APPENDIX C

High-Injury Network Technical Methodology

City of Sacramento Vision Zero Action Plan Update:

High-Injury Network Technical Methodology

Introduction

This memo summarizes the methodology and data used to develop draft several alternative High Injury Networks (HIN) as part of the Sacramento Vision Zero Action Plan Update.

The term HIN is used to describe the set of streets in Sacramento with high concentrations of reported severe injury collisions, as well as other considerations including collisions involving people walking or biking, involving children or the elderly, occurring near schools, and/or occurring within disadvantaged areas. These contextual factors help describe the extent to which vulnerable or disadvantaged portions of the population experience a disproportionate burden due to traffic violence.

The HIN developed as part of the City's 2018 Vision Zero Action Plan only considered collision history. By also incorporating collision victim and built environment factors that are related to severe injury collisions, the HIN can help prioritize locations associated with these factors. This memo summarizes options for how collision and contextual factors can be weighted to create the HIN. The ultimate purpose of the HIN is to help City staff direct limited resources to the locations with the greatest opportunities to improve safety by modifying design, operations, or maintenance – or investing in specific education or enforcement strategies – aimed at reducing the number and severity of collisions.

Methodology

The methodology to create these HIN alternatives is based on best practices identified from a review of recent Safe System-focused Vision Zero programs, as well as the recent definition and creation of *Safety Corridors* throughout the State, as described in more detail on page 7.

Data Inputs

Collision Data

The draft HIN was developed using collision data from January 1, 2015 through December 31, 2024. The collision data is from the City of Sacramento's Crossroads collision database. The dataset only includes injury collisions (i.e., collisions in which at least one party sustained an injury; the data set includes collisions resulting in fatal injuries) on City streets, excluding collisions on state-owned facilities (e.g., US 50 and I-5).

Two special collision factors involving vulnerable road users (VRU) were also considered if the collision involved:

- People walking or biking
- People 17 and under or 65 and over

Contextual Data

In addition to collision data, the HIN development used the following contextual datasets:

- Location of Schools
- Persistent Poverty Census Tracts (2020 Census)

Collision Severity Weighting

Weighting collisions by severity results in a higher score for locations where more severe collisions have occurred. As a result, these locations are more likely to appear on the HIN. Collision severity weights are derived based on California Local Road Safety Manual crash costs, as shown in **Table 1**.

Table 1: Collision Weights

Severity	Crash Cost	Weight**
Fatal and Severe Injury (KSI)	$2,860,000*	5.1
Evident Injury – Other Visible	$193,000	1.3
Possible Injury – Complaint of Pain	$110,000	1

Source: California Local Road Safety Manual, Appendix D, 2024 update.
*The fatal and severe injury (KSI) collision cost is an average of the location type costs (signalized intersections, non-signalized intersections, roadway).
** For this analysis, the square root of the cost assumption was used to lower the collision severity weight to give more weight to the contextual factors.

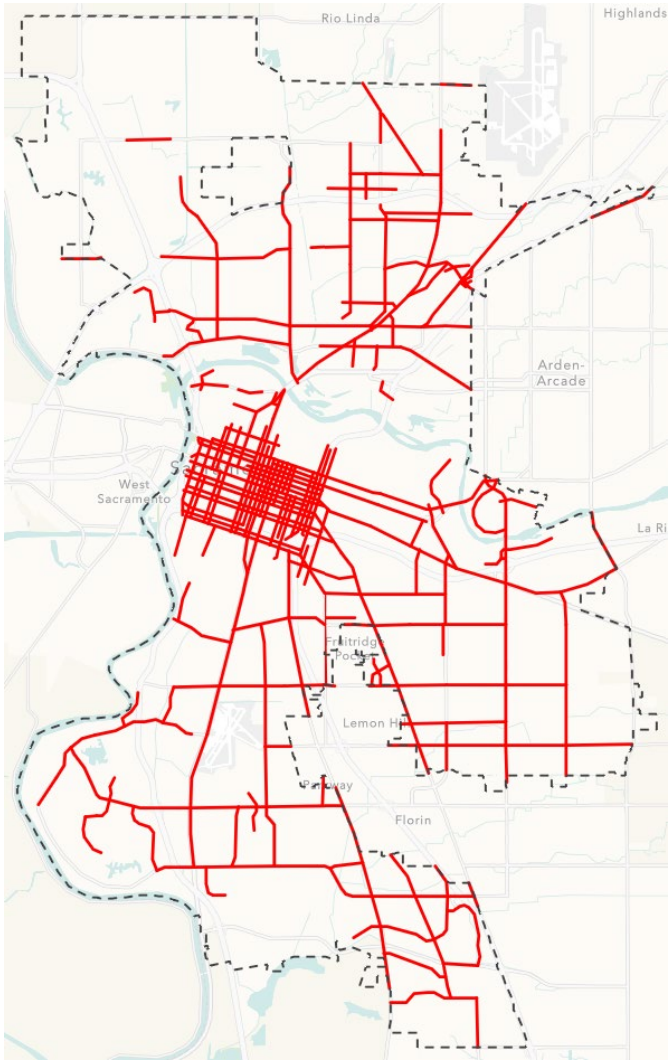
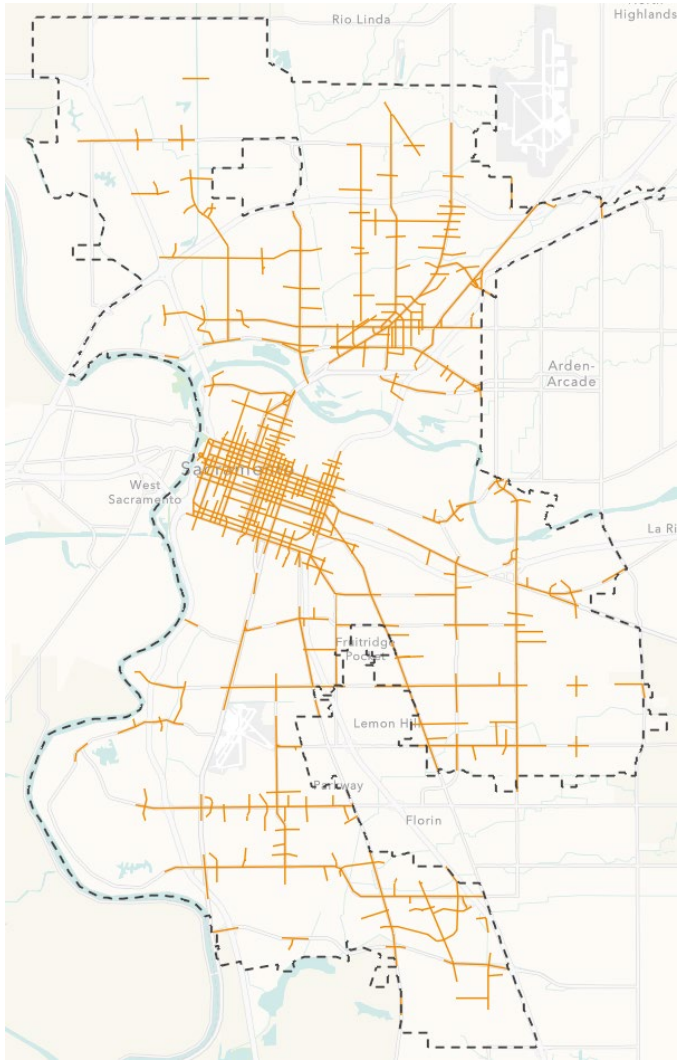
High Injury Network Comparison: 2018 vs 2025

Using the collision severity weights shown in **Table 1**, a draft HIN was developed using reported injury collisions from 2015 to 2024 ('2025 HIN Alternative 1').

2025 HIN Alternative 1 differs from the HIN created as part of the 2018 Action Plan in both the time span of collisions evaluated and the weighting of collisions. The 2018 Plan evaluated collisions between 2009 and 2015 and weighted collisions as a score of 3 if fatal or severe injury or a score 1 visible or complaint of pain injury.

A draft of the streets reflecting the top 5% and top 10% highest scoring roadway segments can be viewed via the Draft HIN Online Webmaps page. **Table 2** below provides a side-by-side comparison of the 2018 Vision Zero Action Plan's HIN (which represented approximately 14% of the roadway network) to the 2025 HIN Alternative 1 (showing the top 10% of the highest scoring streets).

Table 2: Draft HIN Comparisons: 2018 vs Alternative 1

2018 HIN	2025 Alternative 1 HIN (Top 10%)
	

Note: The 2018 Vision Zero Action Plan HIN included collision data from 2009-2015 and represented the top 14% of collisions.

High Injury Network Alternatives: Risk Factor Methodology

In addition to considering collision severity in developing an HIN, local agencies in California also have the flexibility to consider other factors related to the potential for injury or severe collisions.

Based on the flexibility allowed to include additional factors, four alternative versions of the HIN were created to illustrate potential differences:

1. **Collision Only:** Locations are scored based on the number and severity of collisions that occurred there. See 2025 HIN Alternative 1 in Table 2 or Table 4.

2. **Location-Focused:** In addition to weighting collisions based on their severity, collisions that occurred near schools or within areas of persistent poverty are scored even higher giving additional emphasis to those locations on the street network. Therefore, locations near schools or within areas of persistent poverty are more likely to appear on the HIN. See 2025 HIN Alternative 2 in Table 4.

3. **Vulnerable Road User-Focused:** In addition to weighting collisions based on their severity, collisions involving people walking, people biking, youth, and elderly are scored even higher giving additional emphasis to locations where such collisions have occurred. Therefore, locations with such a history of collisions are more likely to appear on the HIN. See 2025 HIN Alternative 3 in Table 4.

4. **Evenly Weighted:** In addition to weighting collisions based on their severity, collisions involving people walking, people biking, youth, and elderly as well as collisions near schools and within areas of persistent poverty are given additional, equal weight. Therefore, locations with any one of those characteristics are slightly more likely to appear on the HIN. See 2025 HIN Alternative 4 in Table 4.

Table 3 presents the data and weights used to develop the HIN alternatives. Weighting will change based on City staff and community input. Adjusting the weights will result in different portions of the street network being identified in the top percentiles.

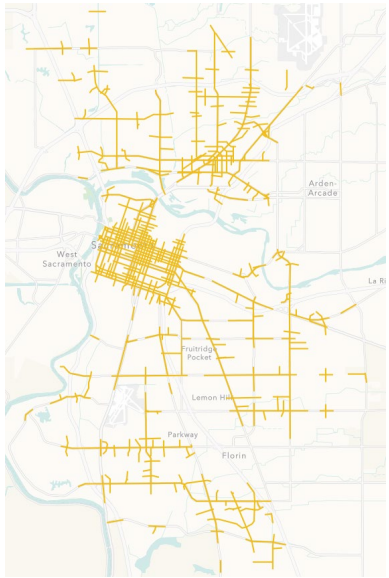
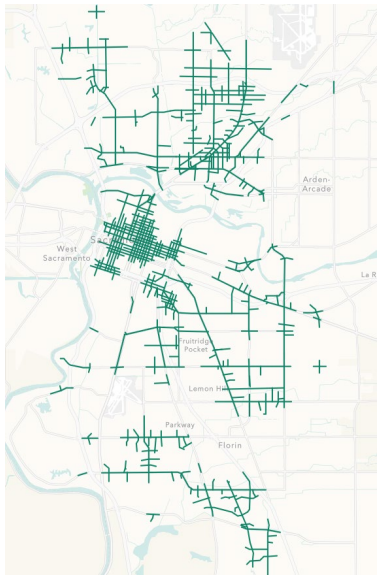
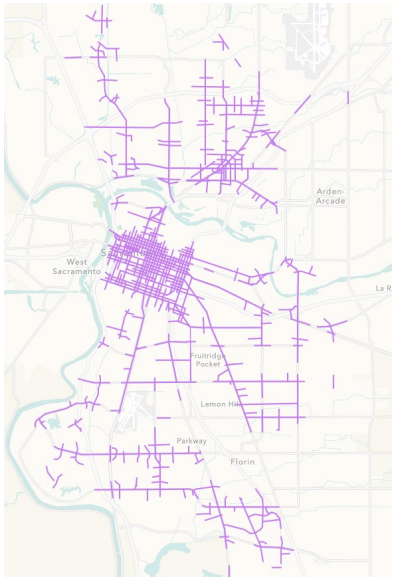
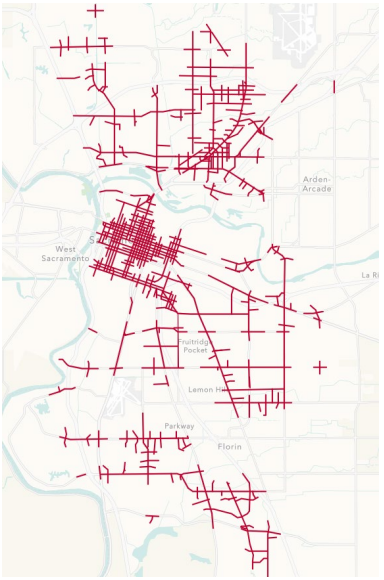
Table 3: High Injury Network Alternative Scoring

Variable	(1) Collision Only	(2) Location Focused	(3) VRU Focused	(4) Evenly Weighted
Collision Factors				
Collision Severity				
Fatal and Severe Injury (KSI)	5.1	5.1	5.1	5.1
Evident Injury – Other Visible	1.4	1.4	1.4	1.4
Possible Injury – Complaint of Pain	1	1	1	1
Additional Factors				
Involves people walking or biking	0	5	**100**	5
Involves people 17 and under or 65 and over	0	5	**100**	5
Contextual Factors				
Location Factors				
Within Persistent Poverty areas	0	**100**	5	5
Within ¼ mile of a school	0	**100**	5	5

Sources: Collision Data – City of Sacramento Crossroads, 2015 – 2024.
Areas of Persistent Poverty – U.S. Census Bureau, 2020.
Notes: All factors/variables are binary. Collision factors are applied to collisions, while contextual factors are applied to the segment or intersection. Collision severity is mutually exclusive, but additional collision factors and contextual factors are not mutually exclusive.

The Draft HIN Online Webmap shows the street segments that scored within the top 10% for each HIN alternative. **Table 4** compares the HIN alternatives.

Table 4: 2025 HIN Draft Alternatives – Top 10%

Alternative 1: Collision data only	Alternative 2: Sensitive Locations Emphasis	Alternative 3: Vulnerable Road Users Emphasis	Alternative 4: Evenly Weighted
			
Roadways only evaluated by the collision severity	Proximity to schools and Persistent Poverty areas get higher scores	Collisions involving people walking or biking, or youth or elderly get higher scores	All factors are weighted evenly

Related Recent Work by City Staff

Under a separate project, City staff recently re-evaluated the posted speed limits across the City to identify where they may be able to lower those speed limits. Part of the speed limit evaluation process includes considering traffic safety. Since 2021, revisions to state law and the California MUTCD, allows City's to identify and designate up to 20% of their street network as a 'Safety Corridor' which then gives the local agency the opportunity to lower the posted speed limit. The CA MUTCD describes the data and process that is to be used to identify 'Safety Corridors'.

Prior to this Vision Zero Action Plan Update, the City underwent a process to identify its initial set of 'Safety Corridors' to be used to re-evaluate posted speed limits. The 'Safety Corridor' analysis included similar data and considerations as the draft HIN alternatives described above. The most significant differences between the 'Safety Corridors' and draft HINs above are:

- 'Safety Corridors' did not evaluate all city-owned public streets in Sacramento whereas the draft HINs presented in this memorandum evaluated all city-owned public streets in Sacramento.
- 'Safety Corridors' used the 2018 Vision Zero Action Plan HIN as one of several data inputs into identifying the 'Safety Corridor' locations whereas the draft HINs presented above did not.
- 'Safety Corridors' used different weighting for the collisions and factors based on City staff input whereas the draft HINs presented above will be revised based on City staff and community input.
- 'Safety Corridors' used slightly older years of collision data whereas the draft HINs presented above use the most, currently available 10-years of collision data.

The draft HINs above were developed in a manner consistent with the CA MUTCD's Safety Corridor requirements. The draft HINs above, once finalized, could be used as the City's 'Safety Corridors' for future speed limit evaluations or could be used as an input into updating the City's 'Safety Corridors' for future speed limit evaluations.

Conclusion

The draft HIN maps were brought to the Technical Advisory Committee (TAC), Task Force (TF), and public for review and feedback. Based on input from City staff, TAC, TF, broader community, and City Council, the **evenly weighted alternative** (4) was selected to move forward. This way, the HIN weighs collisions based on severity, as well as involvement of people walking, people biking, youth, and elderly, and proximity to schools and within areas of persistent poverty.