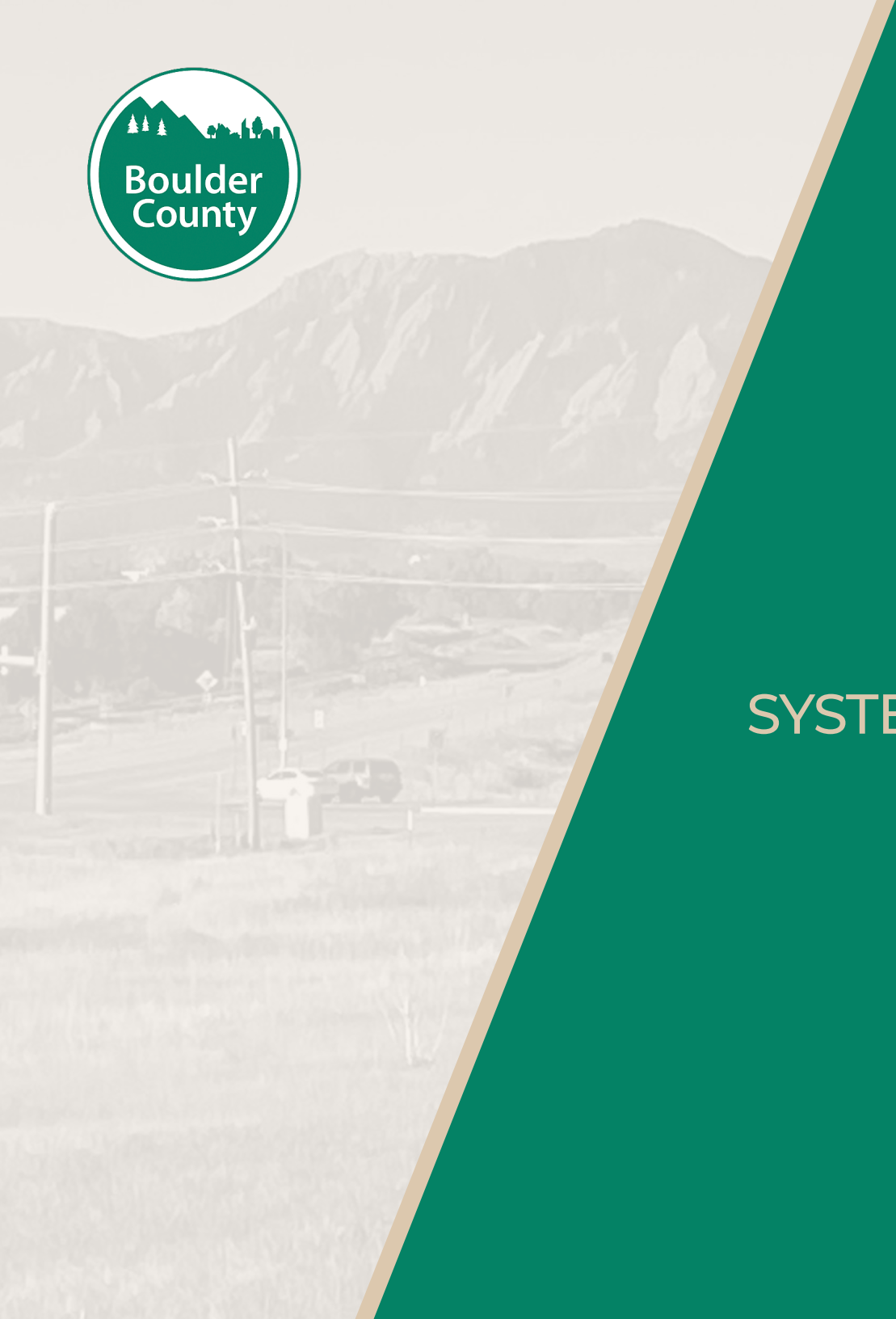

APPENDIX B

SYSTEMWIDE SAFETY ANALYSIS MEMORANDUM

Memorandum

Date: March 28, 2025

To: Boulder County Vision Zero Action Plan Project Team

From: Consor Engineers

Subject: Boulder County Vision Zero Action Plan – Systemwide Safety Analysis

Introduction

As part of the Boulder County Vision Zero Action Plan (VZAP) project, historic crash data was analyzed on unincorporated Boulder County roads, Colorado Department of Transportation (CDOT) roads, and roads in the mountain towns of Jamestown, Nederland, and Ward. The Federal Highway Administration recommends that local agencies take a holistic view of Vision Zero plans to create a safe system that anticipates human mistakes and minimizes impact energy on human bodies so that a crash doesn't result in serious injury or death. The Boulder County VZAP relies on a comprehensive approach to transportation safety that is both reactive and proactive. The reactive component typically focused on site-specific locations based on identifying a High Injury Network and identifying historical crash rends. The proactive component typically addresses locations based on the presence of risk factors and the potential for future crashes.

A systematic safety analysis approach is essential because relying solely on historical crash data can overlook locations that share risk characteristics but have not yet experienced multiple severe crashes. By examining broader trends in crash types, roadway design, and user behavior, a systemwide safety analysis allows for the identification of:

- Roadway characteristics associated with severe crashes – such as high-speed corridors, uncontrolled crossing locations, or lack of pedestrian and bicycle infrastructure.
- Address risk factors proactively – implement safety treatments in locations with similar conditions, even if they have not yet experienced a high number of crashes.
- Maximize resources – implement cost-effective, proven countermeasures across multiple locations instead of being focused on isolated, reactive solutions.

This memorandum presents the findings of the systemwide safety analysis conducted across Boulder County's roadway network. The analysis evaluates crash data, roadway characteristics, and user exposure to determine locations and conditions that contribute to high-risk crash patterns.

What is a High Risk Network?

A High Risk Network (HRN) is a strategy of a systemwide safety analysis, allowing agencies to proactively identify locations where severe crashes are most likely to occur based on risk factors rather than just

historical crash data. The High Risk Network (HRN) differs from a High Injury Network (HIN) because where the HIN identifies locations where the top injury crashes are occurring based on historical crash data to reactively address historical crashes, the HRN identifies locations where there is potential for future crashes based on high risk roadway characteristics. **Figure 1** displays a graphic that visually shows how the HIN and HRN work together as complimentary tools to create a comprehensive and proactive approach to traffic safety. Roadway characteristics are identified as high risk factors on segments and intersections that have the greatest amount of serious injury and fatal crashes (likely on the HIN). Based on those identified high risk factors, other segments and intersections with similar risk factors are identified to be a part of the HRN, regardless of the crash history. This process allows other segments and intersections to be identified that may not have a crash history, but experience the same risk as the severe crash locations. This allows agencies to proactively implement countermeasures systemwide, regardless of crash history, to proactively address traffic safety concerns before crashes do occur.

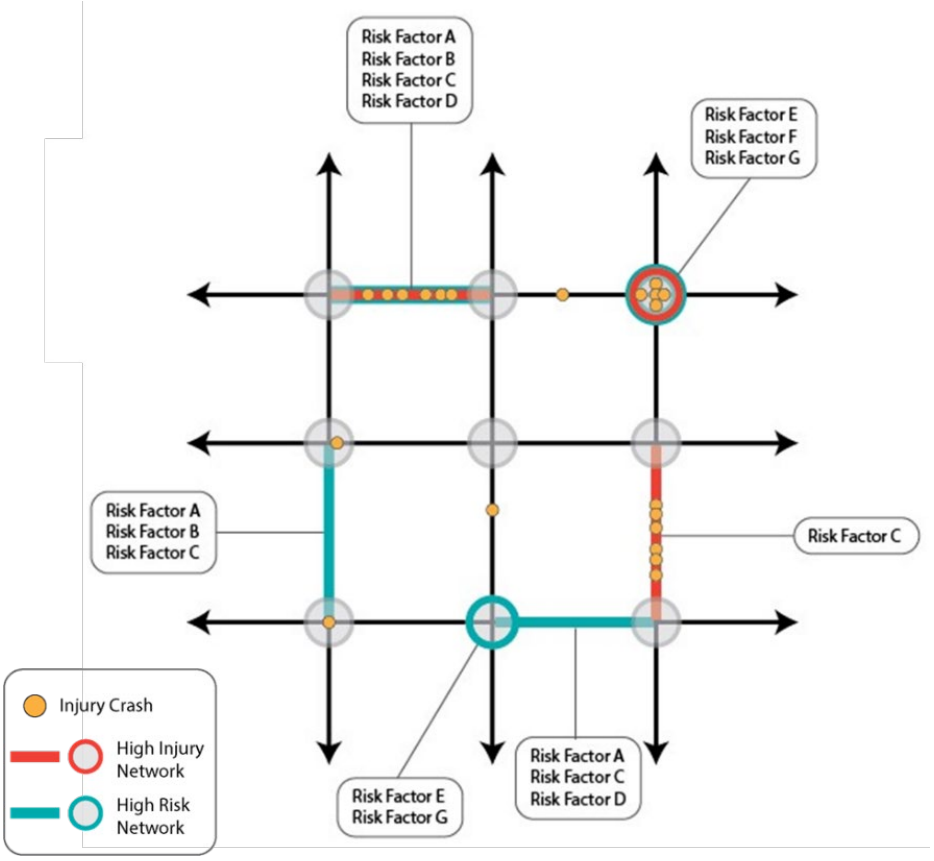

Figure 1. Visualization of HIN and HRN as Comprehensive Tools

High Risk Network Data Collection and Analysis

A combination of historical crash data from 2013 to 2022 and roadway characteristic data was used to identify patterns and potential risk factors. This process was completed for all roads, CDOT highways, and Boulder County roads. CDOT highways and Boulder County roads were looked at separately because it was determined through the crash trend analysis that these roadway types experienced different top crash trends, likely because the roadway contexts of CDOT highways versus county roads are different.

The following roadway factors were used to understand trends between historical crash data and serious injury and fatal crashes:

- Functional Class
- Speed Limit
- Presence of Guard Rails
- Traffic Control (County Roadways only)
- Level of Plow Route (for winter crashes only)
- Presence/type of bicycle facility (bike crashes only)
- Crossing Type (bike/ped crashes only)
- Land Use
- Within ¼ mi of:
    - School
    - Trailhead
    - Open Space
    - Alcohol-Serving Business
    - Bus Stop
    - Library
    - Hospital

For both CDOT highways and county roads, crash patterns were analyzed to identify if there were any roadway factors with disproportionate amounts of serious injury or fatal crashes. This was analyzed by creating matrices that summarized crash types versus the roadway factors for all injury levels, serious injury and fatal crashes, and minor, serious, and fatal crashes. The matrices summarize crash data as provided by Boulder County from 2013 to 2022.

Based on the identified factors showing disproportionate amounts of serious injury and fatal crashes compared to centerline miles and/or number of intersections in the study area, the following factors were identified as risk factors:

<u>Boulder County Roads:</u>

Data Source	Risk Factor	
	Segment	Intersection
Functional Classification	Collector; Arterial	Collector/Minor Arterial; Local/Minor Arterial; Minor Arterial/Minor Arterial
Speed Limit	30+mph	
Presence/type of bicycle facility	No Bicycle Facility	
Land Use*	Rural Residential	

**Note: Land use ended up not being used as a risk factor because the majority of the county is listed as agricultural and forestry land uses; thus, cannot draw adequate conclusions in trends for the remaining land uses.*

CDOT Highways:

Data Source	Risk Factor	
	Segment	Intersection
Functional Classification	None (all roads are state highways)	Collector/Local/SH, Collector/Minor Arterial/SH, Collector/SH, Local/SH, Minor Arterial/SH
Speed Limit	30+mph	
Presence/type of bicycle facility	No Bicycle Facility	

High Risk Network Results

Risk factors that were identified for Boulder County and CDOT Roads were mapped using ArcGIS. The results show only a score of up to 3 for County Segments/Intersections and CDOT Intersections, and only up to 2 for CDOT Segments. As a result, most segments and intersections are identified with very wide distributions in each risk score category as displayed in **Figure 2** below, which does not help identify top locations that should be identified on a HRN. As a result, it was decided to not move forward with publishing an HRN as part of the Boulder County VZAP due to lack of sufficient data. **Figure 3** and **Figure 4** display the mapped number of risk factors for Boulder County roads and CDOT highways, respectively.

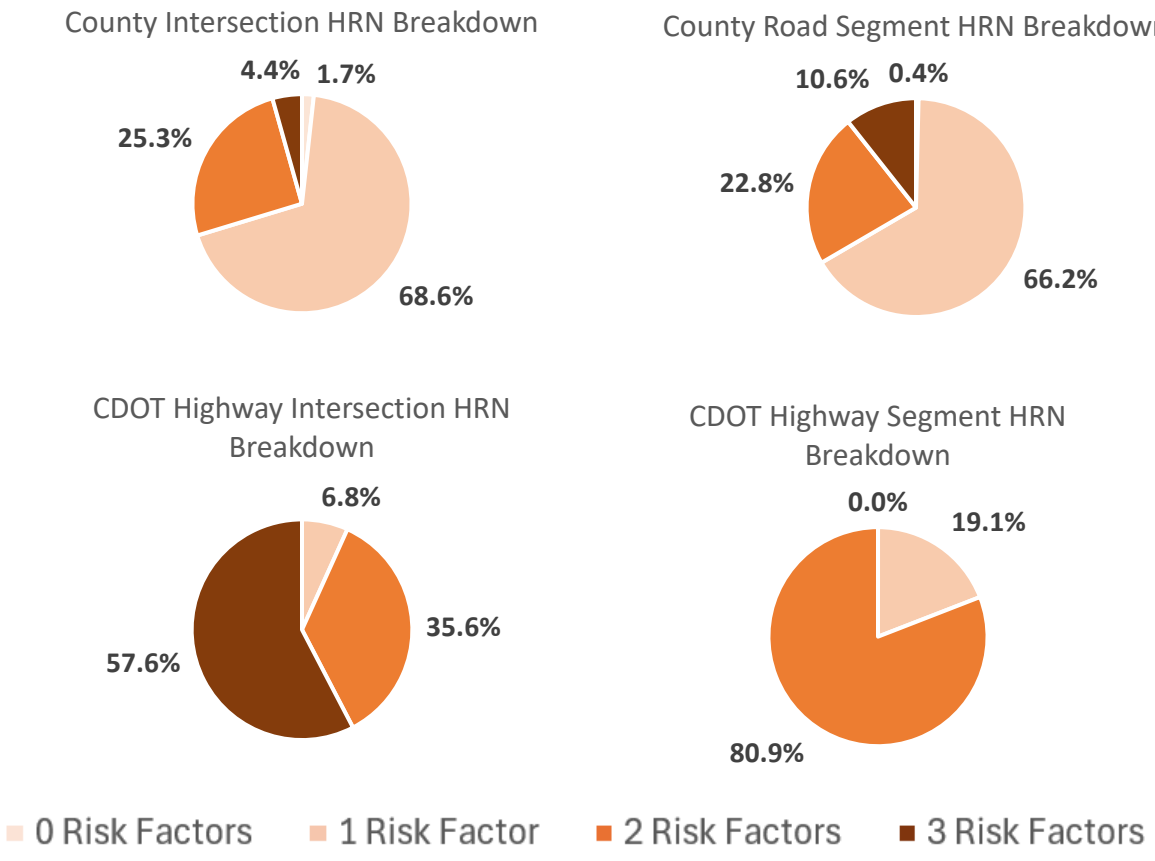

Figure 2. Breakdown of HRN Factor Distribution

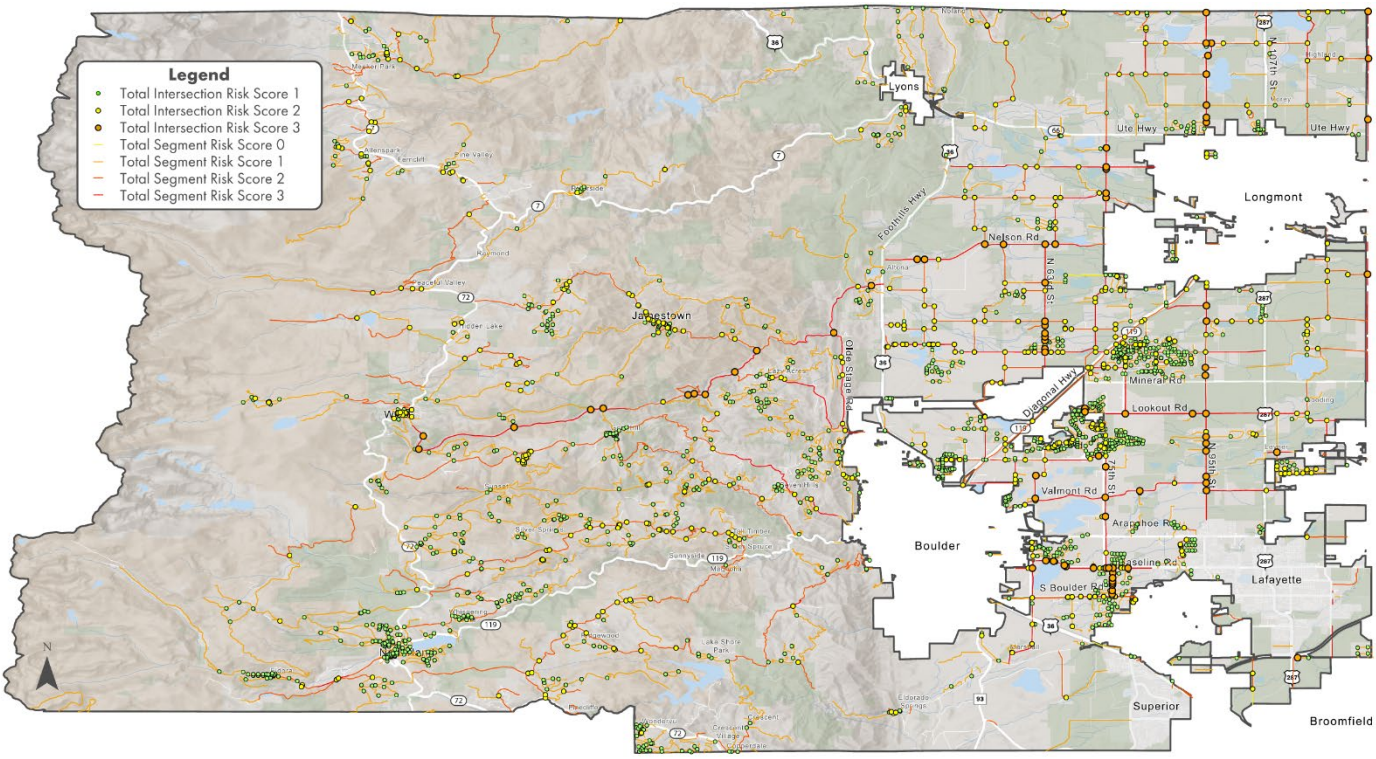

Figure 3. Boulder County Risk Factors

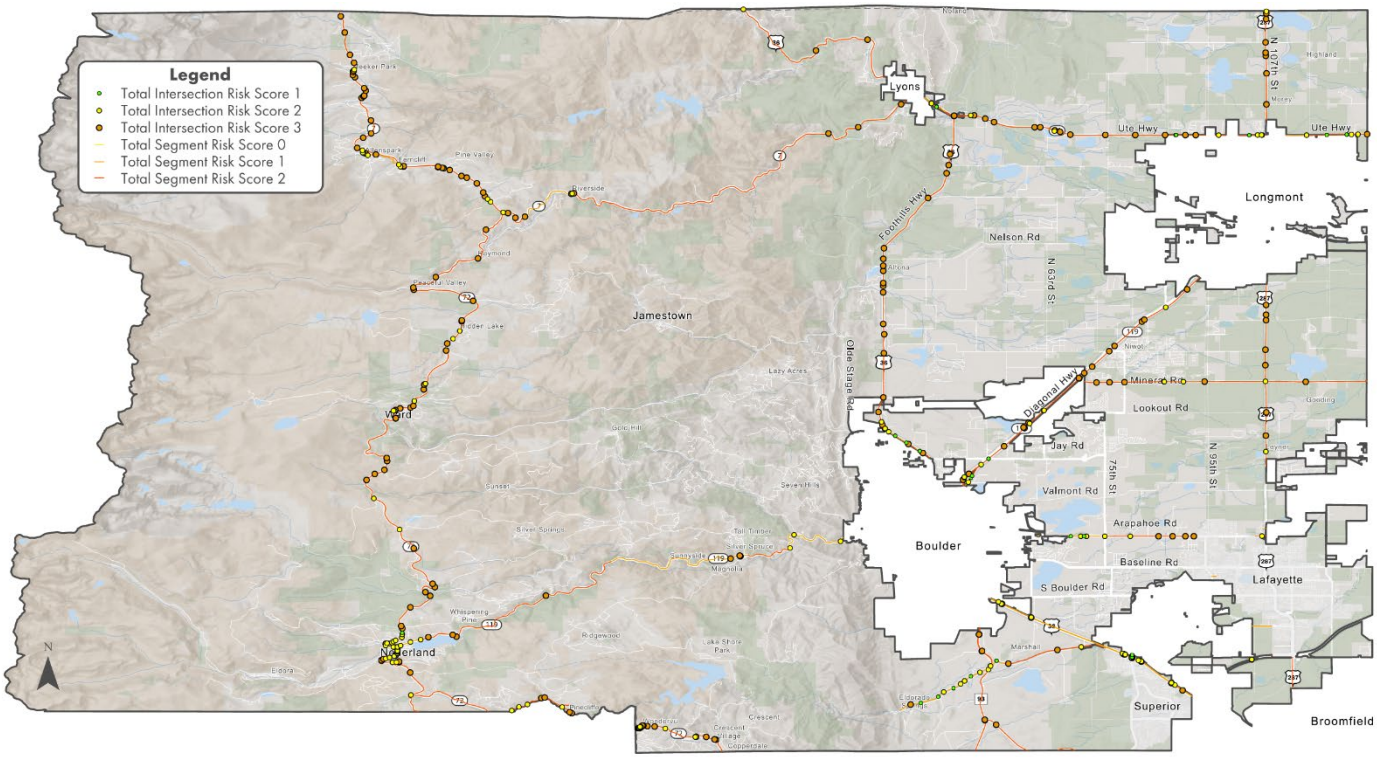

Figure 4. CDOT Highway Risk Factors

Systemwide Crash Types

Although a HRN was not developed as part of the Boulder County VZAP, a systemwide approach to safety and crash reduction in Boulder County will be achieved by focusing on the top five crash types that result in serious injuries and fatalities and implementing solutions to directly address those crash types. These top five crash types account for 77% of fatal and serious injury crashes in Boulder County:

- Single-Vehicle, including departing from the road, colliding with fixed objects, and overturning vehicles
- Bicycle
- Head-On
- Broadside
- Left-Turn

Potential countermeasures should be deployed in locations that share similar crash trends, even if they have not yet experienced a high number of crashes yet. Solutions should be deployed first at locations with known crash history (higher priority), then at areas with similar characteristics (lower priority). Specific countermeasures for each crash type are described in the final Action Plan.

Conclusion and Next Steps

A systemwide safety analysis was completed as part of the Boulder County VZAP project. A systematic safety analysis approach is critical to proactively identifying locations of high risk but may not have yet experienced multiple severe crashes. The development of an HRN was a strategy that was analyzed as part of the Boulder County VZAP project. However, during the development process, obtaining sufficient roadway data sources to adequately draw meaningful conclusions on risk factors was a challenge. As a result, it was decided to not move forward with publishing an HRN as part of the Boulder County VZAP. The development of additional data sources and an HRN was identified as a strategy/action as part of the Action Plan.

Boulder County intends to proactively address transportation safety by focusing on addressing top crash types systemwide that result in serious injury crashes. Crash trends to focus on include single vehicle, bicycle, head-on, broadside, and left-turn. Potential countermeasures should be deployed in locations that share similar crash trends. Locations with a known crash history are higher priority and then areas with similar characteristics but do not have crash trends yet are lower priority.