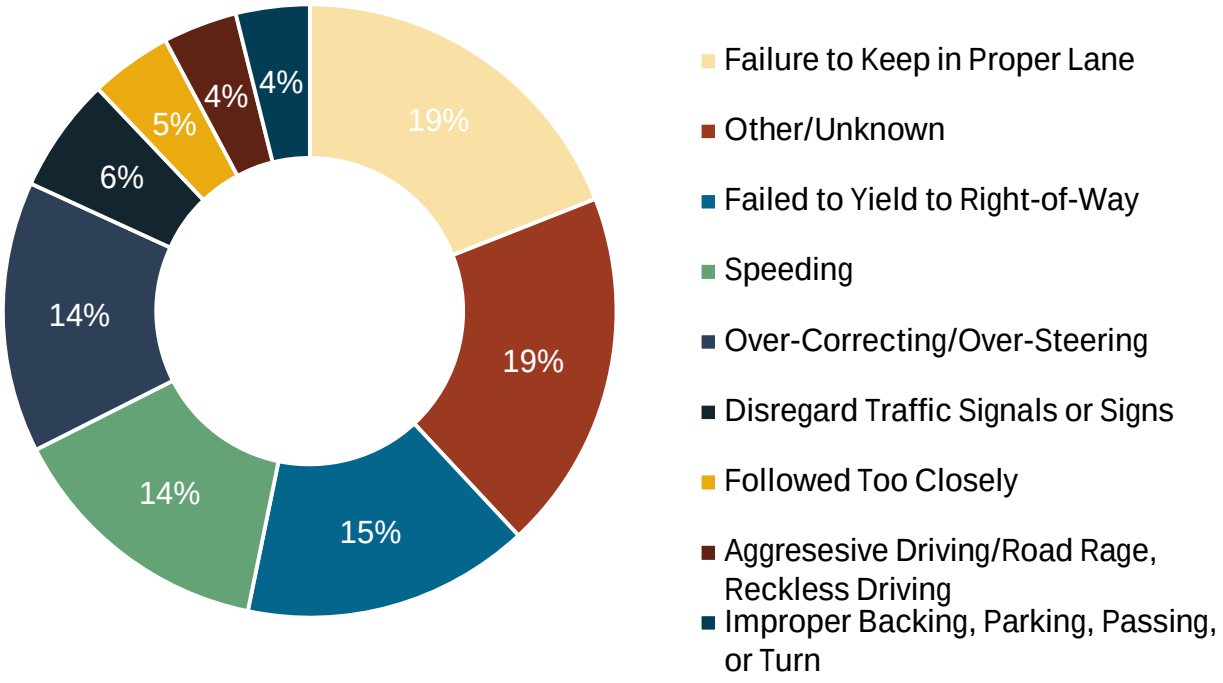

Figure 10. Most Common Fatal and Serious Injury Driver Contributing Factors

3.1.2.4. Vulnerable User Crashes

Vulnerable road users include pedestrians and bicyclists. The crash data shows 38 crashes involving pedestrians and 31 crashes involving bicyclists occurred from 2019 to 2023. Figure 11 shows bicycle-related crashes have decreased since 2019. Pedestrian-related crashes increased significantly after 2019, but in 2023, returned to a lower amount. Figure 12 provides an overview of the fatal and serious injury vulnerable user crashes and shows that both fatal and serious injuries for pedestrians have increased since 2019. The locations of these crashes are displayed in Figure 13 and show a prevalence along major roads in Cedar City such as 200 North (SR-56), Main Street, and Cross Hollow Road.

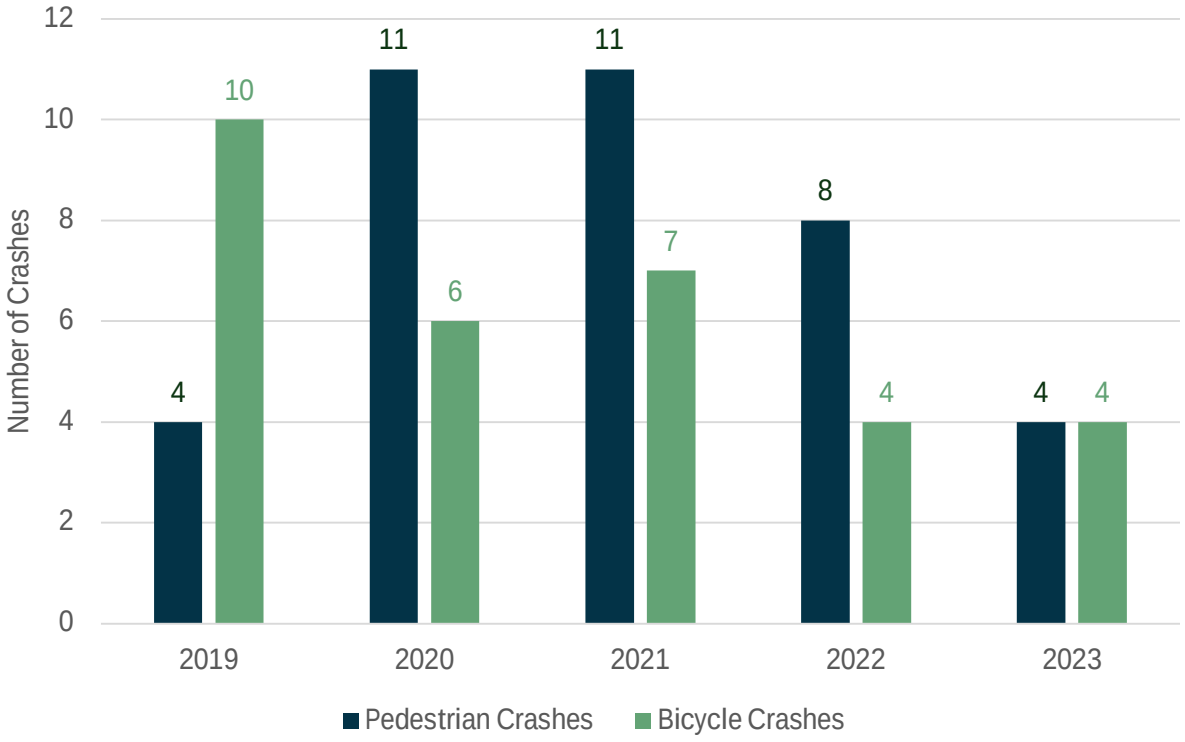

Figure 11. Vulnerable User Crashes by Year, 2019-2023

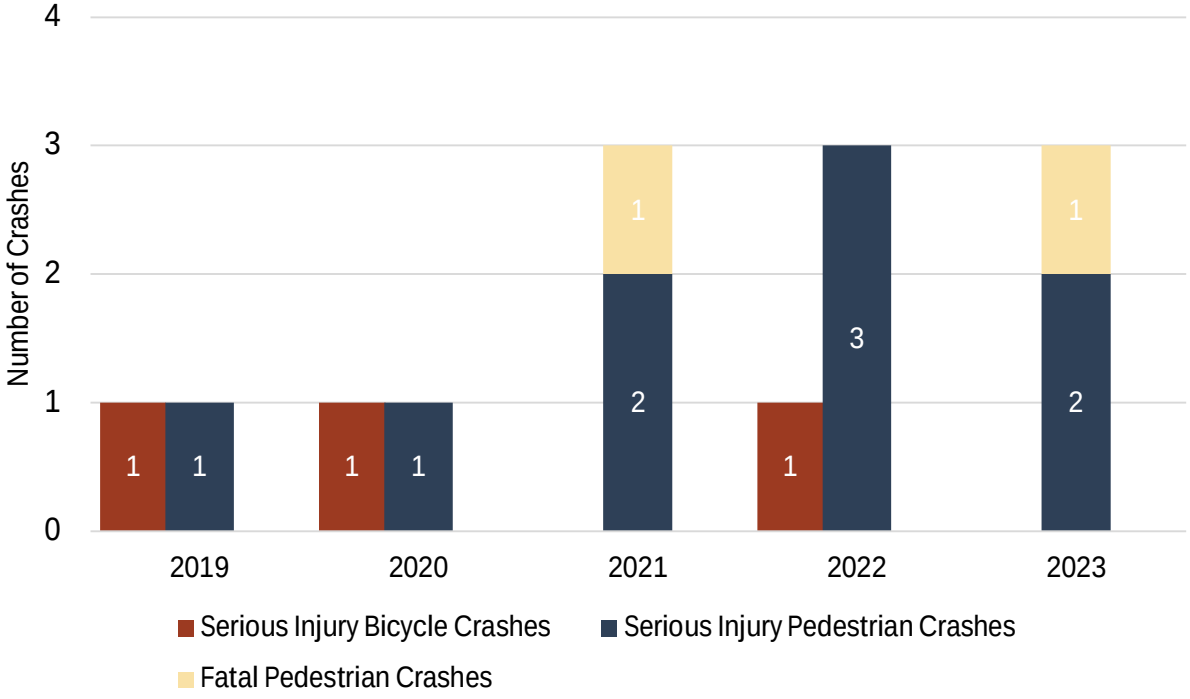

Figure 12. Fatal and Serious Vulnerable User Crashes by Year, 2019-2023

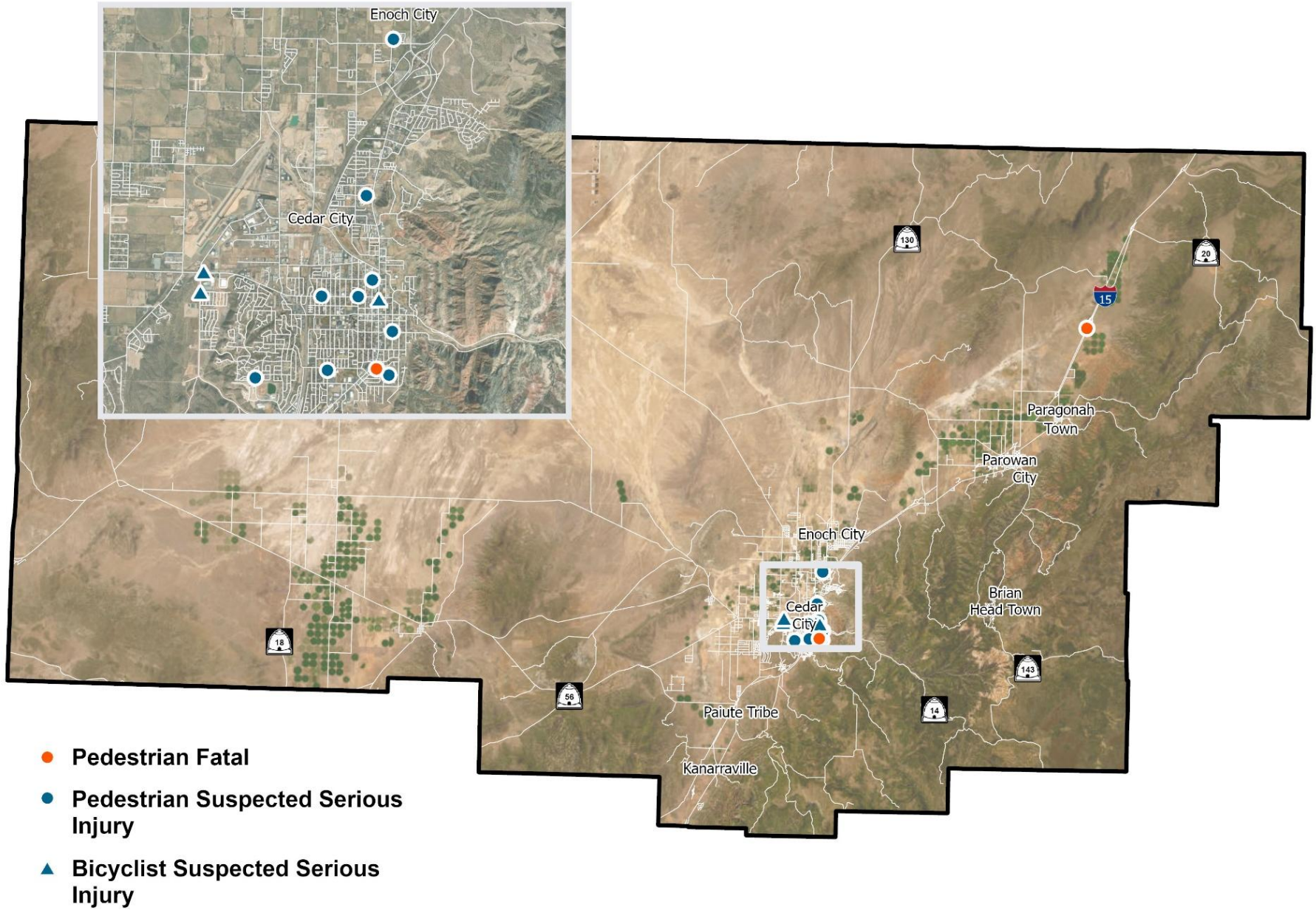

Figure 13. Fatal and Serious Injury Vulnerable User Crashes in Iron County, 2019-2023

3.2. Utah SHSP Emphasis Safety Areas

The Utah SHSP identifies 11 emphasis safety areas, grouped into three categories, to focus the effort of reducing traffic fatalities and serious injuries throughout the State of Utah. The Utah SHSP emphasis safety areas are shown in Figure 14.

To provide insight to emphasis areas in Iron County and each GFA, the number of fatalities and serious injuries corresponding to each emphasis area is compared to the total occurring in Utah.

A ranking is assigned to each emphasis area for the state, Iron County, and each GFA, based on the frequency of fatalities and serious injuries for that emphasis area. A fatality or serious injury may be assigned to multiple emphasis areas. Table 6 includes the total fatalities and serious injuries by emphasis area, and the rank order of emphasis area by the number of traffic fatalities and serious injuries. The table compares rankings for all of Utah, Iron County, and each GFA. Detailed SHSP emphasis area comparisons are provided for each GFA in Appendix A.

This analysis helps to determine priority emphasis areas for Iron County and each GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different from the statewide or County total rankings.

The following five emphasis areas have the highest frequency of fatalities and serious injuries in Iron County. The SAP will identify strategies to address these priority emphasis areas:

1. Roadway departure
2. No safety restraints
3. Speed-related
4. Intersection
5. Teen driver

Utah SHSP Emphasis Safety Areas

- Teen Driving Safety
- Senior Safety
- Speed Management
- Aggressive Driving
- Distracted Driving
- Impaired Driving
- Use of Safety Restraints
- Intersection Safety
- Roadway Departure Crashes
- Motorcycle Safety
- Pedestrian Safety

Figure 14. Utah SHSP Emphasis Areas

Table 6. Utah SHSP Emphasis Safety Area Rank Comparison

Category	Utah SHSP Emphasis Safety Area	Statewide		Iron County		Cedar City GFA	Enoch City GFA	East Iron County GFA	West Iron County GFA	I-15 GFA
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Rank	Rank	Rank	Rank	Rank
		9,470	#	287	#	#	#	#	#	#
Driver	Teen Driver	1,695	4	54	5	3	5	6	3	6
	Older Driver	1,565	7	49	6	2	3	5	9	4
	Speed-Related	2,268	3	78	3	7	9	2	2	3
	Aggressive Driving	615	11	19	10	9	8	9	9	9
	Distracted Driving	732	10	28	8	10	6	10	10	5
	Impaired Driving	1,100	8	27	9	11	7	5	6	7
	No Safety Restraints	1,627	5	85	2	8	1	4	4	2
Roadway	Intersection	3,683	1	67	4	1	2	8	5	11
	Roadway Departure	3,372	2	132	1	4	4	1	1	1
Vulnerable Users	Motorcycle	1,571	6	40	7	5	10	3	7	8
	Pedestrian	1,000	9	15	11	6	11	11	11	10
	Bicycle*	303	12	3	12	12	12	12	12	12

*Bicyclists are not one of the eleven Utah SHSP emphasis areas but was included as part of the SAP safety analysis.

4. SAFETY ANALYSIS METHODOLOGIES

The High-Risk Network for the SAP is developed using multiple safety analyses that identify roadway segments and intersections with the highest safety risk and needs. The High-Risk Network represents locations with the largest potential for safety improvement. The following methodologies contribute to the identification of a High-Risk Network:

- Historic Crashes
- Network Screening
- Conflict Areas
- Risk Characteristics

Figure 15 an overview of the safety analyses performed for the SAP. Each safety analysis component uses different data sets or methodology to help determine high-crash, high-injury, or high-risk locations to identify the resulting High-Risk Network. The four safety analyses combined leads to a High-Risk Score and Network from which potential safety improvement project locations may be identified. The High-Risk Network provides focused information for decisions regarding prioritization of safety improvements.

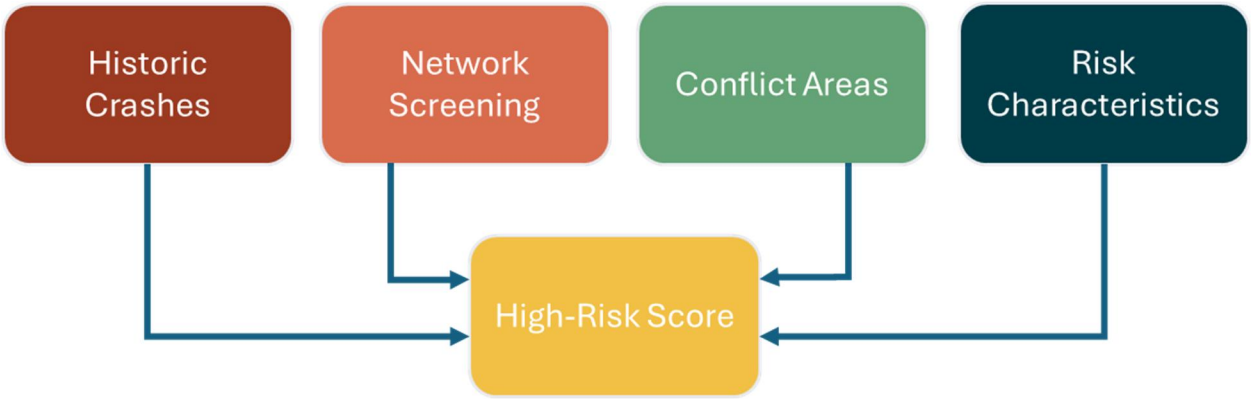

Figure 15. Safety Analysis Components

4.1. Historic Crash Analysis

Understanding the types and locations of vehicle crashes is an important part of analyzing the safety conditions of a roadway network. A component of the SAP is to identify locations with an elevated risk of crashes. The initial step of this analysis is to spatially reference crashes that occurred within the study area.

The following networks were created using the historic crash locations:

- High-Crash Network: Represents roadways and intersections that experience high crash rates and where most crashes occur
- High-Injury Network: Represents roadways and intersections where fatal and serious injury crashes often occur

4.1.1. High-Crash Network

Concentrations of crashes were identified by spatially referencing crashes to individual intersections and roadways, and calculating a crash rate (crashes per mile, all severities) for each roadway segment. For each intersection, a rate of crashes per entering vehicles was calculated. Entering vehicles data was obtained from UDOT.

The resulting High Crash Network represents locations where crashes are occurring at a higher rate in comparison to other locations.

The roadway network shown in Figure 16 illustrates the resulting High-Crash Network. The High-Crash Network includes locations where 50% of all crashes have occurred on the transportation network.

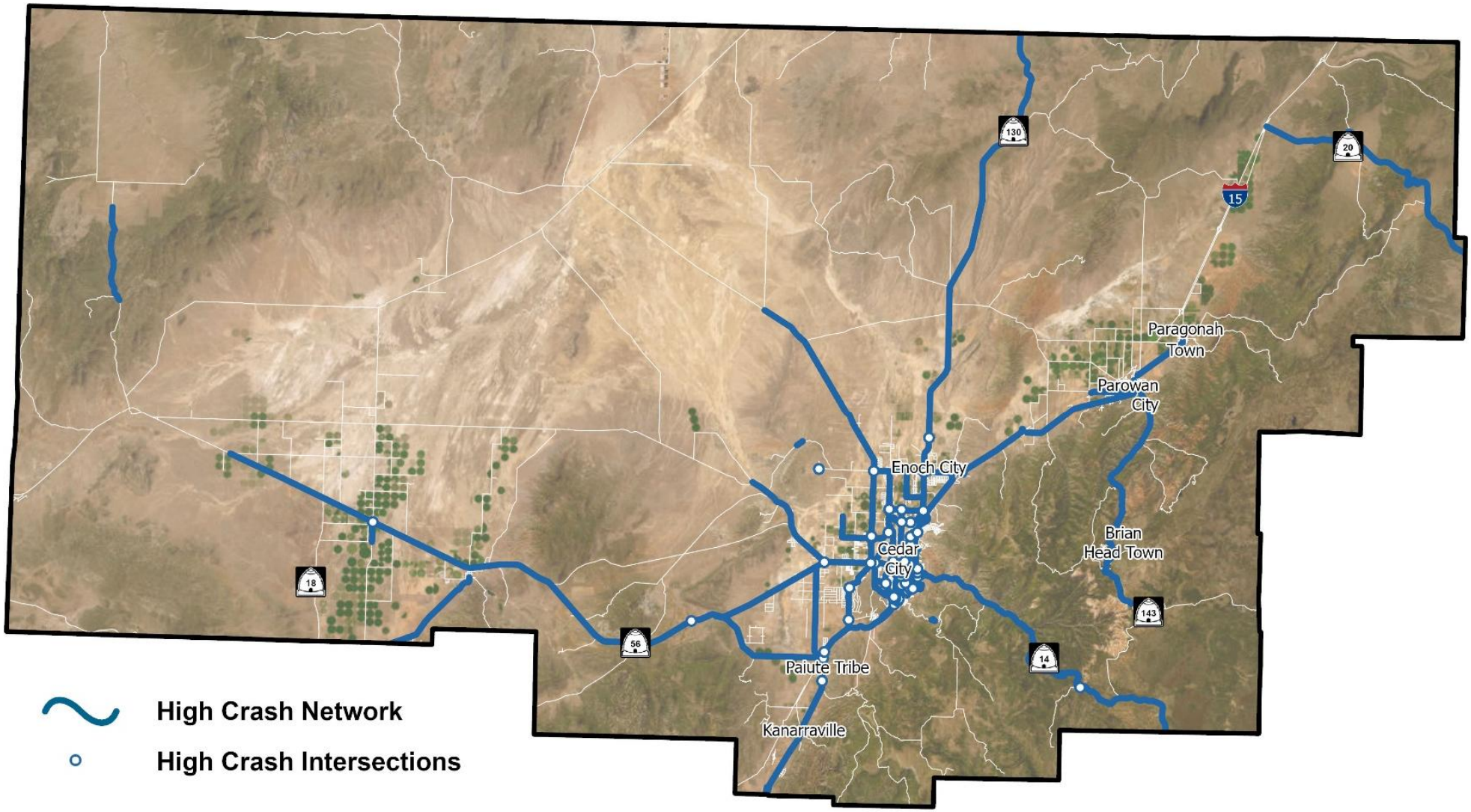

Figure 16. High-Crash Network in Iron County

4.1.2. High-Injury Network

The Safe System Approach strategies and countermeasures seek to not only reduce the number of crashes that occur, but also reduce the severity when a crash does occur. Identifying locations of fatal and serious injury crashes is key to detecting patterns in location or characteristics of the roadways or intersections that are potentially impacting the frequency of severe injury or fatal crashes.

The High-Injury Network was identified by spatially referencing fatal and injury crashes to the roadway network. An "injury rate" of fatal, serious injury, and minor injury crashes per mile was calculated for each roadway segment. A similar injury rate was calculated for intersections as, crashes per million entering vehicles.

Figure 17 shows the resulting High-Injury Network, which represents roadways and intersections where 50% of fatal and injury crashes occurred. Adjacent roadway segments were combined to illustrate more complete corridors or locations with safety issues.

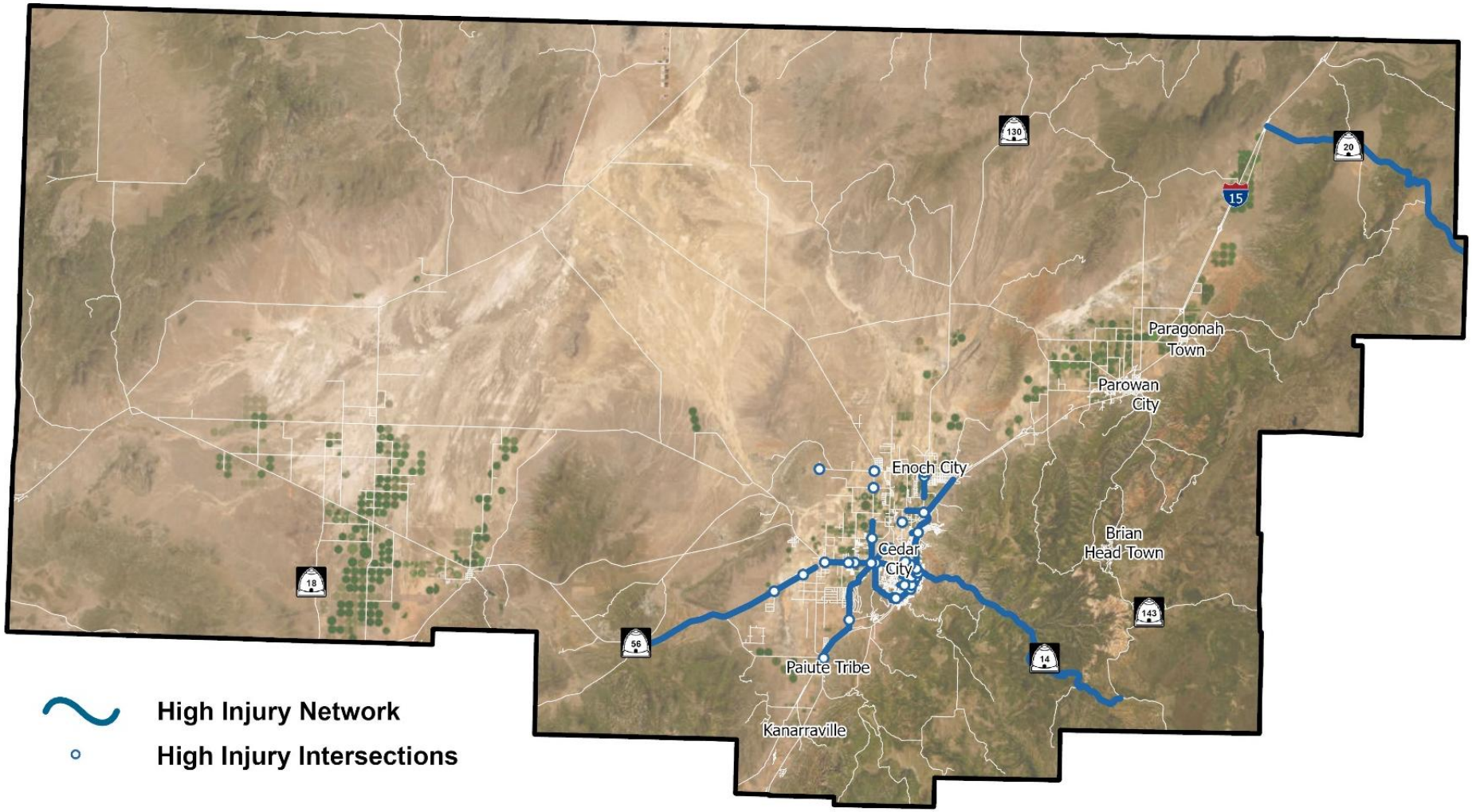

Figure 17. High-Injury Network in Iron County

4.2. Network Screening

The Highway Safety Manual, Volume 1 Part B, Roadway Safety Management Process outlines the process for agencies to monitor and reduce crash frequency and severity on existing roadway networks. The basic structure of the Roadway Safety Management Process is illustrated in Figure 18 and starts with a network screening.

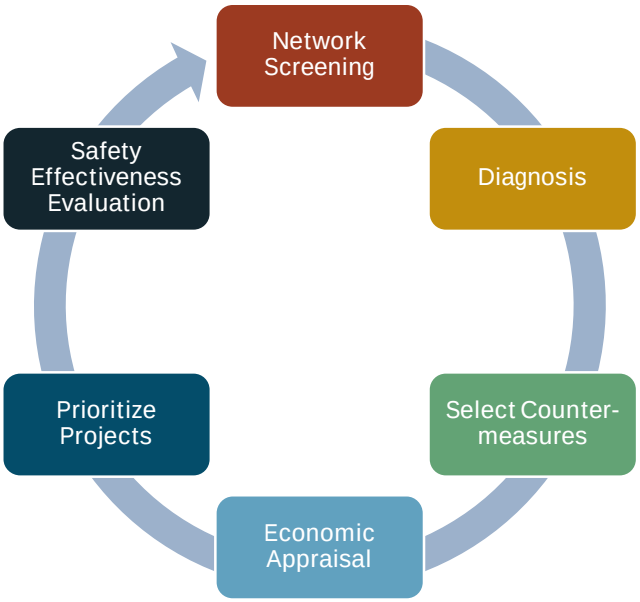

Figure 18. Roadway Safety Management Process

Network screening identifies and ranks locations from most likely to least likely to realize a reduction in crash frequency with the implementation of a particular countermeasure or set of countermeasures. Locations identified as most likely to benefit from a reduction in crash frequency are then evaluated in more detail to identify crash patterns, contributing factors, and appropriate countermeasures. The network screening analysis applied in the SAP is based on the Highway Safety Manual Volume 1, Part B, Chapter 4.

The network screening steps included the following:

1. Establish sub-populations of roadway segments and intersections with similar characteristics. Roadway segments are grouped by their roadway functional classification. Roadway functional classifications include interstate or freeway ramps, major arterials, secondary arterials, collector arterials and local streets. Intersections are grouped by their control type, either signalized or unsignalized.
2. Calculate individual crash rates for each sub-population.
3. Identify locations with more crashes than expected by comparing to the sub-population level crash rates. This is known as the *critical crash rate analysis*.

Each crash metric is summarized in the following sections and the detailed results for Each GFA is provided in Appendix A.

4.2.1. Critical Crash Rate

The critical crash rate method is a statistical review of locations to determine where risk is higher as compared to similar locations with the same functional classification and similar traffic volumes. It also helps to identify systemic patterns that may be prioritized and addressed.

The critical crash rate analysis compares the observed crash rate to the expected crash rate at a particular location, based on the facility type and traffic volume using a calculated average crash rate for the specific type of intersection or roadway segment being analyzed. Based on UDOT collected traffic volumes and a weighted crash rate for each facility type, a critical crash rate threshold is established at the 95% confidence level to determine locations with higher crash rates that are unlikely to be random. The threshold is calculated for each location based on its traffic volume and the crash profile of similar facilities, consistent with equations specified in the Highway Safety Manual, Chapter 4.

A critical crash rate differential is determined for each intersection and roadway segment by calculating the difference of the location-specific critical crash rate and the expected critical crash rate. A positive critical crash rate differential indicates a location with higher-than-expected crashes or a location with a potential for safety improvement.

The analysis identifies intersections and roadway segments with the highest critical crash rate differentials for all roadways and intersections in Iron County

4.2.2. Network Screening Results

Roadway segments and intersections identified through critical crash rate analysis are shown in Figure 19. These locations represent those with a positive critical crash rate differential. A positive critical crash rate differential is an indication of a location with a potential for safety improvement. A detailed list of each roadway segment and intersection is provided in Appendix A with the associated number of crashes. These locations represent those with the highest potential for safety improvement and should be considered as potential project locations.

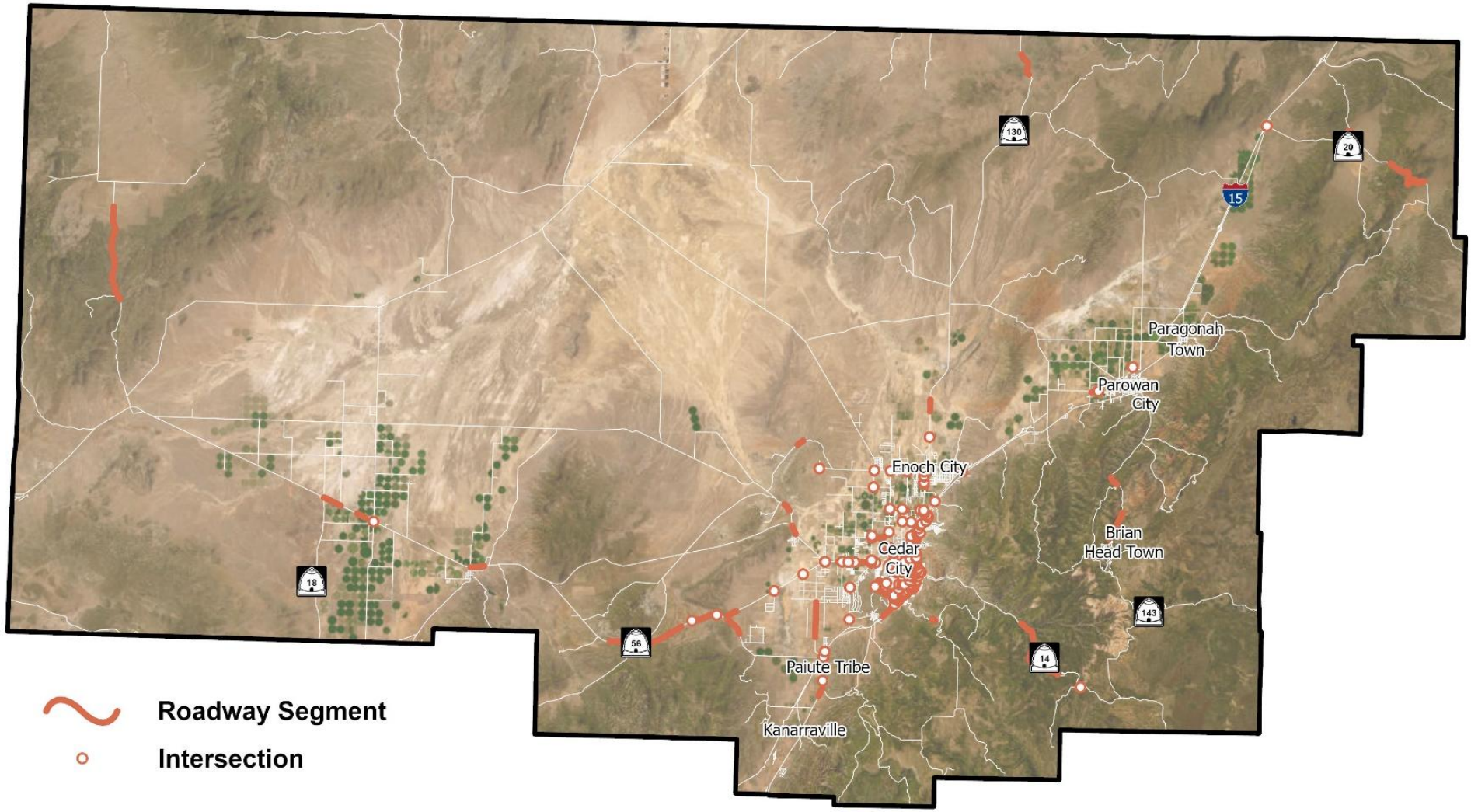

Figure 19. Critical Crash Rate Roadway Network in Iron County

4.3. Conflict Areas

Conflict Areas analysis used data provided by Replica, obtained for the Iron County area, to proactively address areas of greater potential safety risks. Replica is an online data platform that aggregates cellular data to identify mobility patterns and trends in travel. Replica provides a digital application called Safe Streets Planner that combines detailed multimodal data with driving event data to identify and prioritize high conflict or risk corridors.

Replica's cellular data includes indicators of certain risky behaviors including speeding, distracted driving, and hard-braking. The number of instances or "events" of risky behaviors is used to calculate a risk score for each roadway. Risky events captured in the data include speeding, phone handling, sudden braking, sudden acceleration, and suspected collisions (or near-miss collisions). Risk scores are calculated to represent the proportion of risky events to the number of total vehicle trips on a roadway. Roadways with higher risk scores represent roadways with the most safety conflicts.

The following metrics were isolated in Replica to identify the highest risk roadways in Iron County from the data set:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking
- Active Transportation (pedestrians and bicyclist) high-risk corridors

The maximum risk score is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are included in the Replica Conflict Network shown in Figure 20 and Figure 21 for Iron County.

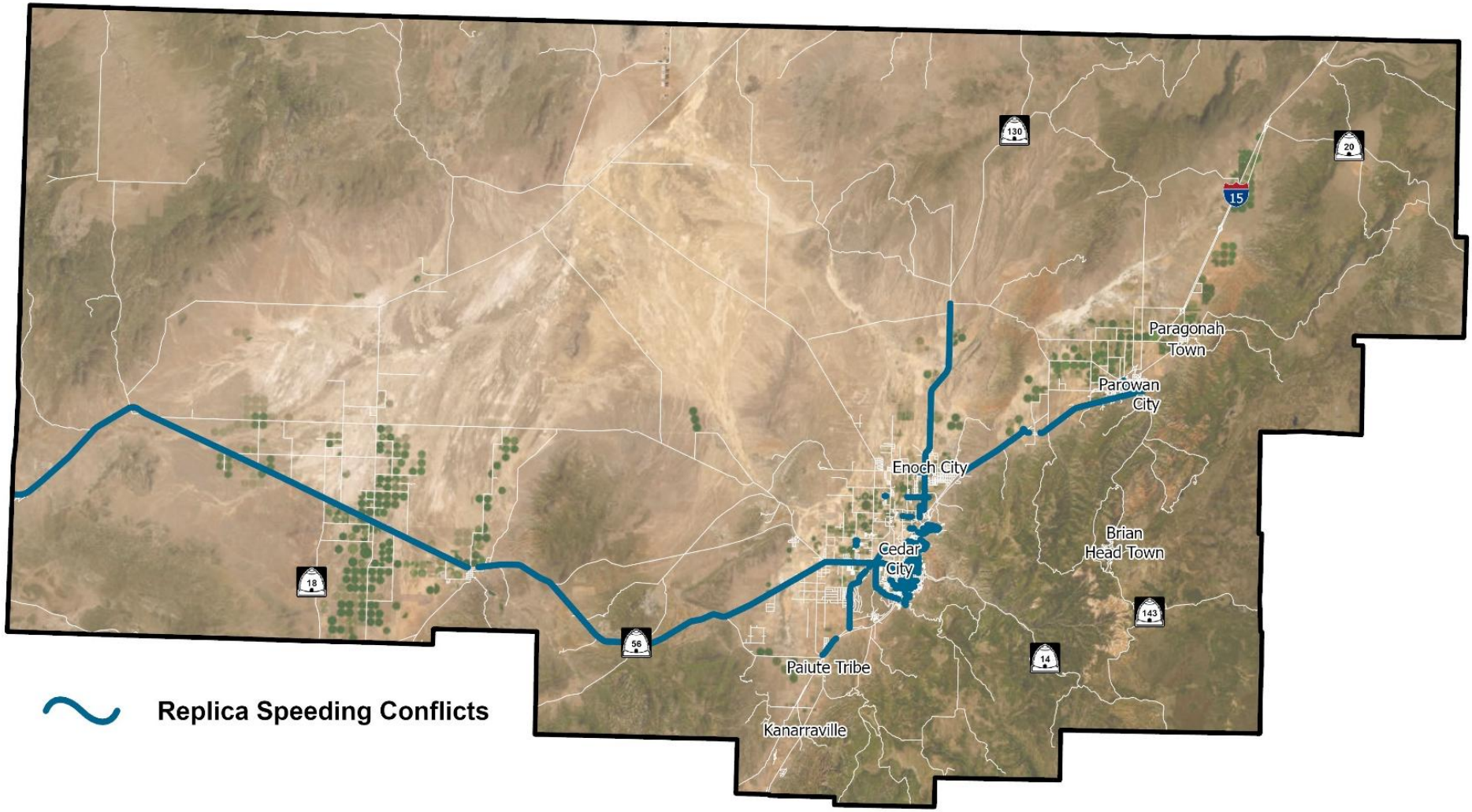

Figure 20. Replica Speeding High-Risk Roadway Network in Iron County

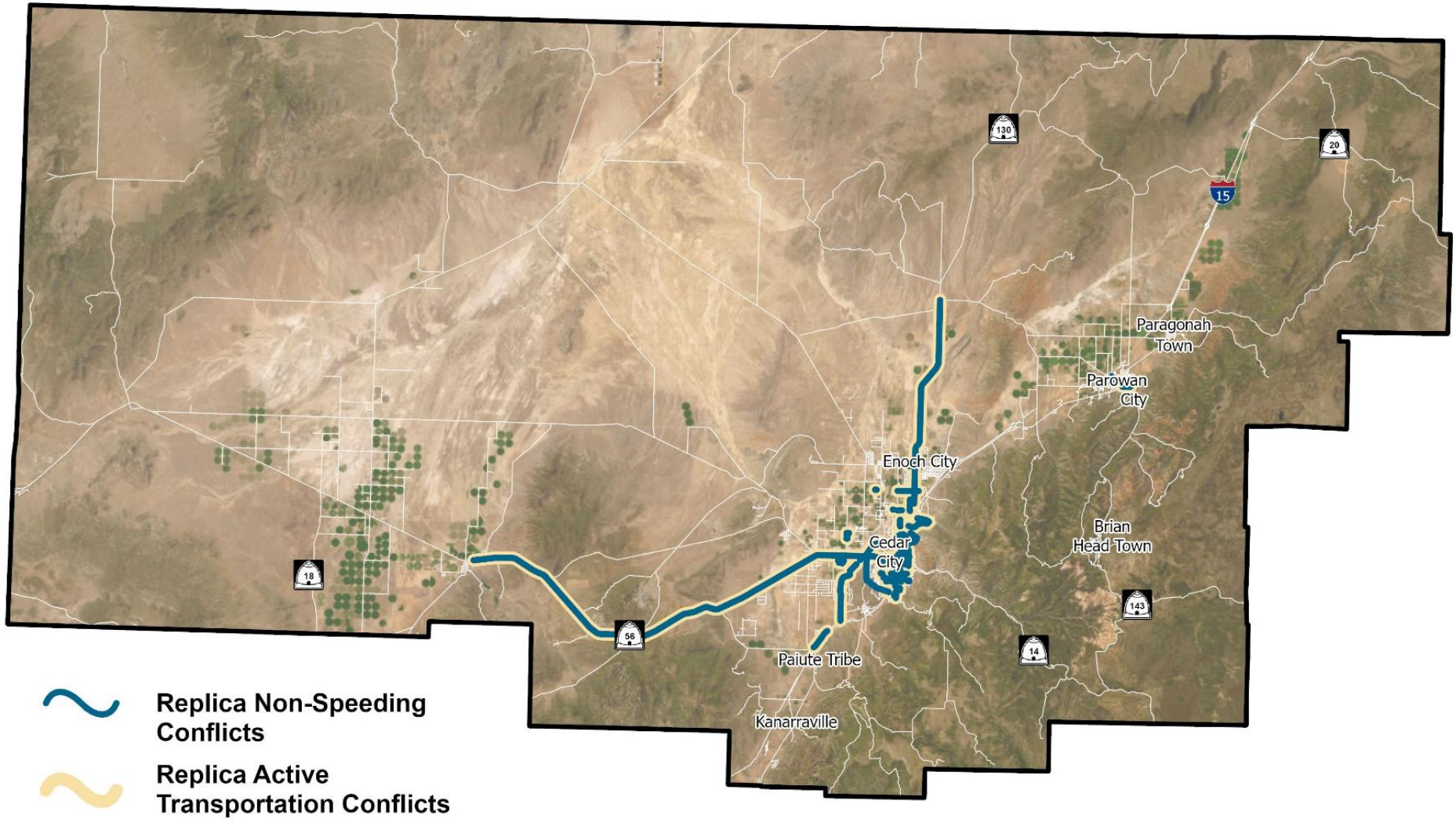

Figure 21. Replica Non-Speeding Roadway Network in Iron County

4.4. Roadway Characteristics Risk Analysis

A roadway characteristic risk analysis was performed to identify characteristics that may lead to fatal and serious injury crashes occurring on roadway segments within each GFA, using the following two sub-analyses:

- Crash Profile Risk Assessment
- usRAP Risk Factors Analysis

4.4.1. Crash Profile Risk Assessment

The Crash Profile Risk Assessment reviewed fatal and serious injury crashes reported in the SAP study area to identify attributes that correspond to a higher frequency of fatal and serious injury crashes. A point value was assigned to each characteristic or attribute based on the frequency per the review. A risk factor score was calculated for each state and federal aid route. Note, the dataset used in this analysis is only available for state or federal aid routes.

Table 7 outlines the Crash Profile Risk factor scoring framework. The roadway characteristic data used in this assessment is extracted from UDOT's United States Road Assessment Program (usRAP) dataset. UDOT collects and maintains usRAP data for state and federal aid routes for the entire state. Local roads were not included in this analysis because sufficient data regarding their attributes is not available. This analysis identifies roadway segments where improvements may be made to reduce potential for crashes. Figure 22 shows the Crash Profile Risk network in Iron County.

Table 7. Crash Profile Risk Assessment Scoring

Risk Factor	Characteristic	Measurement & Points	Max Points	Explanation
Traffic Volume	Average Annual Daily Traffic (AADT)	1: <750 2: 750-1,000 3: 1,000-1,350 4: 1,350-2,000 5: 2,000+	5	A review of regional crash data shows that: Roadways with more than 2,000 ADT experience approximately 75.4% of all crashes. Roadways with ADT of 10,000 to 20,000 experience approximately 66.3% of all fatal and serious injury crashes.
Speed	Speed Limit – Miles Per Hour (MPH)	1: ≤ 25 2: 30 MPH 3: 40 MPH 4: 50 MPH	5	A review of regional crash data shows that:

Risk Factor	Characteristic	Measurement & Points	Max Points	Explanation
		5: ≥ 60 MPH		71.4% of fatal and serious injury crashes occurred on roadways with a posted speed limit of 50 MPH. 21.4% of fatal and serious injury crashes occurred on roadways with a posted speed limit of 40 MPH or less. 7.1% of fatal and serious injury crashes occurred on roadways with a posted speed limit of 60 mph or above.
Roadway Type	Cross Section	2: 4 Lane Undivided 3: 2 Lane w/TWLTL 4: 4 Lane w/TWLTL 5: 2 Lane Undivided	5	A review of regional crash data shows that: 36.8% of fatal and serious injury crashes in rural areas occurred on two-lane undivided roadways. 30.2% of fatal and serious injury crashes in rural areas occurred on four-lane undivided roadways. 26.6% of fatal and serious injury crashes in rural areas occurred on four-lane roadways with TWLTL.
Lighting Condition	Presence of Lighting	0: Lighting 5: No Lighting	5	FHWA estimates that lighting can reduce crashes by up to 28% (for night-time injury crashes).
Access Density	Presence of Commercial Access	0: No Commercial Access 5: Commercial Access	5	5.6% of fatal and serious injury crashes occurred on segments with at least one commercial access.
Centerline Condition	Presence of Centerline Rumble Strip	0: Rumble Strip 5: No Rumble Strip	5	FHWA estimates that centerline longitudinal rumble strips can reduce head-on fatal and serious injury crashes by 44%-64%
Shoulder Condition	Presence of Shoulder Rumble Strip	0: Rumble Strip 5: No Rumble Strip	5	FHWA estimates that shoulder rumble strips can reduce single vehicle, run-off-road fatal and serious injury crashes on two lane rural roads by 13%-51%
Shoulder Condition	Presence of Paved Shoulder	1: ≥3.3' Paved Shoulder 3: <3.3' Paved Shoulder 5: No Paved Shoulder	5	11.3% of fatal and serious injury crashes occurred on segments with non-paved shoulders.
Roadside Hazard	Presence of Fixed Object	0: No Roadway Fixed Object 1: Distance to Fixed Object (≥ 16.4')	5	HSM crash prediction models for urban roadways segments indicate a reduction in total crashes with greater offsets to fixed objects

Risk Factor	Characteristic	Measurement & Points	Max Points	Explanation
		3: Distance to Fixed Object (3.3'-< 16.4') 5: Distance to Fixed Object (< 3.3')		
Geometrics	Curve	0: No Curve or Gentle Curve 2: Moderate Curve 5: Sharp or Very Sharp Curve	5	25.4% of fatal and serious injury crashes in the study area occurred on roadways with sharp or very sharp curves.

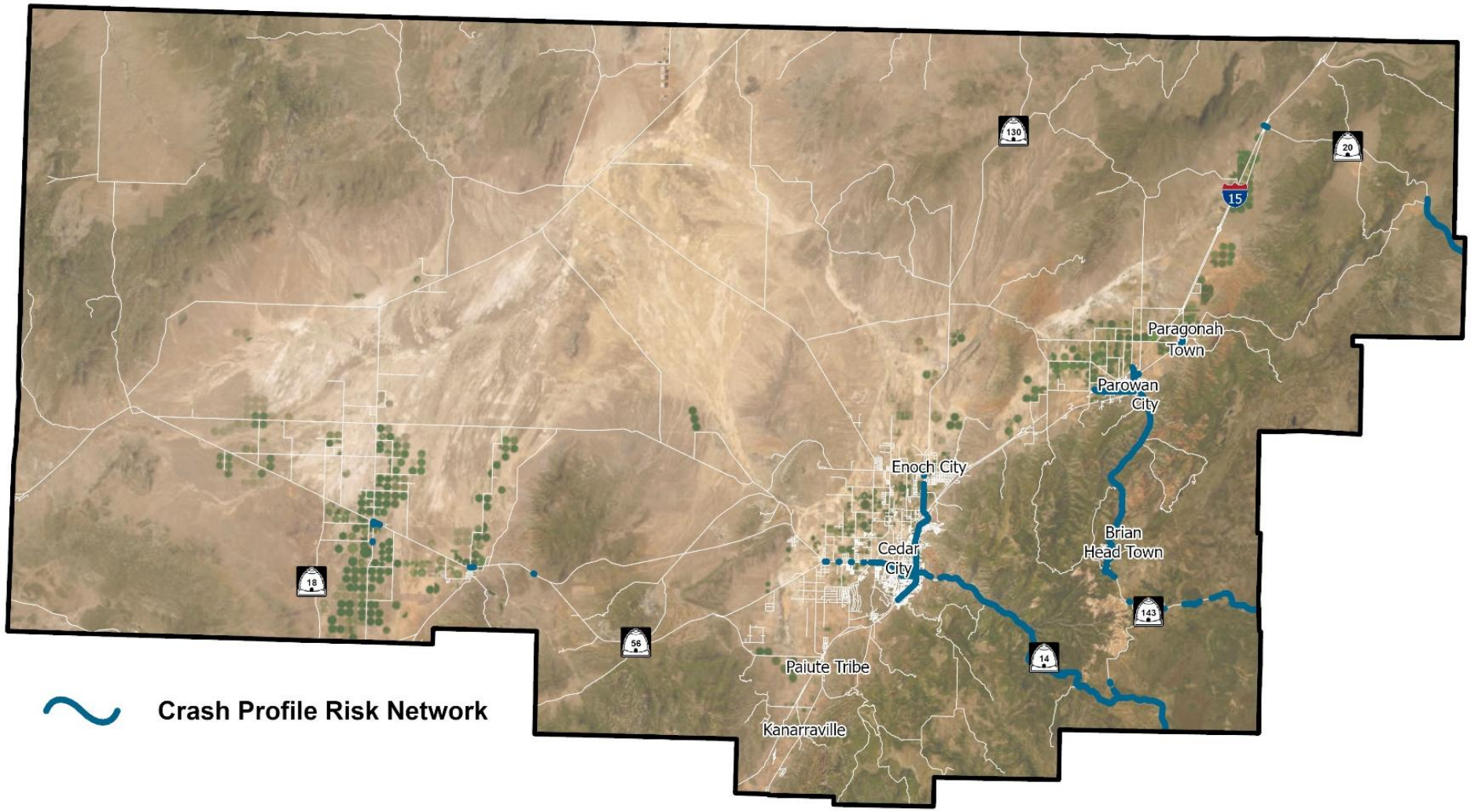

Figure 22. Crash Profile Risk Roadway Network in Iron County

4.4.2. usRAP Risk Factors Analysis

The usRAP is a proactive tool for analyzing the safety of a roadway. usRAP is recommended to be supplemented by other crash data and safety assessments.

Software (known as ViDA) analyzes usRAP roadway data and outputs star ratings on a 1-5 scale for vehicle, pedestrian, and bicycle risk. Star ratings are assigned to each segment of a roadway network. Star ratings consider road infrastructure attributes known to impact the likelihood of a crash occurring and its severity. A roadway's star rating is based on the presence or absence of design and traffic control features. Stars are awarded depending on the level of safety that is "built-in" to the roadway. Five-star roadways have the most safety-related design and traffic control features. One-star roadways have the fewest safety-related design and traffic operational features. In practice, 5-star rated roads are rare. The safest roads are usually in the 3 star and above range. The best candidates for safety improvements usually fall in the 2 star and below range.

Separate star ratings are assigned for vehicle occupants, bicyclists, and pedestrians. The star ratings consider factors related to both crash likelihood and crash protection. Previous research has demonstrated that the vehicle-occupant star ratings for roads are strongly related to fatal and serious injury crash frequencies. Figure 23 provides a summary of the usRAP star rating system including characteristics that lead to the star rating.

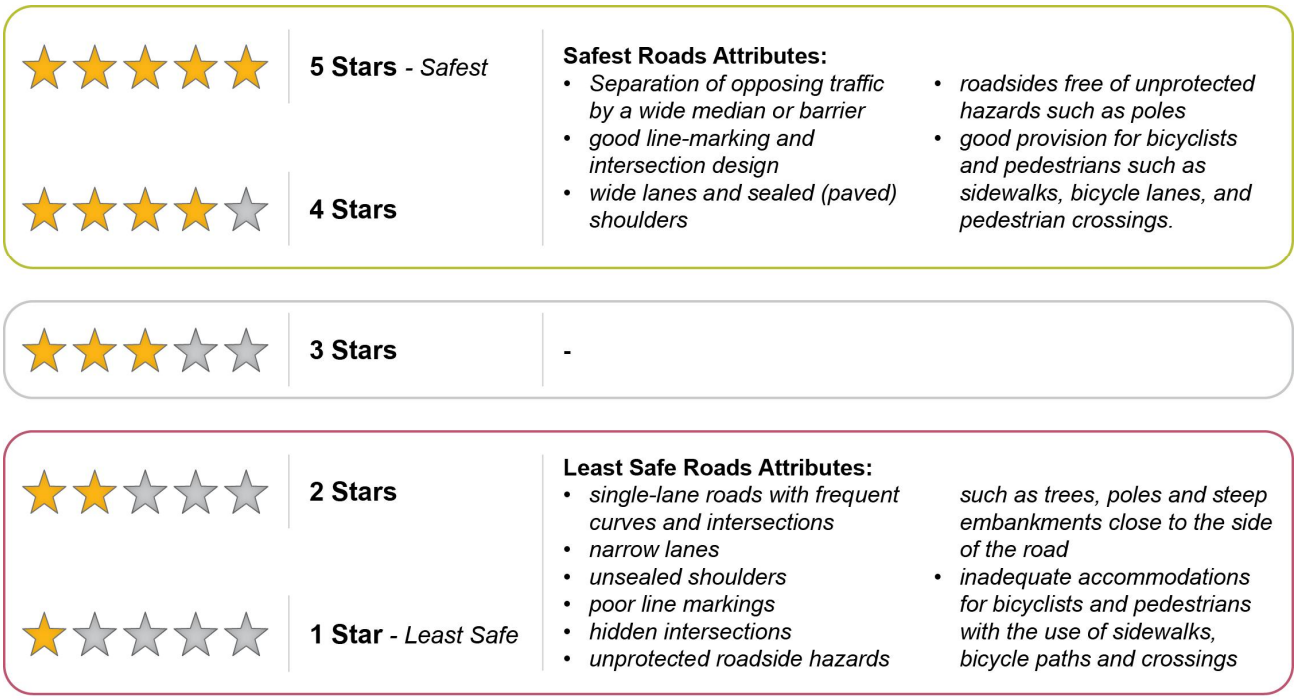

Figure 23. usRAP Star Rating Description

Figure 24 shows the usRAP star rating for all Iron County. Segments with a 1–2-star rating within each GFA are summarized in each GFA in Appendix A.

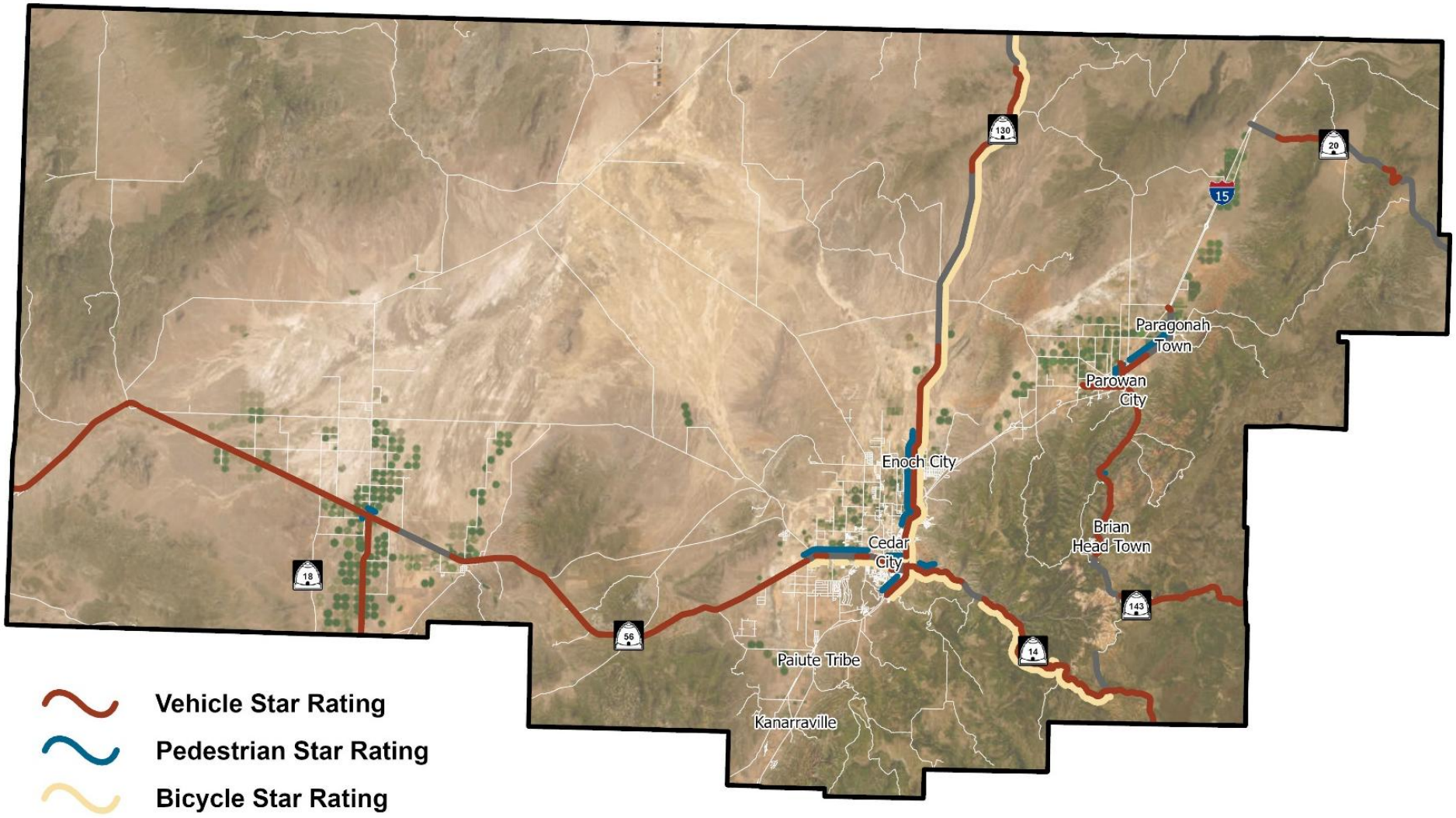

Figure 24. usRAP Risk Star Rating Roadway Network in Iron County

4.5. High-Risk Network Identification

Each of the safety analysis methodologies identified roadway segments or intersections that may benefit from safety improvements to reduce fatalities and serious injuries.

To provide focused information for decisions regarding prioritization of safety improvements, an overlay of each analysis methodology is created to form a High-Risk Network.

Locations included on the High-Risk Network are those identified with the highest safety risk. Note that the High-Risk Network includes intersections identified in the high crash network, high-injury network and the critical crash rate analysis. The High-Risk Network is illustrated in Figure 25.

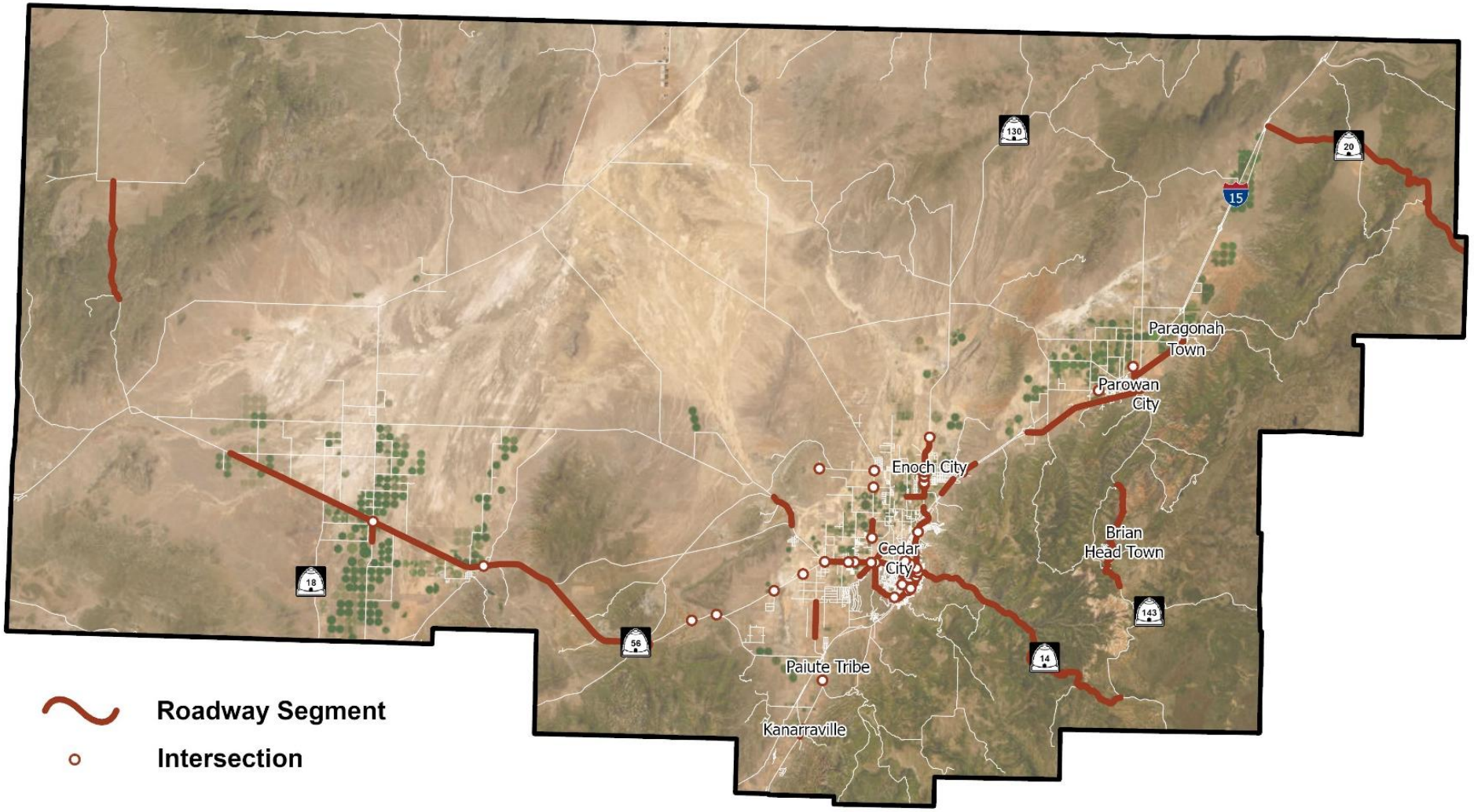

Figure 25. High-Risk Network in Iron County

5. CONCLUSION AND NEXT STEPS

The Safety Action Plan for Iron County will develop a holistic strategy to reduce traffic fatalities and serious injuries on Iron County roadways. The SAP recommendations will be based on the Safe System Approach, a guiding paradigm to address roadway safety and mitigate the risk inherent in complex transportation systems.

The SAP will prioritize strategies to address safety needs identified from the crash analysis. The crash analysis identified trends based on a historical review of crashes and a comparison to the Utah SHSP emphasis areas.

- Historical crash analysis: Provides an overview of the most frequent crash types and contributing factors.
- Utah SHSP Emphasis Area Comparison: Crashes in Iron County are grouped based on the Utah SHSP Emphasis Areas and are compared to statewide crash data.

The resulting High-Risk Network is a product of the overlay of several individual safety analysis of the roadway and intersection network.

- High-Crash Network: Includes roadways and intersections on which 50% of all crashes occurred and experience high crash rates.
- High-Injury Network: Includes roadways and intersections on which 50% of fatal and serious injury crashes occurred.
- Network Screening: Identifies and ranks locations from most likely to least likely to realize a reduction in crash frequency with the implementation of a particular countermeasure or set of countermeasures.
- Conflict Areas: Identifies roadways where risky, unsafe behaviors typically occur.
- Risk Characteristics: Includes roadways with characteristics that typically contribute to fatal and serious injury crashes.

The crash analysis and High-Risk Network will help inform the identification of locations where safety recommendations could be considered. These locations will be reviewed with stakeholders at workshops scheduled for February 2025. The stakeholders may also discuss the types of safety-focused projects that should be considered. Based on input from the sub-committee, potential projects and strategies will be identified for high priority locations.

6. GEOGRAPHIC FOCUS AREA ANALYSIS RESULTS

A summary of safety analysis results based on the methodologies described in this report for each GFA are compiled in Appendix A. Table 8 identifies the Appendix number by GFA.

Table 8. GFA Directory for Appendix A

Geographic Focus Area	Appendix #
Cedar City	A1
Enoch City	A2
East Iron County	A3
West Iron County	A4
Interstate-15 (I-15)	A5

7. APPENDICES

7.1. Appendix A – Geographic Focus Areas Safety Analysis and Results

7.1.1. Appendix A.1 Cedar City GFA Safety Analysis and Results

7.1.2. Appendix A.2 Enoch City GFA Safety Analysis and Results

7.1.3. Appendix A.3 East Iron County GFA Safety Analysis and Results

7.1.4. Appendix A.4 West Iron County GFA Safety Analysis and Results

7.1.5. Appendix A.5 Interstate 15 GFA Safety Analysis and Results

APPENDIX A.1. CEDAR CITY GFA SAFETY ANALYSIS AND RESULTS

TECHNICAL MEMORANDUM #1

APPENDIX A1

CEDAR CITY GEOGRAPHIC FOCUS AREA SAFETY ANALYSIS

Statutory Notice

23 U.S.C. § 409: US Code - Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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LIST OF TABLES

1. INTRODUCTION

Appendix A1 summarizes the safety analysis performed for the Cedar City Geographic Focus Area (GFA) as part of the Safety Action Plan for all Iron County (SAP).

The safety analysis identified roadway segments and intersections with the highest safety risk and need. The resulting High-Risk Network represents locations with the largest potential for safety improvement. The network helps informs the identification of potential project locations that may be further considered in the SAP.

1.1. Safety Analysis

The safety analysis methodologies are presented in **Section 4** of Technical Memorandum #1 and include the components shown in **Figure 1**. Results of each component are shown in **Table 1**.

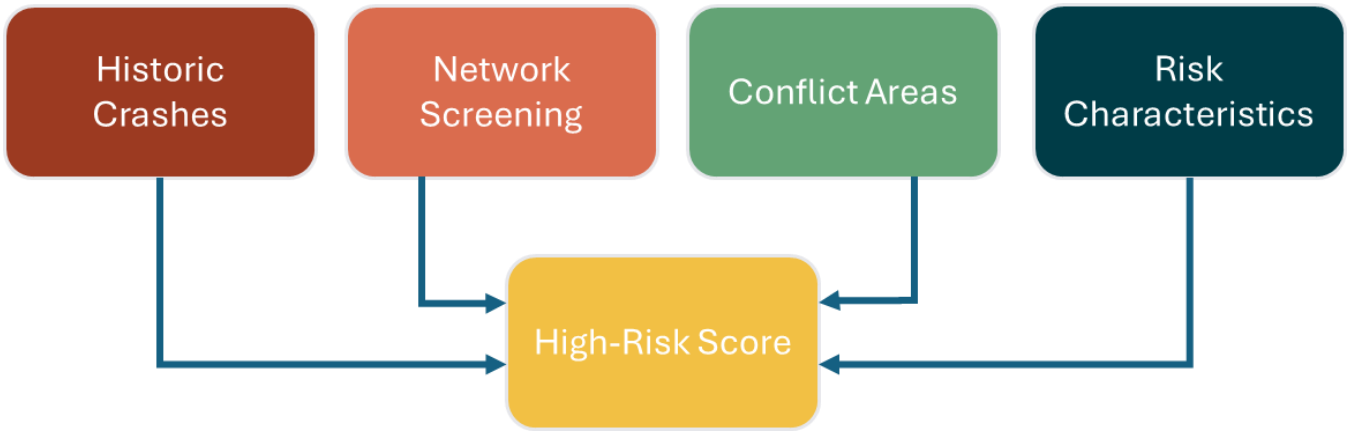

Figure 1. Safety Analysis Components

Table 1. Safety Analysis Components and Results

Safety Analysis Component	Analysis Result(s)
Historical Crash Overview	Frequent crash types and common contributing factors.
Strategic Highway Safety Plan (SHSP) Emphasis Area Analysis	Ranked emphasis areas based on GFA, Iron County, or Statewide crashes.
Historical Crash Analysis	High-crash network.
	High-risk network.
Network Screening Analysis	Critical crash rate network.
Conflict Areas	Speeding, phone handling, sudden braking, and suspected collision networks.
Risk Characteristics	Crash Profile Risk Assessment
	usRAP Risk Factors Analysis

1.2. Appendix Organization

Appendix A1 is organized into the following sections:

- **Section 1** – Introduction
- **Section 2** – Cedar City GFA Study Area and Roadway Network
- **Section 3** – Historic Crash Overview
- **Section 4** – Historic Crash Analysis
- **Section 5** – Network Screening Analysis
- **Section 6** – Conflict Areas
- **Section 7** – Roadway Characteristic Risk Analysis
- **Section 8** – High-Risk Network

2. STUDY AREA

The SAP study area includes each jurisdiction within Iron County. To organize the Iron County jurisdictions and unincorporated areas into manageable analysis areas, Iron County was divided into five GFAs. The Cedar City GFA, shown in **Figure 2,** includes the incorporated boundary of Cedar City.

The safety analyses presented in this appendix are specific to the Cedar City GFA.

Figure 2 highlights the roadway network within the Cedar City GFA study area. Roadways within the study area are divided into the following categories:

- State Routes: Roadways maintained by the Utah Department of Transportation (UDOT)
- Non-State Routes: Jurisdiction-maintained roads

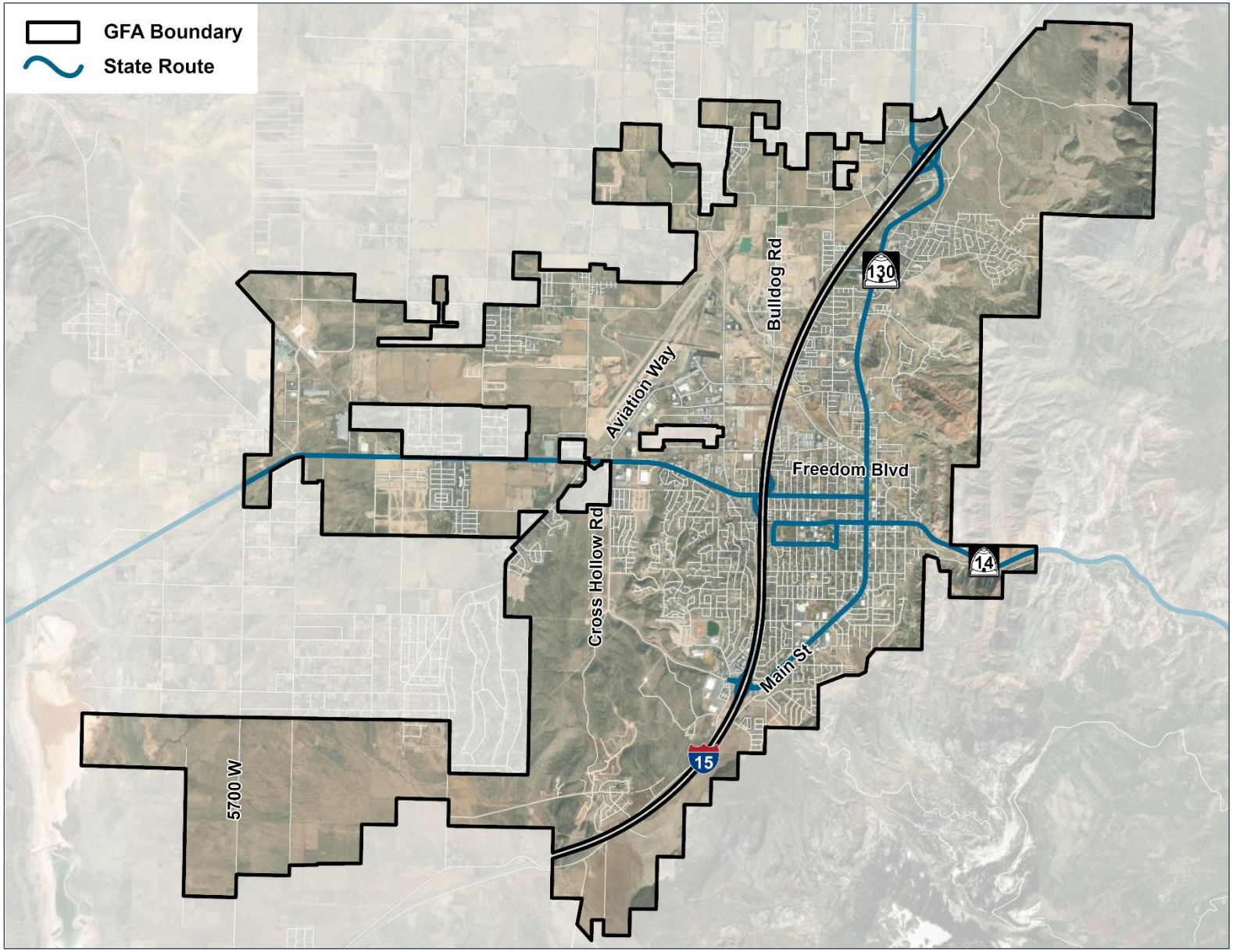

Figure 2. Cedar City GFA Study Area

3. HISTORIC CRASH OVERVIEW

Crash data was obtained from the UDOT database for the most recent completed five-year period, 2019 to 2023. A historic crash review specific to the Cedar City GFA is summarized below.

3.1. Overall Crashes

Figure 3 provides an overview of annual crashes for the Cedar City GFA separated by crash severity. Crash severity is reported as fatal, serious injury, or all other crashes (minor injury, possible injury, or property damage only). A review of the crash data reveals the following:

- The total number of crashes was highest in 2019. After a decrease of all crash severities in 2020, there has been a steady increase in the total number of crashes from 2020 to 2023.
- The number of fatal and serious injury crashes has more than doubled between 2019 and 2023, increasing every year.

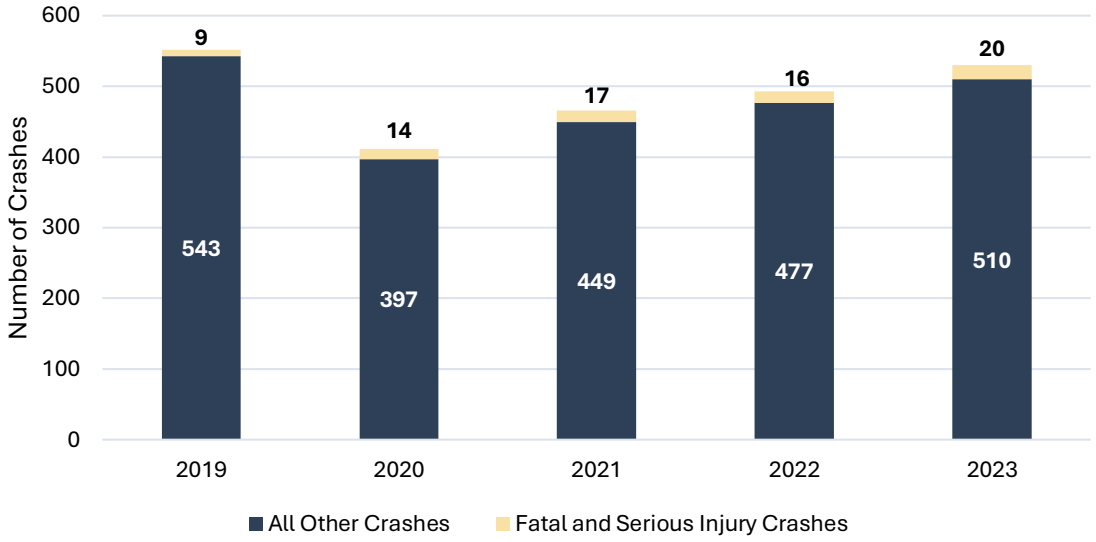

Figure 3. Cedar City GFA Crashes by Year

Table 2 provides an overview of crashes by severity and route type within the Cedar City GFA. A review of the data reveals the following:

- 54% of crashes occurred on State Routes.
- More serious injury crashes occur on non-state routes (40) compared to State Routes (29).
- Fatal and serious injury crashes make up between 3-4% of all crashes in the Cedar City GFA.
- 70% of crashes in the GFA results in no injury or property damage only (PDO).
- Nearly 50% of all the crashes in Iron County occurred within the Cedar City GFA.

Table 2. Crash Severity by Route Type for the Cedar City GFA

Route Type	State Route		Non-State Route		GFA Total		% of Iron County
Crash Severity	Crashes		Crashes		Crashes		%
	#	%	#	%	#	%	
Fatal	4	0.3%	3	0.3%	7	0.3%	18%
Suspected Serious Injury	29	2%	40	4%	69	3%	36%
Suspected Minor Injury	171	13%	147	13%	318	13%	50%
Possible Injury	215	16%	119	11%	334	14%	46%
No Injury / Property Damage Only	909	68%	815	73%	1,724	70%	48%
Route Total	**1,328**	**100%**	**1,124**	**100%**	**2,452**	**100%**	**47%**

3.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in **Figure 4**. A review of the crash data reveals the following:

- An overall increase in fatal and severe injury crashes from 2019 to 2023.
- Fatal crashes reached a maximum of four (4) fatal crashes occurring in one year, 2021.
- The number of serious injury crashes has more than doubled since 2019.

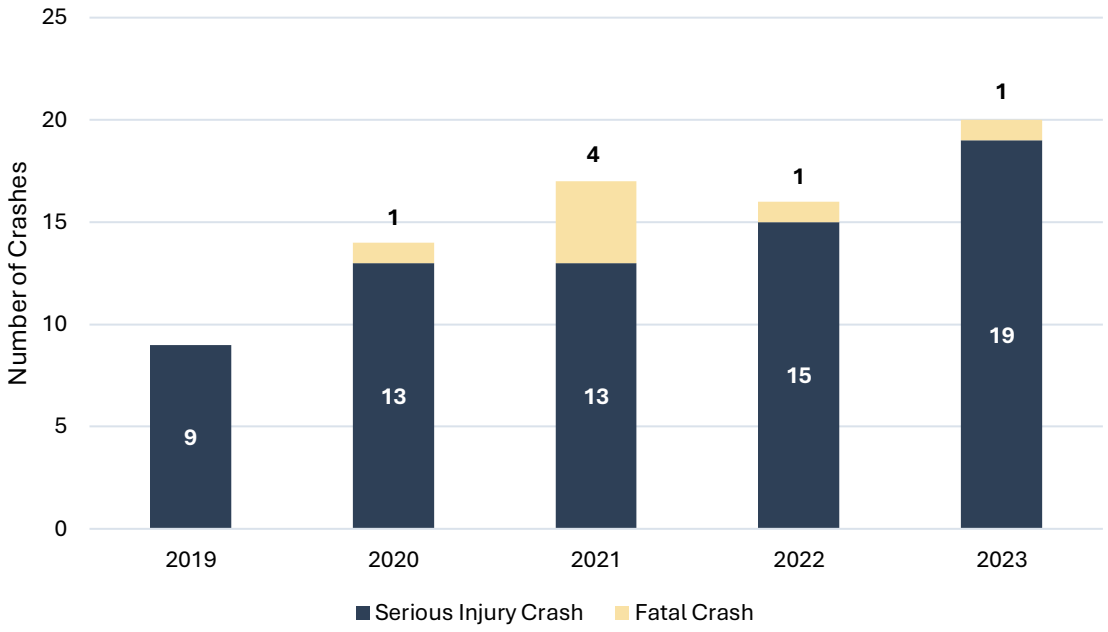

Figure 4. Cedar City GFA Fatal and Serious Injury Crashes by Year

The locations of the fatal and serious injury crashes are displayed in **Figure 5** and show a prevalence of serious injury crashes along Main Street (SR 130) and 200 North (SR 56). Concentrations of crashes around the Royal Hunt Drive/Providence Center Driver & Cross Hollow Road intersection and the intersections with SR 130 near 600 South were observed to be areas where fatal crashes have occurred.

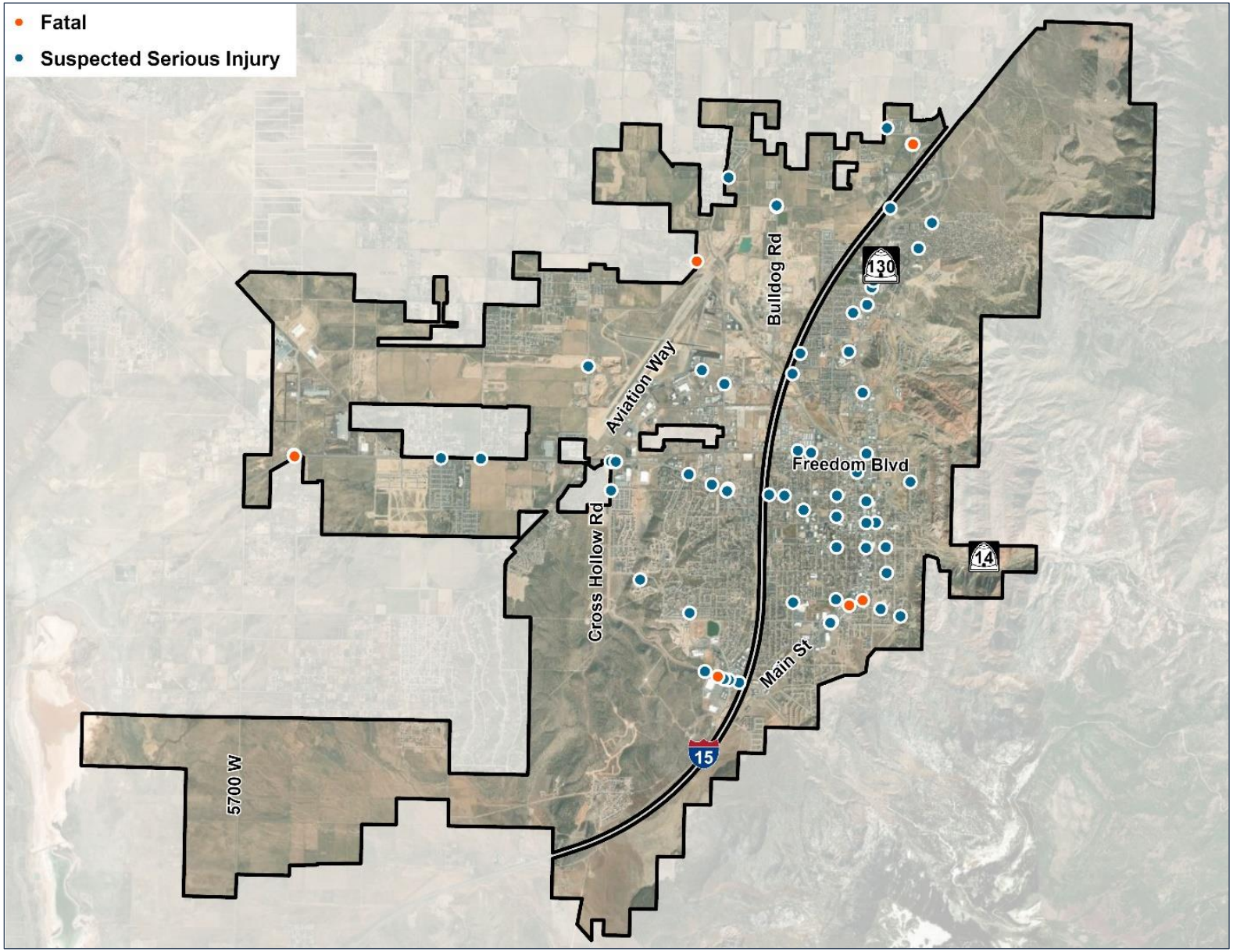

Figure 5. Fatal and Serious Injury Crashes in the Cedar City GFA

3.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collisions is shown in **Figure 6**. The manner of collision represents how two vehicles initially collided. The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization compared to crash type that is summarized in Section 3.3.2. The three most frequent manners of collision that resulted in a fatality or serious injury crash are angle crashes, single vehicle crashes, and rear-end crashes.

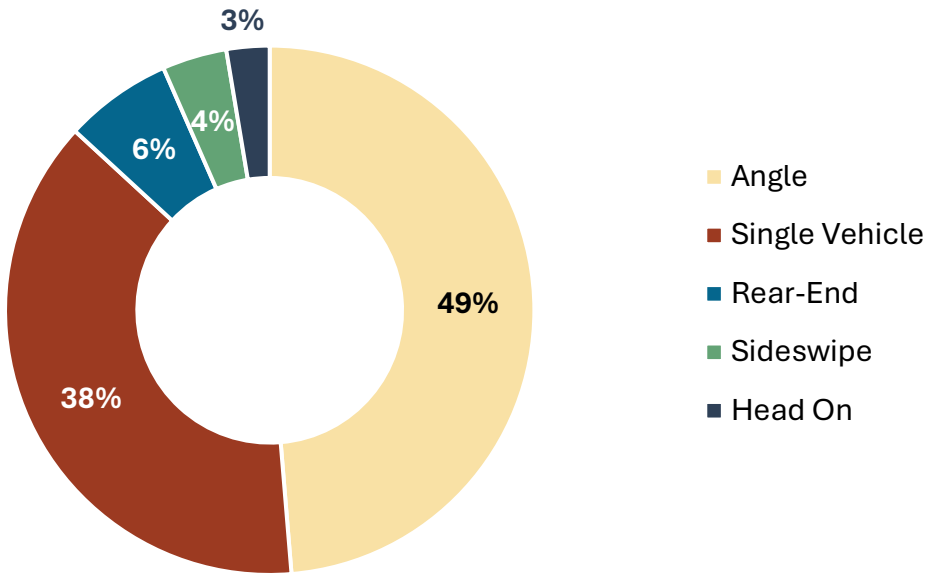

Figure 6. Most Common Fatal and Serious Injury Manners of Collision for the Cedar City GFA

3.2.2. Crash Types

Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type, examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The most common crash types for the Cedar City GFA are summarized in **Figure 7**. The three most frequent fatal and serious injury crash types are left turns at intersections, active transportation (pedestrians or bicyclists), and a crash type recorded as "Other." The next most frequent crash type is roadway departures which include running off the road and lane departure. The crash type "other" may indicate a unique crash scenario or a gap in available data.

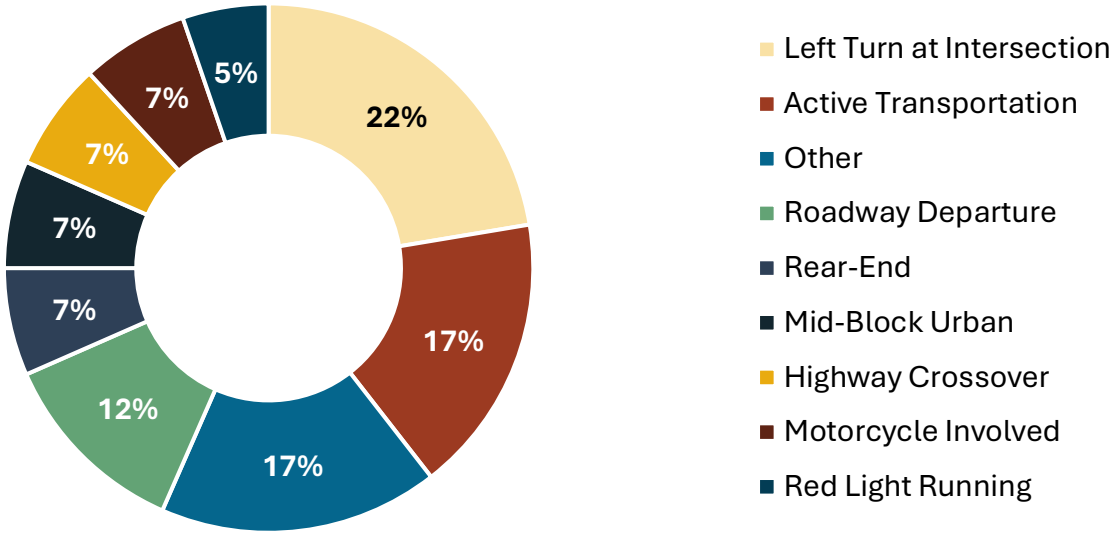

Figure 7. Most Common Fatal and Serious Injury Crash Types for the Cedar City GFA

3.2.3. Driver Contributing Factors

Several factors may contribute to a single crash; however, the driver contributing factors shown in **Figure 8** only represent the first driver specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. The data shows that the three most frequent driver contributing factors are vehicles failing to yield to proper right-of-way, disregarding traffic signals, and over-correcting or oversteering. The second most frequent driver contributing factor is "Other/Unknown" which may indicate a unique scenario or highlight a gap in data collection.

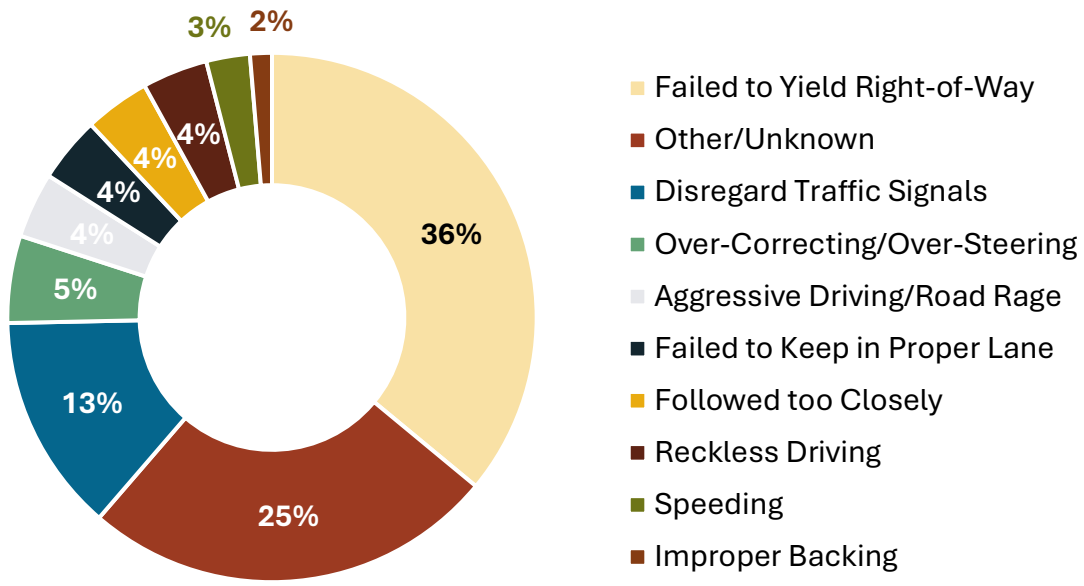

Figure 8. Most Common Fatal and Serious Injury Crash Driver Contributing Factors for the Cedar City GFA

3.2.4. Vulnerable User Crashes

Vulnerable road users include pedestrians and bicyclists. The data shows 34 crashes involving pedestrians and 26 crashes involving bicyclists in the Cedar City GFA from 2019 to 2023. **Figure 9** shows that the number of pedestrian and bicycle crashes have decreased since 2020.

Figure 10 summarizes fatal and serious injury pedestrian and bicycle crashes. While the total number of vulnerable user crashes decreased, fatalities and serious injuries increased.

The locations of the fatal and serious injury vulnerable user crashes are displayed in **Figure 11** and show a prevalence along major roads such as 200 North (SR 56) and Main Street (SR 130).

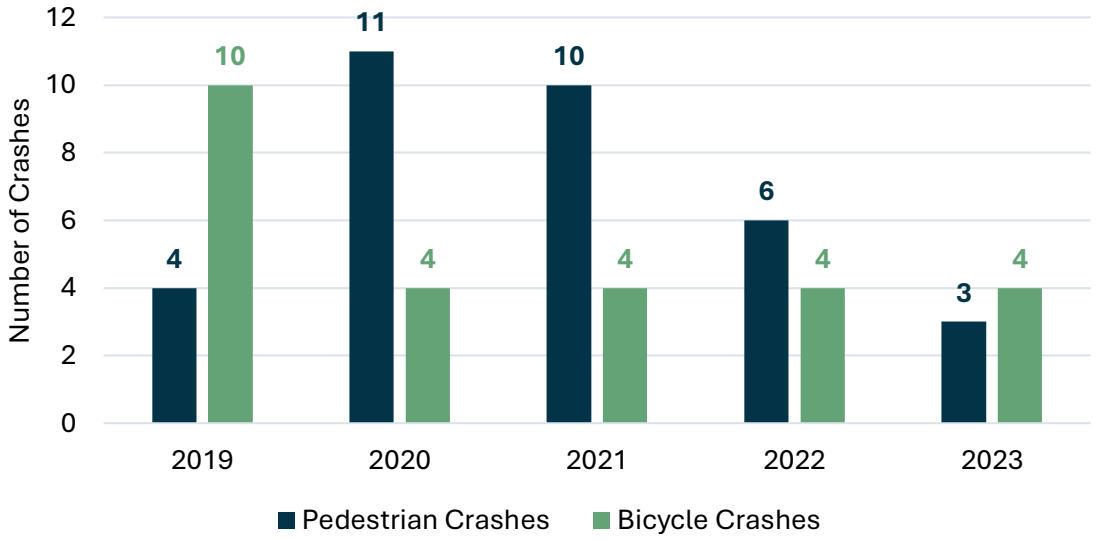

Figure 9. Vulnerable User Crashes by Year for the Cedar City GFA

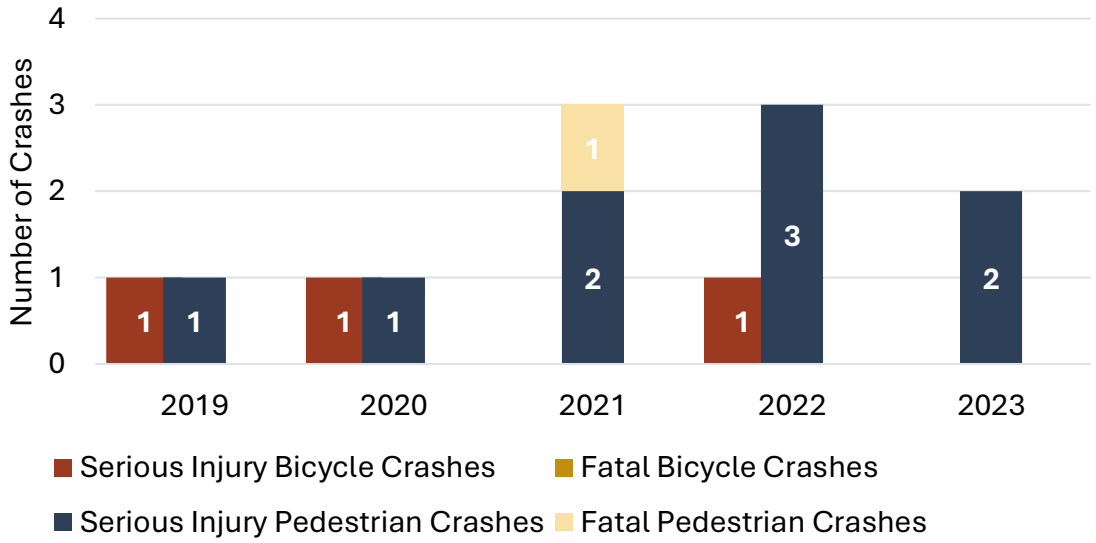

Figure 10. Fatal and Serious Injury Vulnerable User Crashes by Year for the Cedar City GFA

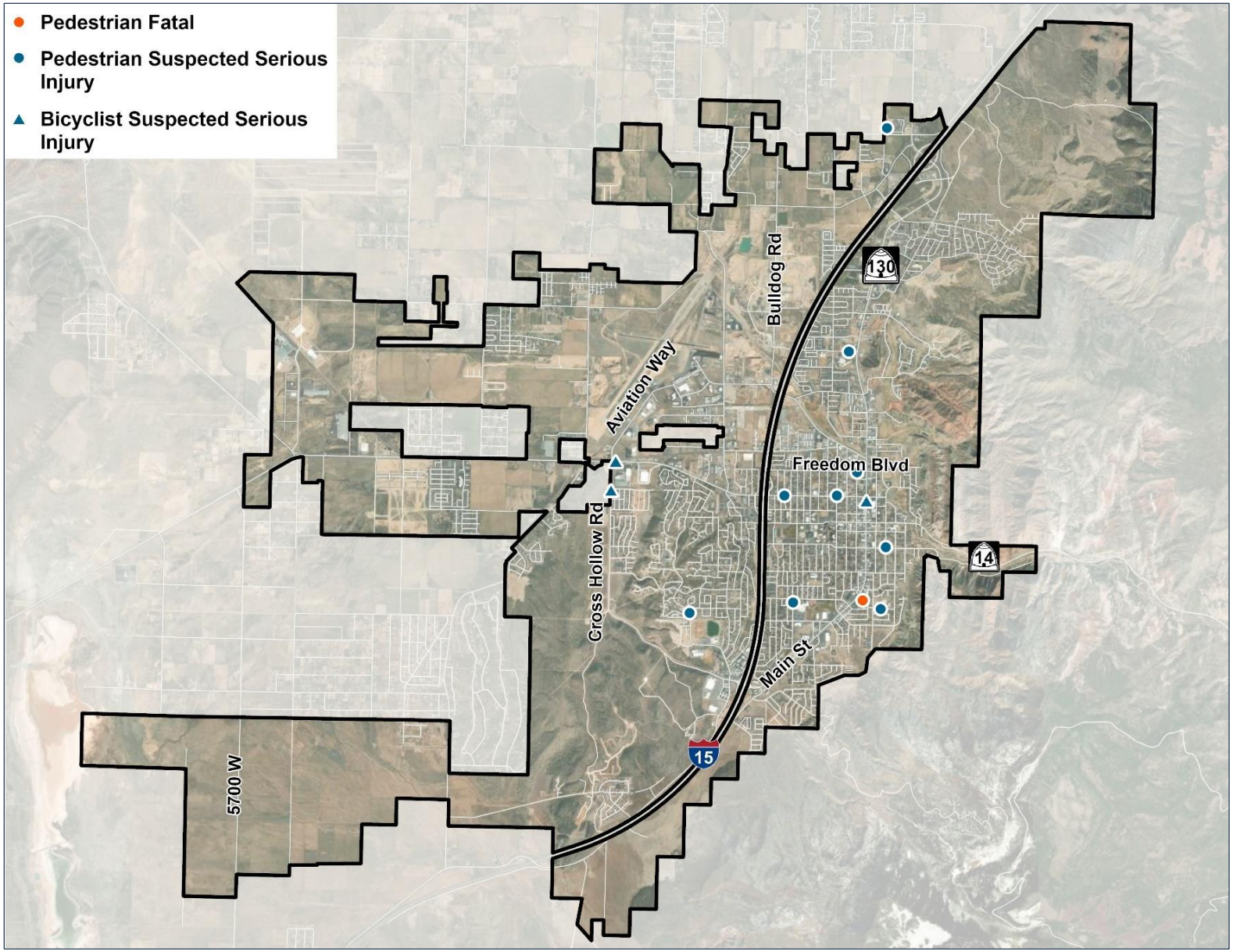

Figure 11. Fatal and Serious Injury Pedestrian and Bicycle Crashes in the Cedar City GFA

3.3. Utah SHSP Emphasis Safety Area Analysis

The SHSP emphasis area analysis ranks the frequency of fatalities and serious injuries in the Cedar City GFA for each of the eleven Utah SHSP emphasis safety areas. A fatality or serious injury may be assigned to multiple emphasis areas.

The rankings of the emphasis areas compare the Cedar City GFA, the state of Utah, and all of Iron County.

This analysis helps to determine priority emphasis areas for the Cedar City GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different than the statewide or County rankings.

Table 3 summarizes the Utah SHSP Emphasis Area comparison analysis. The following emphasis areas have the highest frequency of fatalities and serious injuries in the Cedar City GFA. The SAP will identify strategies to address these priority emphasis areas:

- Intersections
- Older Drivers
- Teen Drivers
- Roadway Departure
- Motorcycles

Table 3. Utah SHSP Emphasis Area Comparison for the Cedar City GFA

Category	Utah SHSP Safety Emphasis Area	Statewide		Iron County		Cedar City GFA		
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Change in Rank from County
Driver	Teen Driver	1,695	4	54	5	19	3	2
	Older Driver	1,565	7	49	6	20	2	4
	Speed-Related	2,268	3	78	3	11	7	-4
	Aggressive Driving	615	11	19	10	10	9	1
	Distracted Driving	732	10	28	8	8	10	-2
	Impaired Driving	1,100	8	27	9	3	11	-2
	No Safety Restraints	1,627	5	85	2	10	8	-6
Roadway	Intersection	3,683	1	67	4	42	1	3
	Roadway Departure	3,372	2	132	1	16	4	-3
Special Users	Motorcycle	1,571	6	40	7	15	5	2
	Pedestrian	1,000	9	15	11	13	6	5
	Bicycle*	303	12	3	12	3	12	0

**While Bicycles are not one of the eleven Utah SHSP emphasis areas, they are included as part of the CSAP safety analysis.*

4. HISTORIC CRASH ANALYSIS

A component of the SAP is to identify locations with an elevated risk of crashes. The initial step of this analysis is to spatially reference crashes that occurred within the study area.

The following networks were created in the historic crash analysis using the historic crash locations:

- **High-Crash Network**: Represents roadways and intersections on which the most crashes occur and experience high crash rates.
- **High-Injury Network**: Represents roadways and intersection on which fatal and injury crashes typically occur.

4.1. High-Crash Network

The roadway network shown in **Figure 12** is identified as the High-Crash network. The High-Crash network includes locations on which 50% of all crashes in the GFA occurred and locations experiencing high crash rates.

4.2. High-Injury Network

Figure 13 shows the identified High-Injury network. The High-Injury network represents the roadways on which 50% of fatal and injury crashes have occurred.

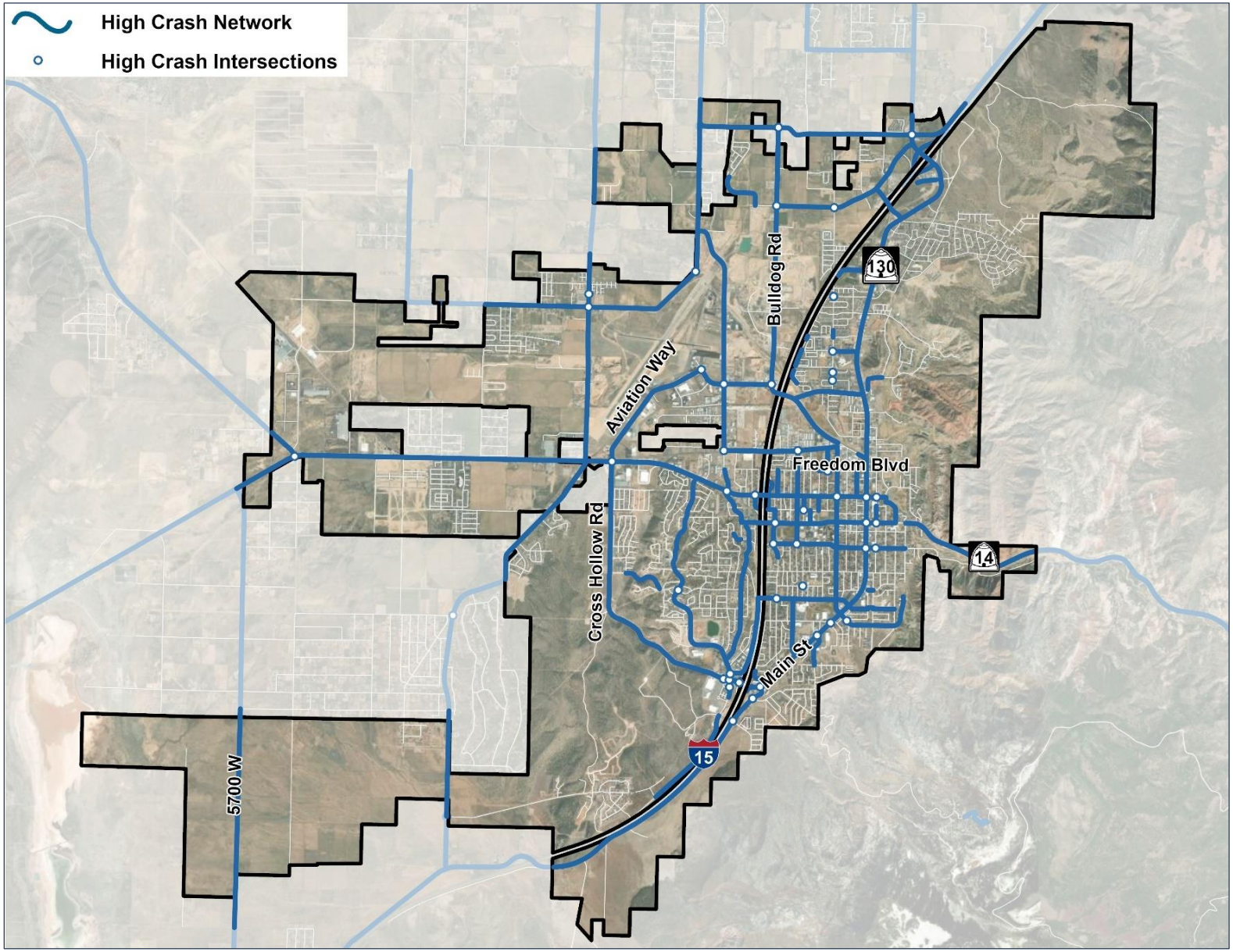

Figure 12. High-Crash Network for the Cedar City GFA

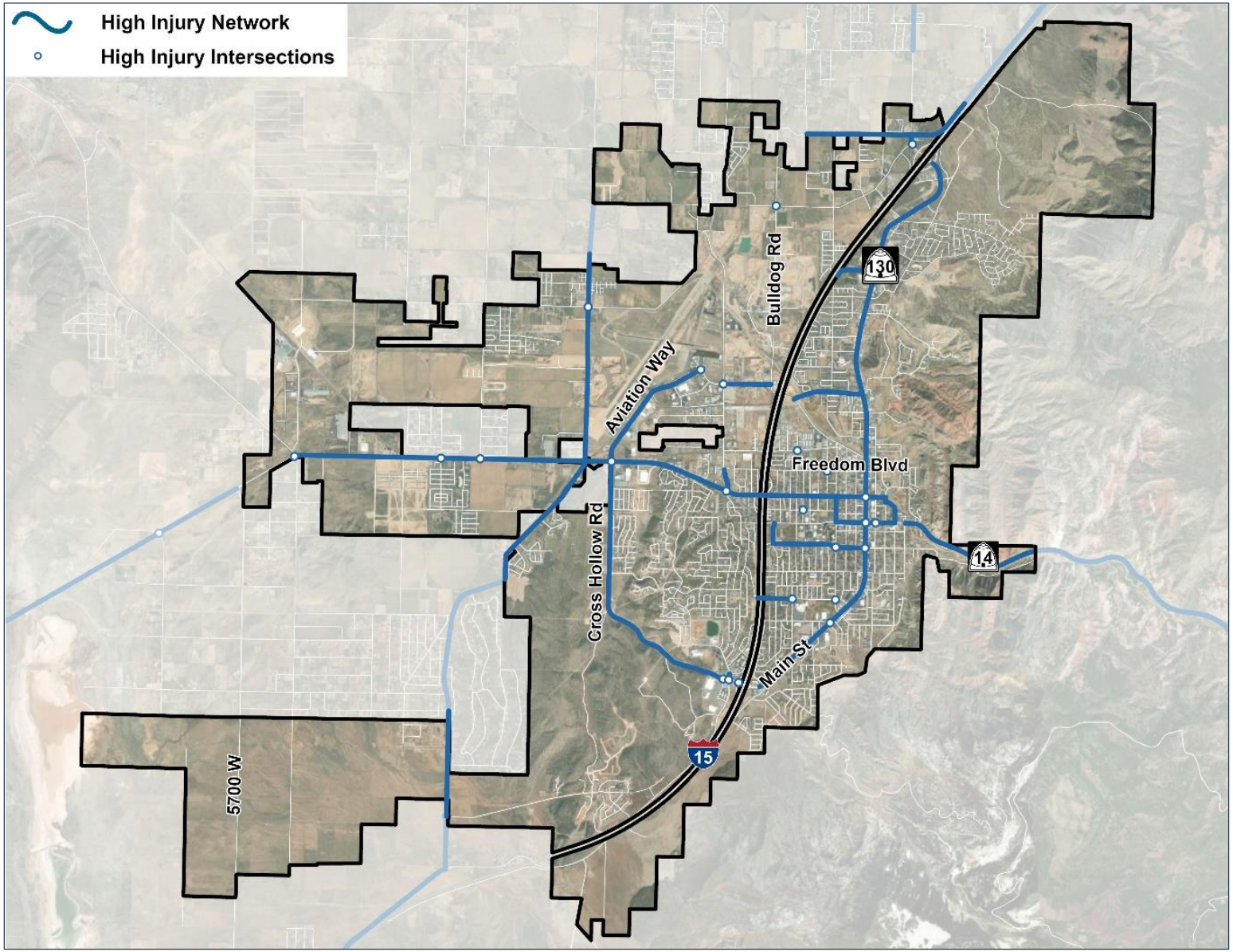

Figure 13. High-Injury Network for the Cedar City GFA

5. NETWORK SCREENING ANALYSIS

A network screening analysis was prepared for the Cedar City GFA informed by a Critical Crash Rate (CCR) analysis. Network screening methodology is detailed in Technical Memorandum #1. A positive CCR differential is an indication of a location with a potential for safety improvement (PSI). All roadways and intersection with a positive CCR differential are shown in **Figure 14.**

These locations represent those with the highest potential for safety improvements and should be considered as project candidate locations.

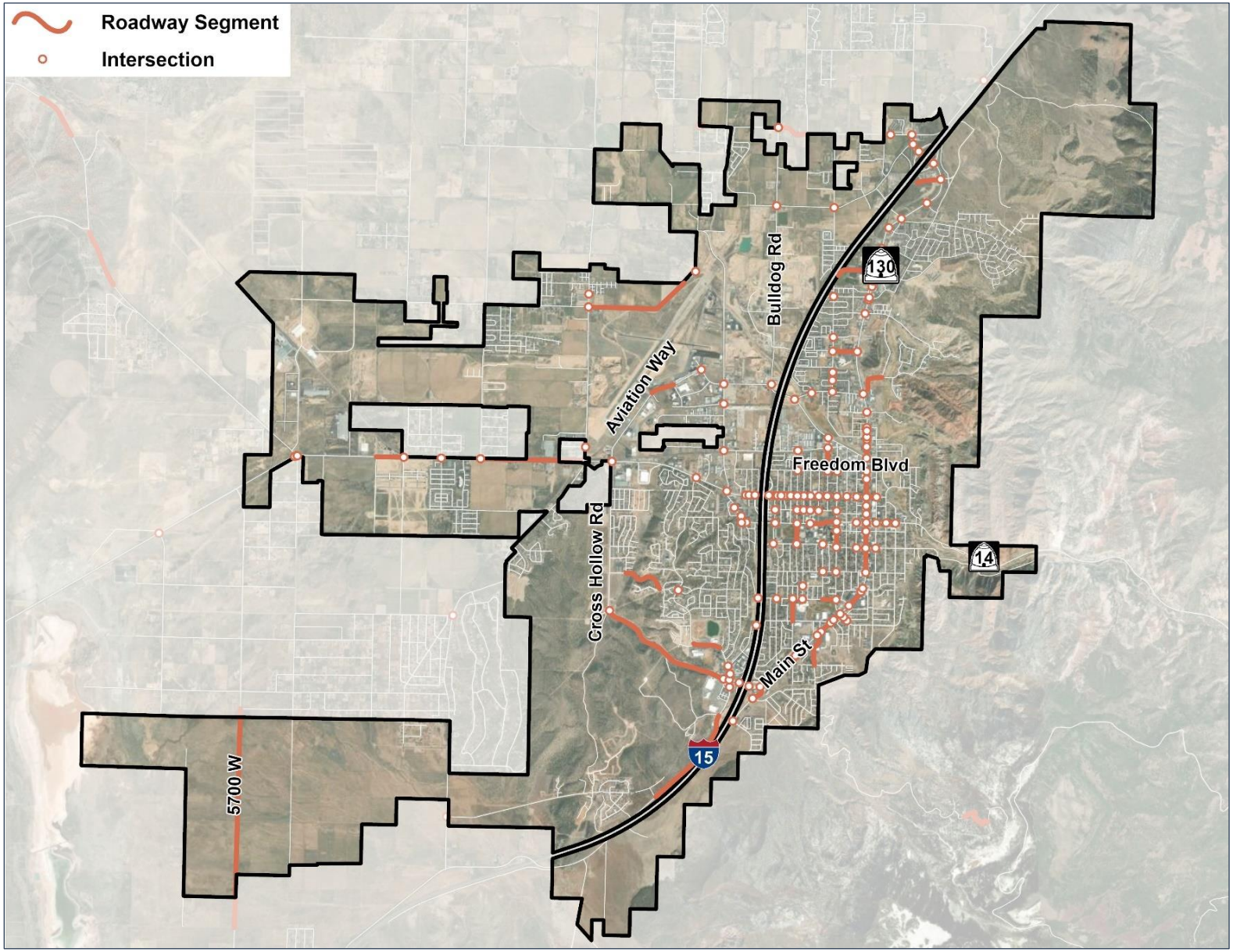

Figure 14. Critical Crash Rate (CCR) Network for the Cedar City GFA

6. CONFLICT AREAS

The conflict area analysis used Replica data obtained for the Iron County area to proactively address areas of greater safety risks. The following data and metrics were isolated in Replica to identify higher risk roadways in the GFA and Iron County:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking
- Active Transportation (pedestrians and bicyclist) high-risk corridors

A maximum risk score within Replica is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are included in the Replica Conflict Networks shown in **Figure 15** and **Figure 16** for the Cedar City GFA.

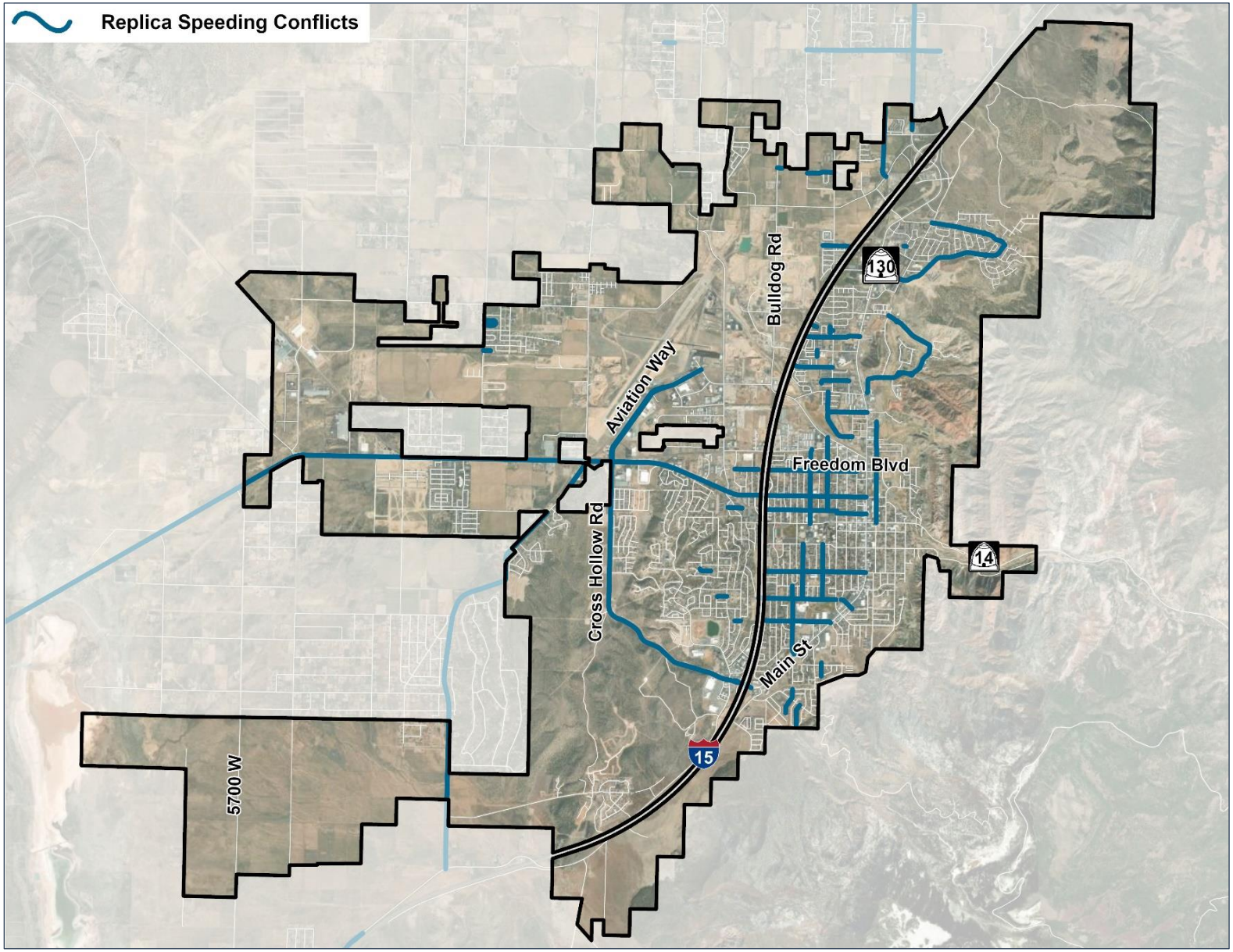

Figure 15. Replica Speeding Conflict Areas for the Cedar City GFA

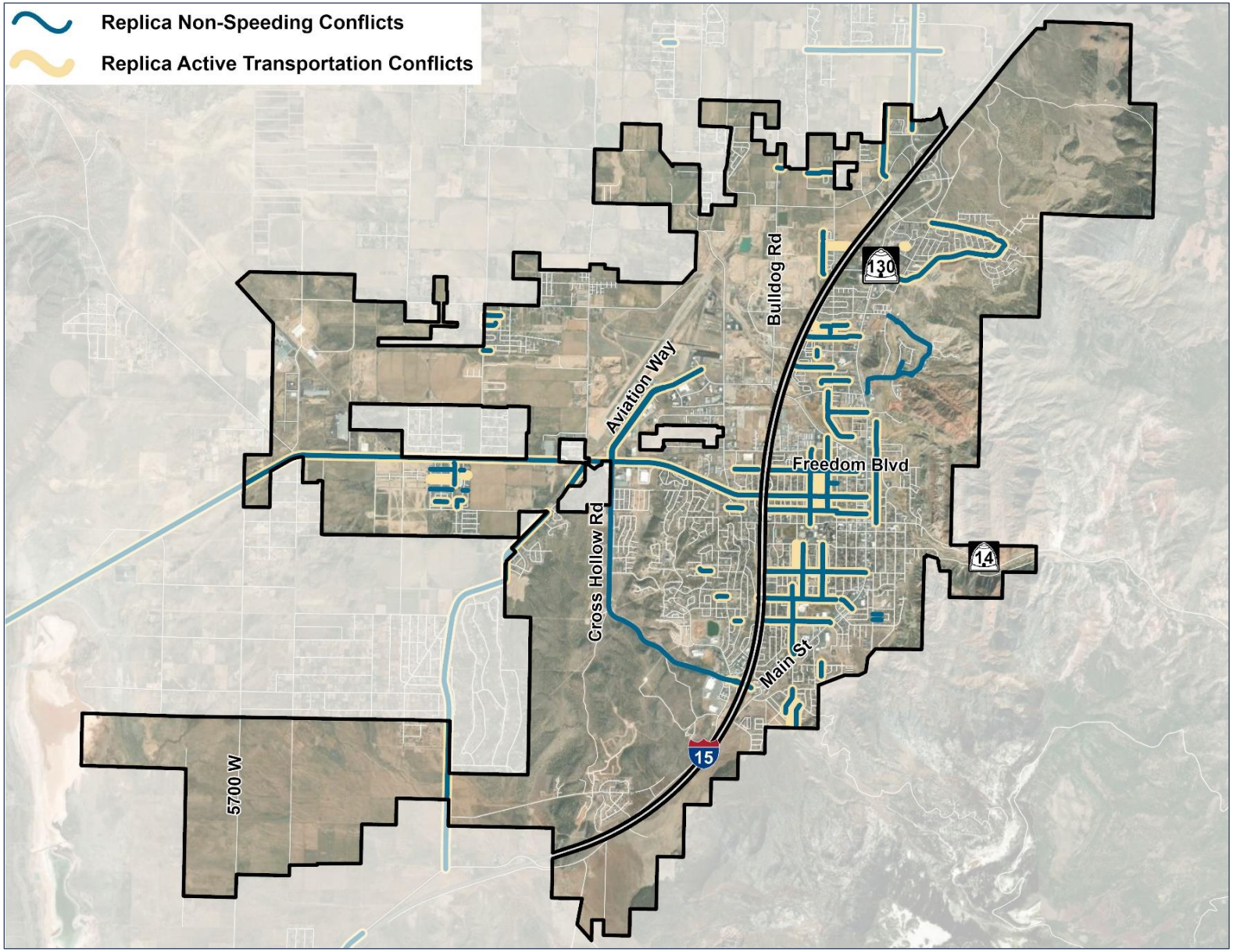

Figure 16. Replica Non-Speeding and Active Transportation Conflict Areas for the Cedar City GFA

7. ROADWAY CHARACTERISTIC RISK ANALYSIS

A roadway characteristic risk analysis was performed using the following sub-analyses:

- Crash Profile Risk Assessment
- usRAP Risk Assessment

7.1. Crash Profile Risk Assessment

This crash profile risk assessment sub-analysis identifies common roadway characteristics for roadways where fatal and serious injury crashes have occurred. Based on various roadway characteristic risks identified from crash report analysis, a risk score was assigned to major routes within the Cedar City GFA. A breakdown of the risk assessment scoring is reported in **Section 4.4** of Technical Memorandum #1. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the Crash Profile Risk Assessment are mapped in **Figure 17**.

7.2. usRAP Risk Assessment

A roadway characteristic risk assessment was performed using roadway feature data collected for Utah's state routes. The risk assessment was performed using usRAP data and tools. The output of the usRAP tool is a star rating, or risk rating, for vehicle, pedestrian, and bicyclist features. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the usRAP risk assessment by star rating are mapped in **Figure 18**.

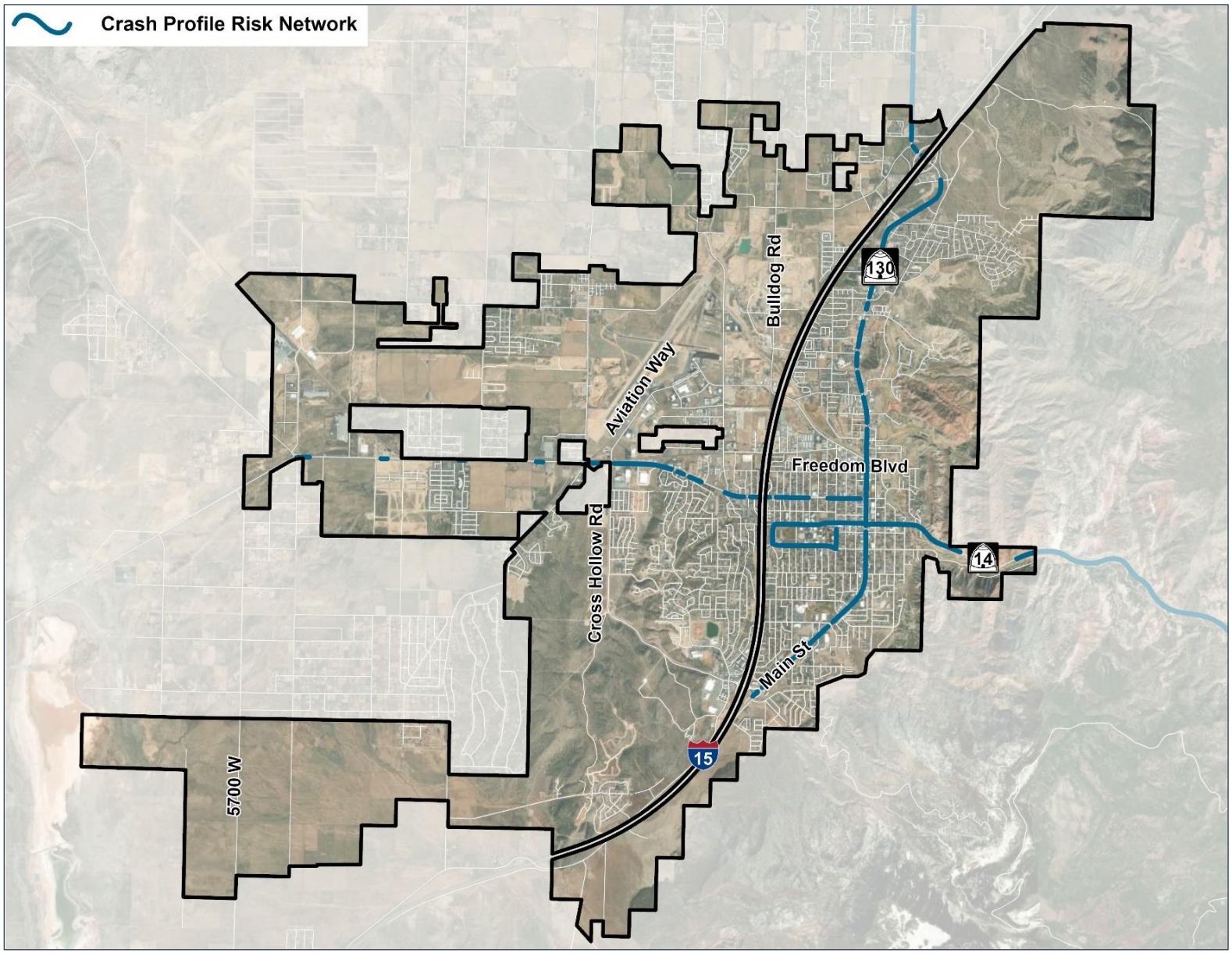

Figure 17. Crash Profile Risk Network for the Cedar City GFA

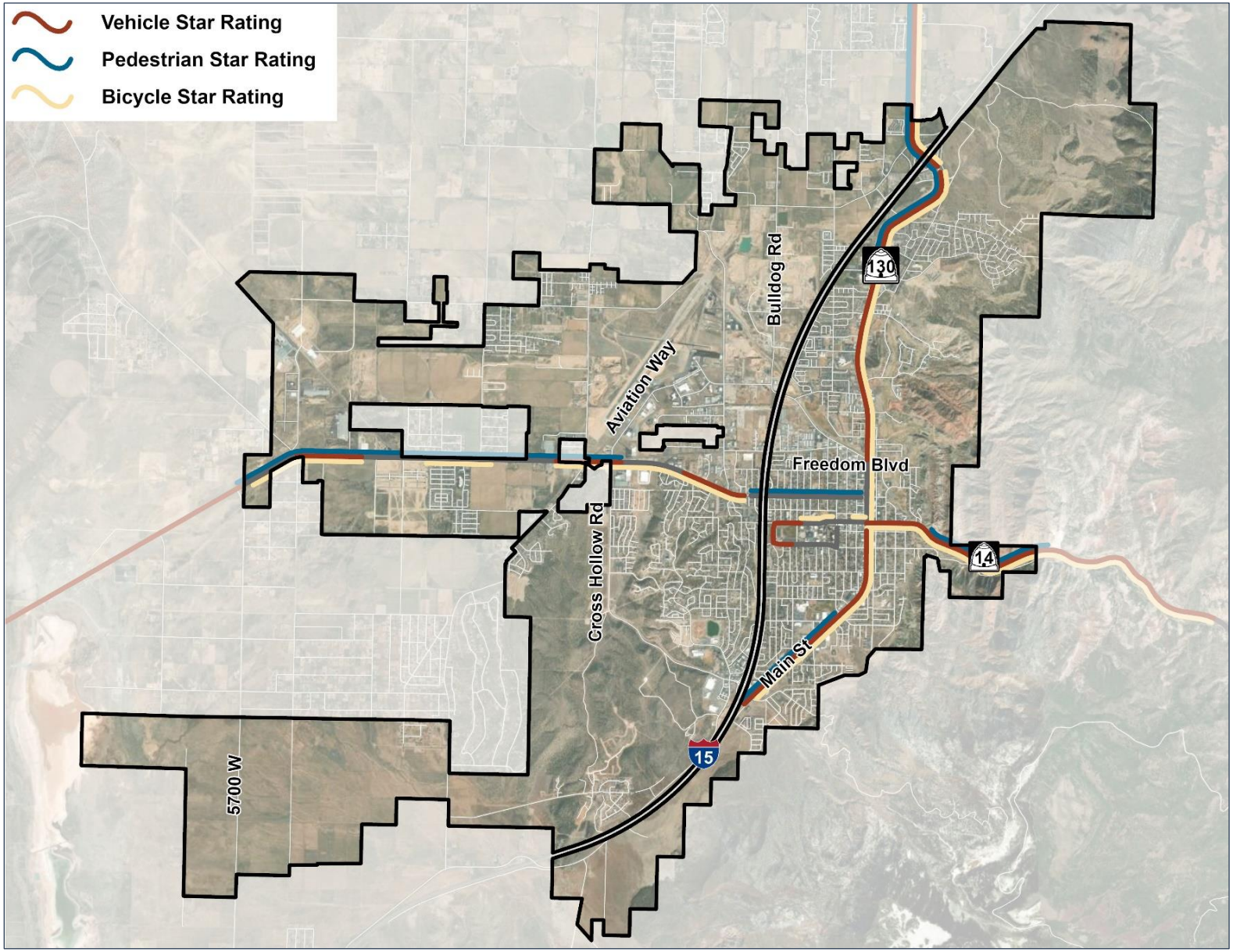

Figure 18. usRAP Risk Network – Star Ratings for the Cedar City GFA

8. HIGH-RISK NETWORK

Each of the safety analysis methodologies identified roadway segments or intersections in the Cedar City GFA that may benefit from safety improvements to reduce fatal and serious injury crashes.

To provide focused information for decisions regarding prioritization of safety improvements, an overlay of each analysis methodology was created to form a High-Risk Network.

A high-risk score, from zero to five, was determined using the approach in **Table 4.** Any location with a positive high-risk score may be considered for safety improvements. Locations with a risk score of three or greater are to be prioritized in the High-Risk Network

The Cedar City GFA High-Risk Network is shown in **Figure 19**. **Table 5** and **Table 6** provide an overview of the high priority roadway segments and intersections included in the High-Risk Network that were presented to stakeholders for comment in December 2024. Up to ten roadway segments and 20 intersections were listed if a location had a positive risk score.

Table 4. High-Risk Scoring Criteria

High Risk Category	Safety Analysis	Scoring Criteria	Risk Score
Historic Crashes	High Crash Network	Highest number of crashes per miles	1
	High Injury Network	Highest number of fatal and injury crashes per mile	1
Network Screening	Critical Crash Rates	Positive critical crash rate differential	1
Conflict Areas	Replica - Speeding Areas	Speeding conflict risk score of 80+	1/3
	Replica - Non-Speeding Areas	Non-speeding conflict risk score of 80+	1/3
	Replica - Active Transportation Areas	Active transportation conflict rick score of 80+	1/3
Risk Characteristics	Crash Profile Risk	Crash Profile Risk score of 60+	1/4
	usRAP Vehicle Star Rating	Star Rating of 1 - 2	1/4
	usRAP Pedestrian Star Rating	Star Rating of 1 - 2	1/4
	usRAP Bicycle Star Rating	Star Rating of 1 - 2	1/4
Maximum High-Risk Score			5

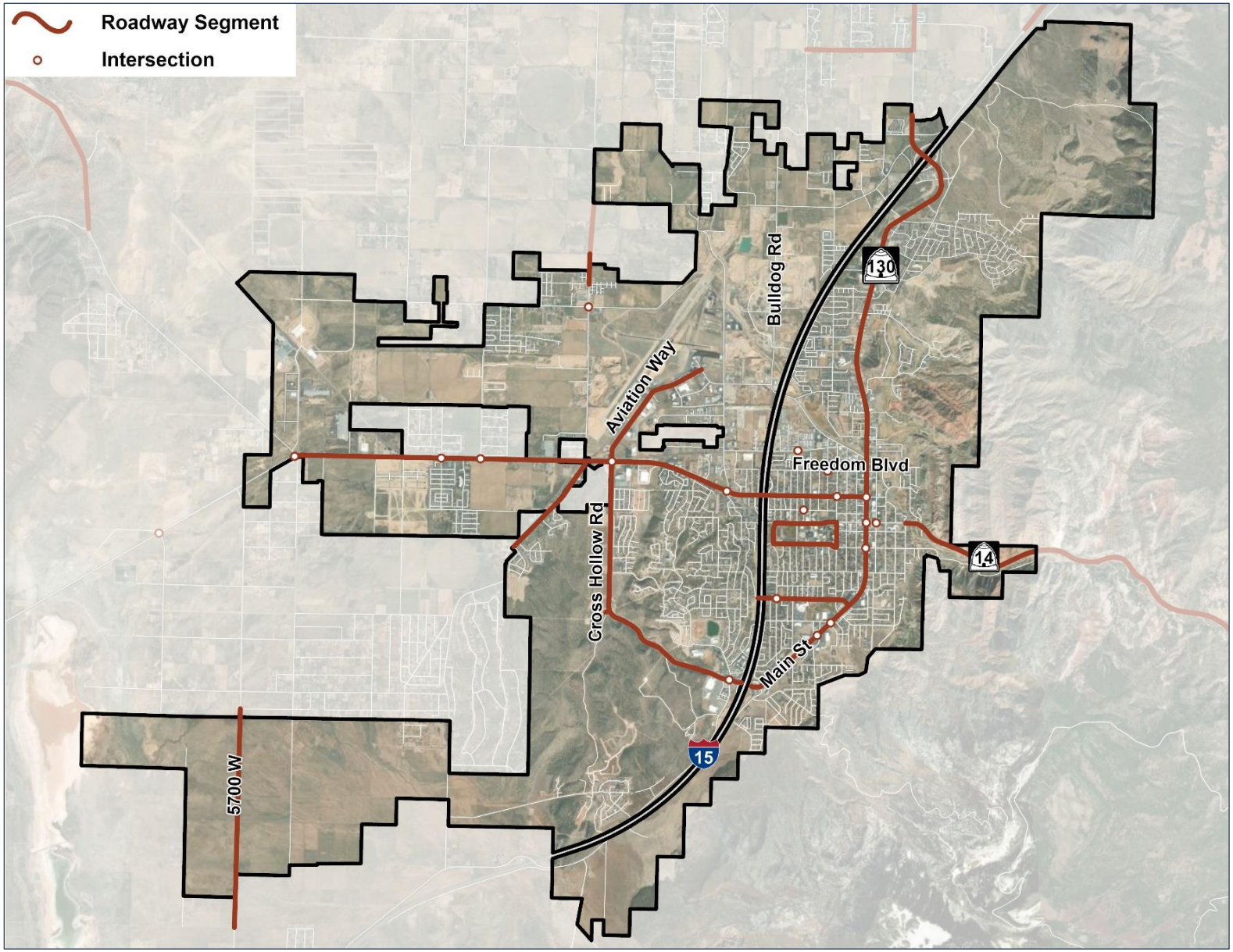

Figure 19. High-Risk Network for the Cedar City GFA

Table 5. Priority High-Risk Roadways for the Cedar City GFA

Roadways				Safety Analysis									
Roadway	Extents	Length (miles)	Functional Classification	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
State Routes													
Main Street (SR 130)	1045 North to I-15	6.0	Other Principal Arterial	X	X	X				X	X	X	X
200 North (SR 56)	Iron Springs Road to I-15	4.5	Other Principal Arterial	X	X	X	X	X	X	X	X	X	X
200 North (SR 56)	I-15 to Main Street (SR 130)	1.0	Other Principal Arterial	X	X	X	X	X	X	X		X	X
SUU Loop (SR 289)	1150 West to 300 West	1.5	Minor Arterial	X	X	X				X	X		X
Center Street (SR 14)	400 Eat to Right Hand Canyon Road	4.5	Minor Arterial	X	X					X	X	X	X
Non- State Routes													
Cross Hollow Road	SR 56 to I-15	3.0	Minor Arterial	X	X	X	X	X	X				
Aviation Way	SR 56 to Airport Road	1.5	Major Collector	X	X	X	X	X	X				
600 South	I-15 to Main Street (SR 130)	1.0	Major Collector	X	X		X	X	X				
5700 West	1400 South to 3200 South	2.3	Major Collector	X		X							
Westview Drive	SR 56 to 200 South	1.0	Major Collector	X	X		X	X	X				

Table 6. Priority High-Risk Intersections for the Cedar City GFA

Intersections		Safety Analysis			Supporting Networks						
Intersection	Number of Crashes	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
Signalized Intersections											
Cross Hollow Road/Aviation Way & SR 56	44	X	X	X	X	X	X	X	X	X	X
Westview Drive/3100 West & SR 56	27	X	X	X	X	X	X	X	X	X	X
Main Street (SR 130) & 1925 North	41	X	X	X	X	X	X	X	X	X	X
Airport Road/College Way & SR 56	69	X	X	X	X	X	X	X	X		X
Main Street (SR 130) & 800 South	36	X	X	X	X	X	X		X	X	X
Main Street & SR 56	106	X	X	X	X	X	X	X			X
Providence Center Drive & Cross Hollow Road	50	X	X	X	X	X	X				
Main Street (SR 130) & 200 South	29	X	X	X				X	X		X
Main Street (SR 130) & Center Street (SR 14)	36	X	X	X				X	X		X
300 West & SR 56	31	X		X	X	X	X	X		X	
Unsignalized Intersections											
100 East & Center Street (SR 14)	11	X	X	X	X	X	X	X	X		X
Iron Springs Road & SR 56	11	X	X	X	X	X	X			X	X
700 West & Harding Avenue	7	X	X	X	X	X	X				
400 West & 400 North	5	X	X	X	X	X	X				
3900 West & SR 56	6		X	X	X	X	X			X	X

Intersections		Safety Analysis			Supporting Networks						
Intersection	Number of Crashes	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
4200 West & SR 56	6		X	X	X	X	X			X	X
Main Street (SR 13) & Fir Street	24	X		X				X	X	X	X
800 West & Industrial Road	6	X	X	X							
Lund Highway & 1600 West	14	X	X	X							
1100 West & 600 South	22	X		X	X	X	X				

APPENDIX A.2. ENOCH CITY GFA SAFETY ANALYSIS AND RESULTS

TECHNICAL MEMORANDUM #1

APPENDIX A2

ENOCH CITY GEOGRAPHIC FOCUS AREA SAFETY ANALYSIS

Statutory Notice

23 U.S.C. § 409: US Code - Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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1. INTRODUCTION

Appendix A2 summarizes the safety analysis performed for the Enoch City Geographic Focus Area (GFA) as part of the Safety Action Plan for all Iron County (SAP).

The safety analysis identified roadway segments and intersections with the highest safety risk and need. The resulting High-Risk Network represents locations with the largest potential for safety improvement. The network helps informs the identification of potential project locations that may be further considered in the SAP.

1.1. Safety Analysis

The safety analysis methodologies are presented in **Section 4** of Technical Memorandum #1 and include the components shown in **Figure 1**. Results of each component are shown in **Table 1**.

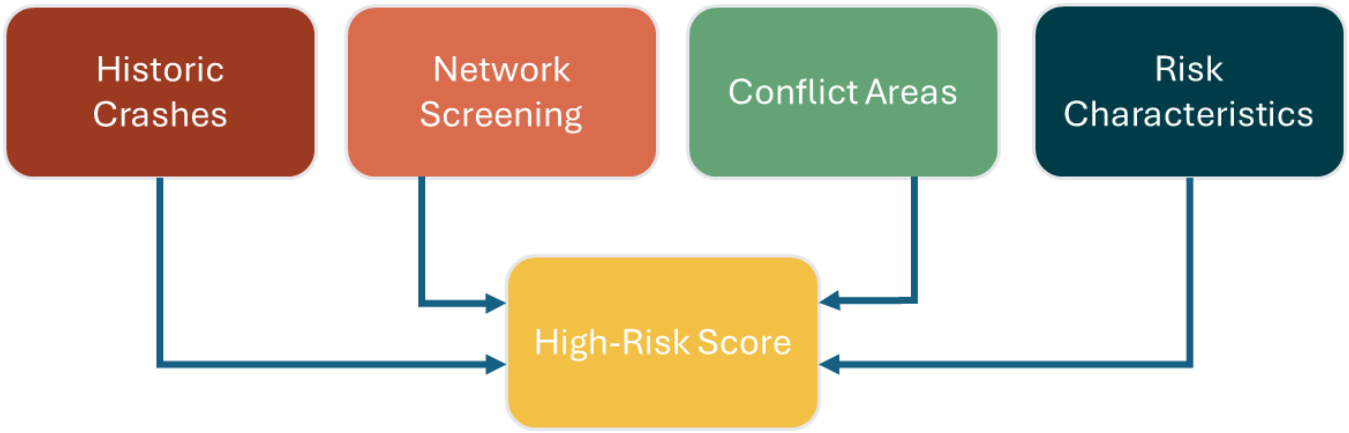

Figure 1. Safety Analysis Components

Table 1. Safety Analysis Components and Results

Safety Analysis Component	Analysis Result(s)
Historical Crash Overview	Frequent crash types and common contributing factors.
Strategic Highway Safety Plan (SHSP) Emphasis Area Analysis	Ranked emphasis areas based on GFA, Iron County, or Statewide crashes.
Historical Crash Analysis	High-crash network.
	High-risk network.
Network Screening Analysis	Critical crash rate network.
Conflict Areas	Speeding, phone handling, sudden braking, and suspected collision networks.
Risk Characteristics	Crash Profile Risk Assessment
	usRAP Risk Factors Analysis

1.2. Appendix Organization

Appendix A2 is organized into the following sections:

- **Section 1** – Introduction
- **Section 2** – Enoch City GFA Study Area and Roadway Network
- **Section 3** – Historic Crash Overview
- **Section 4** – Historic Crash Analysis
- **Section 5** – Network Screening Analysis
- **Section 6** – Conflict Areas
- **Section 7** – Roadway Characteristic Risk Analysis
- **Section 8** – High-Risk Network

2. STUDY AREA

The SAP study area includes each jurisdiction within Iron County. To organize the Iron County jurisdictions and unincorporated areas into manageable analysis areas, Iron County was divided into five GFAs. The Enoch City GFA, shown in **Figure 2,** includes the incorporated boundary of Enoch City.

The safety analyses presented in this appendix are specific to the Enoch City GFA.

Figure 2 highlights the roadway network within the Enoch City GFA study area. Roadways within the study area are divided into the following categories:

- State Routes: Roadways maintained by the Utah Department of Transportation (UDOT)
- Non-State Routes: Jurisdiction-maintained roads

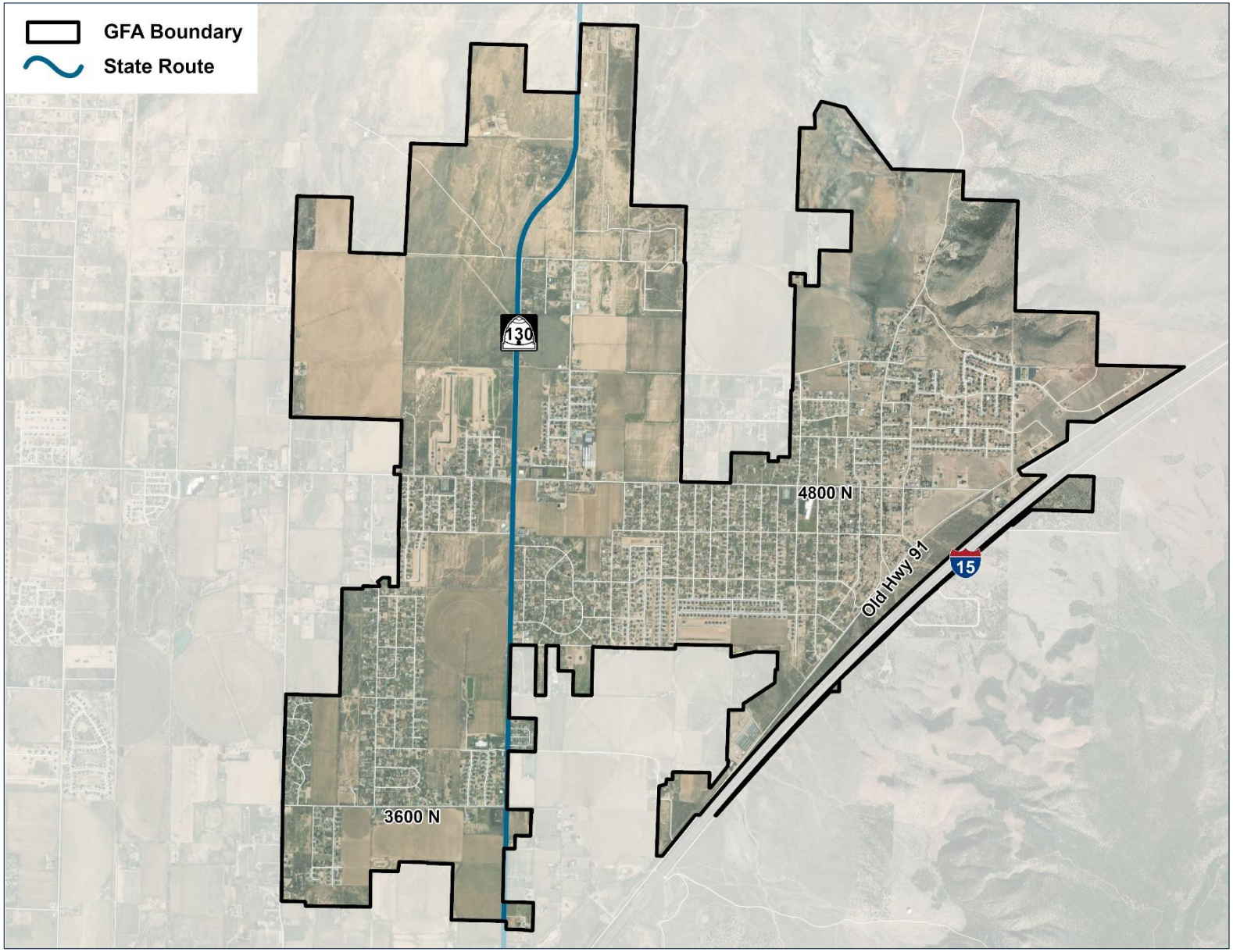

Figure 2. Enoch City GFA Study Area

3. HISTORIC CRASH OVERVIEW

Crash data was obtained from the UDOT database for the most recent completed five-year period, 2019 to 2023. A historic crash review specific to the Enoch City GFA is summarized below.

3.1. Overall Crashes

Figure 3 provides an overview of annual crashes for the Enoch City GFA separated by crash severity. Crash severity is reported as fatal, serious injury, or all other crashes (minor injury, possible injury, or property damage only). A review of the crash data reveals the following:

- The total number of crashes was highest in 2020. There has since been a gradual decrease in the number of crashes and the number of crashes in 2023 is less than in 2019, 5 years ago.
- No fatal or serious injury crashes occurred in 2022 and only 1 occurred in 2023. In the most recent five years the number of fatal and serious injury crashes has never been greater than two per year.

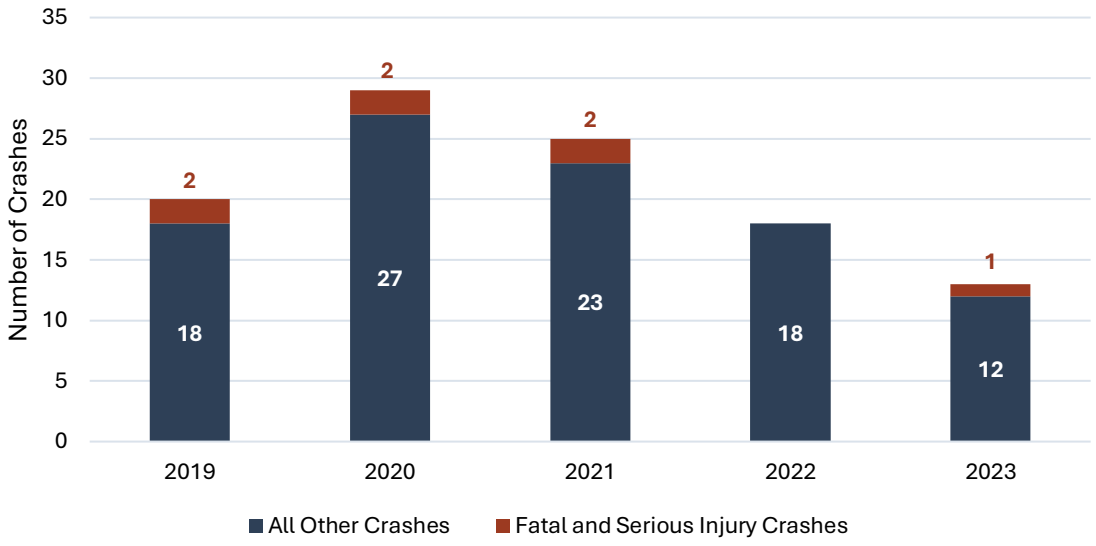

Figure 3. Enoch City GFA Crashes by Year

Table 2 provides an overview of crashes by severity and route type within the Enoch City GFA. A review of the data reveals the following:

- 38% of crashes occurred on State Routes.
- All the fatal crashes in the GFA occurred on non-state routes
- Fatal and serious injury crashes make up between 3-5% of all crashes in the Enoch City GFA.
- 61% of crashes in the GFA resulted in no injury or property damage only (PDO).
- 5% of all the fatal crashes in Iron County occurred within the Enoch City GFA.

Table 2. Crash Severity by Route Type for the Enoch City GFA

Route Type	State Route		Non-State Route		GFA Total		% of Iron County
Crash Severity	Crashes		Crashes		Crashes		%
	#	%	#	%	#	%	
Fatal	0	0%	2	3%	2	2%	5%
Suspected Serious Injury	2	5%	3	5%	5	5%	3%
Suspected Minor Injury	7	18%	7	11%	14	13%	2%
Possible Injury	8	20%	12	18%	20	19%	3%
No Injury / Property Damage Only	23	58%	41	63%	64	61%	2%
Route Total	**40**	**100%**	**65**	**100%**	**105**	**100%**	**2%**

3.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in **Figure 4**. A review of the crash data reveals the following:

- No fatal crashes occurred in 2021, 2022, and 2023.
- The combination of fatal and serious injury crashes has never exceeded two per year.
- The number of fatal and serious injuries have decreased between 2019 and 2023.

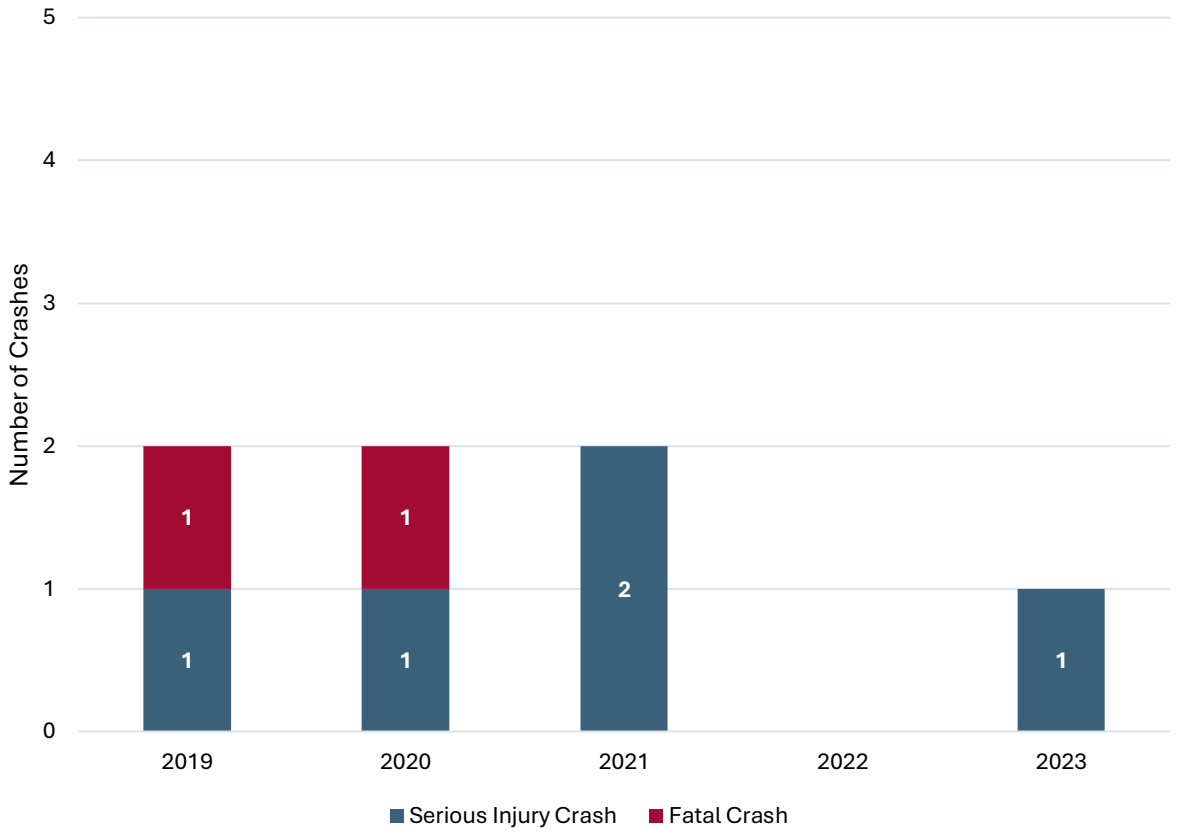

Figure 4. Enoch City GFA Fatal and Serious Injury Crashes by Year

The locations of the fatal and serious injury crashes are displayed in **Figure 5** shows both fatal crashes occurring at the intersection of SR 130 and 4800 North. There is also a prevalence of severe crashes along Main Street (SR 130) and in the residential areas surrounding Stage Coach Lane.

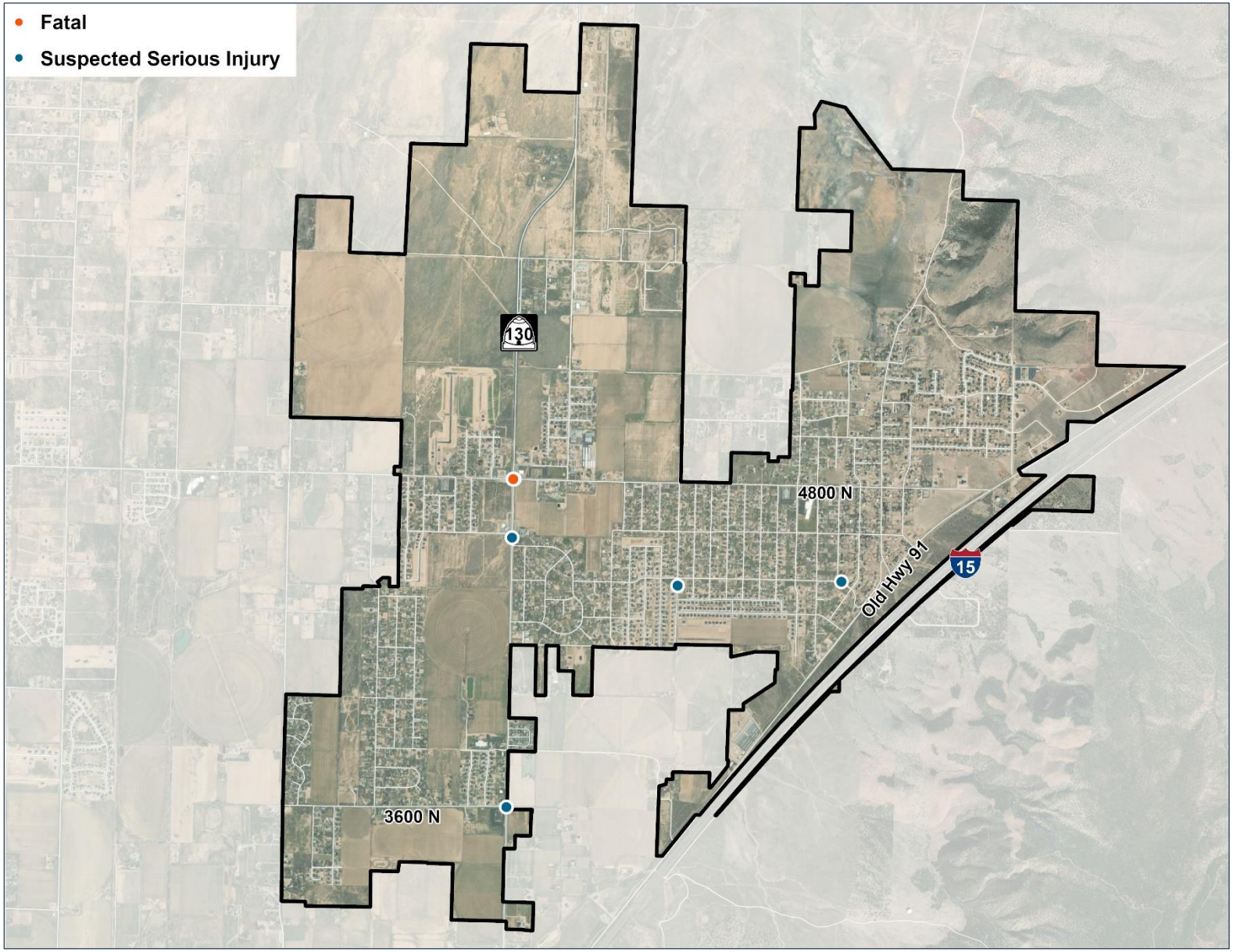

Figure 5. Fatal and Serious Injury Crashes in the Enoch City GFA

3.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collisions is shown in **Figure 6**. The manner of collision represents how two vehicles initially collided. The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization compared to crash type that is summarized in Section 0. The three most frequent manners of collision that resulted in a fatality or serious injury crash are angle crashes, rear-end crashes, and parked vehicle crashes.

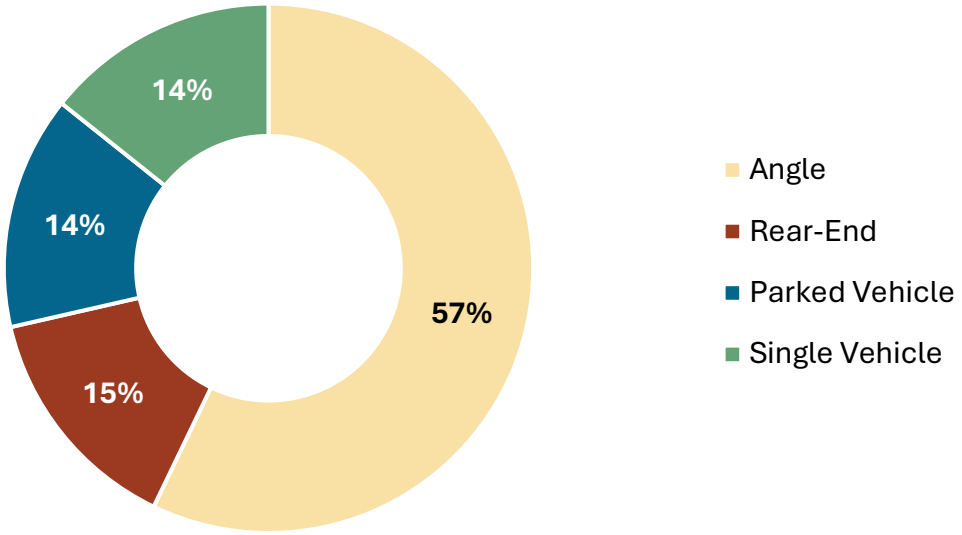

Figure 6. Most Common Fatal and Serious Injury Manners of Collision for the Enoch City GFA

3.2.2. Crash Types

Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type, examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The most common crash types for the Enoch City GFA are summarized in **Figure 7**. The three most frequent fatal and serious injury crash types are recorded as "Other," roadway departures, and rear-end crashes. The crash type "other" may indicate a unique crash scenario or a gap in available data.

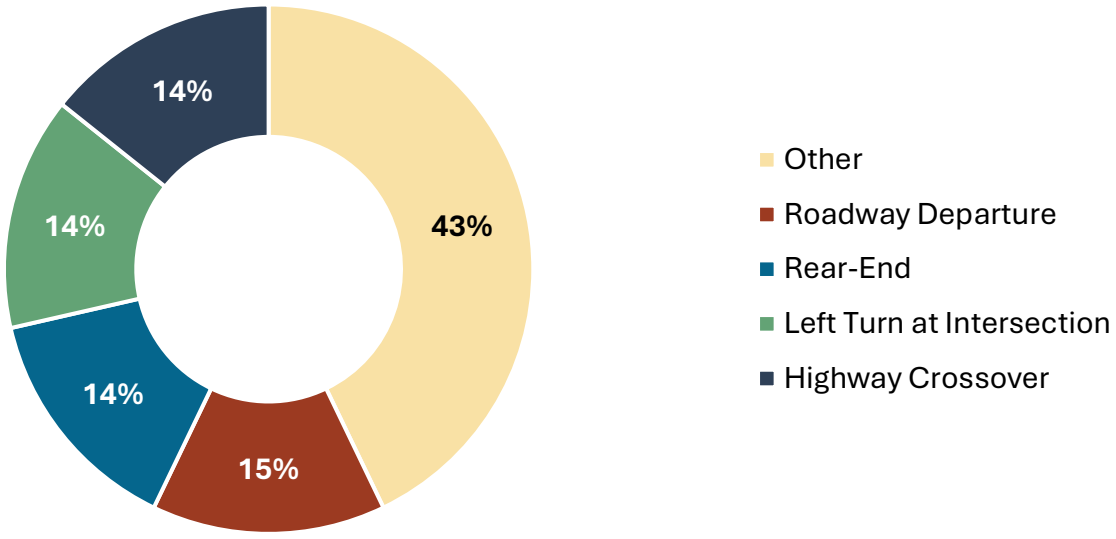

Figure 7. Most Common Fatal and Serious Injury Crash Types for the Enoch City GFA

3.2.3. Driver Contributing Factors

Several factors may contribute to a single crash; however, the driver contributing factors shown in **Figure 8** only represent the first driver specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. The data shows that the three most frequent driver contributing factors are vehicles failing to yield to proper right-of-way, disregarding traffic signals, and reckless or aggressive driving.

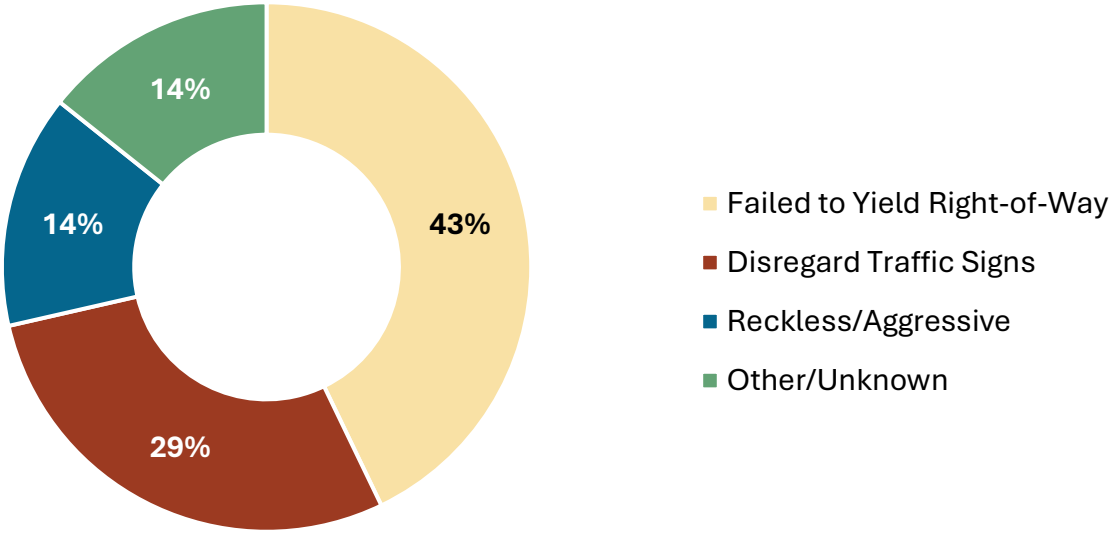

Figure 8. Most Common Fatal and Serious Injury Crash Driver Contributing Factors for the Enoch City GFA

3.2.4. Vulnerable User Crashes

Vulnerable road users include pedestrians and bicyclists. The data shows one crash involving a pedestrian and 3 crashes involving bicyclists occurred in the Enoch City GFA from 2019 to 2023. No fatal or serious injury crashes involving a pedestrian or bicyclist occurred in the Enoch City GFA in the five-year analysis period.

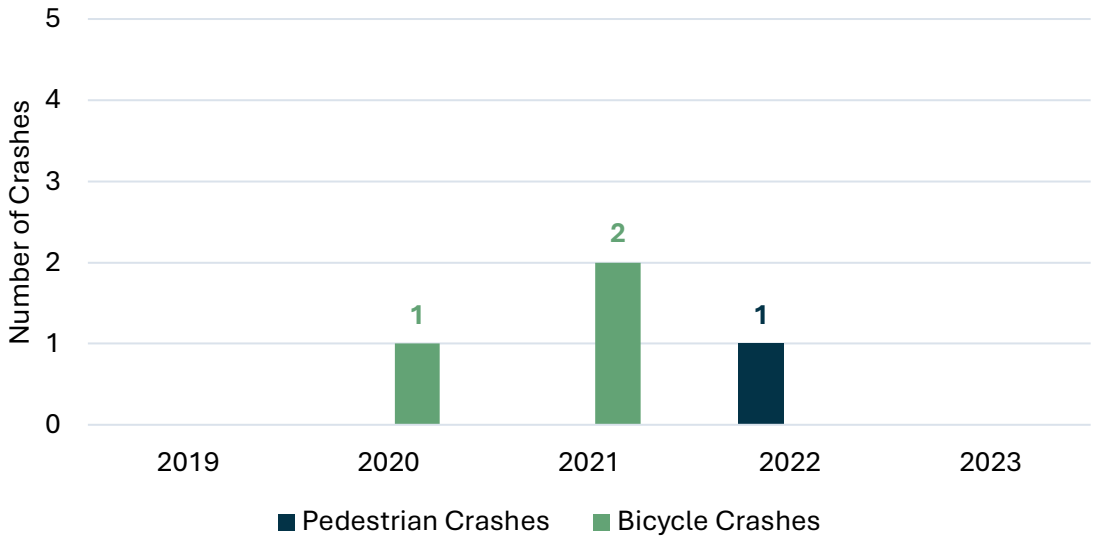

Figure 9. Vulnerable User Crashes by Year for the Enoch City GFA

3.3. Utah SHSP Emphasis Safety Area Analysis

The SHSP emphasis area analysis ranks the frequency of fatalities and serious injuries in the Enoch City GFA for each of the eleven Utah SHSP emphasis safety areas. A fatality or serious injury may be assigned to multiple emphasis areas.

The rankings of the emphasis areas compare the Enoch City GFA, the state of Utah, and all of Iron County.

This analysis helps to determine priority emphasis areas for the Enoch City GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different than the statewide or County rankings.

Table 3 summarizes the Utah SHSP Emphasis Area comparison analysis. The following emphasis areas have the highest frequency of fatalities and serious injuries in the Enoch City GFA. The SAP will identify strategies to address these priority emphasis areas:

- No Safety Restraints
- Intersections
- Older Drivers
- Roadway Departures
- Teen Drivers

Table 3. Utah SHSP Emphasis Area Comparison for the Enoch City GFA

Category	Utah SHSP Safety Emphasis Area	Statewide		Iron County		Enoch City GFA		
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Change in Rank from County
Driver	Teen Driver	1,695	4	54	5	2	5	0
	Older Driver	1,565	7	49	6	3	3	3
	Speed-Related	2,268	3	78	3	0	9	-6
	Aggressive Driving	615	11	19	10	1	8	2
	Distracted Driving	732	10	28	8	2	6	2
	Impaired Driving	1,100	8	27	9	1	7	2
	No Safety Restraints	1,627	5	85	2	8	1	1
Roadway	Intersection	3,683	1	67	4	7	2	2
	Roadway Departure	3,372	2	132	1	2	4	-3
Special Users	Motorcycle	1,571	6	40	7	0	10	-3
	Pedestrian	1,000	9	15	11	0	11	0
	Bicycle*	303	12	3	12	0	12	0

**While Bicycles are not one of the eleven Utah SHSP emphasis areas, they are included as part of the CSAP safety analysis.*

4. HISTORIC CRASH ANALYSIS

A component of the SAP is to identify locations with an elevated risk of crashes. The initial step of this analysis is to spatially reference crashes that occurred within the study area.

The following networks were created in the historic crash analysis using the historic crash locations:

- **High-Crash Network**: Represents roadways and intersections on which the most crashes occur and experience high crash rates.
- **High-Injury Network**: Represents roadways and intersection on which fatal and injury crashes typically occur.

4.1. High-Crash Network

The roadway network shown in **Figure 10** is identified as the High-Crash network. The High-Crash network includes locations on which 50% of all crashes in the GFA have occurred and locations experiencing high crash rates.

4.2. High-Injury Network

Figure 11 shows the identified High-Injury network. The High-Injury network represents the roadways on which 50% of fatal and injury crashes have occurred.

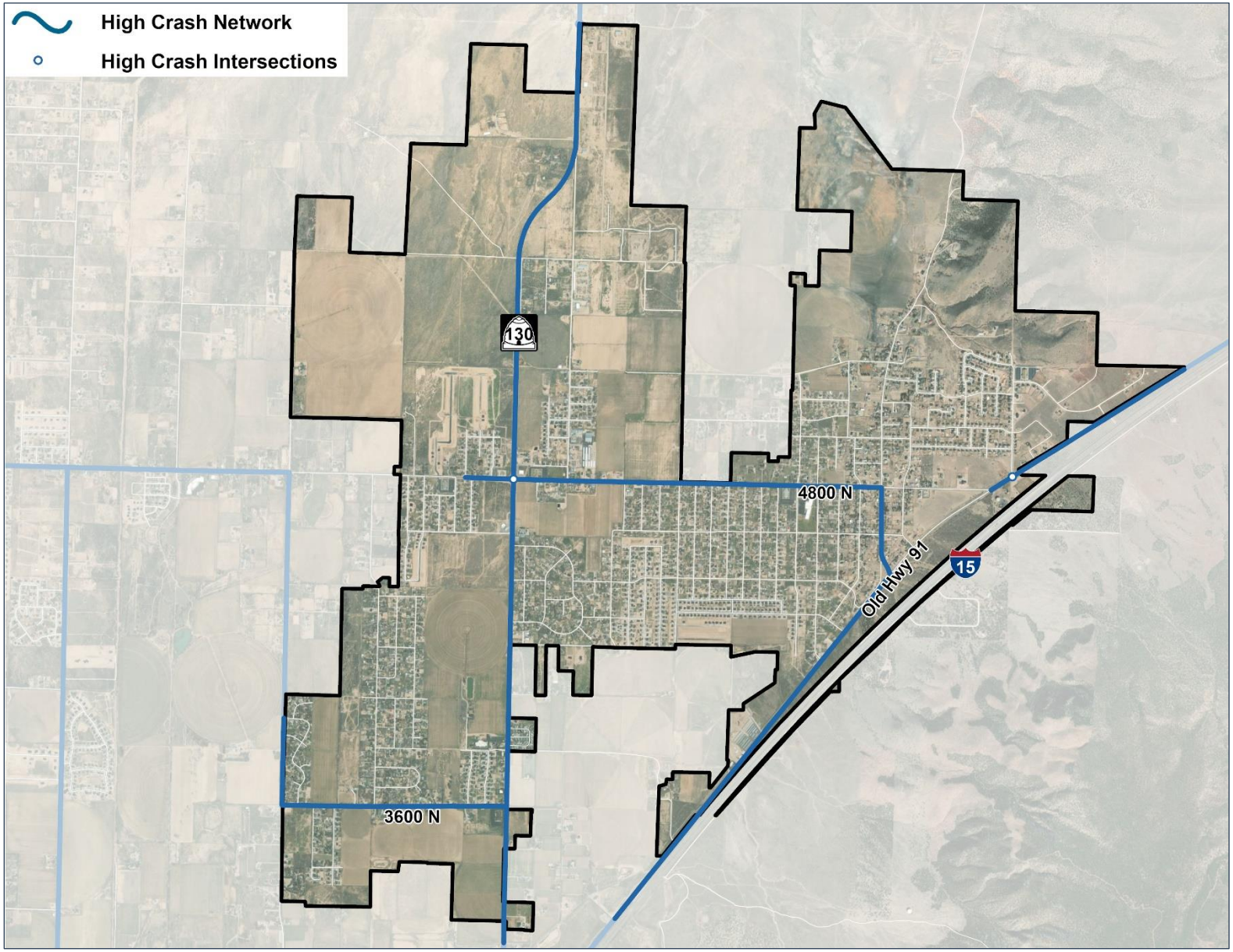

Figure 10. High-Crash Network for the Enoch City GFA

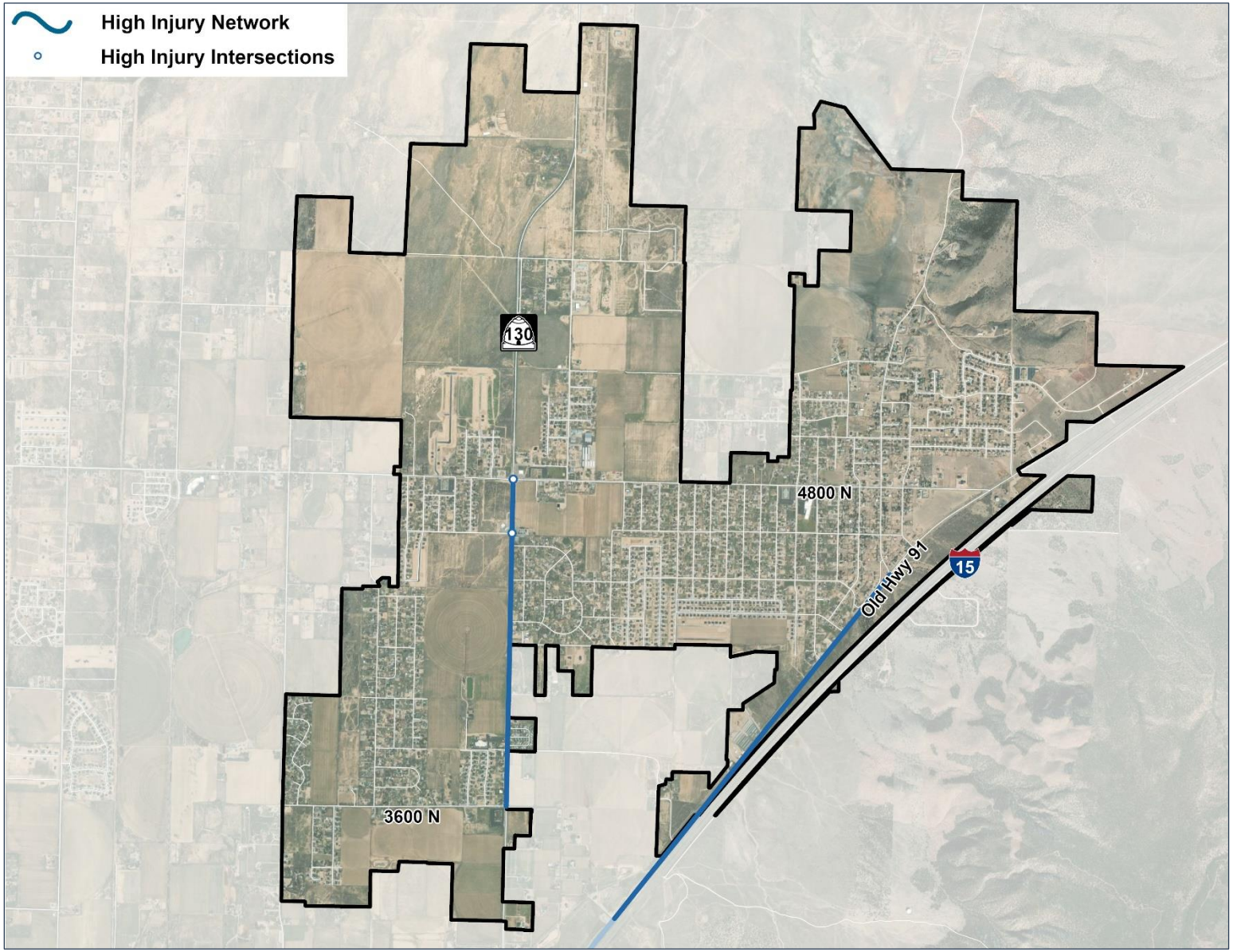

Figure 11. High-Injury Network for the Enoch City GFA

5. NETWORK SCREENING ANALYSIS

A network screening analysis was prepared for the Enoch City GFA informed by a Critical Crash Rate (CCR) analysis. Network screening methodology is detailed in Technical Memorandum #1. A positive CCR differential is an indication of a location with a potential for safety improvement (PSI). All roadways and intersection with a positive CCR differential are shown in **Figure 12.**

These locations represent those with the highest potential for safety improvements and should be considered as project candidate locations.

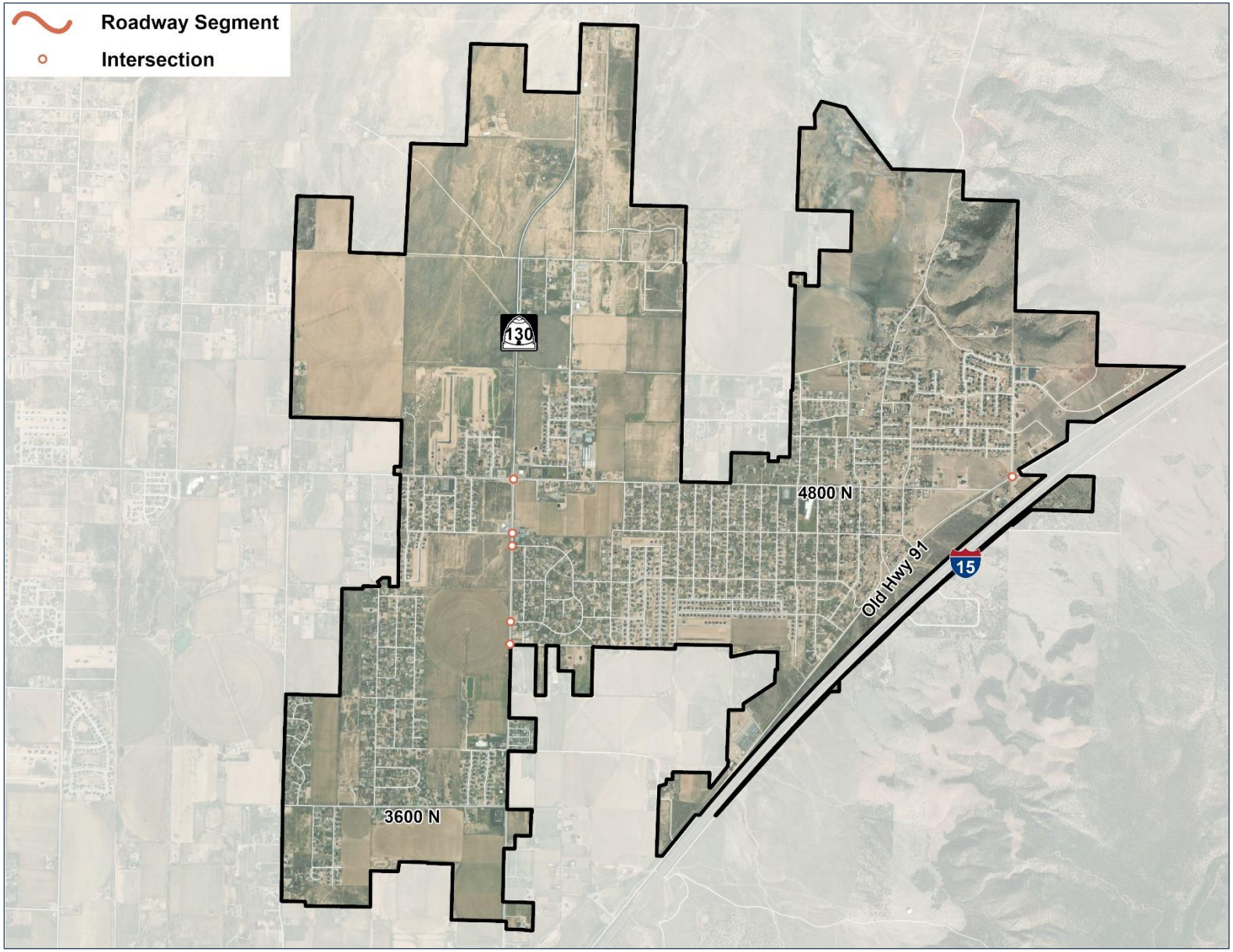

Figure 12. Critical Crash Rate (CCR) Network for the Enoch City GFA

6. CONFLICT AREAS

The conflict area analysis used Replica data obtained for the Iron County area to proactively address areas of greater safety risks. The following data and metrics were isolated in Replica to identify higher risk roadways in the GFA and Iron County:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking
- Active Transportation (pedestrians and bicyclist) high-risk corridors

A maximum risk score within Replica is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are included in the Replica Conflict Networks shown in **Figure 13** and **Figure 14** for the Enoch City GFA.

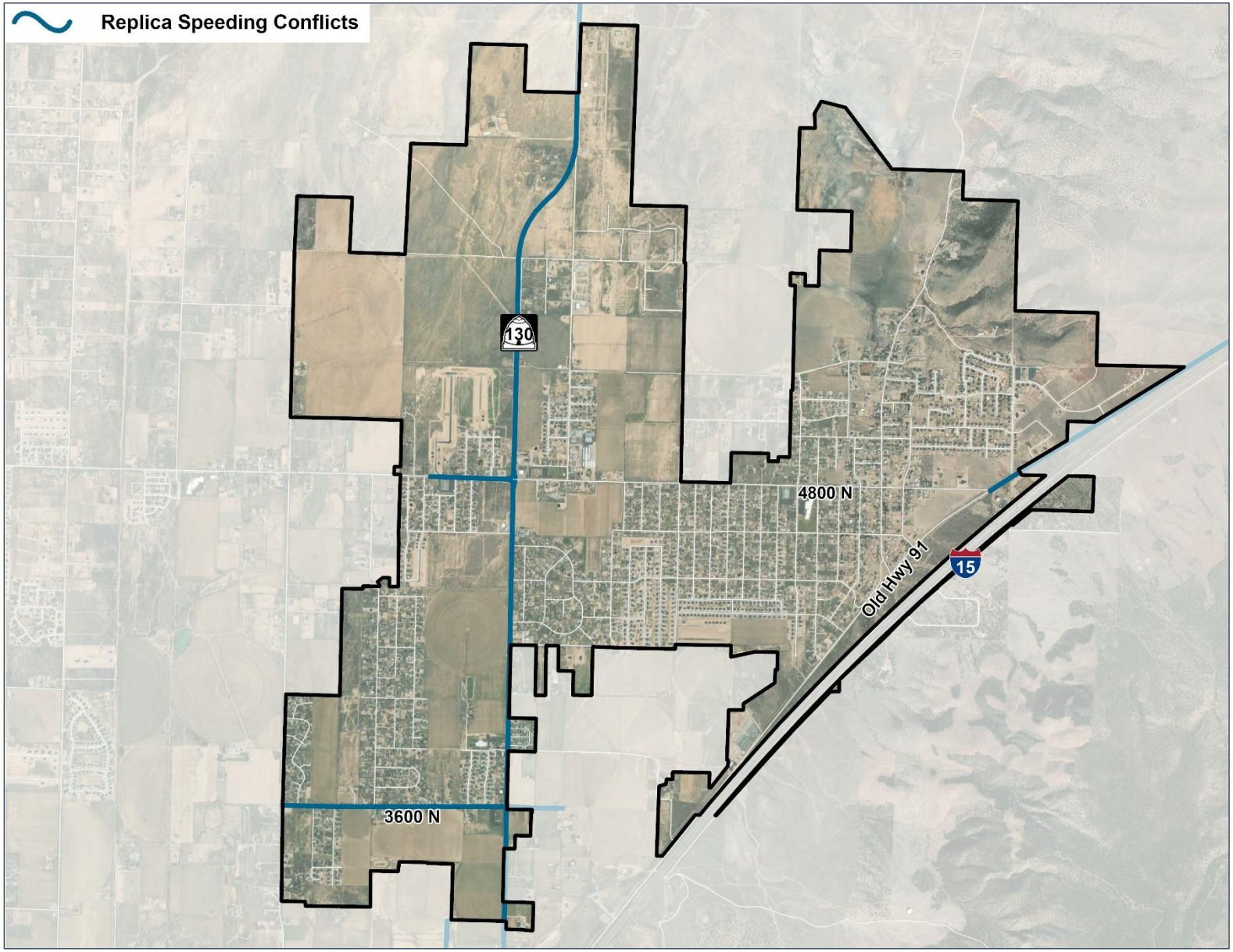

Figure 13. Replica Speeding Conflict Areas for the Enoch City GFA

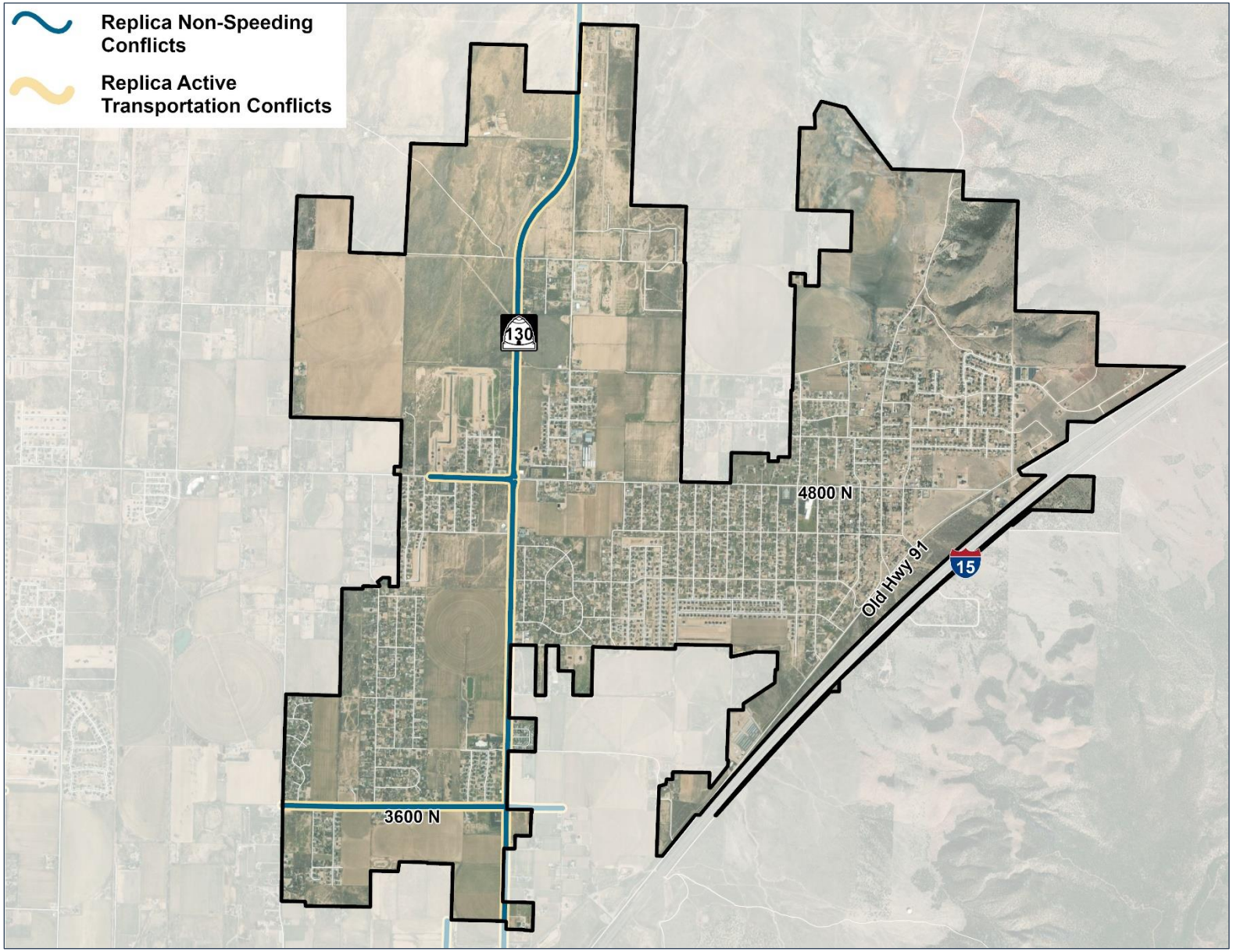

Figure 14. Replica Non-Speeding and Active Transportation Conflict Areas for the Enoch City GFA

7. ROADWAY CHARACTERISTIC RISK ANALYSIS

A roadway characteristic risk analysis was performed using the following sub-analyses:

- Crash Profile Risk Assessment
- usRAP Risk Assessment

7.1. Crash Profile Risk Assessment

This crash profile risk assessment sub-analysis identifies common roadway characteristics for roadways where fatal and serious injury crashes have occurred. Based on various roadway characteristic risks identified from crash report analysis, a risk score was assigned to major routes within the Enoch City GFA. A breakdown of the risk assessment scoring is reported in **Section 4.4** of Technical Memorandum #1. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the Crash Profile Risk Assessment are mapped in **Figure 15**.

7.2. usRAP Risk Assessment

A roadway characteristic risk assessment was performed using roadway feature data collected for Utah's state routes. The risk assessment was performed using usRAP data and tools. The output of the usRAP tool is a star rating, or risk rating, for vehicle, pedestrian, and bicyclist features. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the usRAP risk assessment by star rating are mapped in **Figure 16**.

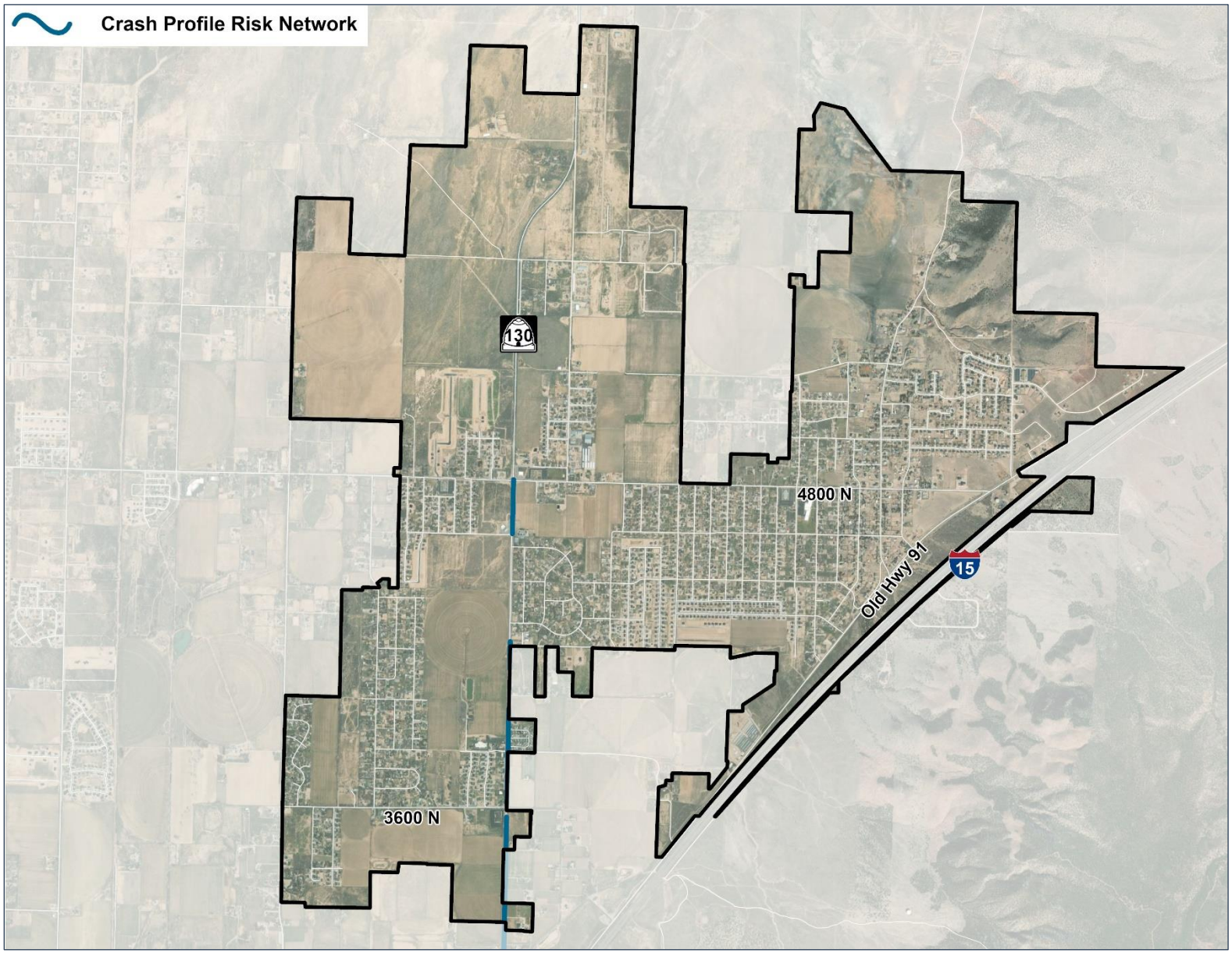

Figure 15. Crash Profile Risk Network for the Enoch City GFA

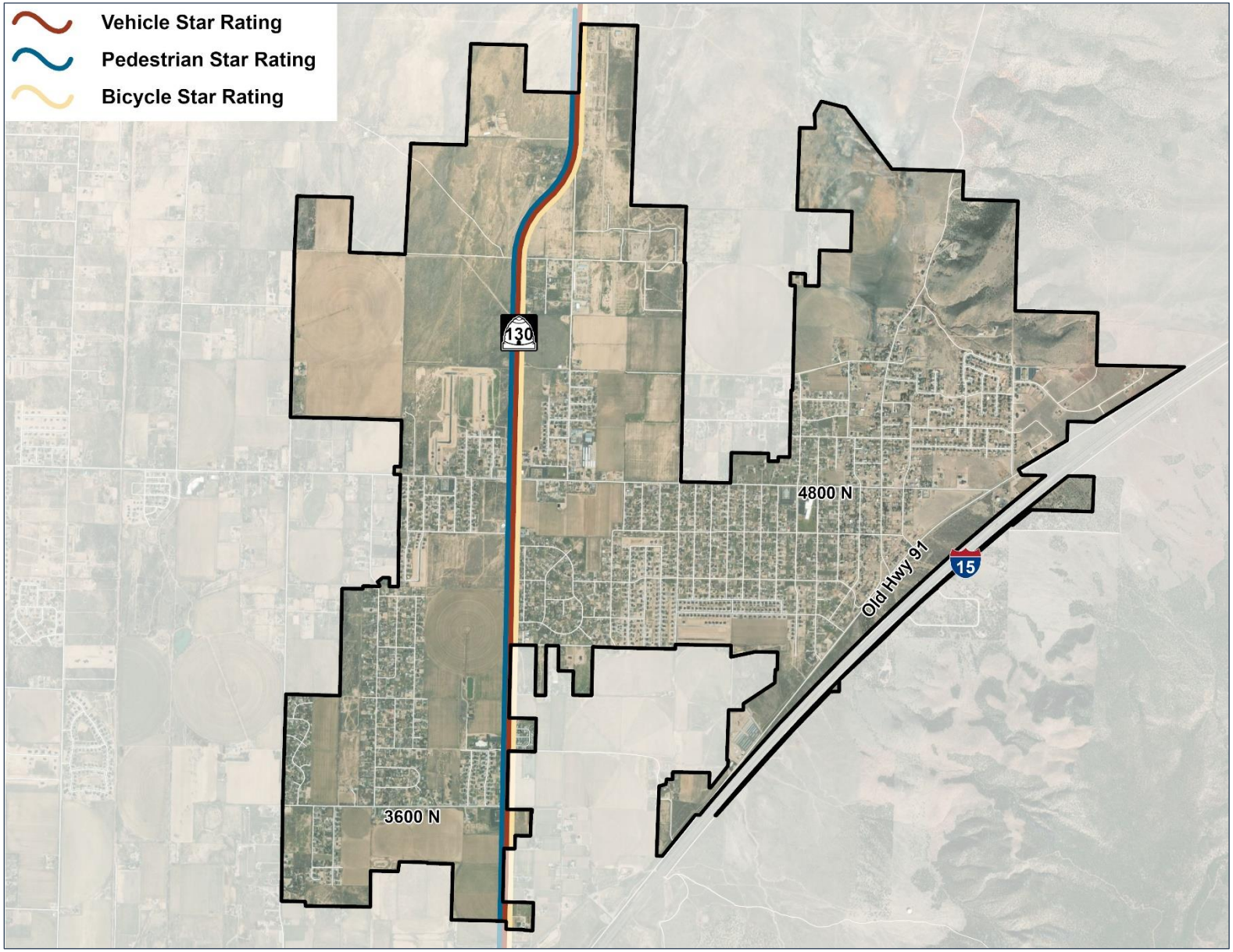

Figure 16. usRAP Risk Network – Star Ratings for the Enoch City GFA

8. HIGH-RISK NETWORK

Each of the safety analysis methodologies identified roadway segments or intersections in the Enoch City GFA that may benefit from safety improvements to reduce fatal and serious injury crashes.

To provide focused information for decisions regarding prioritization of safety improvements, an overlay of each analysis methodology was created to form a High-Risk Network.

A high-risk score, from zero to five, was determined using the approach in **Table 4.** Any location with a positive high-risk score may be considered for safety improvements. Locations with a risk score of three or greater are to be prioritized in the High-Risk Network

The Enoch City GFA High-Risk Network is shown in **Figure 17**. **Table 5** and **Table 6** provide an overview of the high priority roadway segments and intersections included in the High-Risk Network that were presented to stakeholders for comment in December 2024. Up to ten roadway segments and 20 intersections were listed if a location had a positive risk score.

Table 4. High-Risk Scoring Criteria

High Risk Category	Safety Analysis	Scoring Criteria	Risk Score
Historic Crashes	High Crash Network	Highest number of crashes per miles	1
	High Injury Network	Highest number of fatal and injury crashes per mile	1
Network Screening	Critical Crash Rates	Positive critical crash rate differential	1
Conflict Areas	Replica - Speeding Areas	Speeding conflict risk score of 80+	1/3
	Replica - Non-Speeding Areas	Non-speeding conflict risk score of 80+	1/3
	Replica - Active Transportation Areas	Active transportation conflict rick score of 80+	1/3
Risk Characteristics	Crash Profile Risk	Crash Profile Risk score of 60+	1/4
	usRAP Vehicle Star Rating	Star Rating of 1 - 2	1/4
	usRAP Pedestrian Star Rating	Star Rating of 1 - 2	1/4
	usRAP Bicycle Star Rating	Star Rating of 1 - 2	1/4
Maximum High-Risk Score			5

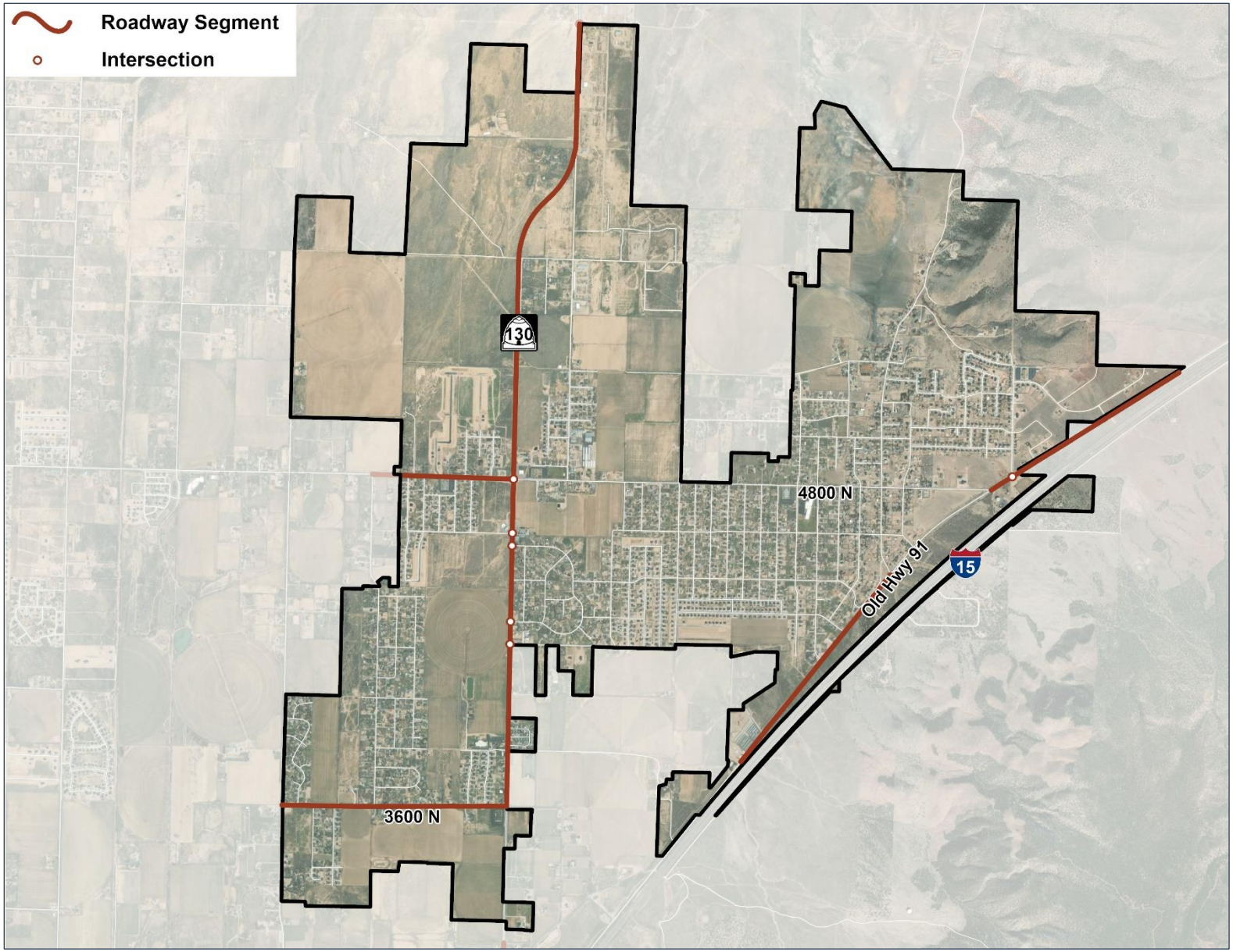

Figure 17. High-Risk Network for the Enoch City GFA

Table 5. Priority High-Risk Roadways for the Enoch City GFA

Roadways				Safety Analysis									
Roadway	Extents	Length (miles)	Functional Classification	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
State Routes													
Minersville Highway (SR 130)	3600 North to Midvalley Road	1.5	Other Principal Arterial	X	X		X	X	X	X	X	X	X
Minersville Highway (SR 130)	Midvalley Road to 6400 North	2.5	Minor Arterial	X		X	X	X	X	X	X	X	X
Non- State Routes													
Midvalley Road	SR 130 to Driftwood Lane	0.8	Major Collector	X			X	X	X				
Old Highway 91	940 East to Enoch Road	1.5	Major Collector	X	X								
Old Highway 91	Midvalley Road to Ravine Road	1.0	Major Collector	X			X						
3600 North	Bulldog Road to SR 130	1.0	Minor Collector	X			X	X	X				

Table 6. Priority High-Risk Intersections for the Enoch City GFA

Intersections		Safety Analysis			Supporting Networks						
Intersection	Number of Crashes	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
Unsignalized Intersections											
SR 130 & Midvalley Road	17	X	X	X				X	X	X	X
SR 130 & 4600 North	3		X	X	X	X	X	X	X	X	X
SR 130 & 6400 North	5	X		X	X	X	X		X	X	X
SR 130 & 4200 North	3			X	X	X	X	X	X	X	X
SR 130 & Blue Sky Drive North	4			X	X	X	X		X	X	X
Heather Hue Road & Old Highway 91	3			X	X	X	X		X	X	X
SR 130 & Blue Sky Drive South	3			X	X	X	X		X	X	X

APPENDIX A.3. EAST IRON COUNTY GFA SAFETY ANALYSIS AND RESULTS

TECHNICAL MEMORANDUM #1

APPENDIX A3

EAST IRON COUNTY GEOGRAPHIC FOCUS AREA SAFETY ANALYSIS

Statutory Notice

23 U.S.C. § 409: US Code - Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Appendix A3 summarizes the safety analysis performed for the East Iron County Geographic Focus Area (GFA) as part of the Safety Action Plan for all Iron County (SAP).

The safety analysis identified roadway segments and intersection with the highest safety risk and need. The resulting High-Risk Network represents locations with the largest potential for safety improvement. The network helps informs the identification of potential project locations that may be further considered in the SAP.

1.1. Safety Analysis

The safety analysis methodologies are presented in **Section 4** of Technical Memorandum #1 and include the components shown in **Figure 1**. Results of each component are shown in **Table 1**.

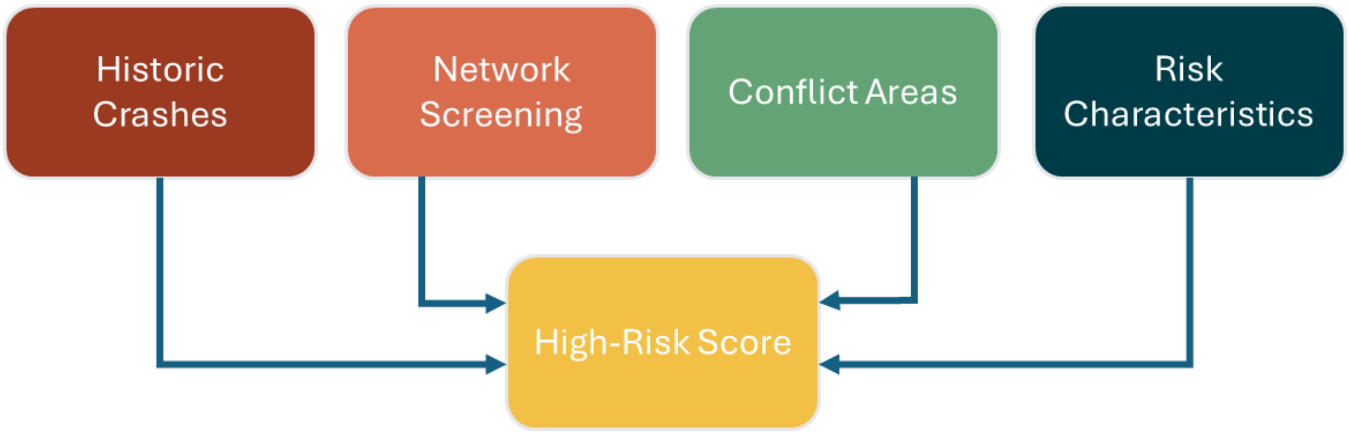

Figure 1. Safety Analysis Components

Table 1. Safety Analysis Components and Results

Safety Analysis Component	Analysis Result(s)
Historical Crash Overview	Frequent crash types and common contributing factors.
Strategic Highway Safety Plan (SHSP) Emphasis Area Analysis	Ranked emphasis areas based on GFA, Iron County, or Statewide crashes.
Historical Crash Analysis	High-crash network.
	High-risk network.
Network Screening Analysis	Critical crash rate network.
Conflict Areas	Speeding, phone handling, sudden braking, and suspected collision networks.
Risk Characteristics	Crash Profile Risk Assessment
	usRAP Risk Factors Analysis

1.2. Appendix Organization

Appendix A3 is organized into the following sections:

- **Section 1** – Introduction
- **Section 2** – East Iron County GFA Study Area and Roadway Network
- **Section 3** – Historic Crash Overview
- **Section 4** – Historic Crash Analysis
- **Section 5** – Network Screening Analysis
- **Section 6** – Conflict Areas
- **Section 7** – Roadway Characteristic Risk Analysis
- **Section 8** – High-Risk Network

2. STUDY AREA

The SAP study area includes each jurisdiction within Iron County. To organize the Iron County jurisdictions and unincorporated areas into manageable analysis areas, Iron County was divided into five GFAs. The East Iron County GFA, shown in **Figure 2**, includes State Route (SR) 130 and sections of SR 56 to approximately Bumblebee Road. The following jurisdictions and agencies east of SR 130 and SR 56 are included in the East Iron County GFA:

- Brain Head Town
- Kanarraville
- The Paiute Indian Tribe of Utah
- Paragonah Town
- Parowan City
- Unincorporated Iron County

The safety analyses presented in this appendix are specific to the East Iron County GFA.

Figure 2 highlights the roadway network within the East Iron County GFA study area. Roadways within the study area are divided into the following categories:

- State Routes: Roadways maintained by the Utah Department of Transportation (UDOT)
- Non-State Routes: Jurisdiction-maintained roads

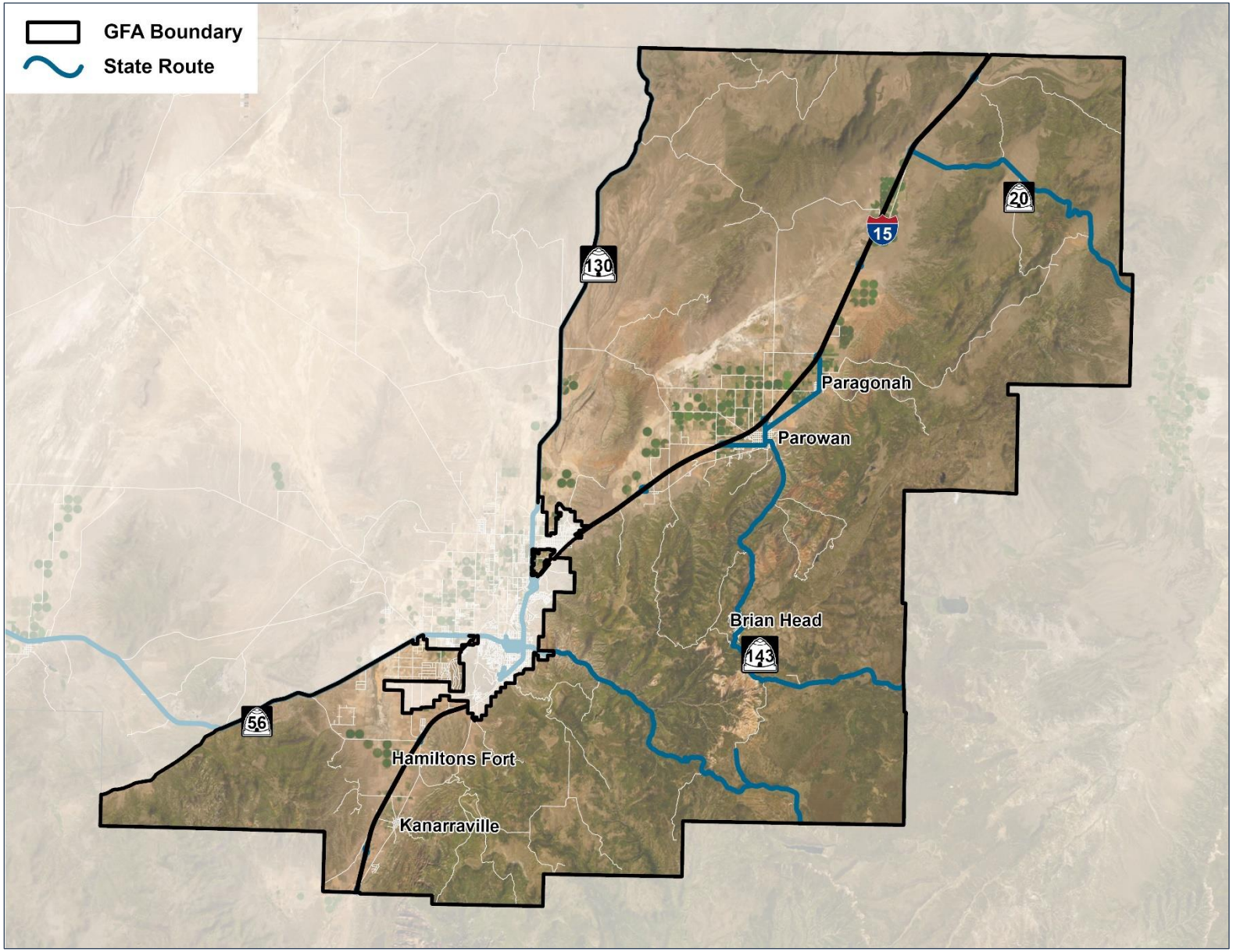

Figure 2. East Iron County GFA Study Area

3. HISTORIC CRASH OVERVIEW

Crash data was obtained from the UDOT database for the most recent completed five-year period, 2019 to 2023. A historic crash review specific to the East Iron County GFA is summarized below.

3.1. Overall Crashes

Figure 3 provides an overview of annual crashes for the East Iron County GFA separated by crash severity. Crash severity is reported as fatal, serious injury, or all other crashes (minor injury, possible injury, or property damage only). A review of the crash data reveals the following:

- The total number of crashes was highest in 2021. Crash severities remained relatively constant from 2019 to 2020.
- The number of fatal and serious injury crashes was the highest in 2022 (16) and slightly decreased in 2023 (11).

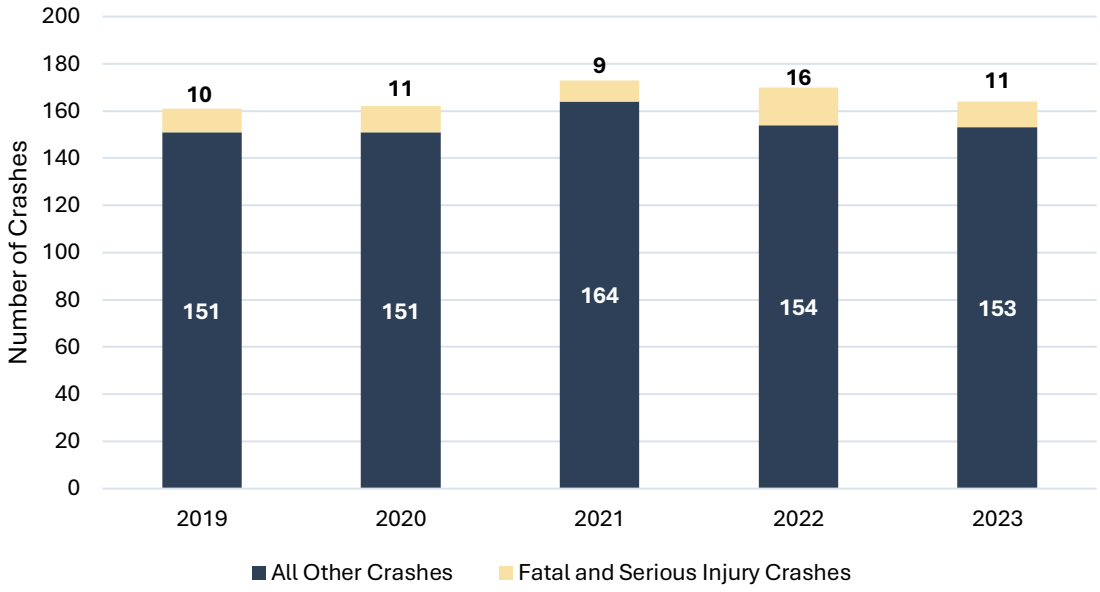

Figure 3. East Iron County GFA Crashes by Year

Table 2 provides an overview of crashes by severity and route type within the East Iron County GFA. A review of the data reveals the following:

- 76% of crashes occurred on State Routes.
- More serious injury crashes occur on State Routes (30) compared to non-state routes (16).
- Fatal and serious injury crashes make up approximately 7% of all crashes in the East Iron County GFA.
- 67% of crashes in the GFA results in no injury or property damage only (PDO).
- 16% of all the crashes in Iron County occurred within the East Iron County GFA.

Table 2. Crash Severity by Route Type for the East Iron County GFA

Route Type	State Route		Non-State Route		GFA Total		% of Iron County
Crash Severity	Crashes		Crashes		Crashes		%
	#	%	#	%	#	%	
Fatal	6	1%	5	2%	11	1%	28%
Suspected Serious Injury	30	5%	16	8%	46	6%	24%
Suspected Minor Injury	82	13%	25	12%	107	13%	17%
Possible Injury	72	11%	37	18%	109	13%	15%
No Injury / Property Damage Only	438	70%	119	59%	557	67%	15%
Route Total	**628**	**100%**	**202**	**100%**	**830**	**100%**	**16%**

3.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in **Figure 4**. A review of the crash data reveals the following:

- An overall increase in fatal and severe injury crashes from 2019 to 2023.
- The number of fatal crashes have increased since 2019, reaching a maximum of four (4) fatal crashes occurring in 2022.

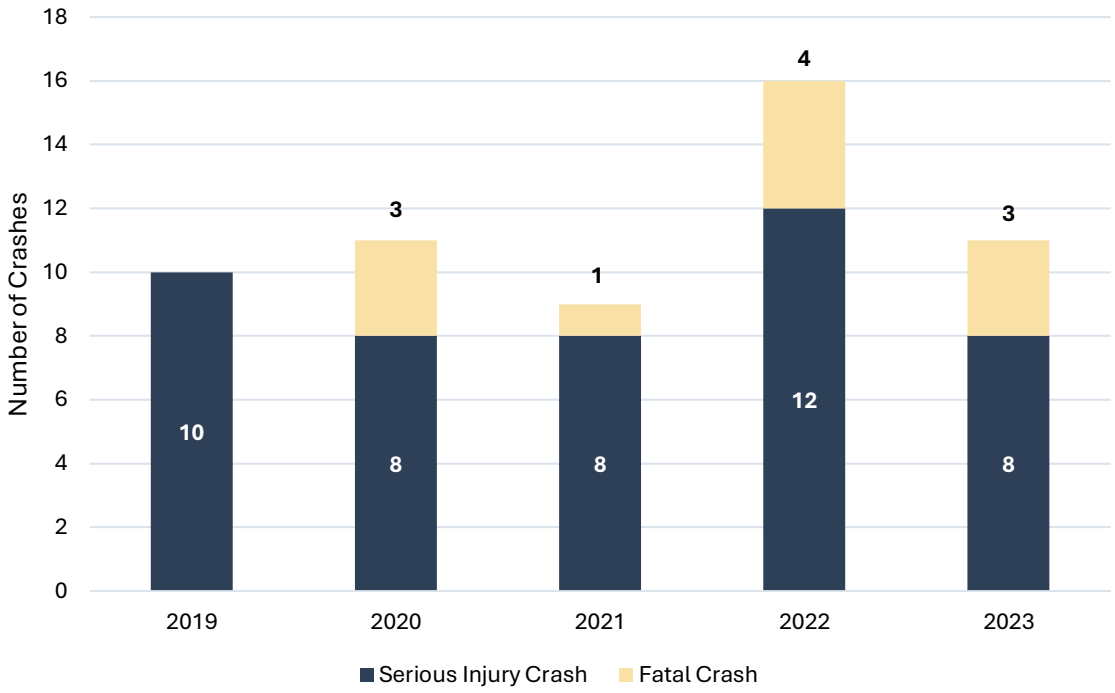

Figure 4. East Iron County GFA Fatal and Serious Injury Crashes by Year

The locations of the fatal and serious injury crashes are displayed in **Figure 5** and show a prevalence of serious injury crashes along SR 20, SR 56, and SR 14. The SR 20 corridor was observed to be an area where a greater number of fatal crashes have occurred.

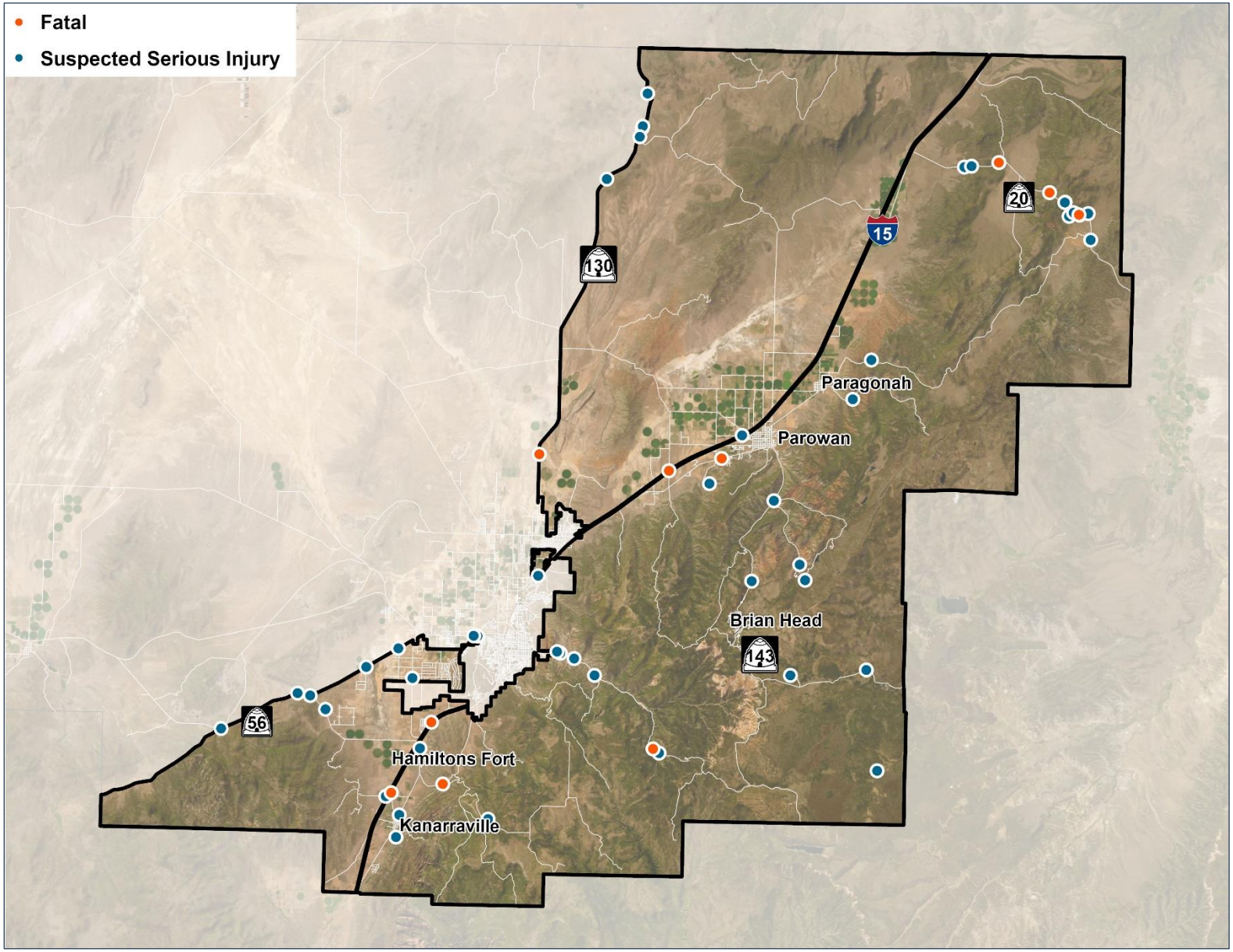

Figure 5. Fatal and Serious Injury Crashes in the East Iron County GFA

3.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collisions is shown in **Figure 6**. The manner of collision represents how two vehicles initially collided. The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization compared to crash type that is summarized in Section 3.3.2. The three most frequent manners of collision that resulted in a fatality or serious injury crash are single vehicle crashes, head on crashes, and rear-end crashes.

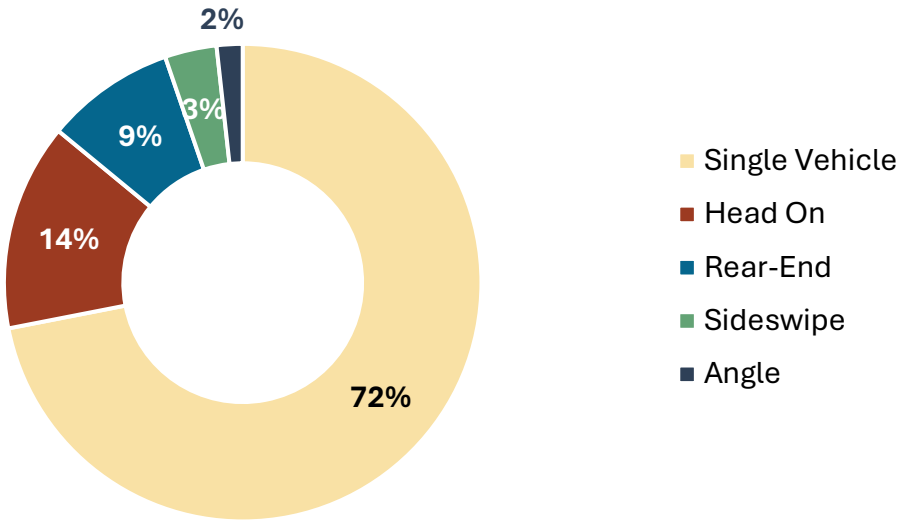

Figure 6. Most Common Fatal and Serious Injury Manners of Collision for the East Iron County GFA

3.2.2. Crash Types

Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type, examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The most common crash types for the East Iron County GFA are summarized in **Figure 7**. The three most frequent fatal and serious injury crash types are roadway departures, highway crossovers, and a crash type recorded as "Other." The crash type "other" may indicate a unique crash scenario or a gap in available data.

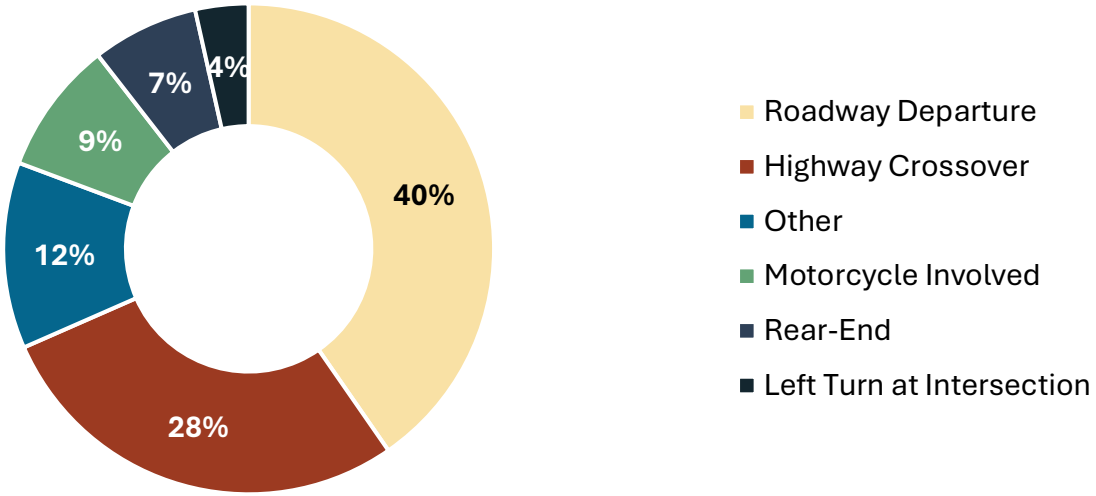

Figure 7. Most Common Fatal and Serious Injury Crash Types for the East Iron County GFA

3.2.3. Driver Contributing Factors

Several factors may contribute to a single crash however, the driver contributing factors shown in **Figure 8** only represent the first driver specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. The data shows that the three most frequent driver contributing factors include speeding, failure to keep in the proper lane, and "Other/Unknown". The "Other/Unknown" contributing crash factor may indicate a unique scenario or highlight a gap in data collection.

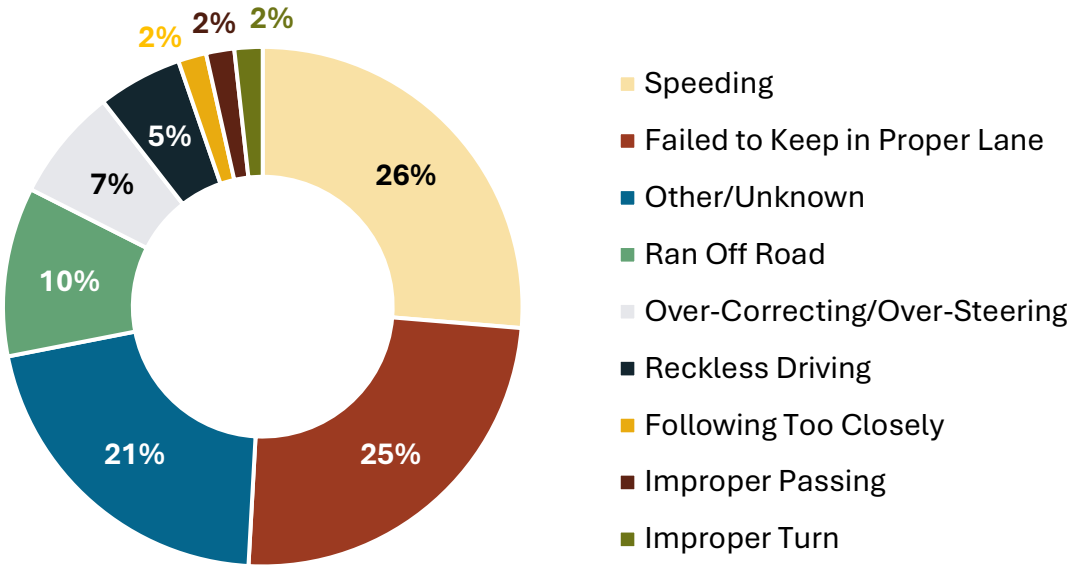

Figure 8. Most Common Fatal and Serious Injury Crash Driver Contributing Factors in the East Iron County GFA

3.2.4. Vulnerable User Crashes

Vulnerable road users include pedestrians and bicyclists. The data shows one crash involving a pedestrian and two crashes involving bicyclists in the East Iron County GFA from 2019 to 2023. **Figure 9** shows that the number of pedestrian and bicycle crashes have decreased since 2022.

No fatal or serious injury vulnerable user crashes occurred in the five-year analysis period.

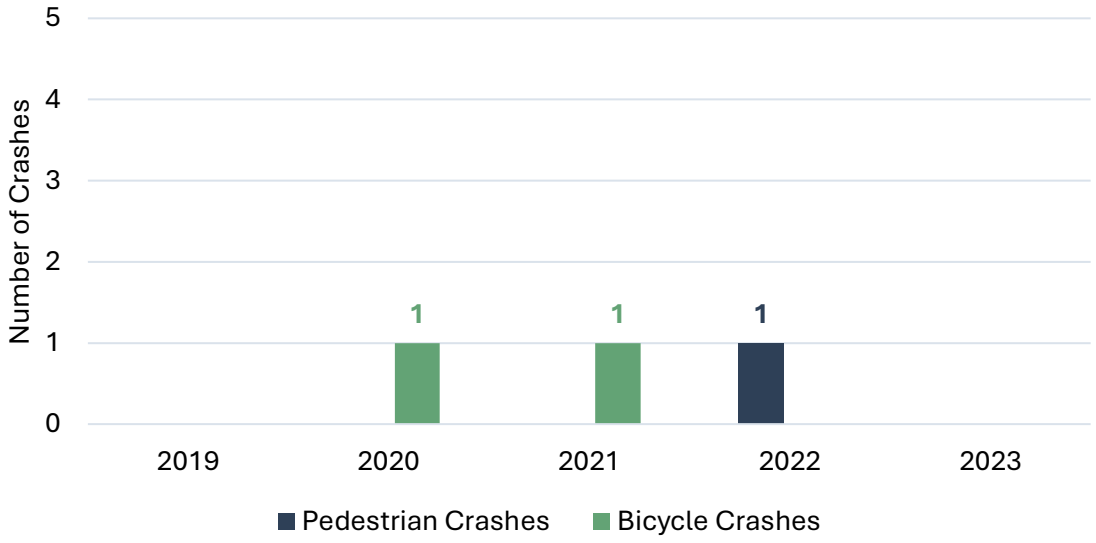

Figure 9. Vulnerable User Crashes by Year for the East Iron County GFA

3.3. Utah SHSP Emphasis Safety Area Analysis

The SHSP emphasis area analysis ranks the frequency of fatalities and serious injuries in the East Iron County GFA for each of the eleven Utah SHSP emphasis safety areas. A fatality or serious injury may be assigned to multiple emphasis areas.

The rankings of the emphasis areas compare the East Iron County GFA, the state of Utah, and all of Iron County.

This analysis helps to determine priority emphasis areas for the East Iron County GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different than the statewide or County rankings.

Table 3 summarizes the Utah SHSP Emphasis Area comparison analysis. The following emphasis areas have the highest frequency of fatalities and serious injuries in the East Iron County GFA. The SAP will identify strategies to address these priority emphasis areas:

- Roadway Departure
- Speed-Related
- Motorcycles
- No Safety Restraints
- Older Drivers

Table 3. Utah SHSP Emphasis Area Comparison for the East Iron County GFA

Category	Utah SHSP Safety Emphasis Area	Statewide		Iron County		East Iron County GFA		
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Change in Rank from County
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Roadway	Intersection	3,683	1	67	4	6	8	-4
	Roadway Departure	3,372	2	132	1	44	1	0
Special Users	Motorcycle	1,571	6	40	7	16	3	4
	Pedestrian	1,000	9	15	11	0	11	0
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**While Bicycles are not one of the eleven Utah SHSP emphasis areas, they are included as part of the CSAP safety analysis.*

4. HISTORIC CRASH ANALYSIS

A component of the SAP is to identify locations with an elevated risk of crashes. The initial step of this analysis is to spatially reference crashes that occurred within the study area.

The following networks were created in the historic crash analysis using the historic crash locations:

- **High-Crash Network**: Represents roadways and intersections on which the most crashes occur and experience high crash rates.
- **High-Injury Network**: Represents roadways and intersection on which fatal and injury crashes typically occur.

4.1. High-Crash Network

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4.2. High-Injury Network

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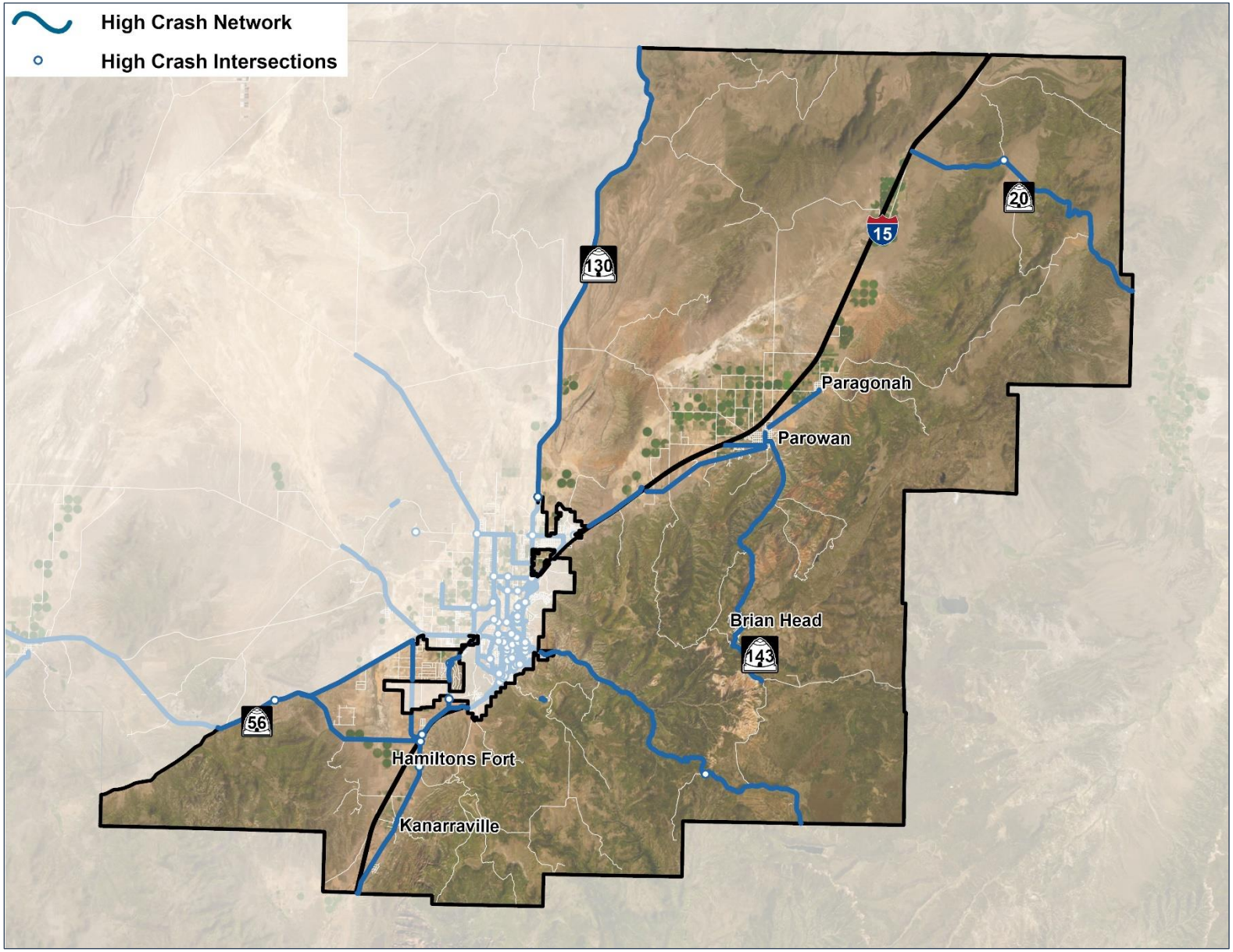

Figure 10. High-Crash Network for the East Iron County GFA

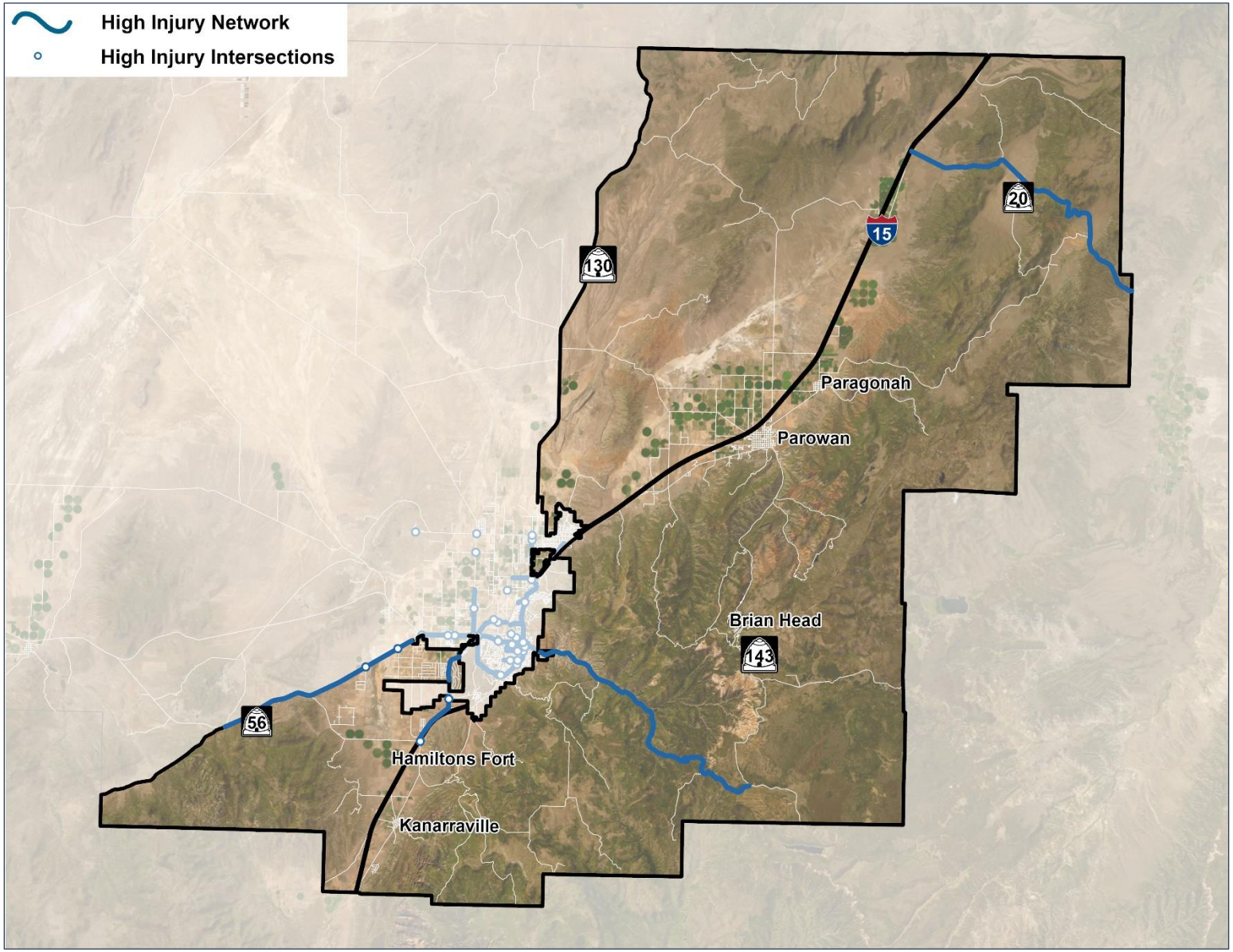

Figure 11. High-Injury Network for the East Iron County GFA

5. NETWORK SCREENING ANALYSIS

A network screening analysis was prepared for the East Iron County GFA informed by a Critical Crash Rate (CCR) analysis. Network screening methodology is detailed in Technical Memorandum #1. A positive CCR differential is an indication of a location with a potential for safety improvement (PSI). All roadways and intersection with a positive CCR differential are shown in **Figure 12.**

These locations represent those with the highest potential for safety improvements and should be considered as project candidate locations.

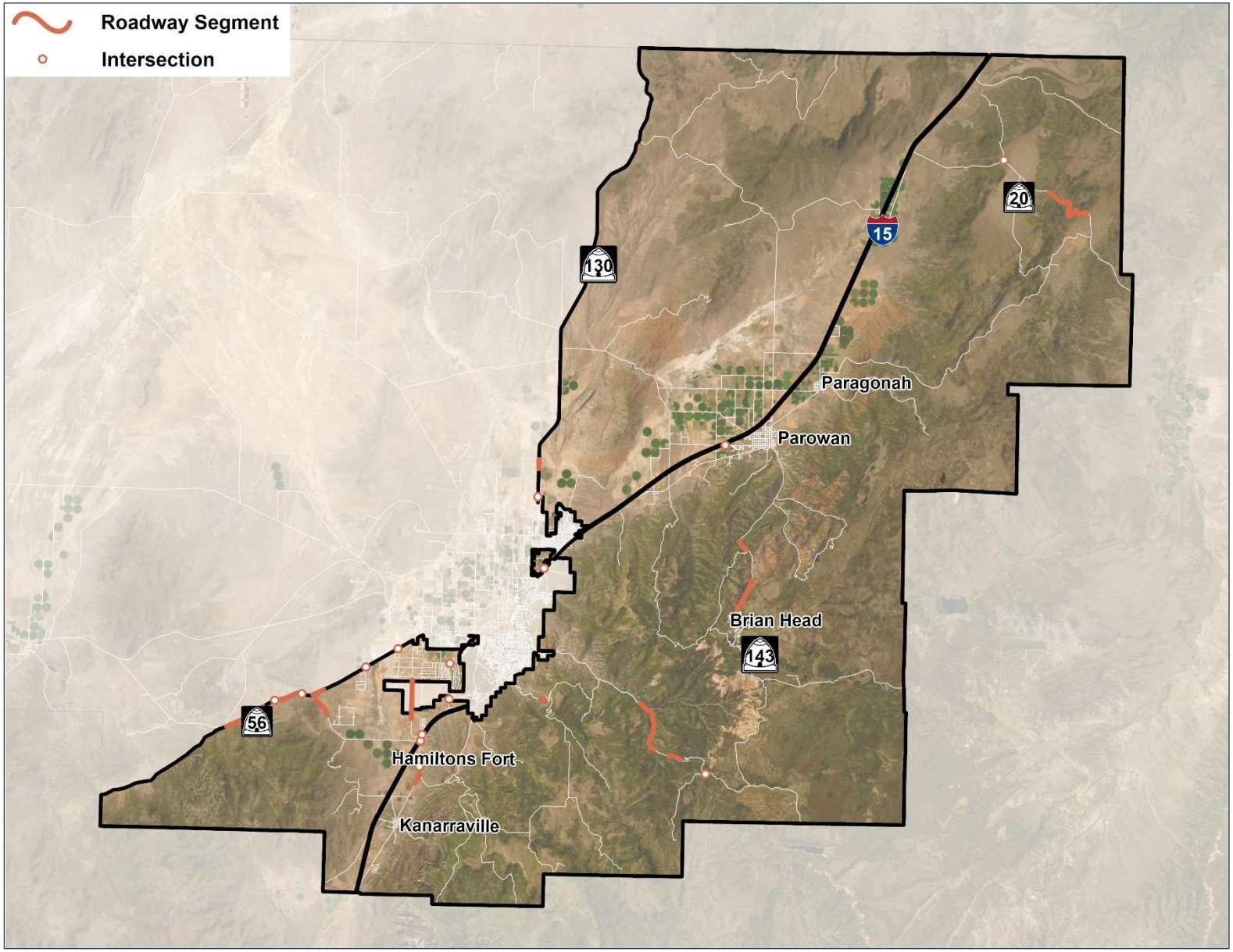

Figure 12. Critical Crash Rate (CCR) Network for the East Iron County GFA

6. CONFLICT AREAS

The conflict area analysis used Replica data obtained for the Iron County area to proactively address areas of greater safety risks. The following data and metrics were isolated in Replica to identify higher risk roadways in the GFA and Iron County:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking
- Active Transportation (pedestrians and bicyclist) high-risk corridors

A maximum risk score within Replica is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are included in the Replica Conflict Networks shown in **Figure 13** and **Figure 14** for the East Iron County GFA.

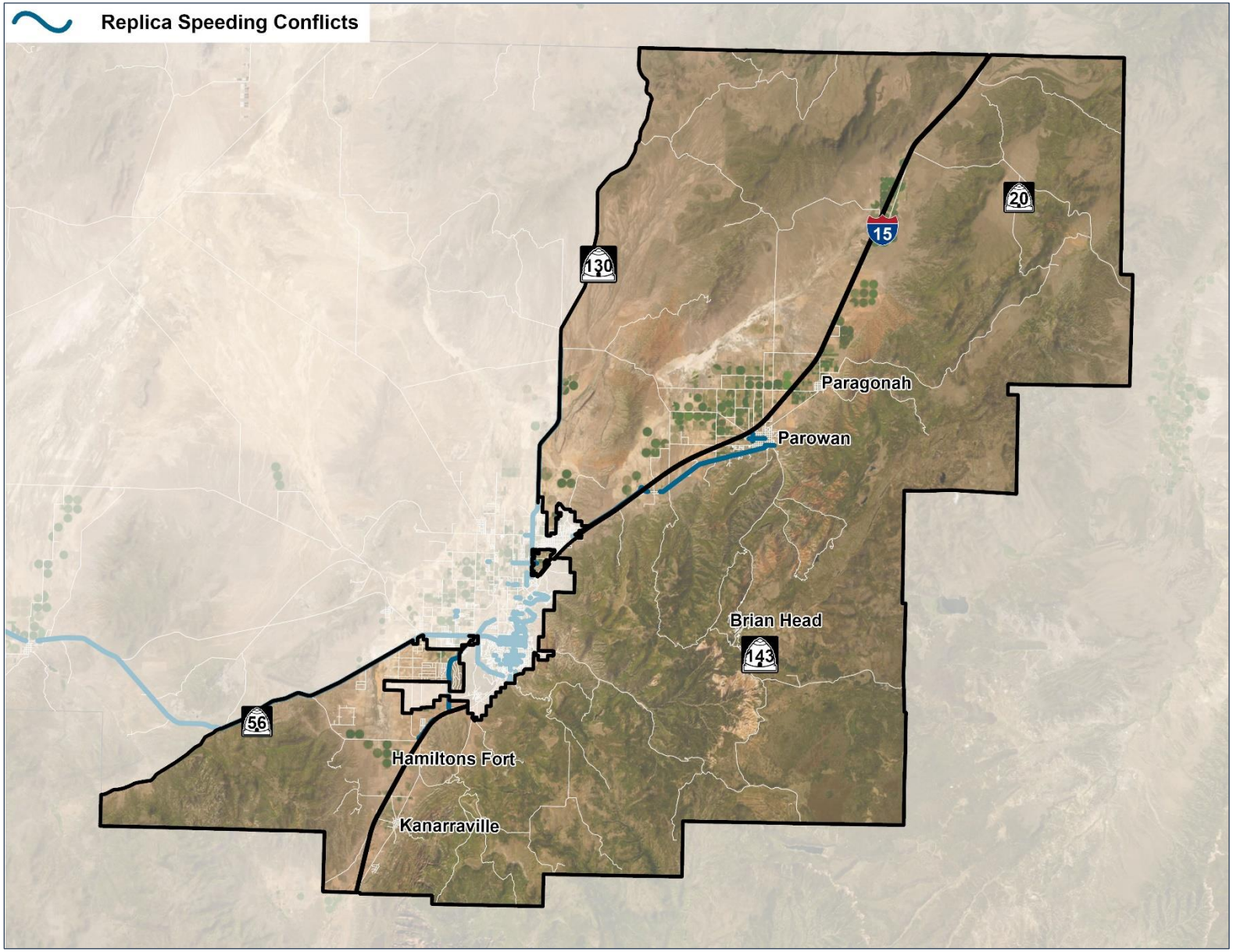

Figure 13. Replica Speeding Conflict Areas in the East Iron County GFA

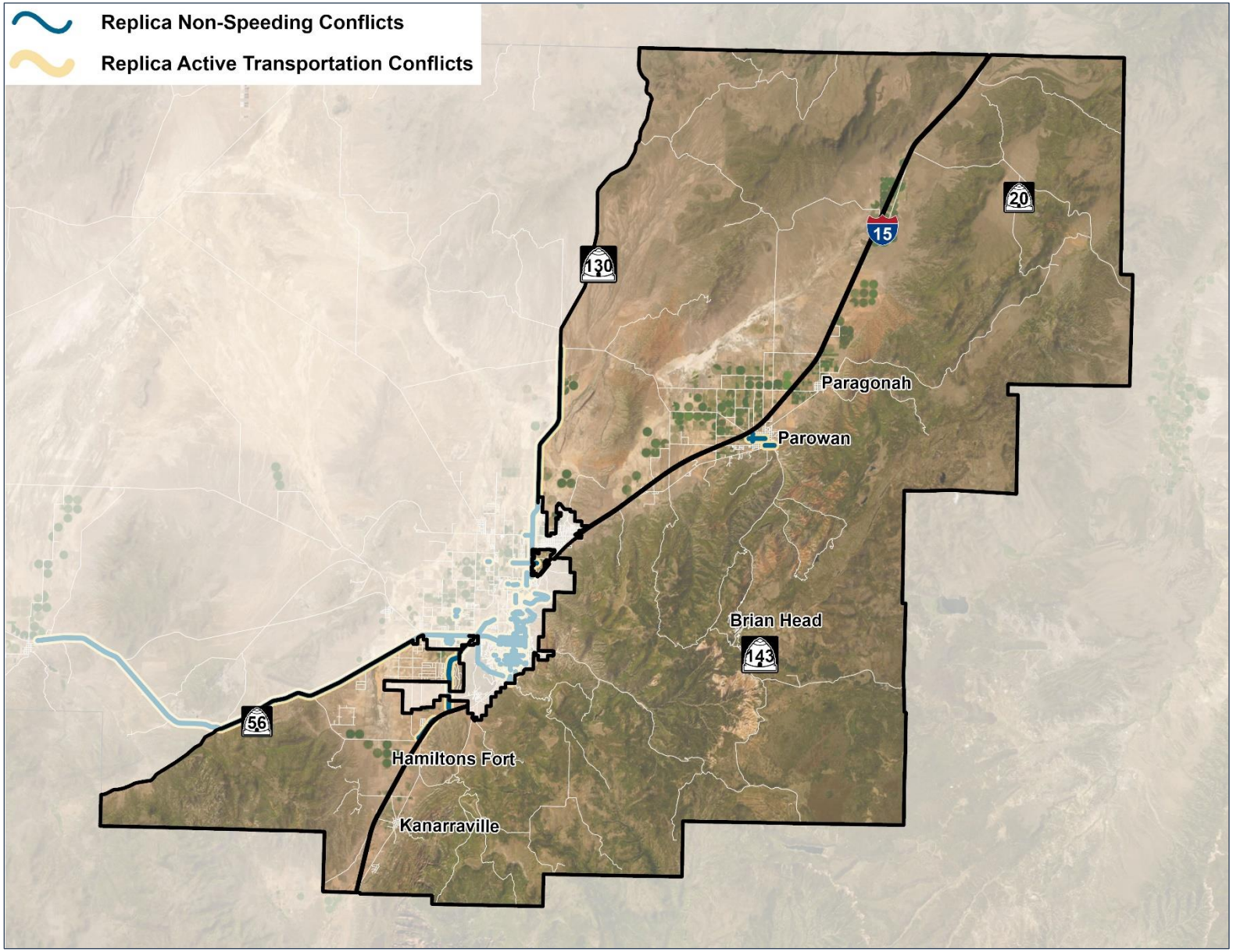

Figure 14. Replica Non-Speeding and Active Transportation Conflict Areas for the East Iron County GFA

7. ROADWAY CHARACTERISTIC RISK ANALYSIS

A roadway characteristic risk analysis was performed using the following sub-analyses:

- Crash Profile Risk Assessment
- usRAP Risk Assessment

7.1. Crash Profile Risk Assessment

This crash profile risk assessment sub-analysis identifies common roadway characteristics for roadways where fatal and serious injury crashes have occurred. Based on various roadway characteristic risks identified from crash report analysis, a risk score was assigned to major routes within the East Iron County GFA. A breakdown of the risk assessment scoring is reported in **Section 4.4** of Technical Memorandum #1. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the Crash Profile Risk Assessment are mapped in **Figure 15**.

7.2. usRAP Risk Assessment

A roadway characteristic risk assessment was performed using roadway feature data collected for Utah's state routes. The risk assessment was performed using usRAP data and tools. The output of the usRAP tool is a star rating, or risk rating, for vehicle, pedestrian, and bicyclist features. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the usRAP risk assessment by star rating are mapped in **Figure 16**.

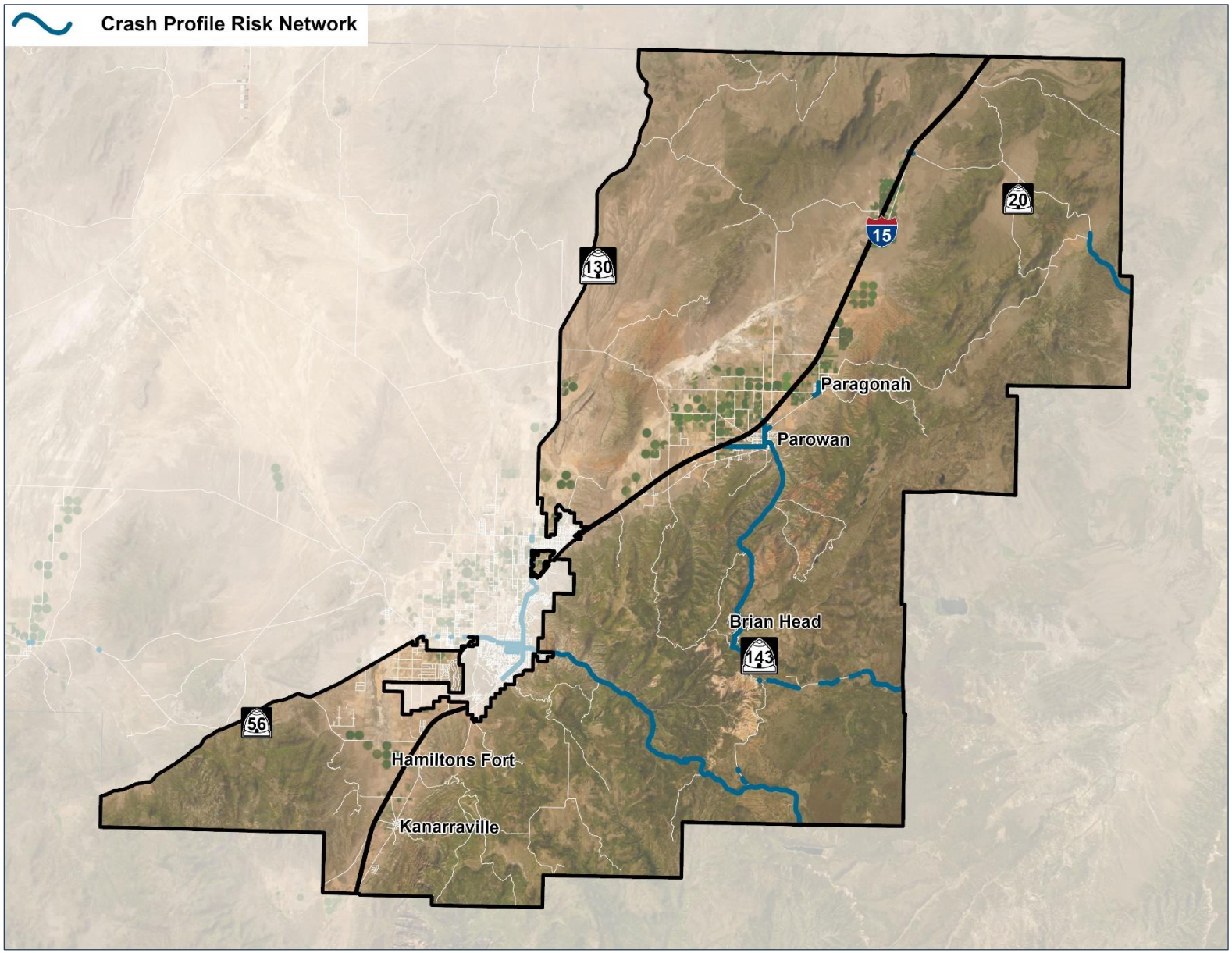

Figure 15. Crash Profile Risk Network for the East Iron County GFA

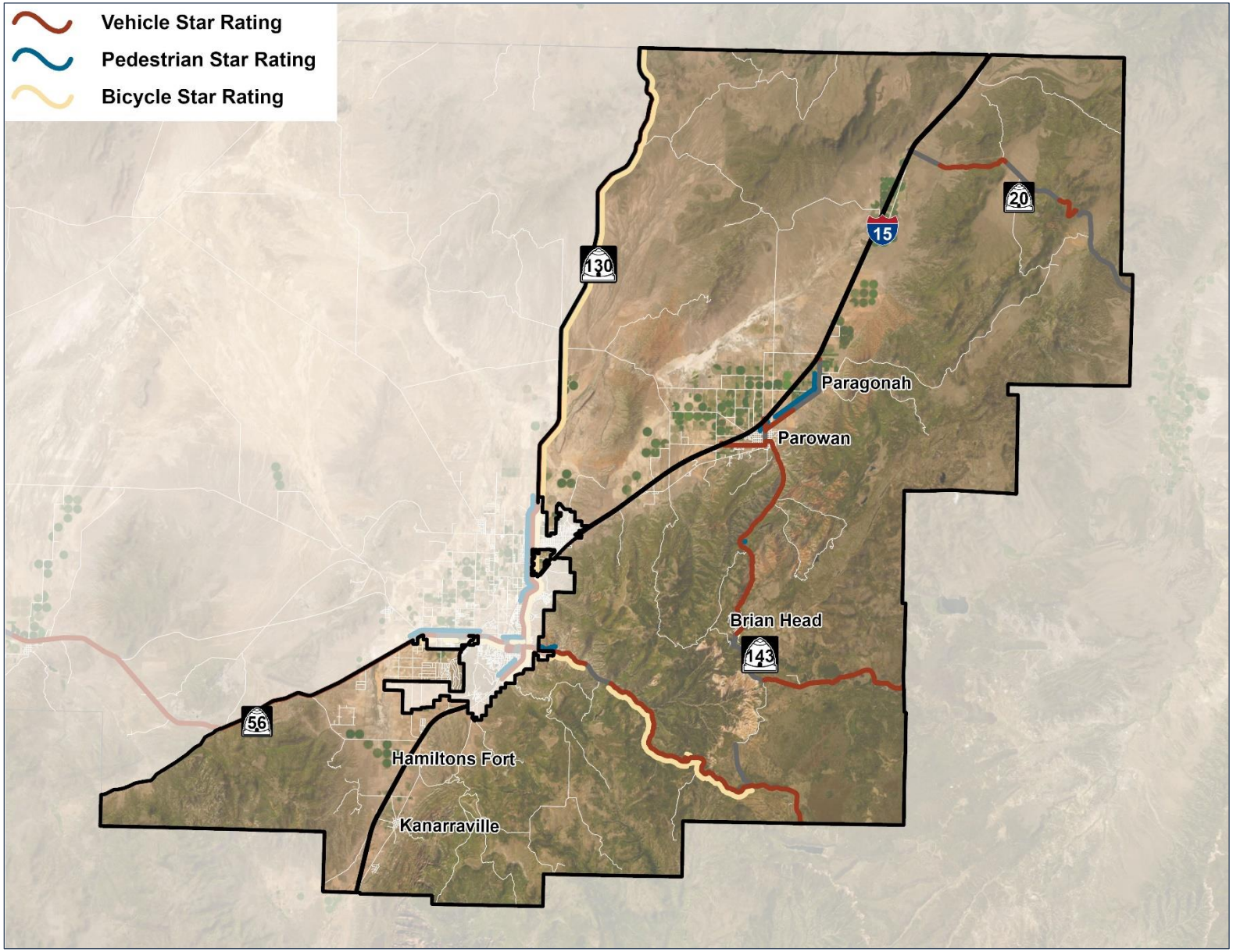

Figure 16. usRAP Risk Network – Star Ratings for the East Iron County GFA

8. HIGH-RISK NETWORK

Each of the safety analysis methodologies identified roadway segments or intersections in the East Iron County GFA that may benefit from safety improvements to reduce fatal and serious injury crashes.

To provide focused information for decisions regarding prioritization of safety improvements, an overlay of each analysis methodology was created to form a High-Risk Network.

A high-risk score, from zero to five, was determined using the approach in **Table 4.** Any location with a positive high-risk score may be considered for safety improvements. Locations with a risk score of three or greater are to be prioritized in the High-Risk Network

The East Iron County GFA High-Risk Network is shown in **Figure 17**. **Table 5** and **Table 6** provide an overview of the high priority roadway segments and intersections included in the High-Risk Network that were presented to stakeholders for comment in December 2024. Up to ten roadway segments and 20 intersections were listed if a location had a positive risk score.

Table 4. High-Risk Scoring Criteria

High Risk Category	Safety Analysis	Scoring Criteria	Risk Score
Historic Crashes	High Crash Network	Highest number of crashes per miles	1
	High Injury Network	Highest number of fatal and injury crashes per mile	1
Network Screening	Critical Crash Rates	Positive critical crash rate differential	1
Conflict Areas	Replica - Speeding Areas	Speeding conflict risk score of 80+	1/3
	Replica - Non-Speeding Areas	Non-speeding conflict risk score of 80+	1/3
	Replica - Active Transportation Areas	Active transportation conflict rick score of 80+	1/3
Risk Characteristics	Crash Profile Risk	Crash Profile Risk score of 60+	1/4
	usRAP Vehicle Star Rating	Star Rating of 1 - 2	1/4
	usRAP Pedestrian Star Rating	Star Rating of 1 - 2	1/4
	usRAP Bicycle Star Rating	Star Rating of 1 - 2	1/4
Maximum High-Risk Score			5

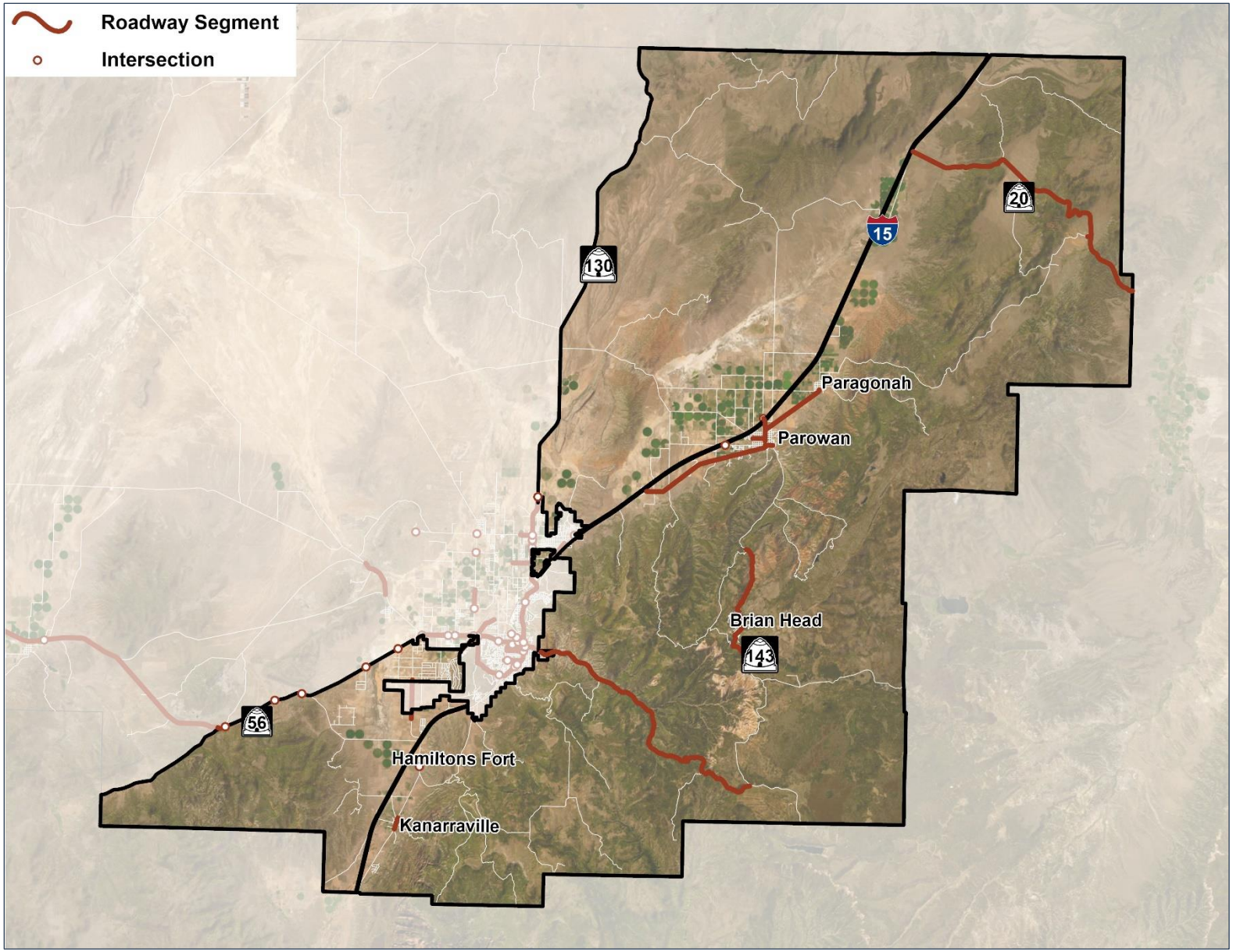

Figure 17. High-Risk Network for the East Iron County GFA

Table 5. Priority High-Risk Roadways for the East Iron County GFA

Roadways				Safety Analysis									
Roadway	Extents	Length (miles)	Functional Classification	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
State Routes													
SR 14	Kolob Road to SR 148	13.0	Minor Arterial	X	X	X				X	X	X	
SR 20	I-15 to Iron County Limits	17.0	Other Principal Arterial	X	X	X				X	X		
SR 143	Dry Lakes Road to Forest Road	7.8	Minor Arterial	X		X				X	X		
SR 271	SR 274 to 200 South	3.8	Major Collector	X						X	X	X	
SR 274	Center Street to I-15	1.25	Minor Arterial	X						X	X	X	
Non- State Routes													
Old Highway 91	200 East to 300 South	1.8	Minor Collector	X			X						
200 South	Main Stret (SR 143) to Center Street (SR 143)	0.5	Local Street				X	X	X				
100 North	600 West to Main Street (SR 274)	0.7	Local Street				X	X	X				
Main Street (Summit)	I-15 to 200 East	0.7	Minor Collector	X			X						
Main Street (Kanarraville)	400 South to 300 North	0.6	Major Collector	X									

Table 6. Priority High-Risk Intersections for the East Iron County GFA

Intersections		Safety Analysis			Supporting Networks						
Intersection	Number of Crashes	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
Unsignalized Intersections											
Old Highway 91 & 5100 South	3	X		X							
I-15 Northbound Ramp & 2nd South	6			X				X	X		
I-15 Southbound Ramp & Main Street	3			X					X		
Comstock Road & SR 56	2				X	X	X		X		
11600 West & SR 56	4	X		X	X	X	X		X		
Bumblebee Drive & SR 56	3			X	X	X	X		X		
7700 West & SR 56	3		X	X	X	X	X		X		
6300 West & SR 56	3		X	X	X	X	X		X		
Old Highway 91 & 5100 South	3	X		X							
I-15 Northbound Ramp & 2nd South	6			X				X	X		

APPENDIX A.4. WEST IRON COUNTY GFA SAFETY ANALYSIS AND RESULTS

TECHNICAL MEMORANDUM #1

APPENDIX A4

WEST IRON COUNTY GEOGRAPHIC FOCUS AREA SAFETY ANALYSIS

Statutory Notice

23 U.S.C. § 409: US Code - Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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LIST OF TABLES

1. INTRODUCTION

Appendix A4 summarizes the safety analysis performed for the West Iron County Geographic Focus Area (GFA) as part of the Safety Action Plan for all Iron County (SAP).

The safety analysis identified roadway segments and intersection with the highest safety risk and need. The resulting High-Risk Network represents locations with the largest potential for safety improvement. The network helps informs the identification of potential project locations that may be further considered in the SAP.

1.1. Safety Analysis

The safety analysis methodologies are presented in **Section 4** of Technical Memorandum #1 and include the components shown in **Figure 1**. Results of each component are shown in **Table 1**.

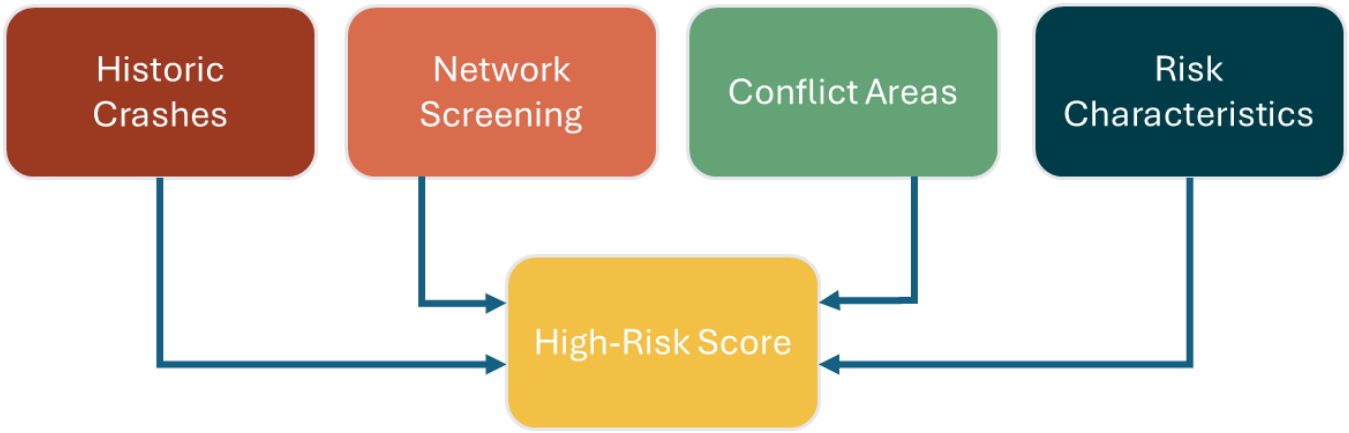

Figure 1. Safety Analysis Components

Table 1. Safety Analysis Components and Results

Safety Analysis Component	Analysis Result(s)
Historical Crash Overview	Frequent crash types and common contributing factors.
Strategic Highway Safety Plan (SHSP) Emphasis Area Analysis	Ranked emphasis areas based on GFA, Iron County, or Statewide crashes.
Historical Crash Analysis	High-crash network.
	High-risk network.
Network Screening Analysis	Critical crash rate network.
Conflict Areas	Speeding, phone handling, sudden braking, and suspected collision networks.
Risk Characteristics	Crash Profile Risk Assessment
	usRAP Risk Factors Analysis

1.2. Appendix Organization

Appendix A4 is organized into the following sections:

- **Section 1** – Introduction
- **Section 2** – West Iron County GFA Study Area and Roadway Network
- **Section 3** – Historic Crash Overview
- **Section 4** – Historic Crash Analysis
- **Section 5** – Network Screening Analysis
- **Section 6** – Conflict Areas
- **Section 7** – Roadway Characteristic Risk Analysis
- **Section 8** – High-Risk Network

2. STUDY AREA

The SAP study area includes each jurisdiction within Iron County. To organize the Iron County jurisdictions and unincorporated areas into manageable analysis areas, Iron County was divided into five GFAs. The West Iron County GFA, shown in **Figure 2,** includes the incorporated boundary of Enoch City.

The safety analyses presented in this appendix are specific to the West Iron County GFA.

Figure 2 highlights the roadway network within the West Iron County GFA study area. Roadways within the study area are divided into the following categories:

- State Routes: Roadways maintained by the Utah Department of Transportation (UDOT)
- Non-State Routes: Jurisdiction-maintained roads

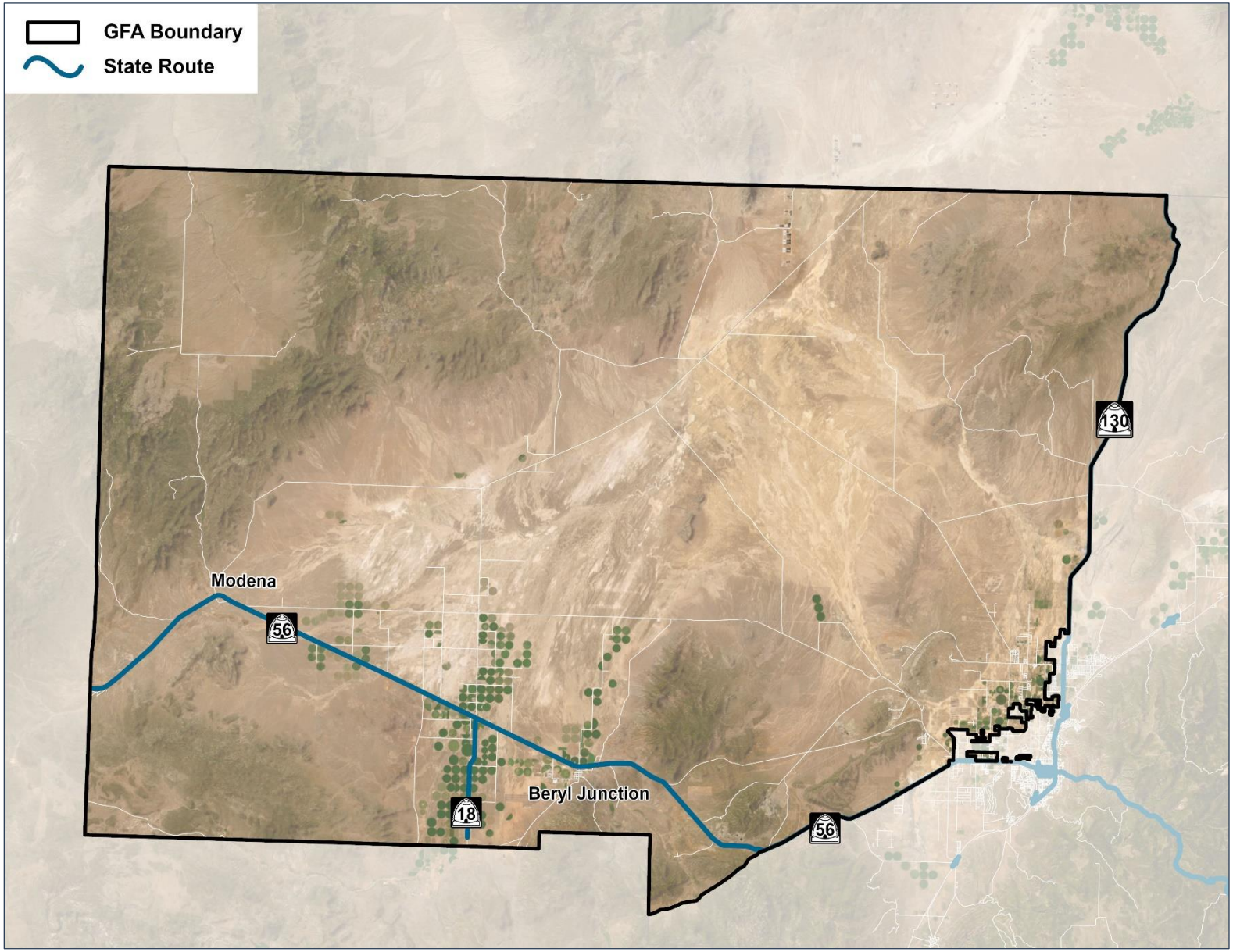

Figure 2. West Iron County GFA Study Area

3. HISTORIC CRASH OVERVIEW

Crash data was obtained from the UDOT database for the most recent completed five-year period, 2019 to 2023. A historic crash review specific to the West Iron County GFA is summarized below.

3.1. Overall Crashes

Figure 3 provides an overview of annual crashes for the West Iron County GFA separated by crash severity. Crash severity is reported as fatal, serious injury, or all other crashes (minor injury, possible injury, or property damage only). A review of the crash data reveals the following:

- The total number of crashes was highest in 2021 and 2023. There has since been a gradual increase in the number of crashes and the number of crashes in 2023 is greater than in 2019, 5 years ago.
- Fatal and serious injury crashes were highest in 2021 and 2022, with the lowest number of fatal and serious injury crashes occurring in 2023.

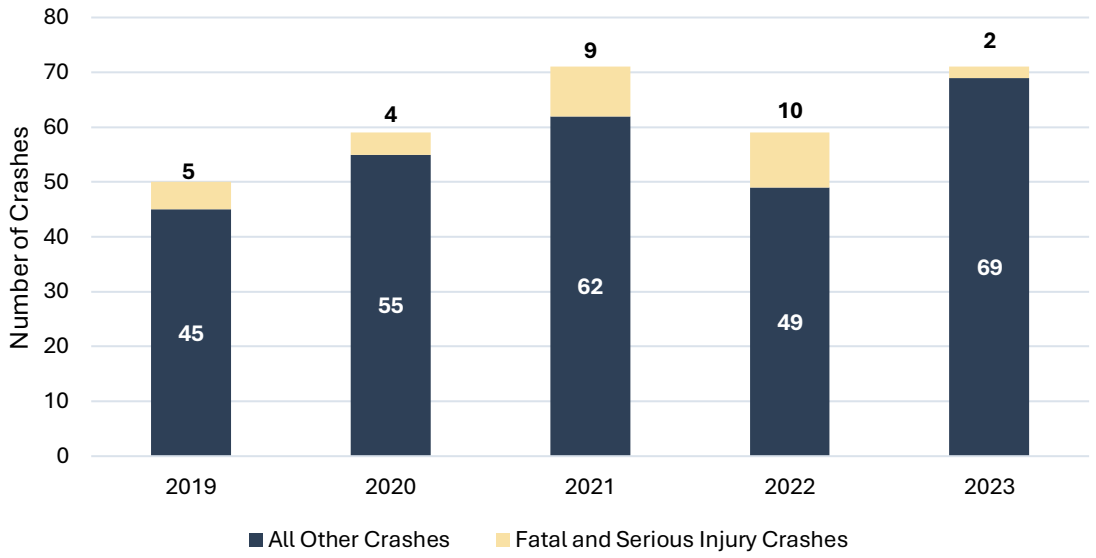

Figure 3. West Iron County GFA Crashes by Year

Table 2 provides an overview of crashes by severity and route type within the West Iron County GFA. A review of the data reveals the following:

- 34% of crashes occurred on State Routes.
- Fatal and serious injury crashes make up approximately 10% of all crashes in the West Iron County GFA.
- 63% of crashes in the GFA resulted in no injury or property damage only (PDO).
- 8% of all the fatal crashes in Iron County occurred within the West Iron County GFA.

Table 2. Crash Severity by Route Type for the West Iron County GFA

Route Type	State Route		Non-State Route		GFA Total		% of Iron County
Crash Severity	Crashes		Crashes		Crashes		%
	#	%	#	%	#	%	
Fatal	1	1%	2	1%	3	1%	8%
Suspected Serious Injury	3	3%	24	12%	27	9%	14%
Suspected Minor Injury	12	12%	24	12%	36	12%	6%
Possible Injury	16	15%	34	17%	50	16%	7%
No Injury / Property Damage Only	72	69%	122	59%	194	63%	5%
Route Total	**104**	**100%**	**206**	**100%**	**310**	**100%**	**6%**

3.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in **Figure 4**. A review of the crash data reveals the following:

- No fatal crashes occurred in 2019, 2020, and 2023.
- The number of fatal and serious injuries have decreased between 2019 and 2023.

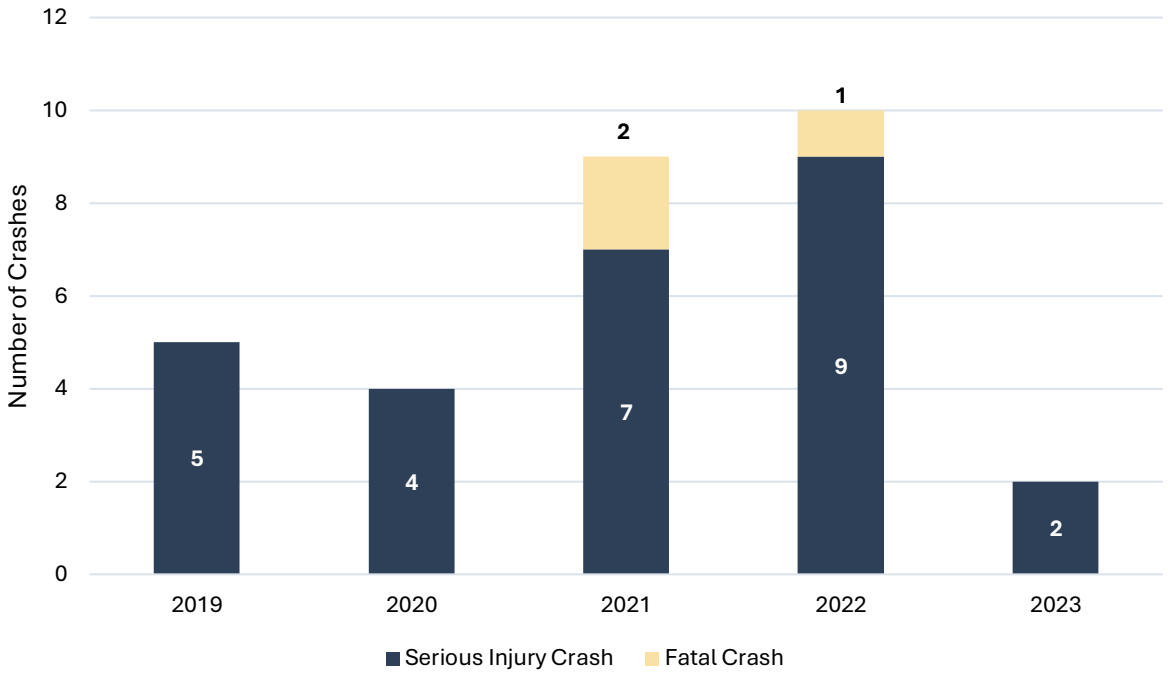

Figure 4. West Iron County GFA Fatal and Serious Injury Crashes by Year

The locations of the fatal and serious injury crashes are displayed in **Figure 5** which shows the fatal crashes occurring on SR 56, SR 18, and a rural road off of SR 18. There is also a prevalence of severe crashes north of Cedar City.

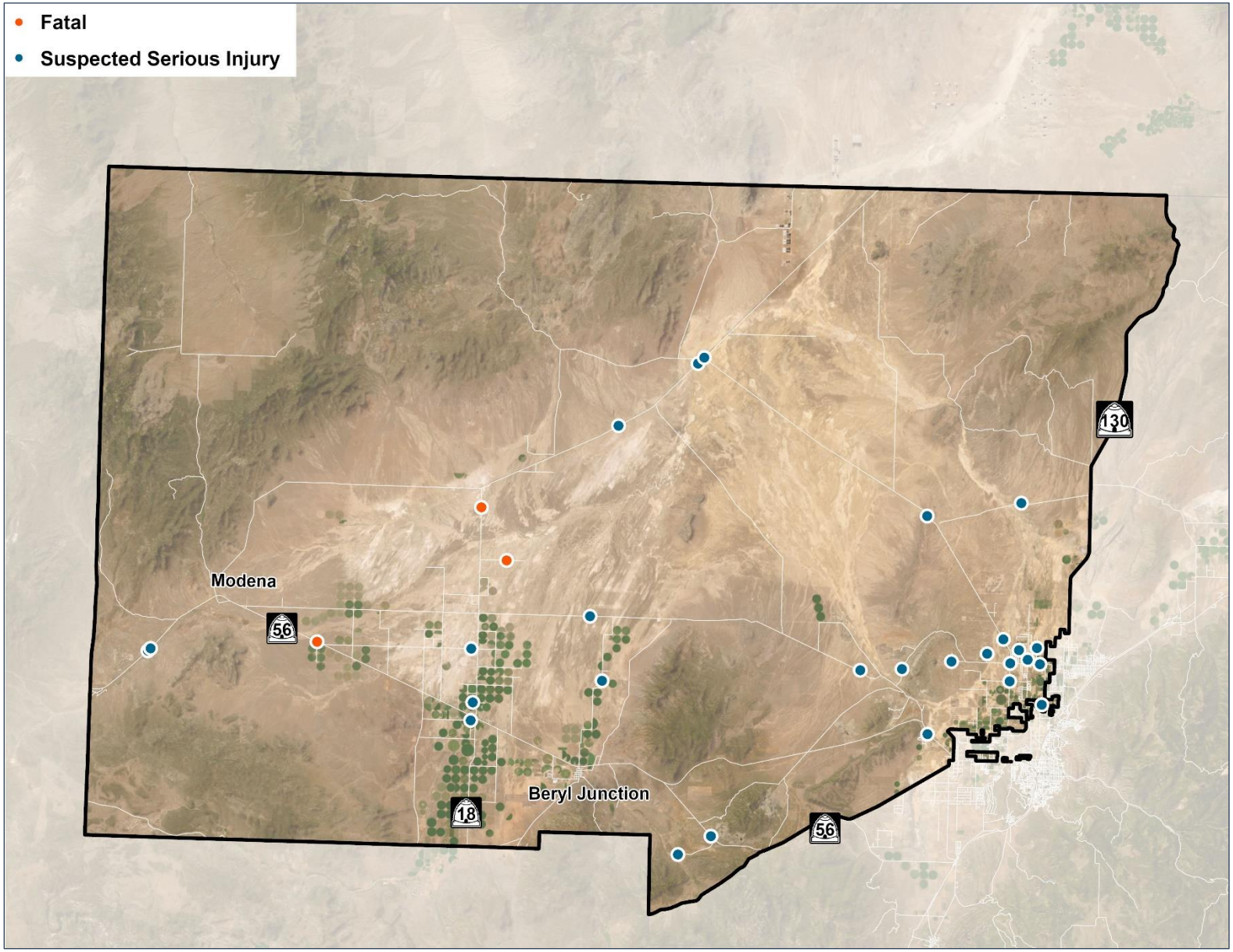

Figure 5. Fatal and Serious Injury Crashes in the West Iron County GFA

3.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collisions is shown in **Figure 6**. The manner of collision represents how two vehicles initially collided. The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization compared to crash type that is summarized in Section 3.3.2. The three most frequent manners of collision that resulted in a fatality or serious injury crash are single vehicle crashes, angle crashes, and parked vehicle crashes.

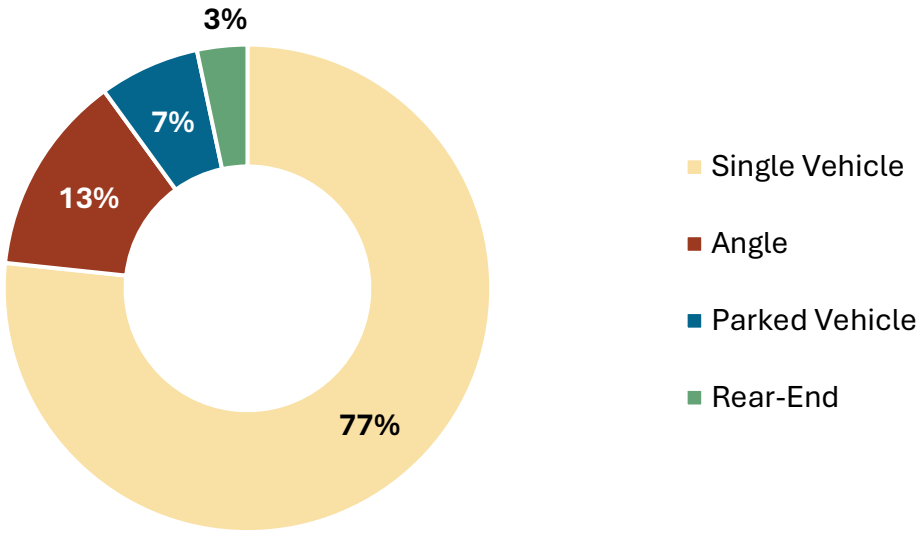

Figure 6. Most Common Fatal and Serious Injury Manners of Collision for the West Iron County GFA

3.2.2. Crash Types

Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type, examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The most common crash types for the West Iron County GFA are summarized in **Figure 7**. The three most frequent fatal and serious injury crash types are recorded as “Other,” roadway departures, and highway crossover crashes. The crash type “other” may indicate a unique crash scenario or a gap in available data.

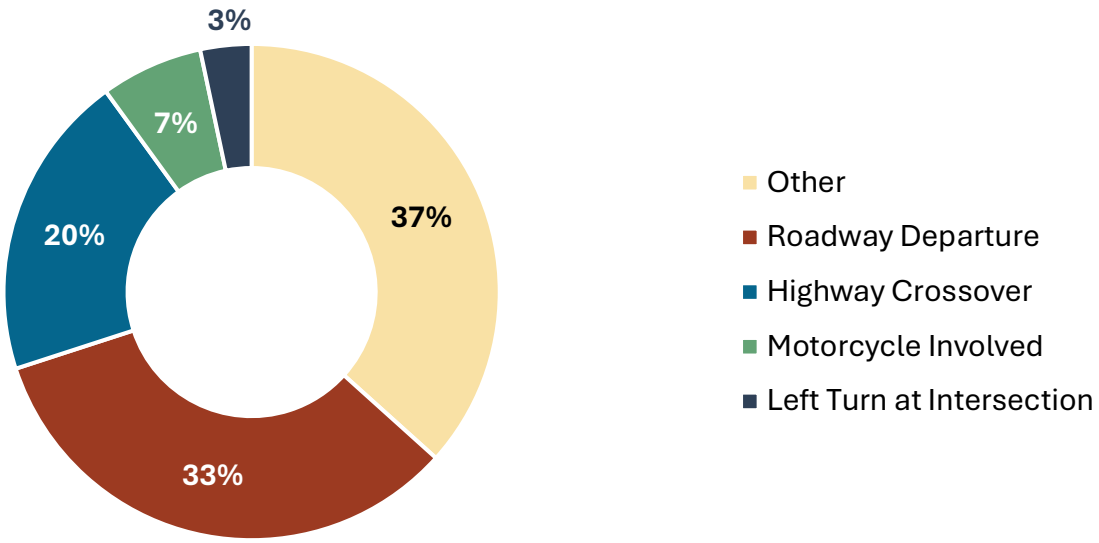

Figure 7. Most Common Fatal and Serious Injury Crash Types for the West Iron County GFA

3.2.3. Driver Contributing Factors

Several factors may contribute to a single crash however, the driver contributing factors shown in **Figure 8** only represent the first driver specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. The data shows that the three most frequent driver contributing factors are over-correcting or over-steering, failing to keep to the proper lane, and speeding.

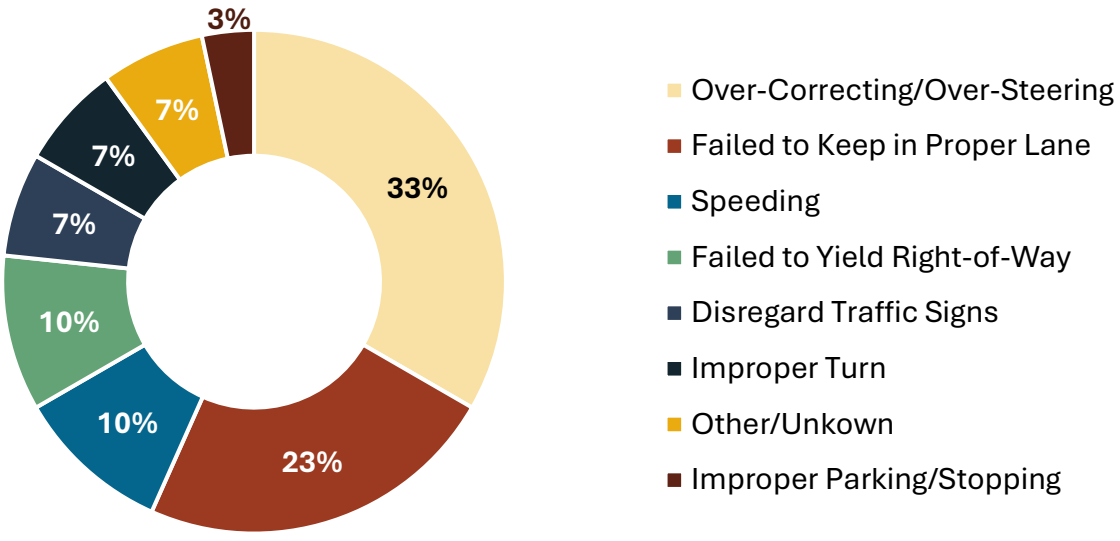

Figure 8. Most Common Fatal and Serious Injury Crash Driver Contributing Factors in the West Iron County GFA

3.2.4. Vulnerable User Crashes

No vulnerable user crashes involving a pedestrian or bicyclist occurred in the West Iron County GFA in the five-year analysis period.

3.3. Utah SHSP Emphasis Safety Area Analysis

The SHSP emphasis area analysis ranks the frequency of fatalities and serious injuries in the West Iron County GFA for each of the eleven Utah SHSP emphasis safety areas. A fatality or serious injury may be assigned to multiple emphasis areas.

The rankings of the emphasis areas compare the West Iron County GFA, the state of Utah, and all of Iron County.

This analysis helps to determine priority emphasis areas for the West Iron County GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different than the statewide or County rankings.

Table 3 summarizes the Utah SHSP Emphasis Area comparison analysis. The following emphasis areas have the highest frequency of fatalities and serious injuries in the West Iron County GFA. The SAP will identify strategies to address these priority emphasis areas:

- Roadway Departures
- Speed-related
- Teen Drivers
- No Safety restraints
- Intersections

Table 3. Utah SHSP Emphasis Area Comparison for the West Iron County GFA

Category	Utah SHSP Safety Emphasis Area	Statewide		Iron County		West Iron County GFA		
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Change in Rank from County
Driver	Teen Driver	1,695	4	54	5	16	3	2
	Older Driver	1,565	7	49	6	2	9	-3
	Speed-Related	2,268	3	78	3	19	2	1
	Aggressive Driving	615	11	19	10	2	10	0
	Distracted Driving	732	10	28	8	3	8	0
	Impaired Driving	1,100	8	27	9	7	6	3
	No Safety Restraints	1,627	5	85	2	15	4	-2
Roadway	Intersection	3,683	1	67	4	12	5	-1
	Roadway Departure	3,372	2	132	1	23	1	0
Special Users	Motorcycle	1,571	6	40	7	5	7	0
	Pedestrian	1,000	9	15	11	0	11	0
	Bicycle*	303	12	3	12	0	12	0

**While Bicycles are not one of the eleven Utah SHSP emphasis areas, they are included as part of the CSAP safety analysis.*

4. HISTORIC CRASH ANALYSIS

A component of the SAP is to identify locations with an elevated risk of crashes. The initial step of this analysis is to spatially reference crashes that occurred within the study area.

The following networks were created in the historic crash analysis using the historic crash locations:

- **High-Crash Network**: Represents roadways and intersections on which the most crashes occur and experience high crash rates.
- **High-Injury Network**: Represents roadways and intersection on which fatal and injury crashes typically occur.

4.1. High-Crash Network

The roadway network shown in **Figure 9** is identified as the High-Crash network. The High-Crash network includes locations on which 50% of all crashes in the GFA occurred and locations experiencing high crash rates.

4.2. High-Injury Network

Figure 10 shows the identified High-Injury network. The High-Injury network represents the roadways on which 50% of fatal and injury crashes have occurred.

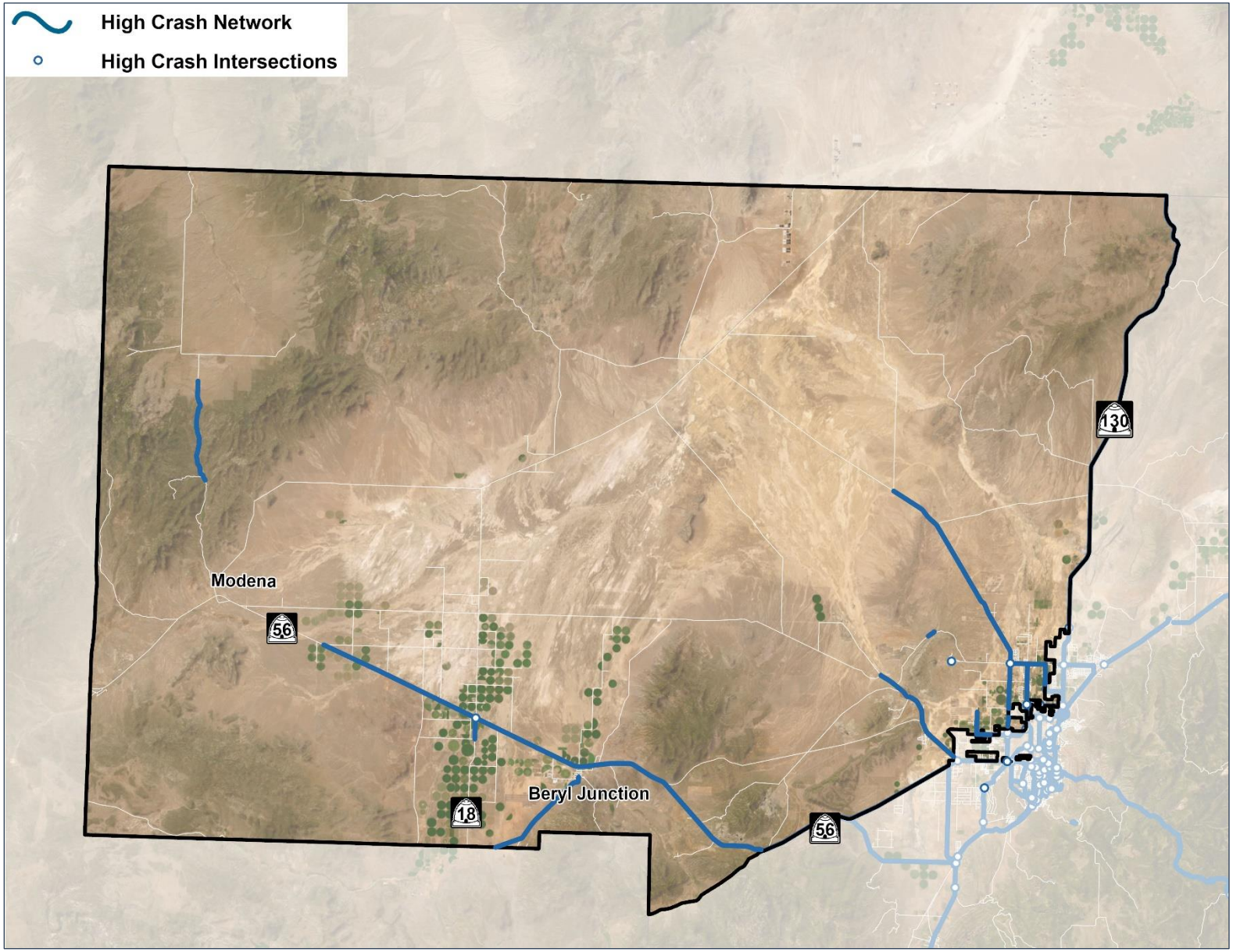

Figure 9. High-Crash Network for the West Iron County GFA

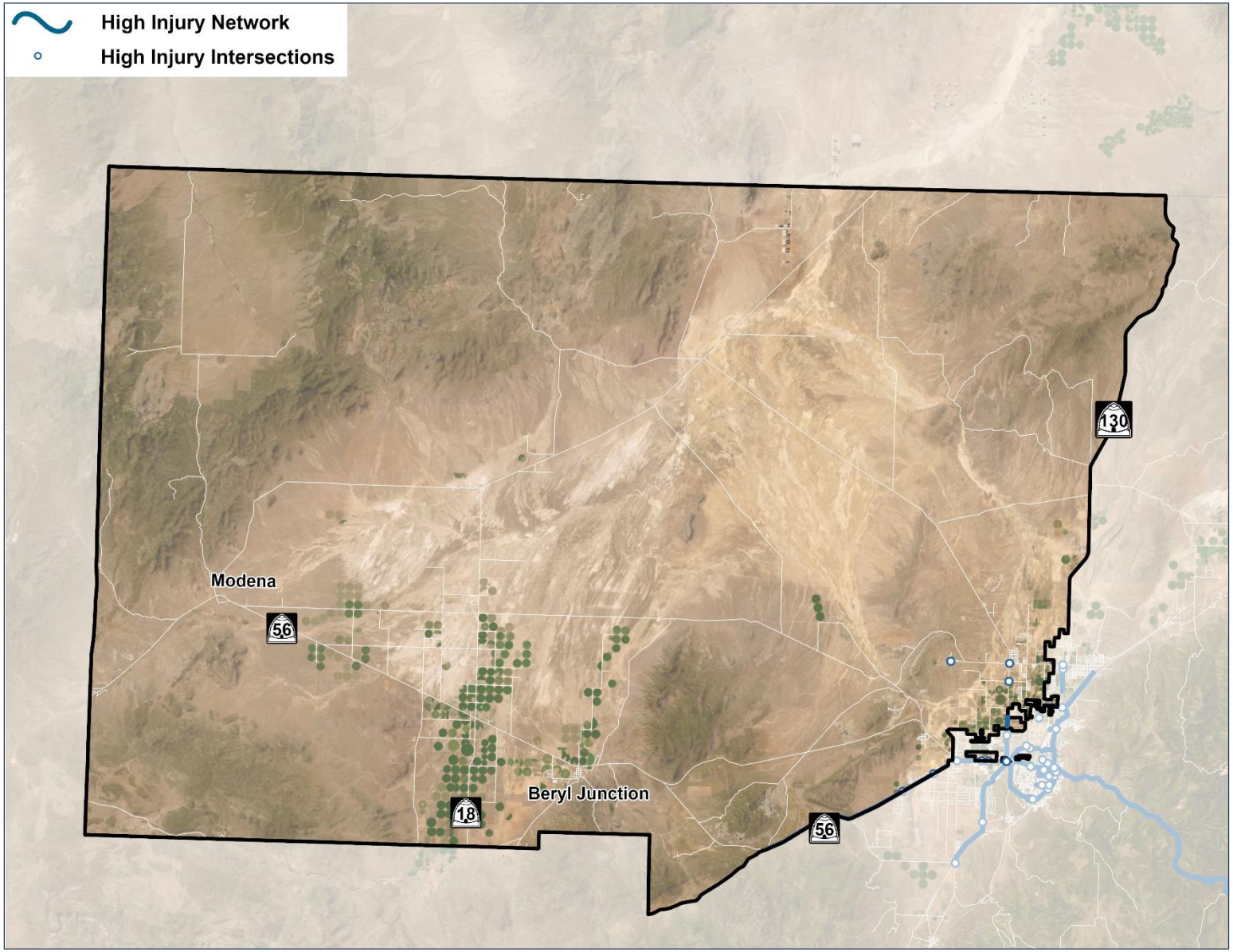

Figure 10. High-Injury Network for the West Iron County GFA

5. NETWORK SCREENING ANALYSIS

A network screening analysis was prepared for the West Iron County GFA informed by a Critical Crash Rate (CCR) analysis. Network screening methodology is detailed in Technical Memorandum #1. A positive CCR differential is an indication of a location with a potential for safety improvement (PSI). All roadways and intersection with a positive CCR differential are shown in **Figure 11.**

These locations represent those with the highest potential for safety improvements and should be considered as project candidate locations.

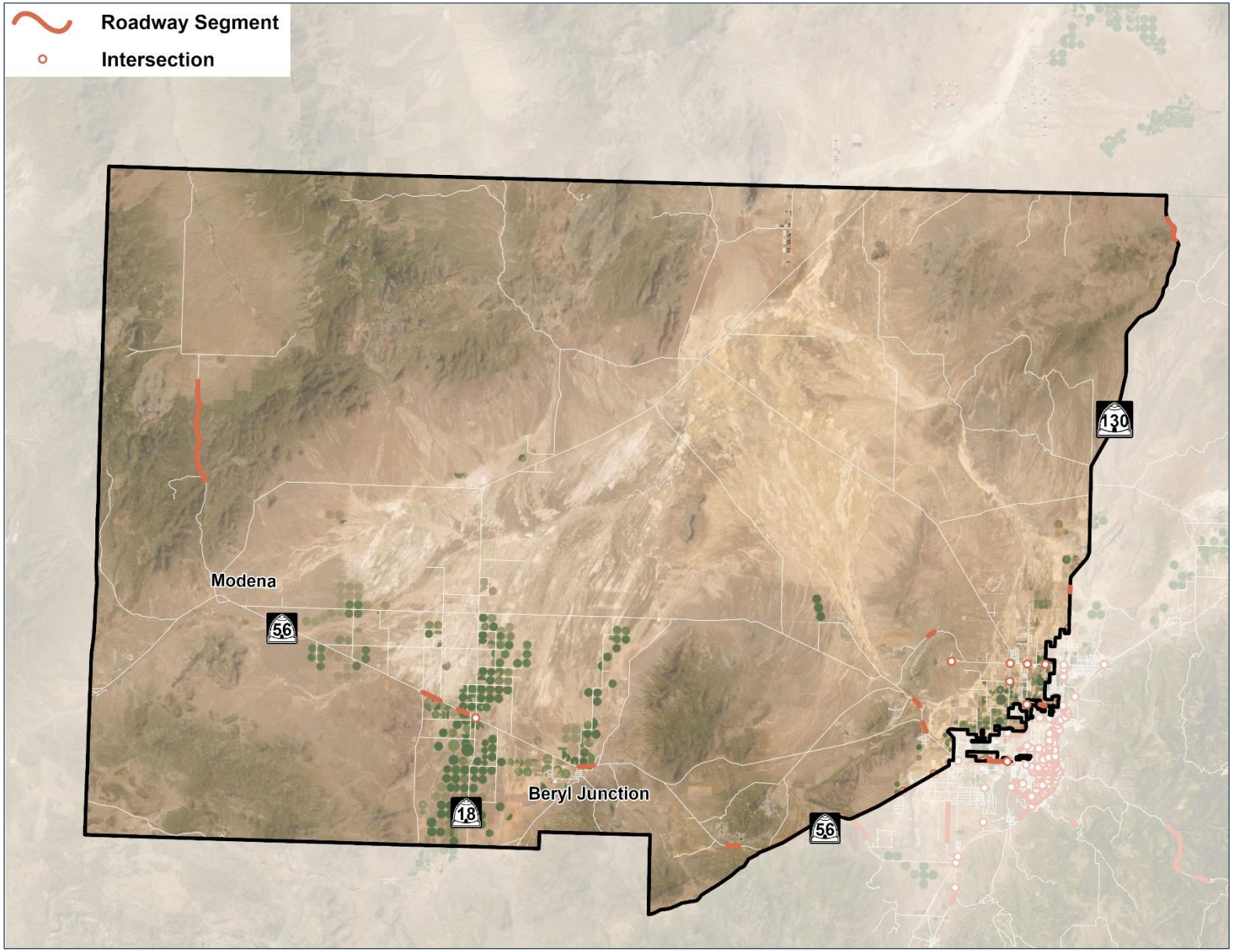

Figure 11. Critical Crash Rate (CCR) Network for the West Iron County GFA

6. CONFLICT AREAS

The conflict area analysis used Replica data obtained for the Iron County area to proactively address areas of greater safety risks. The following data and metrics were isolated in Replica to identify higher risk roadways in the GFA and Iron County:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking
- Active Transportation (pedestrians and bicyclist) high-risk corridors

A maximum risk score within Replica is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are included in the Replica Conflict Networks shown in **Figure 12** and **Figure 13** for the West Iron County GFA.

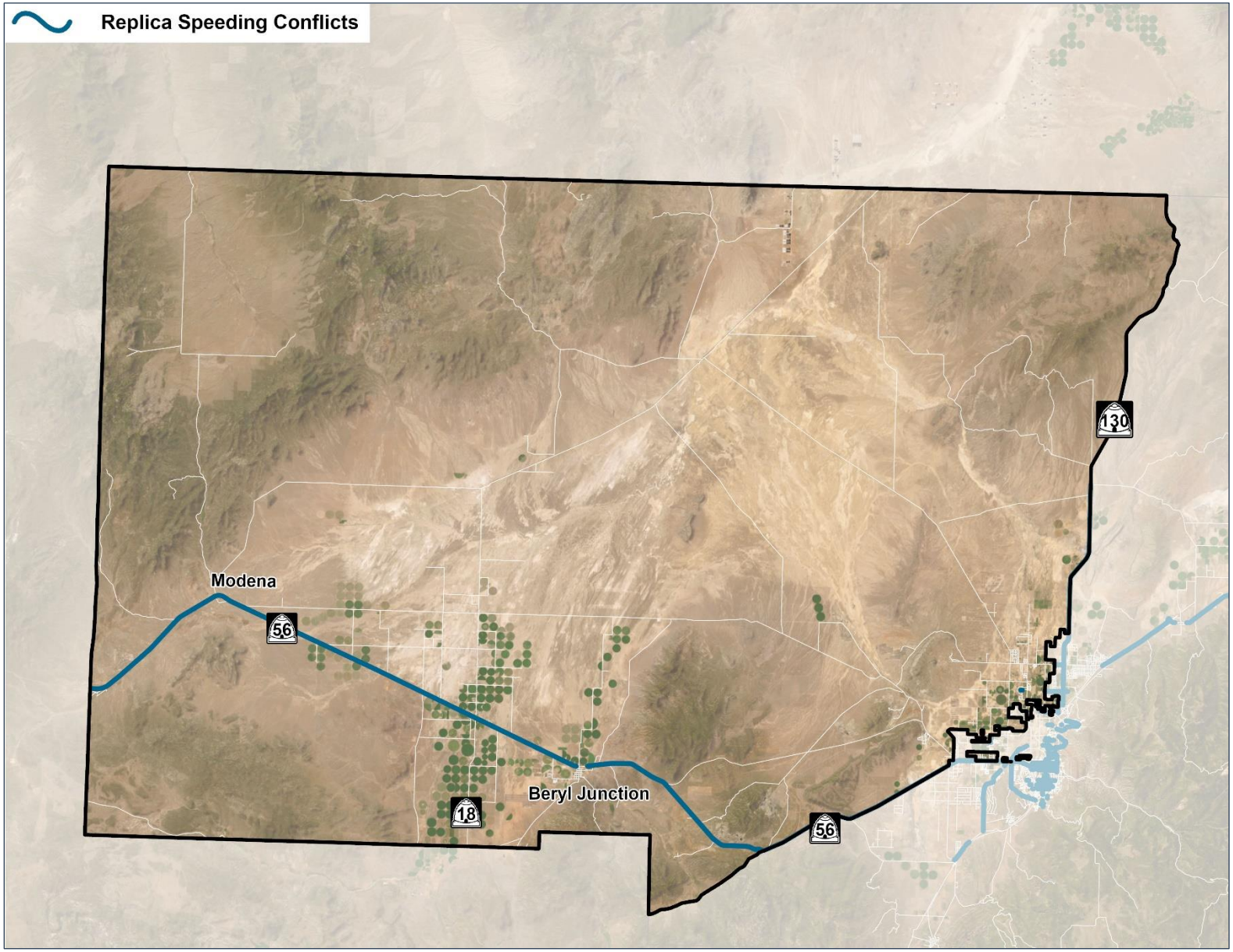

Figure 12. Replica Speeding Conflict Areas in the West Iron County GFA

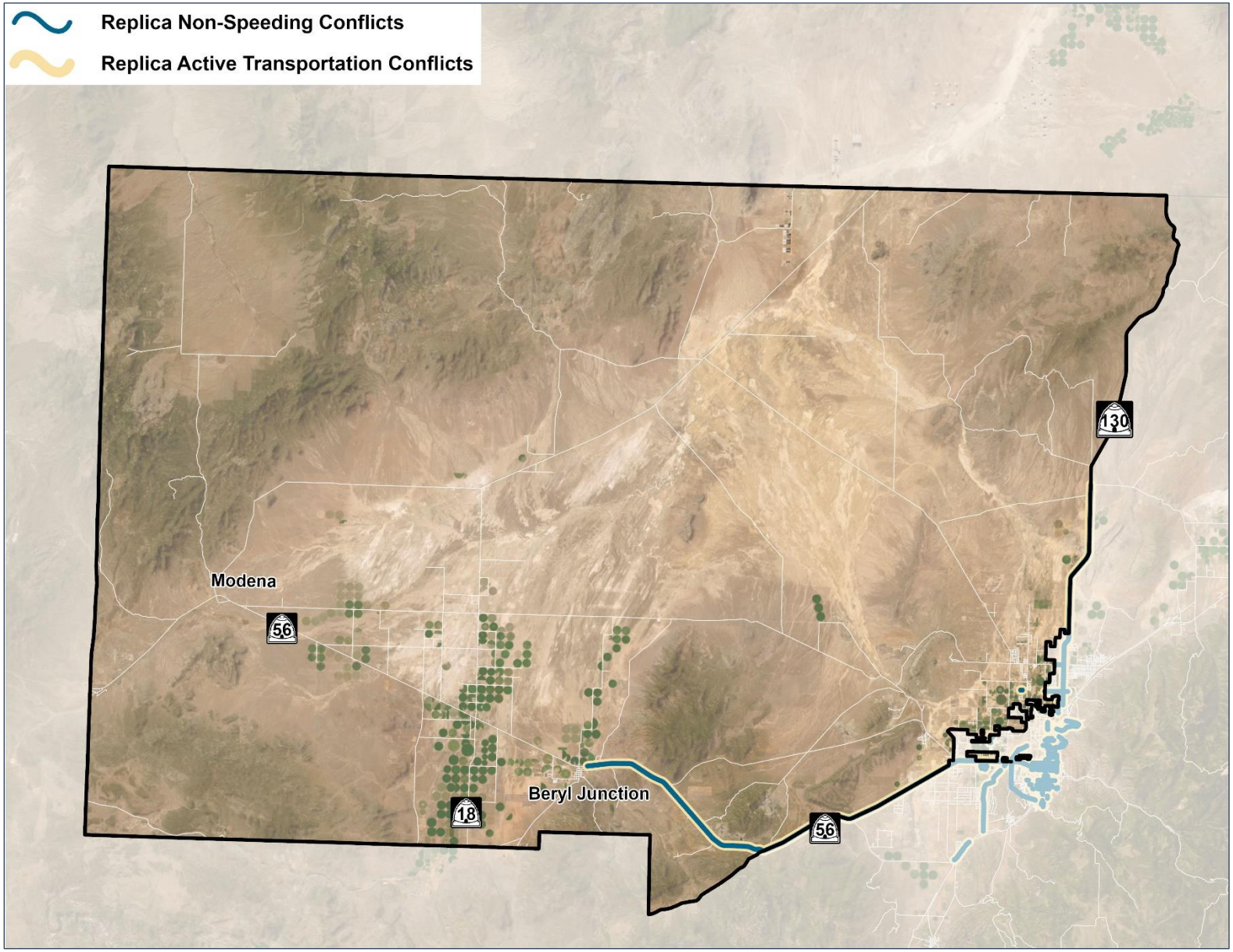

Figure 13. Replica Non-Speeding and Active Transportation Conflict Areas for the West Iron County GFA

7. ROADWAY CHARACTERISTIC RISK ANALYSIS

A roadway characteristic risk analysis was performed using the following sub-analyses:

- Crash Profile Risk Assessment
- usRAP Risk Assessment

7.1. Crash Profile Risk Assessment

This crash profile risk assessment sub-analysis identifies common roadway characteristics for roadways where fatal and serious injury crashes have occurred. Based on various roadway characteristic risks identified from crash report analysis, a risk score was assigned to major routes within the West Iron County GFA. A breakdown of the risk assessment scoring is reported in **Section 4.4** of Technical Memorandum #1. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the Crash Profile Risk Assessment are mapped in **Figure 14**.

7.2. usRAP Risk Assessment

A roadway characteristic risk assessment was performed using roadway feature data collected for Utah's state routes. The risk assessment was performed using usRAP data and tools. The output of the usRAP tool is a star rating, or risk rating, for vehicle, pedestrian, and bicyclist features. This assessment is limited to state and federal routes since the roadway characteristic data is only available for those route types. The results of the usRAP risk assessment by star rating are mapped in **Figure 15**.

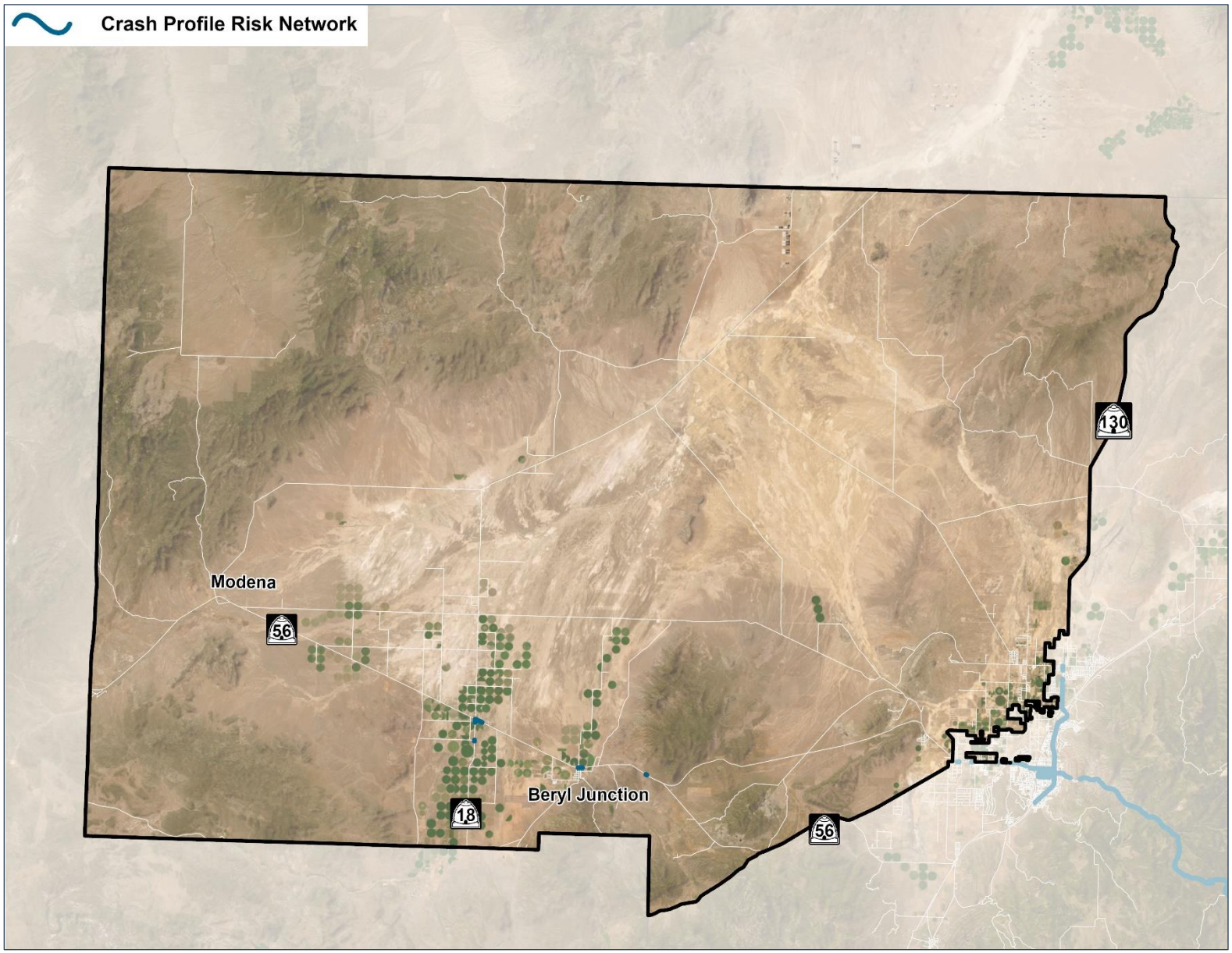

Figure 14. Crash Profile Risk Network for the West Iron County GFA

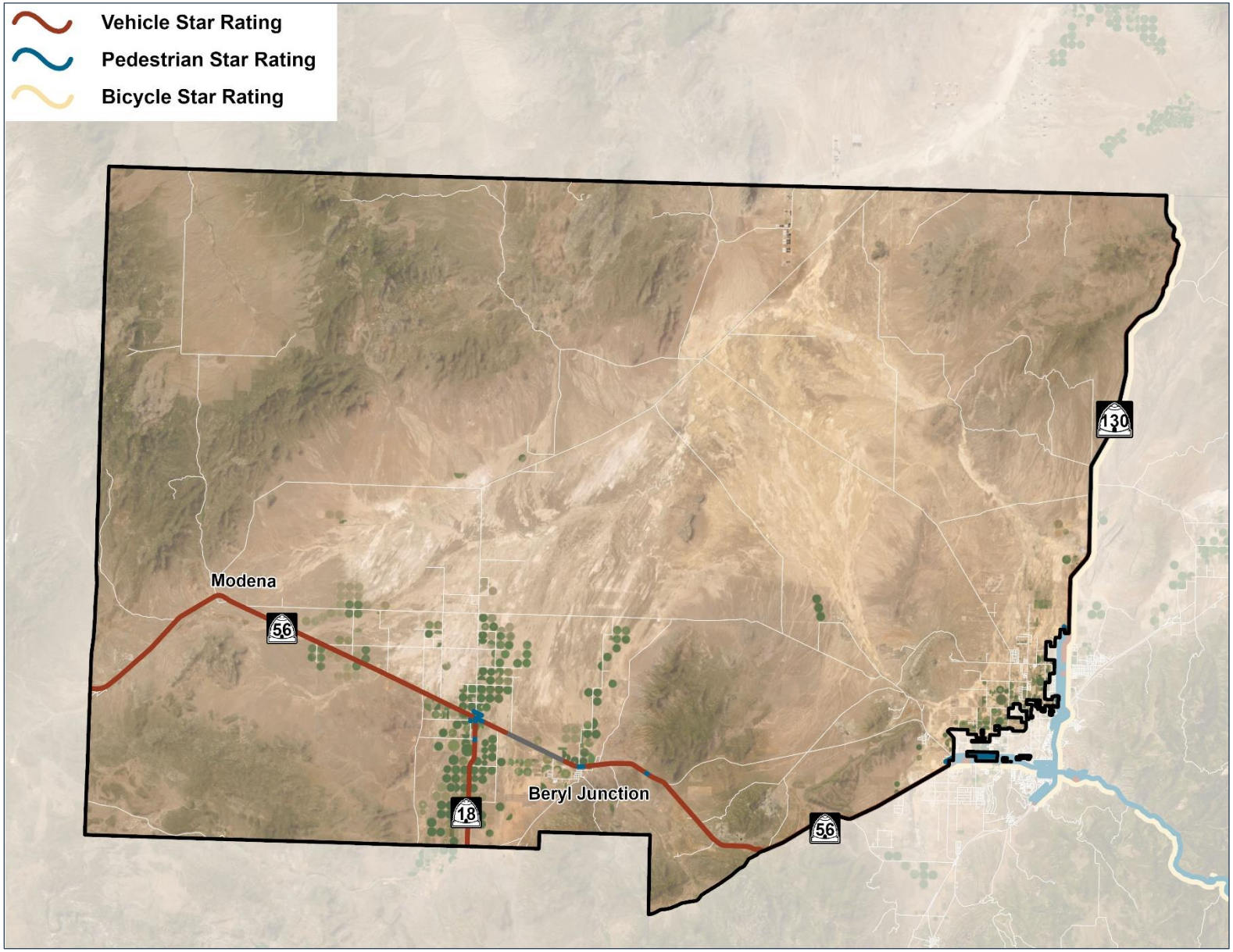

Figure 15. usRAP Risk Network – Star Ratings for the West Iron County GFA

8. HIGH-RISK NETWORK

Each of the safety analysis methodologies identified roadway segments or intersections in the West Iron County GFA that may benefit from safety improvements to reduce fatal and serious injury crashes.

To provide focused information for decisions regarding prioritization of safety improvements, an overlay of each analysis methodology was created to form a High-Risk Network.

A high-risk score, from zero to five, was determined using the approach in **Table 4.** Any location with a positive high-risk score may be considered for safety improvements. Locations with a risk score of three or greater are to be prioritized in the High-Risk Network

The West Iron County GFA High-Risk Network is shown in **Figure 16**. **Table 5** and **Table 6** provide an overview of the high priority roadway segments and intersections included in the High-Risk Network that were presented to stakeholders for comment in December 2024. Up to ten roadway segments and 20 intersections were listed if a location had a positive risk score.

Table 4. High-Risk Scoring Criteria

High Risk Category	Safety Analysis	Scoring Criteria	Risk Score
Historic Crashes	High Crash Network	Highest number of crashes per miles	1
	High Injury Network	Highest number of fatal and injury crashes per mile	1
Network Screening	Critical Crash Rates	Positive critical crash rate differential	1
Conflict Areas	Replica - Speeding Areas	Speeding conflict risk score of 80+	1/3
	Replica - Non-Speeding Areas	Non-speeding conflict risk score of 80+	1/3
	Replica - Active Transportation Areas	Active transportation conflict rick score of 80+	1/3
Risk Characteristics	Crash Profile Risk	Crash Profile Risk score of 60+	1/4
	usRAP Vehicle Star Rating	Star Rating of 1 - 2	1/4
	usRAP Pedestrian Star Rating	Star Rating of 1 - 2	1/4
	usRAP Bicycle Star Rating	Star Rating of 1 - 2	1/4
Maximum High-Risk Score			5

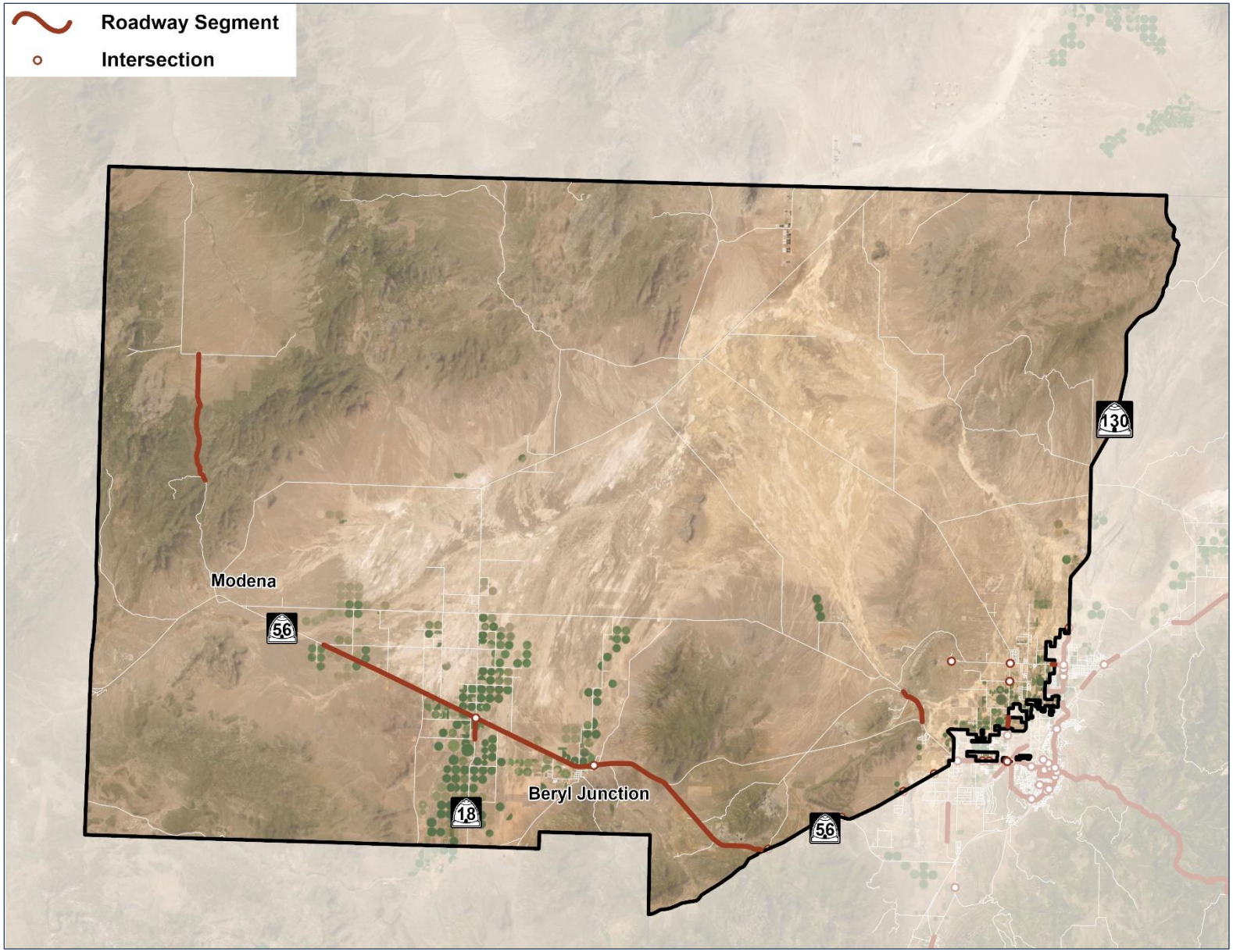

Figure 16. High-Risk Network for the West Iron County GFA

Table 5. Priority High-Risk Roadways for the West Iron County GFA

Roadways				Safety Analysis									
Roadway	Extents	Length (miles)	Functional Classification	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
State Routes													
SR 56	National Forest Road to Main Street	12.3	Minor Arterial	X		X	X	X	X	X	X		
SR 56	Main Street to 3200 north	15.9	Minor Arterial	X		X	X			X	X	X	
SR 18	800 South to SR 56	1.3	Minor Arterial	X						X	X	X	
Non- State Routes													
Iron Springs Road	Desert Mound Road to Comstock Road	2.3	Major Collector	X		X							
3100 West	1775 North to 2400 North	0.8	Major Collector	X	X								
Modena Canyon Road	M X Ranch to Hamblin Valley Road	7.3	Local Street	X		X							

Table 6. Priority High-Risk Intersections for the West Iron County GFA

Intersections		Safety Analysis			Supporting Networks						
Intersection	Number of Crashes	High Crash Network	High Injury Network	Critical Crash Rate	Replica Speeding	Replica Non Speeding	Replica Active Transportation	Crash Profile Risk	usRAP Vehicle Star Rating	usRAP Pedestrian Star Rating	usRAP Bicycle Star Rating
Unsignalized Intersections											
SR 18 & SR 56	7	X		X	X			X	X	X	
5700 West & Midvalley Road	3	X	X	X							
3100 West & Midvalley Road	7	X	X	X							
100 North & SR 56	2				X	X	X		X		
100 North & 4000 North	3		X	X							

APPENDIX A.5. INTERSTATE 15 GFA SAFETY ANALYSIS AND RESULTS

TECHNICAL MEMORANDUM #1

APPENDIX A5

I-15 GEOGRAPHIC FOCUS AREA SAFETY ANALYSIS

Statutory Notice

23 U.S.C. § 409: US Code - Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

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1. INTRODUCTION

Appendix A5 summarizes the safety analysis performed for the Interstate 15(I-15) Geographic Focus Area (GFA) as part of the Safety Action Plan for all Iron County (SAP).

I-15 was isolated as its own GFA because the interstate facilities are not eligible for Safe Streets and Roads for All (SS4A) funding. However, I-15 is the primary north-south connection through Iron County and serves the other GFAs included in the SAP.

An overview of historic crashes is provided in this appendix. A High-Risk Network was not developed for the I-15 GFA because the interstate will not be advanced to identifying SS4A eligible safety project locations.

1.1. Appendix Organization

Appendix A5 is organized into the following sections:

- Section 1 – Introduction
- Section 2 – I-15 GFA Study Area
- Section 3 – Historic Crash Overview
- Section 4 – Conflict Areas

2. STUDY AREA

The SAP study area includes each jurisdiction within Iron County. To organize the Iron County jurisdictions and unincorporated areas into manageable analysis areas, Iron County was divided into five GFAs. The I-15 GFA, shown in Figure 1, includes approximately 60 miles of I-15 from milepost 42 to mile post 101.

The historic crash summaries presented in this appendix are specific to the I-15 GFA which includes crashes occurring on the main lanes of I-15 and interchange ramps.

Figure 1 highlights the I-15 GFA study area and surrounding jurisdictions.

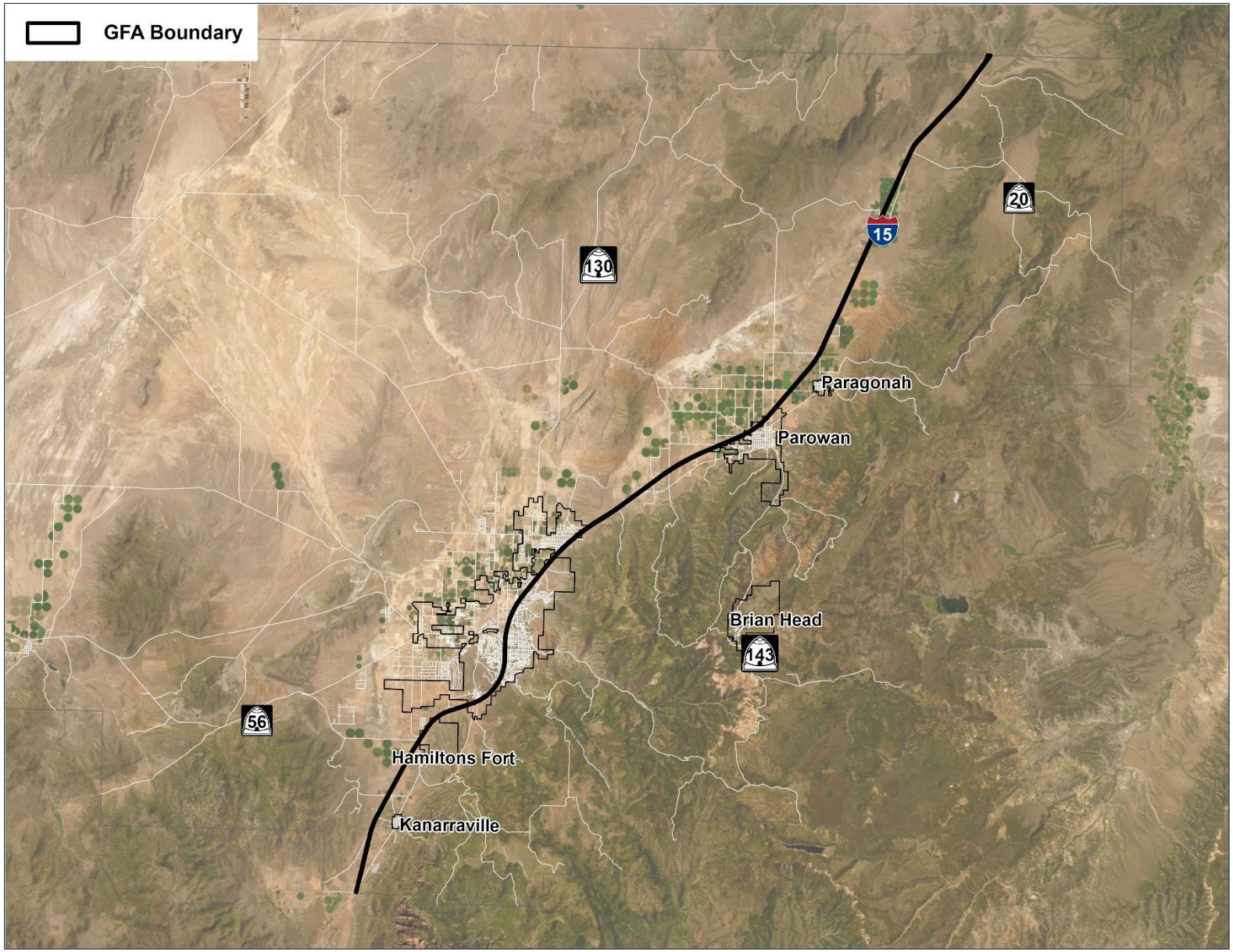

Figure 1. I-15 GFA Study Area

3. HISTORIC CRASH OVERVIEW

Crash data was obtained from the UDOT database for the most recent completed five-year period, 2019 to 2023. A historic crash review specific to the I-15 GFA is summarized below.

3.1. Overall Crashes

Figure 2 provides an overview of annual crashes for the I-15 GFA separated by crash severity. Crash severity is reported as fatal, serious injury, or all other crashes (minor injury, possible injury, or property damage only). A review of the crash data reveals the following:

- The total number of crashes has fluctuated over the five-year analysis period, reaching the highest number of crashes in 2019, 2021, and 2023.
- An average number of 12 fatal and serious injury crashes have occurred each year.
- 4% of the crashes that occurred in 2023 were fatal or serious injury crashes.

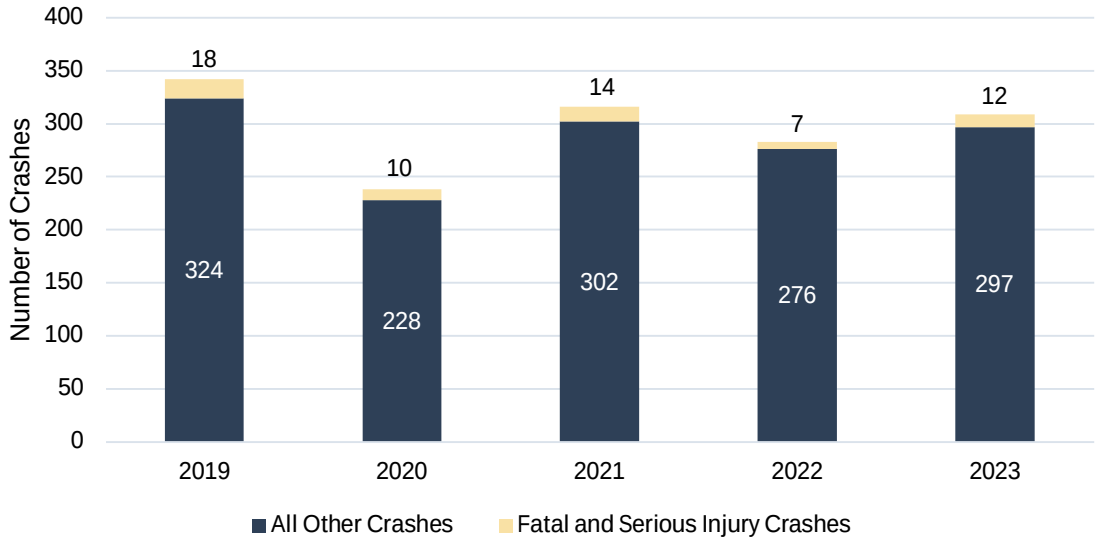

Figure 2. I-15 GFA Crashes by Year

Table 1 provides an overview of crashes by severity within the I-15 GFA and a comparison to all crashes analyzed in Iron County. A review of the data reveals the following:

- 71% of crashes resulted in no injury or property damage only.
- 41% of all fatal crashes in Iron County occurred on I-15.
- Crashes on I-15 make up 29% of all crashes that occurred in Iron County between 2019 and 2023.
- At least 23% of each crash severity in Iron County occurred on I-15.

Table 1. Crash Severity by Route Type for the I-15 GFA

Route Type	State Route (GFA Total)		% of Iron County
Crash Severity	Crashes		%
	#	%	
Fatal	16	1%	41%
Suspected Serious Injury	45	3%	23%
Suspected Minor Injury	156	11%	25%
Possible Injury	206	14%	29%
No Injury / Property Damage Only	1,061	71%	29%
Route Total	1,484	100%	29%

3.2. Fatal and Serious Injury Crashes

The number of fatal and serious injury crashes by year is summarized in Figure 3. A review of the crash data reveals the following:

- An overall decrease in fatal and severe injury crashes from 2019 to 2023.
- The number of fatal crashes has increased since 2019, reaching a maximum of five (5) fatal crashes occurring in 2023.

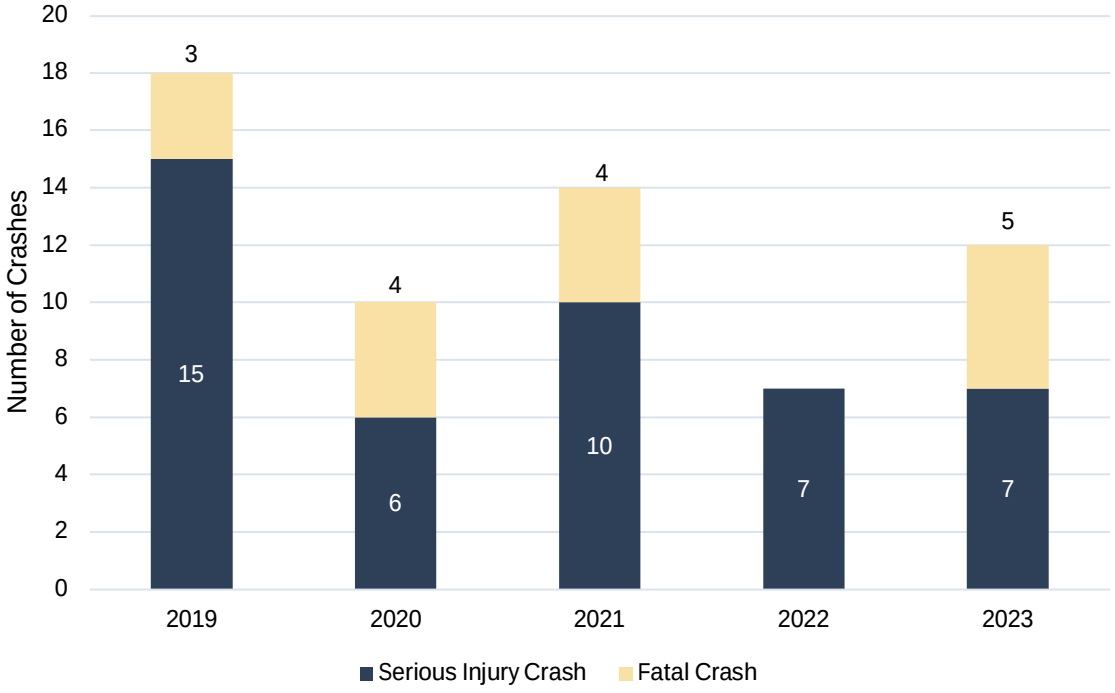

Figure 3. I-15 GFA Fatal and Serious Injury Crashes by Year

The locations of the fatal and serious injury crashes are displayed in Figure 4 and show a prevalence of fatal injury crashes at interchanges and intersections with I-15.

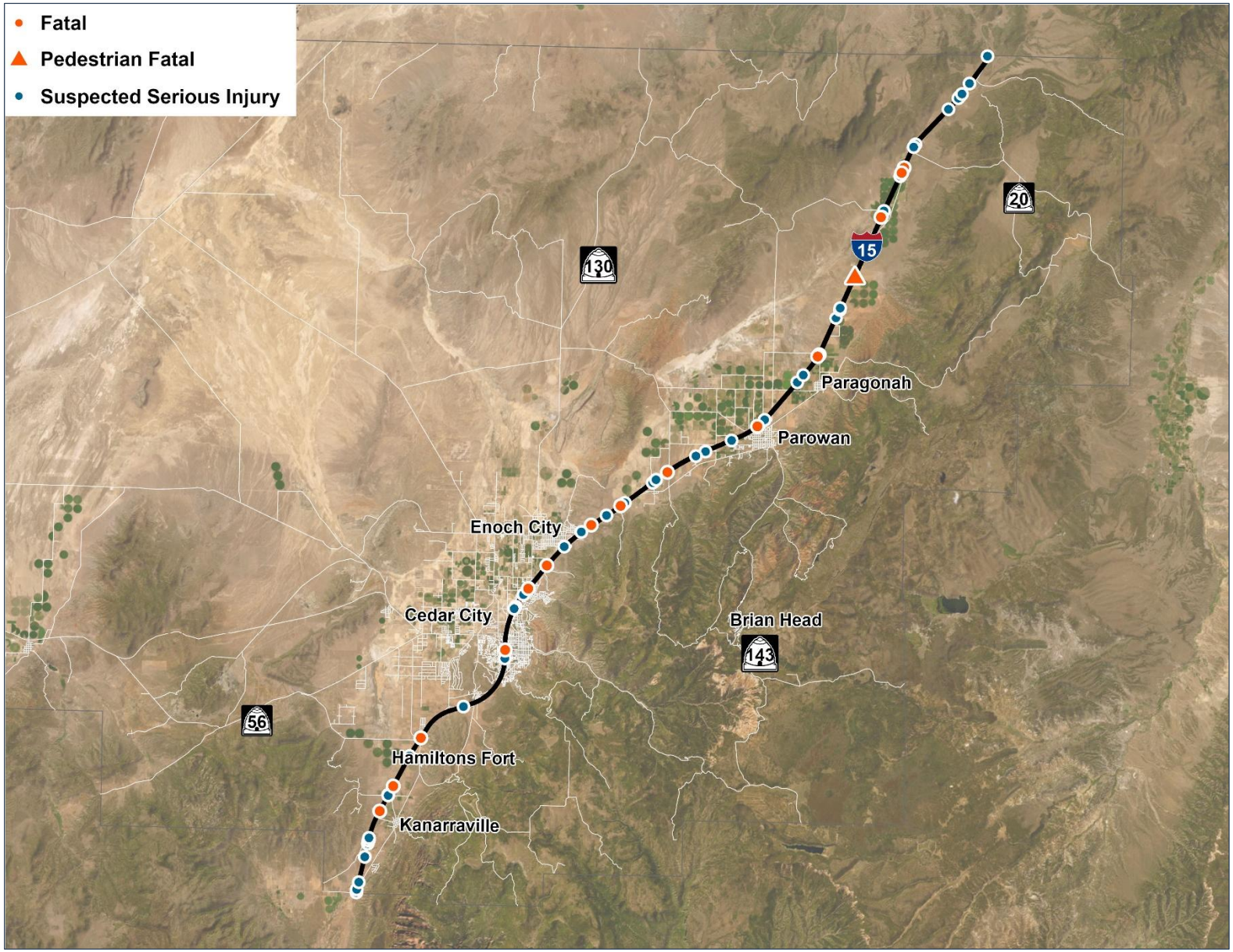

Figure 4. Fatal and Serious Injury Crashes in the I-15 GFA

3.2.1. Manner of Collision

An overview of fatal and serious injury crashes by the most common manners of collisions is shown in Figure 5. The manner of collision represents how two vehicles initially collided. The recorded manner of collision may overlap with the recorded crash type, as manner of collision is a more detailed categorization compared to crash type that is summarized in Section 3.2.2. The three most frequent manners of collision that resulted in a fatal or serious injury crash are single vehicle crashes, rear-end crashes, and sideswipe crashes.

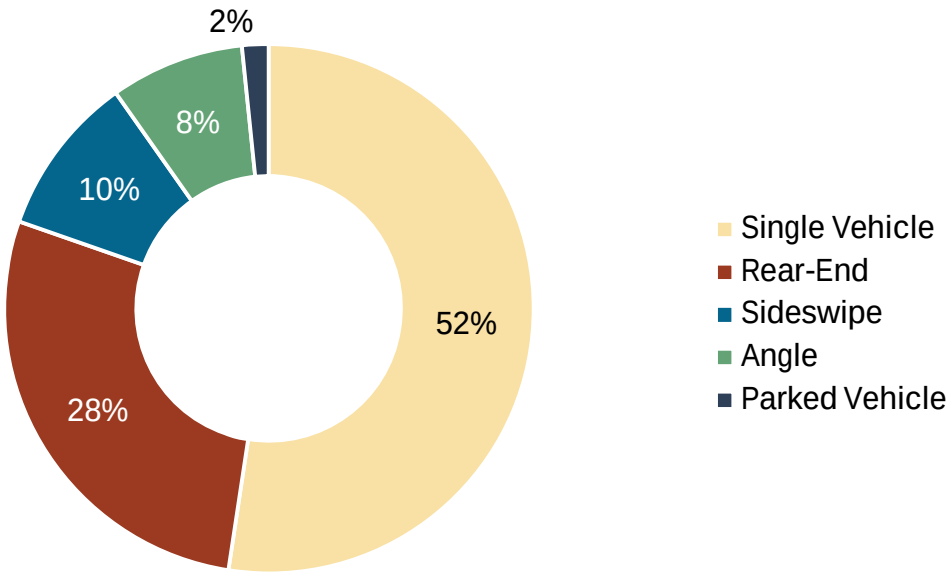

Figure 5. Most Common Fatal and Serious Injury Manners of Collision for the I-15 GFA

3.2.2. Crash Types

Crash type represents a query of multiple data fields, including the manner of collision. Each crash is assigned only one primary crash type, examples include left turns at intersections, rear -ends, sideswipes, and roadway departure crashes.

The most common crash types for the I-15 GFA are summarized in Figure 6. The three most frequent fatal and serious injury crash types are highway crossovers, rear-end crashes, and a crash type recorded as "Other." The crash type "other" may indicate a unique crash scenario or a gap in available data. The next most frequent crash type is roadway departures which include running off the road and lane departures.

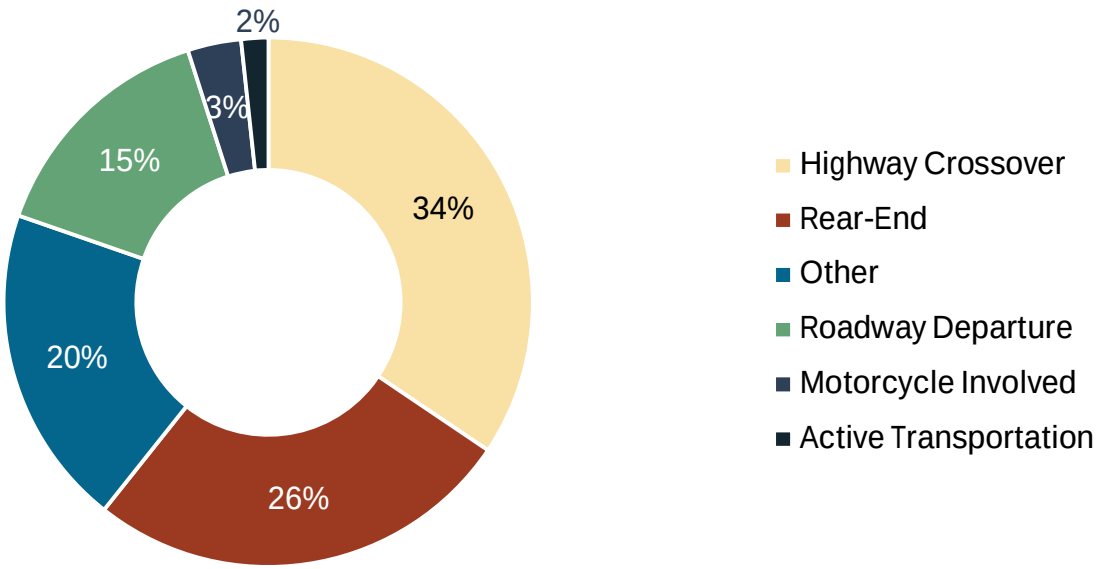

Figure 6. Most Common Fatal and Serious Injury Crash Types for the I-15 GFA

3.2.3. Driver Contributing Factors

Several factors may contribute to a single crash; however, the driver contributing factors shown in Figure 7 only represent the first driver specific contributing factor as recorded in the crash report. The first driver contributing factor recorded in the crash report indicates the primary cause of a crash. The data shows that the three most frequent driver contributing factors include failure to keep in the proper lane, speeding, and "Other/Unknown". The "Other/Unknown" contributing crash factor may indicate a unique scenario or highlight a gap in data collection.

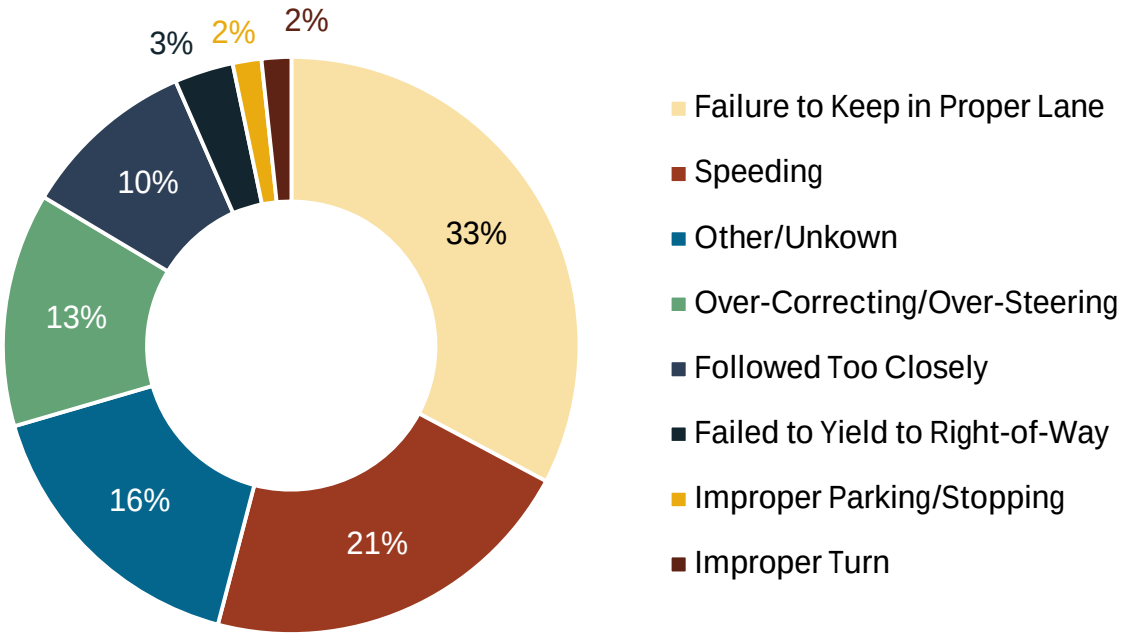

Figure 7. Most Common Fatal and Serious Injury Crash Driver Contributing Factors in the I-15 GFA

3.2.4. Vulnerable User Crashes

Vulnerable road users include pedestrians and bicyclists. The data shows two crashes involving pedestrians and zero crashes involving bicyclists in the I-15 GFA from 2019 to 2023. The pedestrian involved crashes occurred in 2021 and 2023, the 2023 crash resulted in a fatality.

3.3. Utah SHSP Emphasis Safety Area Analysis

The SHSP emphasis area analysis ranks the frequency of fatalities and serious injuries in the I-15 GFA for each of the eleven Utah SHSP emphasis safety areas. A fatality or serious injury may be assigned to multiple emphasis areas.

The rankings of the emphasis areas compare the I-15 GFA, the state of Utah, and all of Iron County.

This analysis helps to determine priority emphasis areas for the I-15 GFA, based on whether the ranked frequency of fatalities and serious injuries within the GFA are significantly different than the statewide or County rankings.

Table 2 summarizes the Utah SHSP Emphasis Area comparison analysis. The following emphasis areas have the highest frequency of fatalities and serious injuries in the I-15 GFA. The SAP identified the priority emphasis areas for the I-15 GFA:

- Roadway Departure
- No Safety Restraints
- Speed-Related
- Older Drivers
- Distracted Driving

Table 2. Utah SHSP Emphasis Area Comparison for the I-15 GFA

Category	Utah SHSP Safety Emphasis Area	Statewide		Iron County		I-15 GFA		
		Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Fatalities and Serious Injuries	Rank	Change in Rank from County
Driver	Teen Driver	1,695	4	54	5	7	6	-1
	Older Driver	1,565	7	49	6	13	4	2
	Speed-Related	2,268	3	78	3	19	3	0
	Aggressive Driving	615	11	19	10	2	9	1
	Distracted Driving	732	10	28	8	13	5	3
	Impaired Driving	1,100	8	27	9	7	7	2
	No Safety Restraints	1,627	5	85	2	37	2	0
Roadway	Intersection	3,683	1	67	4	0	10	-6
	Roadway Departure	3,372	2	132	1	47	1	0
Special Users	Motorcycle	1,571	6	40	7	4	8	-1
	Pedestrian	1,000	9	15	11	2	11	1
	Bicycle*	303	12	3	12	0	12	0

**While Bicycles are not one of the eleven Utah SHSP emphasis areas, they are included as part of the CSAP safety analysis.*

4. CONFLICT AREAS

The conflict area analysis used Replica data obtained by the County to proactively address areas of greater safety risks. The following data and metrics were isolated in Replica to identify higher risk roadways in the GFA and Iron County:

- Speeding
- Non-Speeding Events: Suspected Collisions, Phone Handling (Distracted Driving), and Sudden Braking

A maximum risk score within Replica is 100 points. Roadways with a risk score of 80 or more in any of the Replica metrics analyzed are shown in Figure 8 for the I-15 GFA. Approximately 20 miles of I-15 has an elevated risk of speeding, phone handling, and sudden braking identified by Replica. The section of highest risk on I-15 is from milepost 51 to milepost 71, with sudden braking prevalent at both Cedar City interchanges.

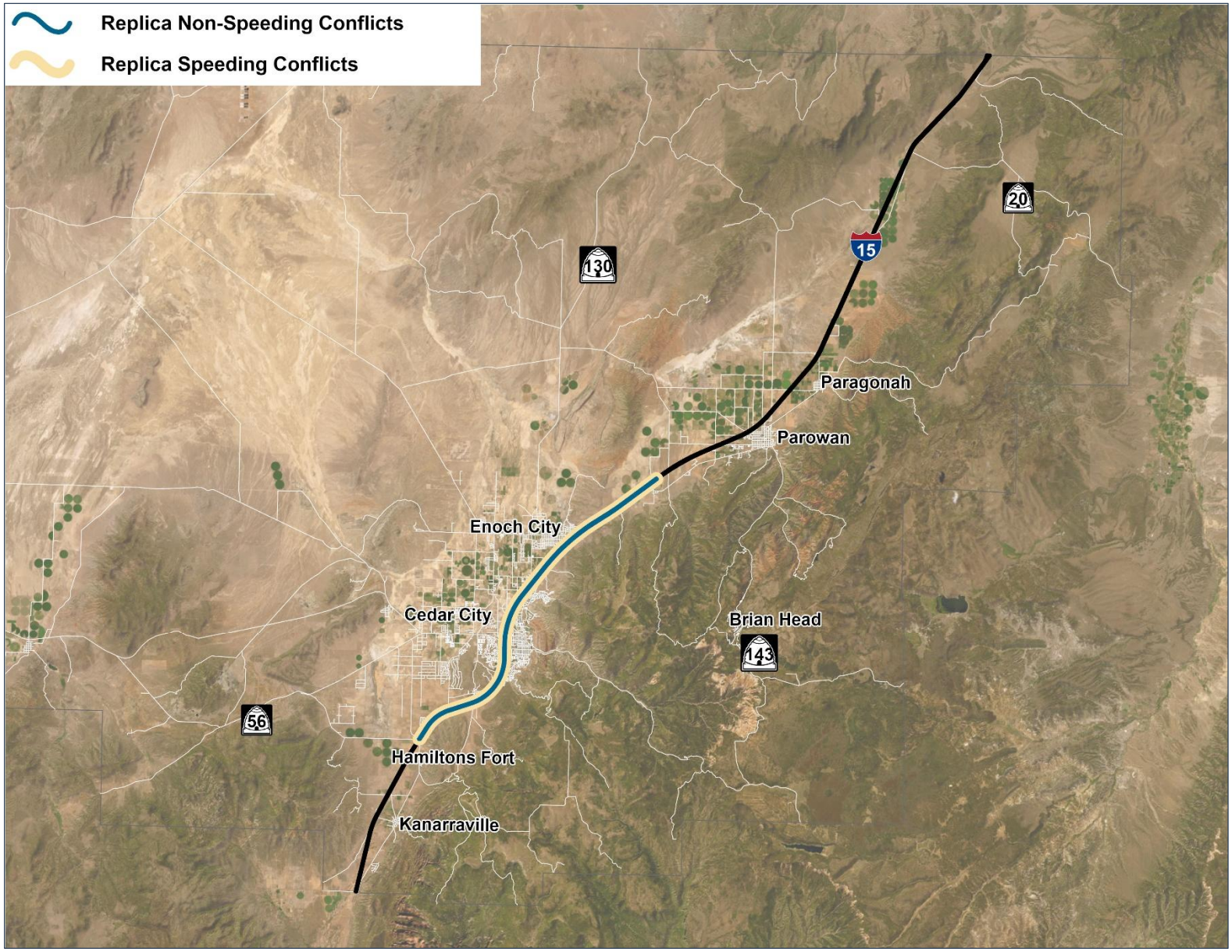

Figure 8. Replica Speeding Conflict Areas in the I-15 GFA

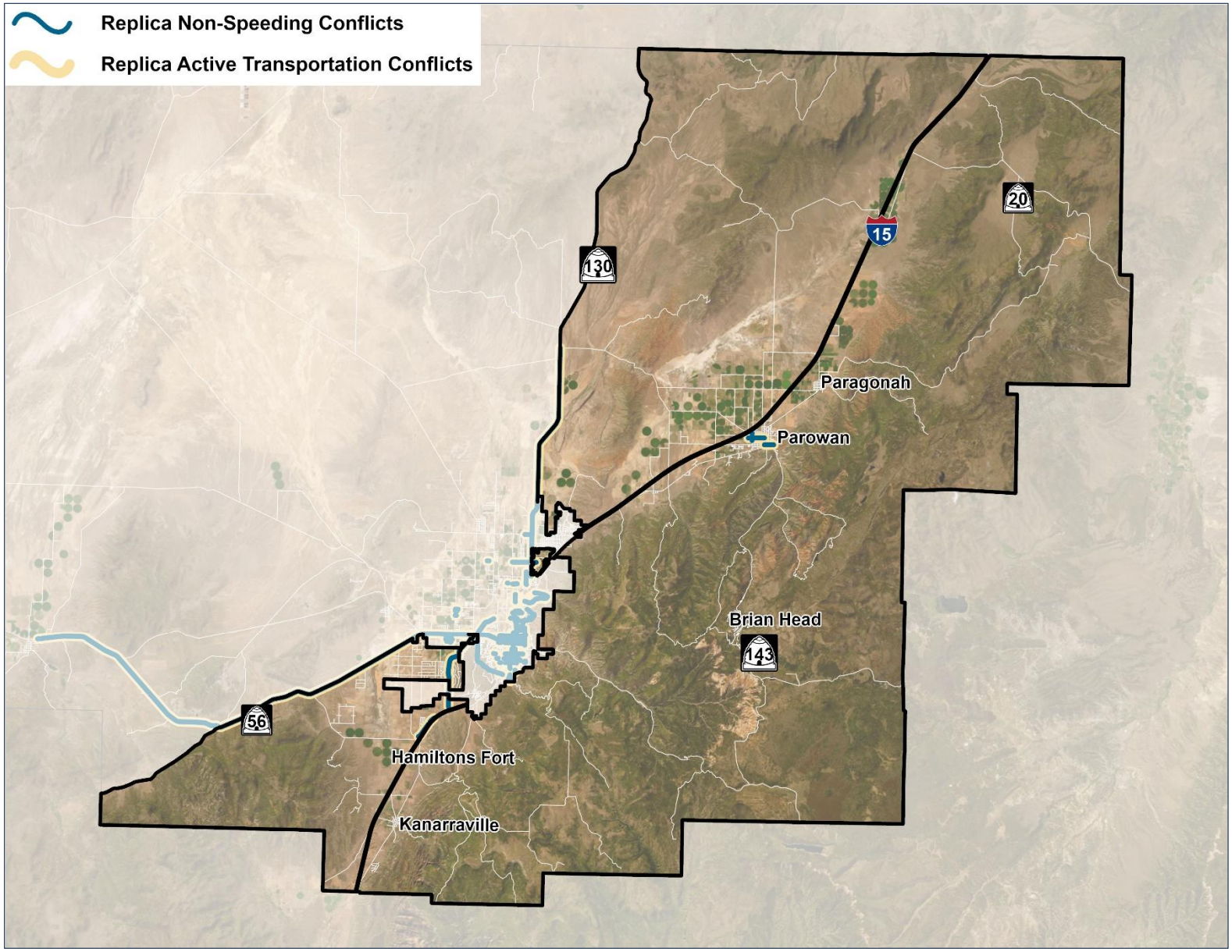

Figure 9. Replica Non-Speeding and Active Transportation Conflict Areas for the I-15 GFA

5. CONCLUSION

I-15 is managed and maintained by the Utah Department of Transportation. However, state departments of transportation are not eligible to apply for SS4A funds. As such, the Iron County SAP reviewed crash data for the I-15 corridor but will not make recommendations for improvements to I-15.

Historic crash overview findings were presented to the Iron County Rural Planning Organization in December 2024.