APPENDIX E

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CITY OF FRESNO VISION ZERO HIGH INJURY NETWORK & PRIORITY LOCATIONS

DATE: March 18, 2025

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SUBJECT: City of Fresno Vision Zero Action Plan Project #24540-000

BACKGROUND

The purpose of this memorandum is to identify a High Injury Network (HIN) for the City of Fresno and recommended preliminary priority intersections and segments within the city. This memorandum serves as an addendum to the "Fresno Crash Trends and Emphasis Area" Memorandum and uses similar methodology and the same data sources.

KEY FINDINGS

The HIN is a subset of the city's overall roadway network representing concentrations of past severe and fatal injury crashes, and is one way to prioritize safety improvements. Key findings of the HIN identification are:

- The HIN is uniformly distributed throughout the city, representing 14% of roadway centerline miles, and including north-south and west-east roadways;
- The HIN consists of approximately 81% of all crashes within the city and 89% of all fatal and severe injury crashes;
- Nearly 50% of the HIN is made up of arterials; and
- Less than 5% of the HIN is made up of local roads.

A complementary way to prioritize safety improvements is to identify a smaller set of problematic locations (intersections and segments). Key findings of the preliminary priority locations are:

- Over 25% of crashes occurred at or on the intersections and segments;
- All locations align with the overall HIN; and
- Intersection locations primarily occur north of Downtown Fresno.

METHODOLOGY

HIGH INJURY NETWORK

The HIN was developed by mapping crashes that occurred in the City of Fresno between 2019 to 2023 and identifying which roadways made up the majority of fatal or severe injury crashes that occurred, as shown in **Figure 1**. The HIN is primarily made up of arterial (49%) and collector (42%) roadway classifications, while the remaining HIN roadway types include local, expressways, scenic arterials, collectors, drives or expressways. However, the HIN includes a majority of all arterial (86%) and collector (53%) roadway miles in the city (**Figure 2**).

The HIN makes up 14% of the total roadway network, 81% of all crashes, and 89% of all fatal and severe injury crashes on the roadway network.

89% of fatal and severe injury crashes occur on just 14% of Fresno's roadways.

Per recent California legislature such as Assembly Bill 43 (AB43), cities are allowed additional ways to reduce speed limits such as identifying safety corridors which can include up to 20% of a jurisdiction roadway network. The City may seek to identify HIN roadways as safety corridors.

PRELIMINARY PRIORITY INTERSECTIONS AND SEGMENTS

Preliminary priority intersections and segments were identified using ArcGIS and crash data statistics.

Preliminary intersection identification and prioritization were determined based on intersection-based crashes, control type, and number and severity of crashes that occurred in the last five-year period. Preliminary segment identification and prioritization were similarly determined but based on non-intersection related crashes, and density of crashes to control for segment length. Once segments with the highest frequency and severity of crashes were identified, crashes at intersections along those segments were added back into the segment crash totals.

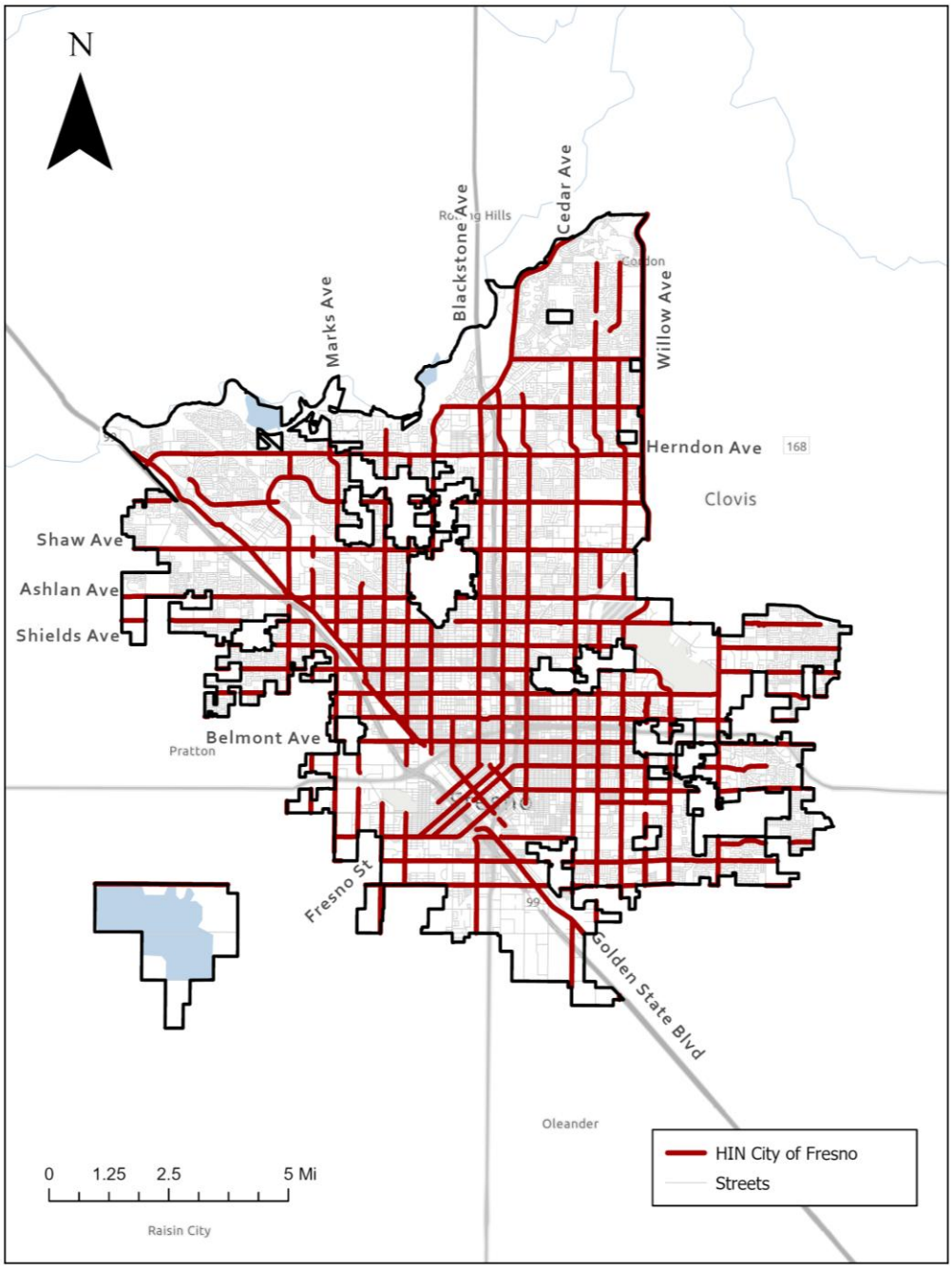

FIGURE 1. HIGH INJURY NETWORK

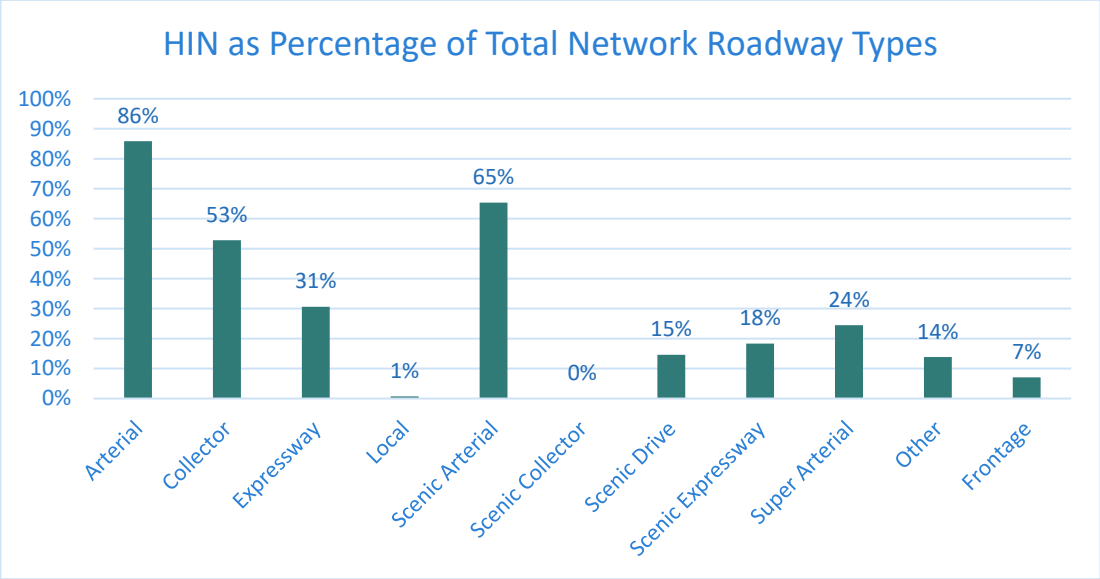

FIGURE 2. HIGH INJURY NETWORK AS PERCENTAGE OF TOTAL ROAD NETWORK BY TYPE

EQUIVALENT PROPERTY DAMAGE ONLY

Equivalent Property Damage Only (EPDO) is a tool in determining the fiscal cost of crashes based on severity and facility types and is a methodology consistent with the Highway Safety Manual, the Caltrans Local Roadway Safety Manual (LRSM), and FHWA benefit/cost analysis. An EPDO score for a crash severity and facility type is calculated as the ratio of the cost for the category and that of a Property Damage Only (PDO) crash. Crash scores for segments and intersections are calculated as the sum of all crashes that have occurred during the study period for that facility. The EPDO costs provided in the Caltrans LRSM are described in **Table 1.** The EPDO weighted scores used in this analysis for each severity have been rounded for ease of calculation and are listed in **Table 2**.

TABLE 1. HIGHWAY SAFETY MANUAL EPDO COST MATRIX

Severity (S)	Crash Severity *	Location Type	Crash Cost ***
3	**Fatality and Severe Injury Combined (KA)	Signalized Intersection	$2,162,000
3		Non-Signalized Intersection	$3,440,000
3		Roadway	$2,978,000
2	Evident Injury – Other Visible (B)		$193,000
1	Possible Injury–Complaint of Pain (C)		$110,000
0	Property Damage Only (O)		$18,000

* The letters in parenthesis (K, A, B, C and O) refer to the KABCO scale; it is commonly used by law enforcement agencies in their crash reporting efforts and is further documented in the HSM.

** Figures were calculated based on an average Fatality (K) / Severe Injury (A) ratio for each area type. These costs are used in the HSIP Analyzer.

*** Based on Table 7-1, Highway Safety Manual (HSM), First Edition, 2010. Adjusted to 2024 Dollars.

Source: Caltrans Local Roadway Safety – A Manual for California's Local Road Owners, 2024.

TABLE 2. EPDO CRASH SEVERITY WEIGHTED

CRASH SEVERITY	WEIGHTED EPDO
COMPLAINT OF PAIN	6
VISIBLE INJURY	10
FATAL AND SERIOUS INJURIES	150

RECOMMENDED EMPHASIS AREAS

The recommended emphasis areas identified in the "Fresno Crash Trends and Emphasis Area" Memorandum include categories such as crash types, driver behaviors, infrastructure, and safety culture. Relevance to emphasis areas were used as an additional guide to determine priority intersections and segments. Emphasis areas were based on historic crash trends and identified in either the 2022 City of Fresno Local Road Safety Plan (LRSP) or during the current City of Fresno Vision Zero Plan analysis. The complete breakdown of recommended emphasis areas and where they were identified is listed in **Table 3**.

The primary emphasis area crash types of fatal and severe injury crashes are pedestrian, or motorcycle involved, broadside, and hit object crashes. The four crash types included in **Table 3** make up 90% of fatal and severe injury crashes. Risky behaviors can include impaired driving (i.e., alcohol, drugs) and unsafe speeds which are 34% of fatal and severe injury crashes.

TABLE 3. RECOMMENDED EMPHASIS AREAS

CATEGORIES	FACTORS	SOURCE
CRASH TYPES	Pedestrian Involved Crashes	2022 LRSP
	Motorcycle Involved Crashes	Updated 2019-2023 crash analysis
	Broadside Crashes	2022 LRSP
	Hit Object Crashes	2022 LRSP
RISKY BEHAVIORS	Impaired Driving	Updated 2019-2023 crash analysis
	Unsafe Speeds	Updated 2019-2023 crash analysis
INFRASTRUCTURE	Signalized intersections along high-volume, high-speed arterials	2022 LRSP

CATEGORIES	FACTORS	SOURCE
SAFETY CULTURE	Collision data reporting and monitoring	2022 LRSP

PRELIMINARY PRIORITY LOCATIONS

ANALYSIS APPROACH

Using the collision data acquired from SWITRS and Crossroads, a visual and quantitative review of collisions on the City's HIN was conducted in ArcGIS Pro. The data source was converted to a heat map to identify segment density and segments with a high volume of crashes. Crashes that were analyzed include intersection and non-intersection crashes, as an intersection is still part of a segment. All identified segments were reviewed against the recommended emphasis areas to determine segment relevance.

Once the high-crash locations were identified, each location was ranked based on the following metrics.

- **KSI Crashes.** The number of crashes resulting in a fatality or severe injury at a location.
- **Total Crashes.** The total number of recorded crashes associated with the location.
- **EPDO Score.** The EPDO score, providing a weighted score based on number and severity of crashes, provides a ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

PRELIMINARY PRIORITY INTERSECTIONS

Within the city, 11 intersections were identified as preliminary priority locations. The intersection locations are shown in **Figure 3**. The preliminary intersections crashes and EPDO rank are summarized in **Table 4**. As described in **Table 4**, each identified intersection contained over ten crashes and at least two fatal or severely injured crashes. The recommended preliminary priority intersections were reviewed for consistency with the recommended emphasis areas. Each segment's location and associated emphasis areas are summarized in **Table 5**.

Priority Intersections Identified in the 2020 LRSP

Several of the intersections identified in the 2020 LRSP were not highlighted in this analysis. **Table 6** below lists the intersections and their total number of KSIs and crashes in the current analysis period along with the associated EPDO score. As listed, the top 10 intersections from the 2020 LRSP have fewer total crashes and KSI crashes than those identified in this memorandum with more recent crash totals.

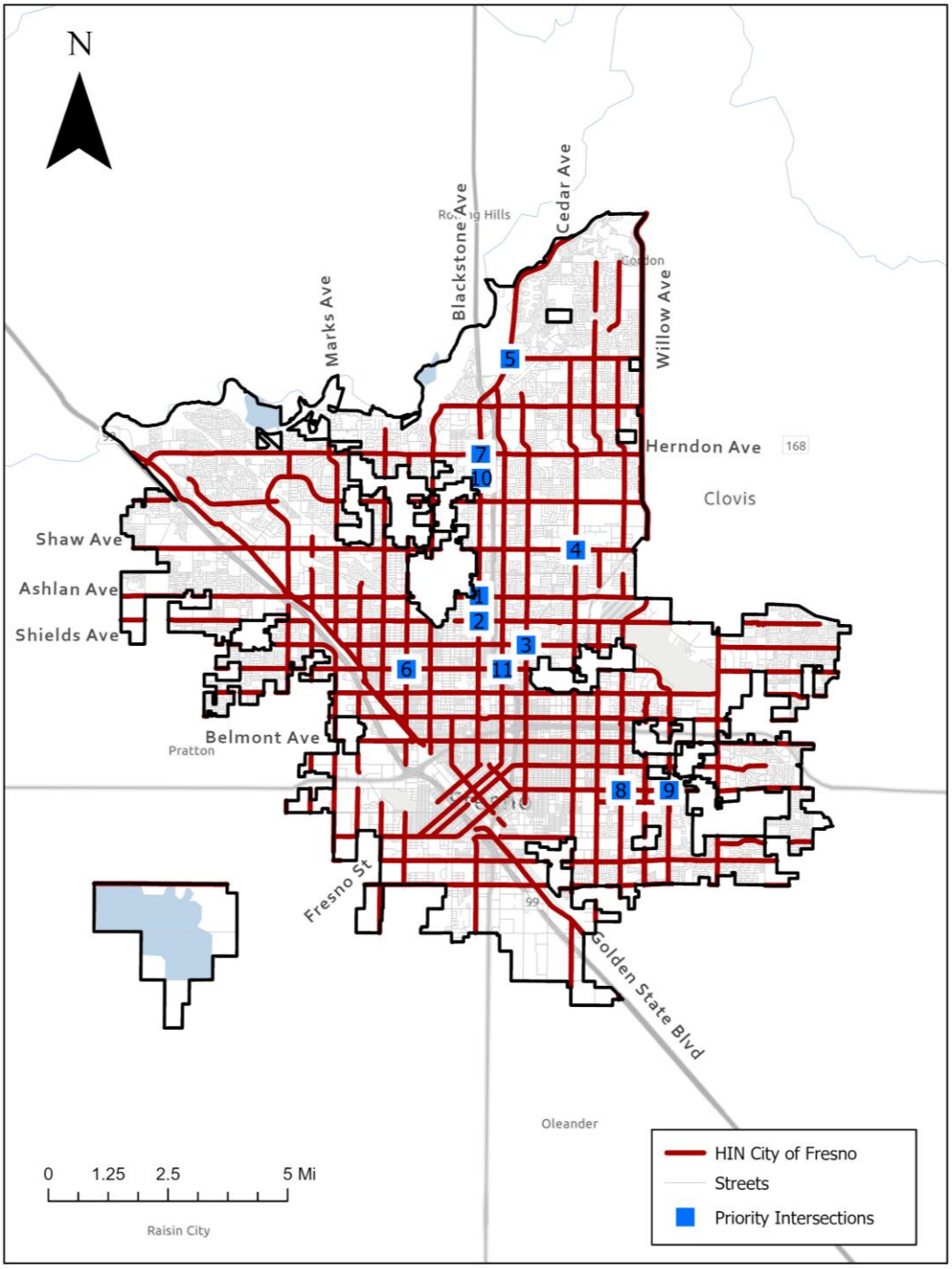

FIGURE 3. PRIORITY PRELIMINARY INTERSECTIONS

TABLE 4: PRELIMINARY PRIORITY INTERSECTIONS

INTERSECTION ID	IDENTIFIED IN 2020 LRSP[1]	INTERSECTION	KSI CRASHES	TOTAL # OF CRASHES	EPDO SCORE
1	N	Blackstone Ave/ Ashlan Ave	10	27	1626.00
2	N	Blackstone Ave/ Dakota Ave	7	25	1198.00
3	N	First St/ Shields Ave	7	19	1138.00
4	N	Cedar Ave/ Shaw Ave	7	11	1078.00
5	N	Friant Rd/ Shepherd Ave	5	28	912.00
6	N	Fruit Ave/ Clinton Ave	5	20	864.00
7	N	Blackstone Ave/ Herndon Ave	4	20	712.00
8	N	Chestnut Ave/ Cesar Chavez Blvd	4	17	698.00
9	N	Peach Ave/ Cesar Chavez Blvd	4	15	690.00
10	Y	Blackstone Ave/ Sierra Ave	3	13	526.00
11	N	Fresno St/Clinton Ave	2	23	462.00

[1] While many exact intersections were not identified in this memorandum, many of the same roadways identified in the 2020 LRSP were identified in the preliminary intersections. Blackstone Ave/Sierra Ave is identified as a top 20 intersection in the 2020 LRSP.

TABLE 5: PRELIMINARY PRIORITY INTERSECTIONS EMPHASIS AREAS MATRIX

INTERSECTION	PEDESTRIAN INVOLVED CRASHES	MOTORCYCLE INVOLVED CRASHES	BROADSIDE CRASHES	HIT OBJECT CRASHES	IMPAIRED DRIVING	UNSAFE SPEED	SIGNALIZED INTERSECTION
BLACKSTONE AVE/ ASHLAN AVE	11	2	8	0	1	2	Y
BLACKSTONE AVE/ DAKOTA AVE	8	2	12	0	0	4	Y
FIRST ST/SHIELDS AVE	4	2	6	2	3	3	Y
CEDAR AVE/SHAW AVE	1	2	5	0	3	0	Y
FRIANT RD/SHEPHERD AVE	0	1	25	0	2	1	Y
FRUIT AVE/CLINTON AVE	2	1	11	0	0	1	Y
BLACKSTONE AVE/ HERNDON AVE	2	1	8	0	1	2	Y
CHESTNUT AVE/ CESAR CHAVEZ BLVD	4	1	3	0	1	7	Y
PEACH AVE/ CESAR CHAVEZ BLVD	6	0	5	0	1	0	Y
BLACKSTONE AVE/ SIERRA AVE	5	0	3	2	2	3	Y
FRESNO ST/CLINTON AVE	2	0	11	0	4	1	Y

TABLE 6. 2020 LRSP TOP 10 INTERSECTIONS

INTERSECTION	KSI CRASHES	TOTAL # OF CRASHES	EPDO SCORE
FIRST STREET/ SHAW AVE	0	6	40.00
BLACKSTONE AVE/ BULLARD AVE	1	4	168.00
FRESNO ST/ SHIELDS AVE	1	12	228.00
FIRST ST/ GETTYSBURG AVE	2	7	484.00
AUDUBON DR/ FRIANT RD	2	6	328.00
CEDAR AVE/ SHIELDS AVE	1	4	176.00
BLACKSTONE AVE/ GARLAND AVE	0	1	6.00
BLACKSTONE AVE/ CORNELL AVE	0	4	28.00
CEDAR AVE/ FOUNTAIN WY	2	4	312.00
VALENTINE AVE/ WEBER AVE	0	1	10.00

PRELIMINARY PRIORITY SEGMENTS

Through a review of high collision segments along the HIN, 10 were identified as potential priority segments within the city. The priority segments are shown in **Figure 4**. The segments vary in length, averaging just under two miles per segment. As listed in **Table 7**, each identified roadway consisted of over 50 crashes per segment and over 50 crashes per mile. Of the preliminary segments, two are North/South corridors and all are adjacent to highways. The 10 identified segments EPDO scores were calculated and ranked from highest to lowest, as shown in **Table 8**. The recommended preliminary priority segments were reviewed for consistency with the recommended emphasis areas. Each segment's location and associated emphasis areas are summarized in **Table 9**.

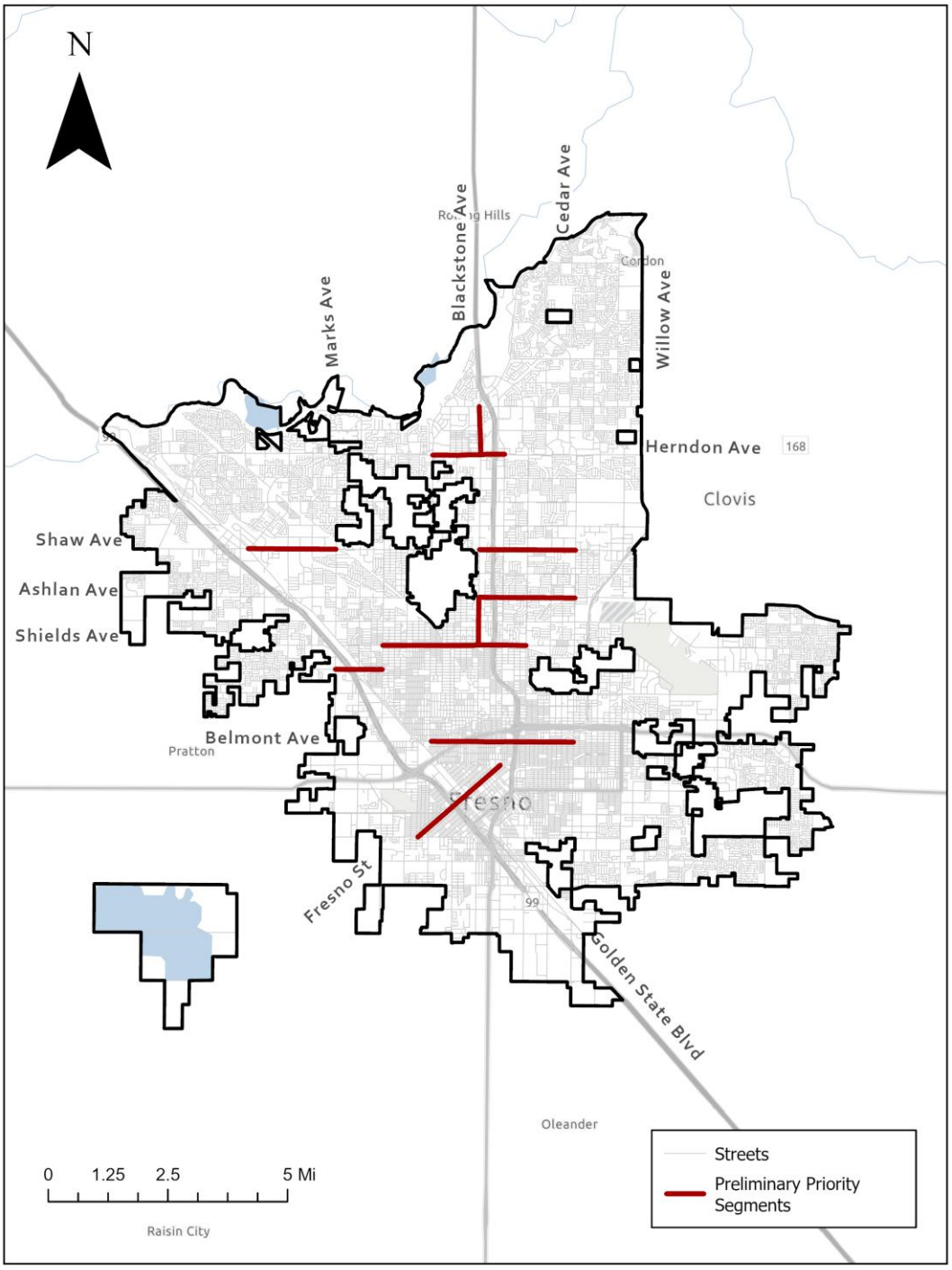

FIGURE 4. PRELIMINARY PRIORITY SEGMENT LOCATIONS

TABLE 7. PRELIMINARY PRIORITY SEGMENTS

STREET	FROM	TO	TOTAL # OF SEGMENT CRASHES	SEGMENT MILES	EPDO SCORE	EPDO PER MILE
BLACKSTONE AVENUE	Ashlan Avenue	Shields Avenue	83	1.00	3478	3478.00
SHAW AVENUE	Blackstone Avenue	Cedar Avenue	101	2.01	3442	1712.44
SHIELDS AVENUE	West Avenue	First Avenue	125	2.93	4894	1670.31
ASHLAN AVENUE	Blackstone Avenue	Cedar Avenue	82	2.01	3332	1657.71
CLINTON AVENUE	Marks Avenue	West Avenue	60	0.98	1596	1628.57
BELMONT AVENUE	Palm Avenue	Cedar Avenue	138	2.99	4592	1535.79
BLACKSTONE AVENUE	Nees Avenue	Herndon Avenue	53	1.01	1538	1522.77
SHAW AVENUE	Golden State Boulevard	Marks Avenue	100	1.84	2444	1328.26
FRESNO STREET	Cesar Chavez Boulevard	Divisadero Street	114	2.28	2680	1175.44
HERNDON AVENUE	Palm Avenue	Fresno Street	71	1.5	1510	1006.67

TABLE 8. PRELIMINARY PRIORITY SEGMENTS CRASH TOTALS

STREET	FROM	TO	KSI CRASHES	VISIBLE INJURY	COMPLAINT OF PAIN	TOTAL # OF CRASHES	EPDO SCORE
BLACKSTONE AVENUE	Ashlan Avenue	Shields Avenue	20	25	38	83	3478
SHAW AVENUE	Blackstone Avenue	Cedar Avenue	19	25	57	101	3442
SHIELDS AVENUE	West Avenue	First Avenue	28	28	69	125	4894
ASHLAN AVENUE	Blackstone Avenue	Cedar Avenue	19	26	37	82	3332
CLINTON AVENUE	Marks Avenue	West Avenue	8	21	31	60	1596
BELMONT AVENUE	Palm Avenue	Cedar Avenue	25	41	72	138	4592
BLACKSTONE AVENUE	Nees Avenue	Herndon Avenue	8	17	28	53	1538
SHAW AVENUE	Golden State Boulevard	Marks Avenue	12	29	59	100	2444
FRESNO STREET	Cesar Chavez Boulevard	Divisadero Street	13	31	70	114	2680
HERNDON AVENUE	Palm Avenue	Fresno Street	7	19	45	71	1510

TABLE 9. PRELIMINARY PRIORITY SEGMENTS EMPHASIS AREAS MATRIX

SEGMENT	PEDESTRIAN INVOLVED CRASHES	MOTORCYCLE INVOLVED CRASHES	BROADSIDE CRASHES	HIT OBJECT CRASHES	IMPAIRED DRIVING	UNSAFE SPEED	HIGH VOLUME, HIGH-SPEED ARTERIALS
BLACKSTONE AVE FROM ASHLAN AVE TO SHIELDS AVE	29	4	23	2	1	20	Y
SHAW AVE FROM BLACKSTONE AVE TO CEDAR AVE	16	7	32	6	8	23	Y
SHIELDS AVE FROM WEST AVE TO FIRST AVE	18	5	60	6	14	22	Y
ASHLAN AVE FROM BLACKSTONE AVE TO CEDAR AVE	11	7	33	8	6	17	Y
CLINTON AVE FROM MARKS AVE TO WEST AVE	8	2	24	1	5	21	N
BELMONT AVE FROM PALM AVE TO CEDAR AVE	32	7	60	4	14	15	N
BLACKSTONE AVE FROM NEES AVE TO HERNDON AVE	13	6	25	1	2	10	Y
SHAW AVE FROM GOLDEN STATE BLVD TO MARKS AVENUE	14	5	33	4	9	27	Y
FRESNO ST FROM CESAR CHAVEZ BLVD TO DIVISIADERO ST	21	2	68	2	6	9	Y
HERNDON AVE FROM PALM AVE TO FRESNO AVE	2	3	18	8	4	31	N

SUMMARY

The HIN makes up 14% of the total roadway network and consists of 81% of all crashes, and 89% of all fatal and severe injury crashes in the city. Based on findings of the preliminary locations, over 25% of crashes occurred on the priority intersections and segments. Approximately 15% of all broadside crashes occurred on the priority segments. Of all vehicle/pedestrian crashes, approximately 19% occurred on the identified segments. Unsafe speed crashes were 17% of all crashes on the priority segments. At priority intersections, of all vehicle/pedestrian intersection crashes in the city, 14% occurred at the identified intersections. Of all intersection crashes that were fatal or severe injuries, 16.5% occurred at the preliminary intersections.

NEXT STEPS

The preliminary priority intersections and segments were identified based on crash-related statistics, including frequency and severity of crashes. The preliminary intersections and segments will be refined into a top five list of each by incorporating additional prioritization factors that were identified through discussions with City staff and resulting from the community engagement process. Prioritization factors that may be considered include closeness to key destinations, such as schools, parks, community centers, transit stops, along with areas that have low vehicle ownership, concentrations of youth/senior populations, and disadvantaged communities. Overlaying maps of these areas with the HIN and preliminary priority locations will allow for a final recommended list of priorities.