



# **APPENDIX E**

## 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 focuses on site-specific locations based on identifying a High Injury Network and identifying historical crash trends. The proactive component typically addresses locations based on the presence of risk factors and the potential for future crashes.

This memorandum presents the findings of the systemwide safety analysis conducted on Boulder County's roadway network to support the proactive approach. The analysis attempted to evaluate crash data and roadway characteristics to determine locations and conditions that contribute to high-risk crash patterns. The ultimate goal was to use these insights to develop a High-Risk Network (HRN) that would complement the High-Injury Network (HIN) by highlighting road segments with the greatest potential for future serious injury and fatal crashes. However, after a thorough review of the available data, the project team concluded that current datasets lack the completeness and consistency required to reliably determine enough risk factors. As such, while the methodology holds promise, further data collection and refinement would be needed before a formal HRN can be established in Boulder County. Given current data limitations, the recommended approach shifted from creating a HRN to targeting the most common severe crash types across the county and applying proven countermeasures where crashes have occurred and at other locations with similar conditions. It is believed that this approach can still be effective and is aligned with current available resources.

## Methodology

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 is used to help reactively address locations where the top injury crashes are occurring based on historical crash data, 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 complementary 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 number 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 allows agencies to proactively implement countermeasures systemwide, regardless of whether crashes have already occurred, to proactively address traffic safety concerns before crashes do occur.

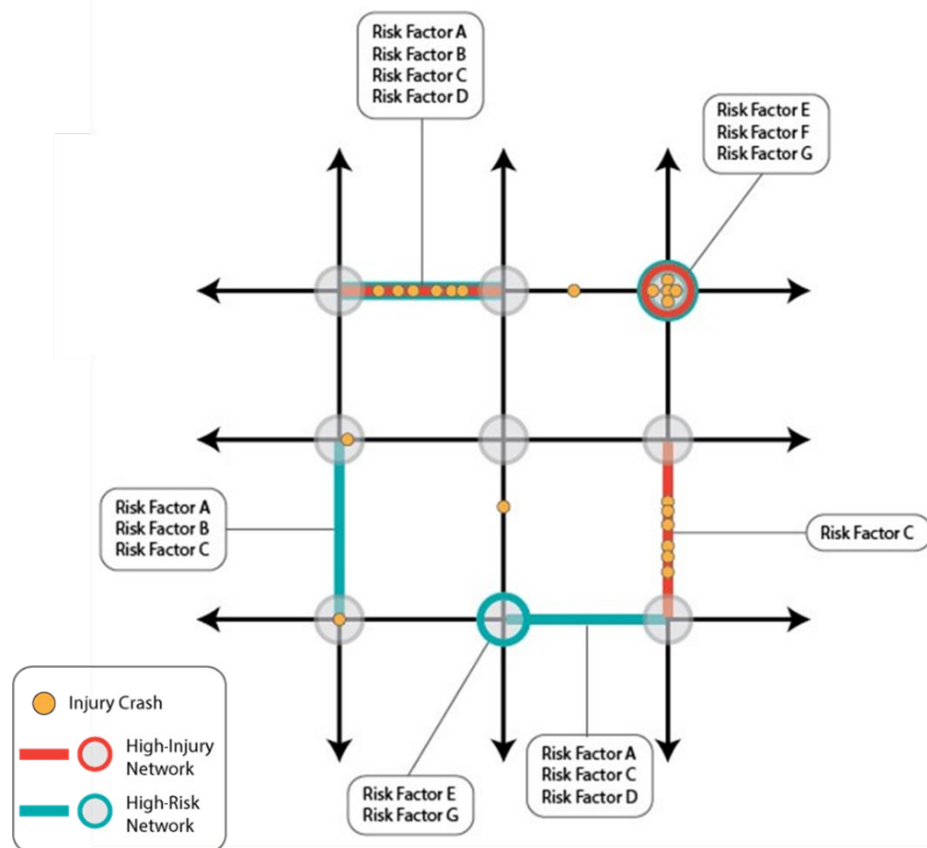


Figure 1. Visualization of HIN and HRN as Comprehensive Tools

## 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 3 subsets of the transportation network: all roads, CDOT highways only, and Boulder County roads only. CDOT highways and Boulder County roads were analyzed separately because the crash trend analysis showed that these roadway types experienced different top crash trends, likely because of the higher speeds and volumes on CDOT highways, as compared to county roads. 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 Guardrails
- 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 numbers of serious injury or fatal crashes compared to the roadway miles (or intersections) with each characteristic/factor. For example, collectors make up 13% of the Boulder County roadway system but were the location of 36% of severe crashes.

The following factors were identified as potential risk factors:

**Boulder County Roads:**

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	
<i>Maximum Score</i>	<i>County Segment: 4</i>	<i>County Intersection: 4</i>

*\*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	
<i>Maximum Score</i>	<i>CDOT Segment: 2</i>	<i>CDOT Intersection: 3</i>

Risk factors that were identified in the above tables for Boulder County and CDOT Roads were mapped using ArcGIS. For each segment or intersection, scores were tallied based how many of the risk factors that location had. For example, a county road segment had a maximum score possible of four, because four risk factors were identified (Functional Class of either Collector or Arterial, 30+ mph speed limit, no bicycle facility, rural residential land use).

## Findings

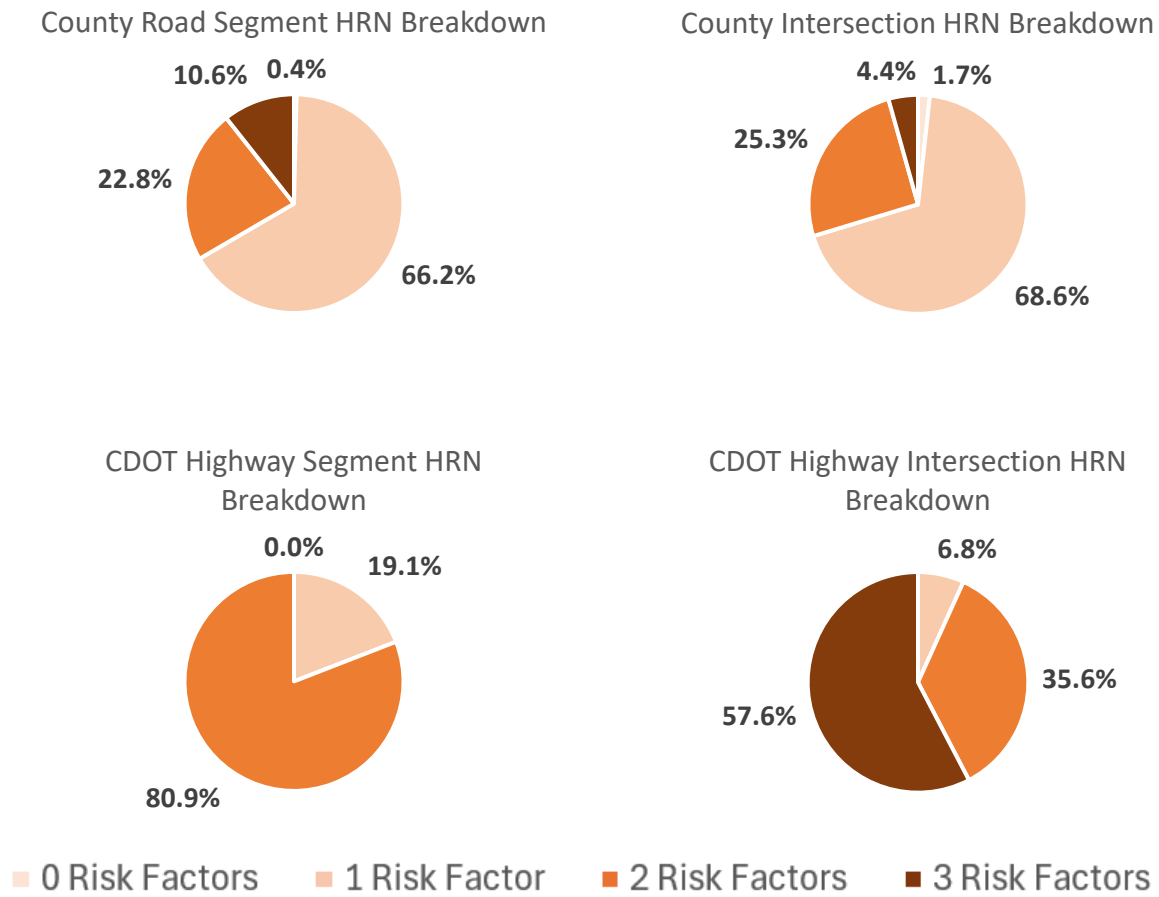
For County Segments/Intersections and CDOT Intersections the highest scores tallied in the data was three, while for CDOT Segments the highest calculated score was two. As a result, the segments and intersections fall into very broad score categories without clear locations rising to the top as displayed in **Figure 2** below, which does not help identify priority 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. Based on the lack of definitive and sufficient data, it was decided to not move forward with developing an HRN as part of the Boulder County VZAP but to use a different approach to address crashes proactively systemwide.

## Recommended Approach

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 proactively implementing solutions to directly address those crash types and the risks associated with similar conditions where crashes are already occurring. 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 **Appendix F – Countermeasure Toolkit** of the final Boulder County Vision Zero Action Plan.



*Figure 2. HRN Factor Distribution by Category*



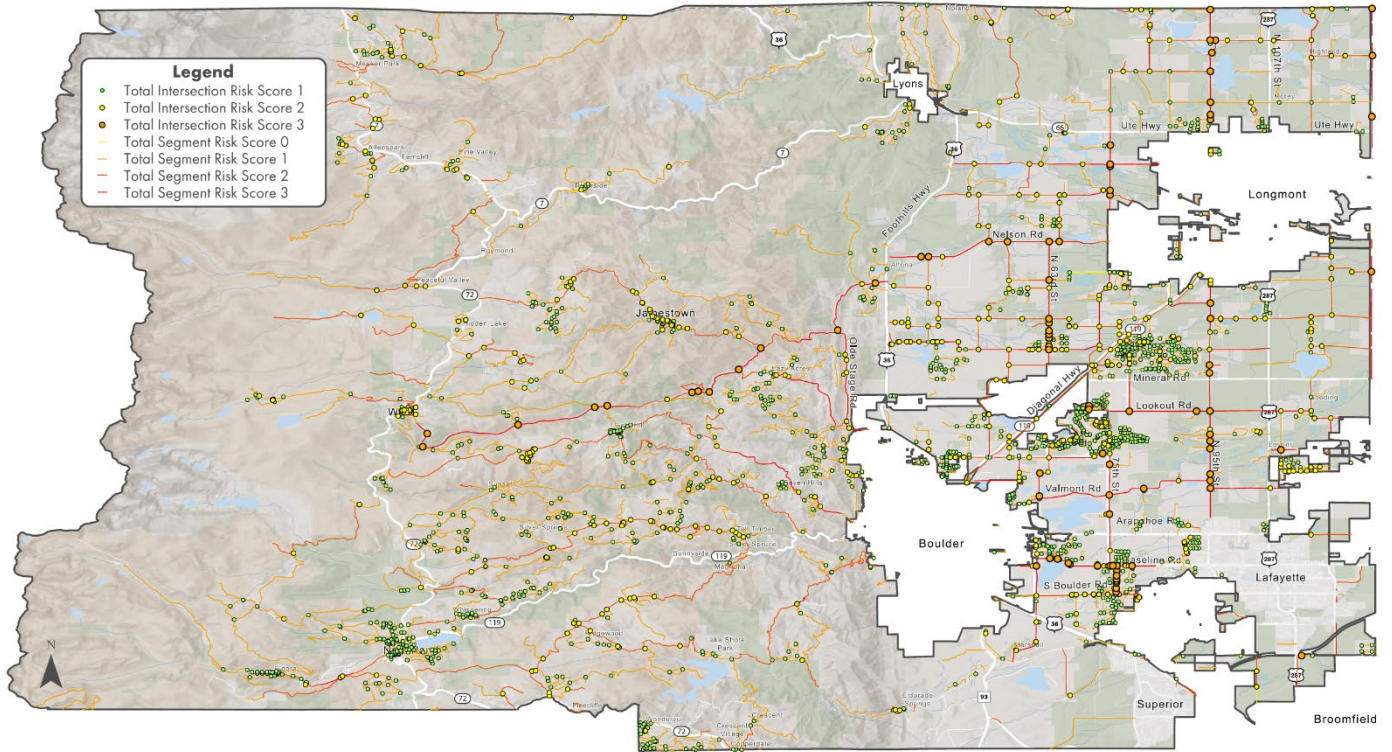


Figure 3. Boulder County Risk Factors

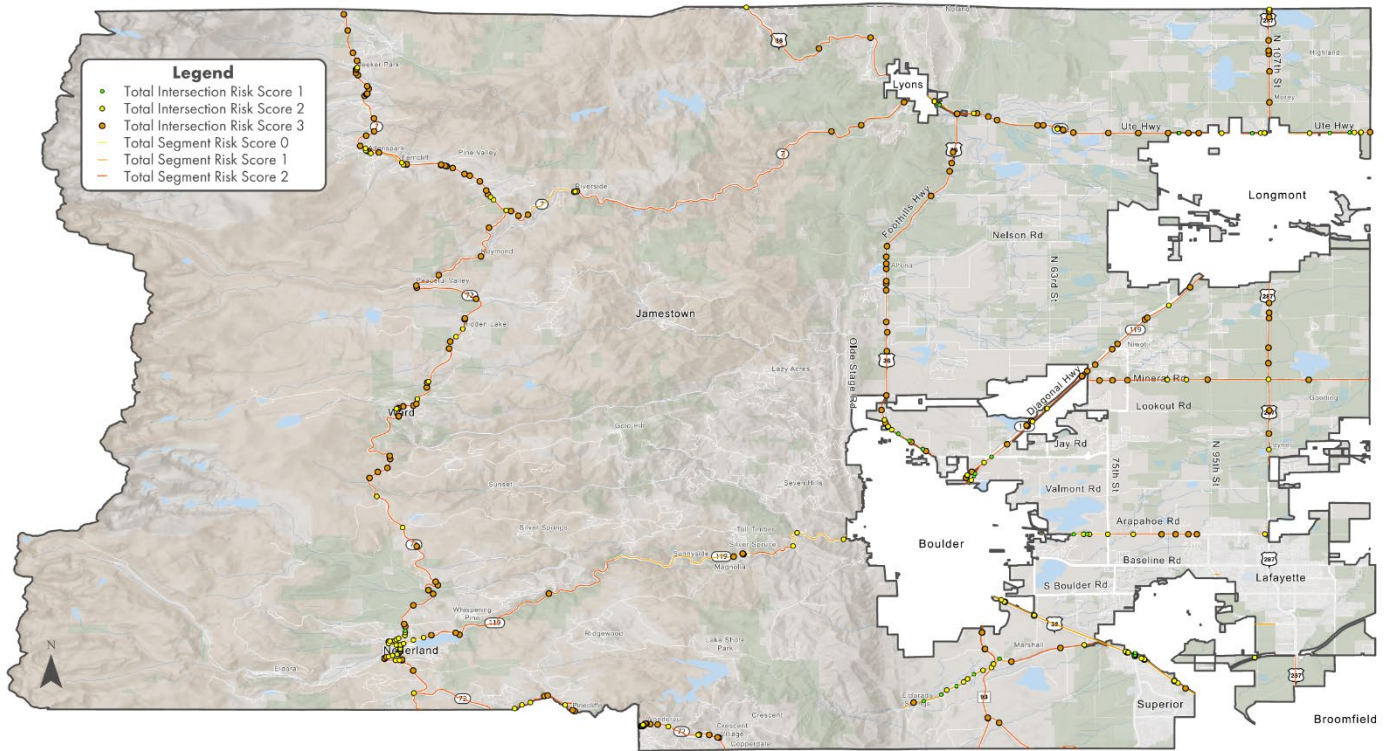


Figure 4. CDOT Highway Risk Factors