

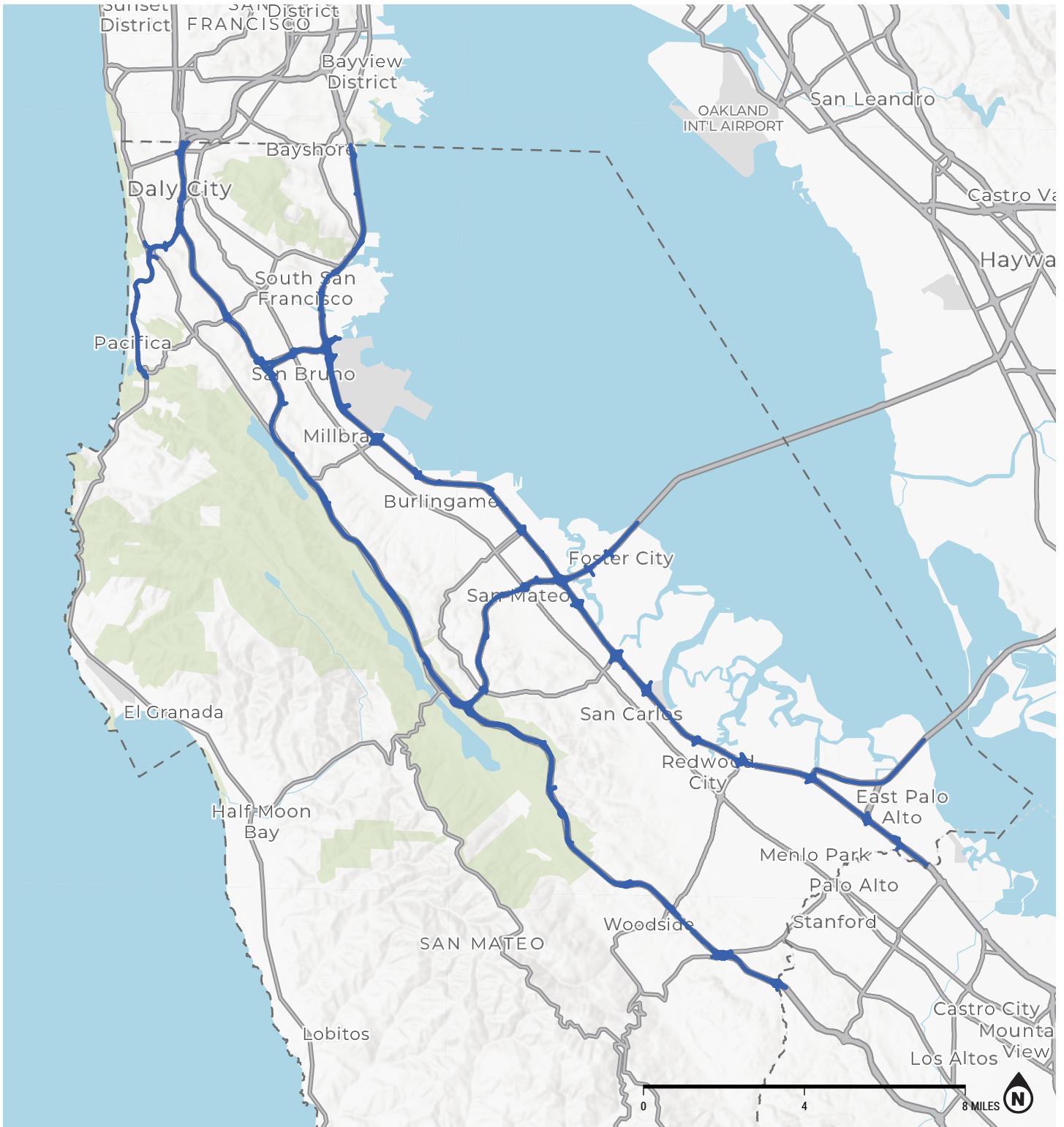


Youth-Based High Injury Network (HIN) Methodology

A HIN is designed to identify a manageable subset of the roadway network where the majority of severe collisions occur to aid prioritization of future safety infrastructure investments. This requires two data sources:

- **Road centerline network** representing all roads in San Mateo County, provided by [San Mateo County GIS Enterprise Database](#). **Map 1** shows the location of interstates, freeways, and other limited-access roads that were excluded from consideration in the network, including portions of Highway 101 in north San Mateo County. The rest of Highway 101 is included where it functions as an at-grade arterial that is accessible to active modes. Road segments were aggregated by name and split into roughly ½ mile corridors to reduce the amount of fragmentation in the final HIN.
- **Collision data** for all collisions occurring from 2014 through 2020¹ was downloaded from the [Transportation Injury Mapping System \(TIMs\)](#) which has all injury and higher severity collisions from SWITRS and filtered to remove collisions that occurred on roadways excluded from the network or outside of the county.

¹ 2020 data was provisional at the time of download.



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EXCLUDED ROADWAYS

ELEMENT

- Excluded Roadway
- San Mateo County

Map 1. Limited-access roadways that were excluded from consideration in the HIN.



The HIN synthesizes information about collision characteristics, crash patterns, and user types to identify roadway segments that account for the highest number of specific types of collisions. In this analysis, the HIN considers not only the intensity of all collisions, but it also provides specific emphasis on KSI collisions, those that involve youth, or those that involve an active mode. Specifically, the analysis assigns a higher weight to these collision types, as listed below:

- **Severe Collisions:** (10x weight) Any victim is killed or severely injured.
- **Youth-Involved Collisions:** (10x weight) Any victim is under the age of 18.
- **Active Modes-Involved Collisions:** (10x weight) Any victim is a bicyclist or pedestrian.

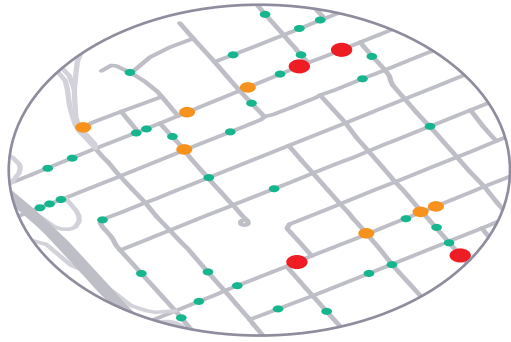
Through this weighting process, each segment in the road network is assigned a Combined Safety Priority Index (CSPI) score based on three underlying weighted collision densities, one for each collision type. The CSPI is produced from a weighted sum that combines severe (20%), youth-involved (40%) and active mode-involved (40%) collision densities to assign an index that indicates the number and weight of collisions occurring around a corridor.

To translate the CSPI to a HIN, corridors are added to the HIN starting with the highest CSPI score until 55 percent of severe collisions are captured on included roadways. This minimizes the total amount of roadway miles while maximizing the number of collisions of concern to be addressed.

Figure 1. This figure visually illustrates the general process to generate high injury networks.

Severity Weighting

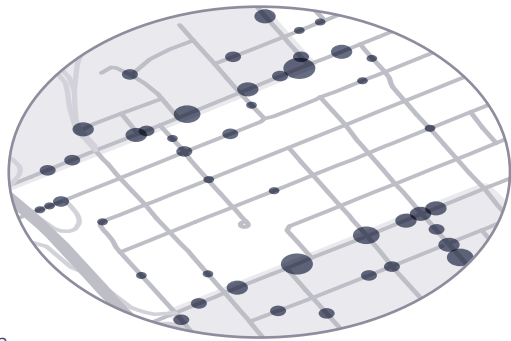
- Minor Injury
- Serious Injury
- Fatality



Aggregate Weighting

- Lowest
- Highest

Highly Vulnerable Areas

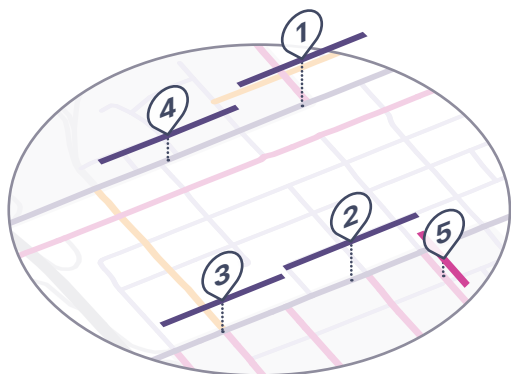


Severity Index

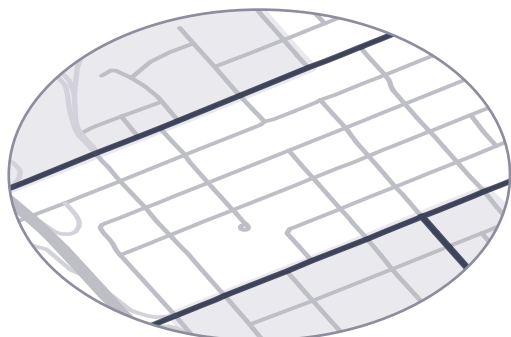
- Lowest
- Highest



1 Order Segment is Added to High Injury Network



— High Injury Network



Determining the High Injury Network

Severity Weighting

One goal of a High Injury Network (HIN) is to identify an improvable subset of a community's streets that address the majority of collisions where a victim is Killed or Severely Injured (KSI). To achieve this, KSI collisions are assigned higher scores so they have more "weight" relative to collisions with less tragic outcomes.

Other Considerations

These scores can also be modified to include other considerations such as whether collisions involve vulnerable road users (bicyclists and pedestrians) or occur in socially vulnerable communities. These factors can be directly incorporated into the weights associated with each collision.

Severity Index

After weights are developed, they are associated to the network, aggregated, and normalized so that we can understand the relative intensities of collisions of concern.*

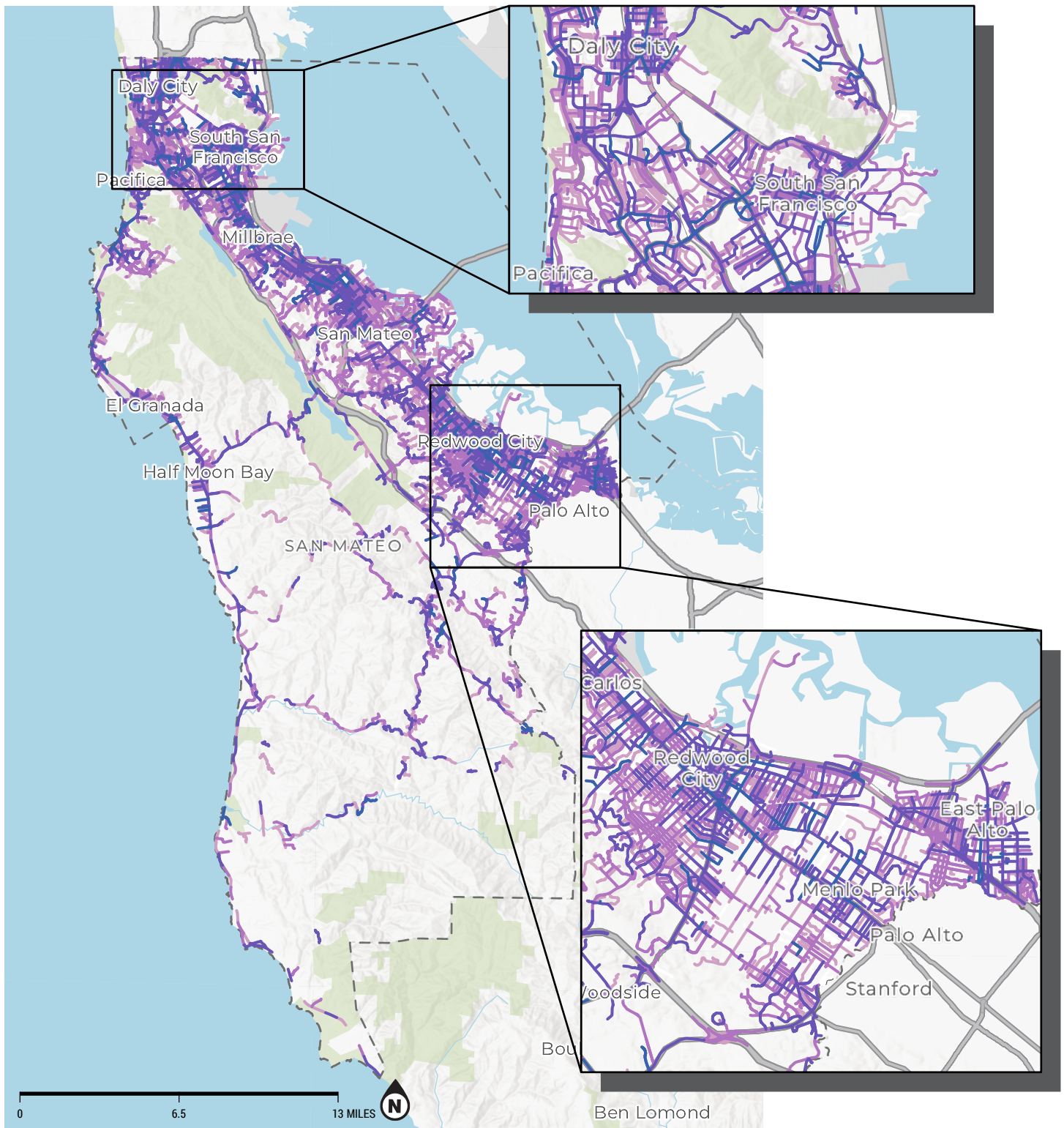
Accumulated Collisions by Severity Index

Once an index is created, we progressively add segments to the HIN in the order indicated by the Severity index. As more segments are added to the network look at KSI (or other collisions of interest) directly on the network, and track the percentage of collisions on the network relative to the percentage of its length.

High Injury Network

At some point, a final High Injury Network determination is found based on stakeholder feedback and a qualitative review of when each additional mile added to the HIN starts to see a decreasing rate of severe collisions being added.

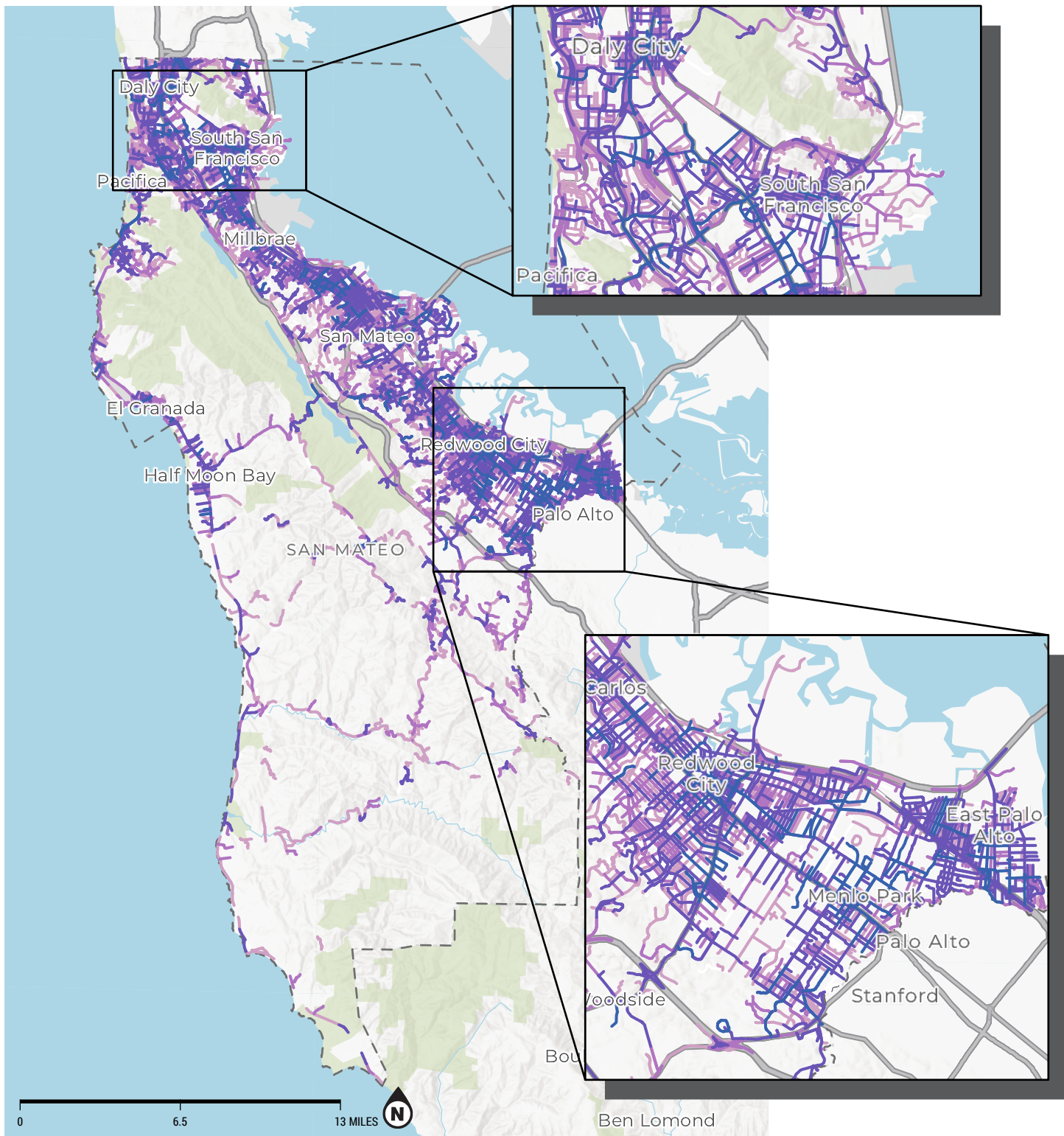
*There are many methods available develop a final index including kernel density estimation (euclidean or network based), rolling window analysis, or aggregations to a segment normalized by network miles.



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SEVERITY WEIGHTED
COLLISION DENSITY

- SEVERITY WEIGHTED
 COLLISION DENSITY
- High Collision Density
 - Low Collision Density

Map 2. Severity weighted collision density.



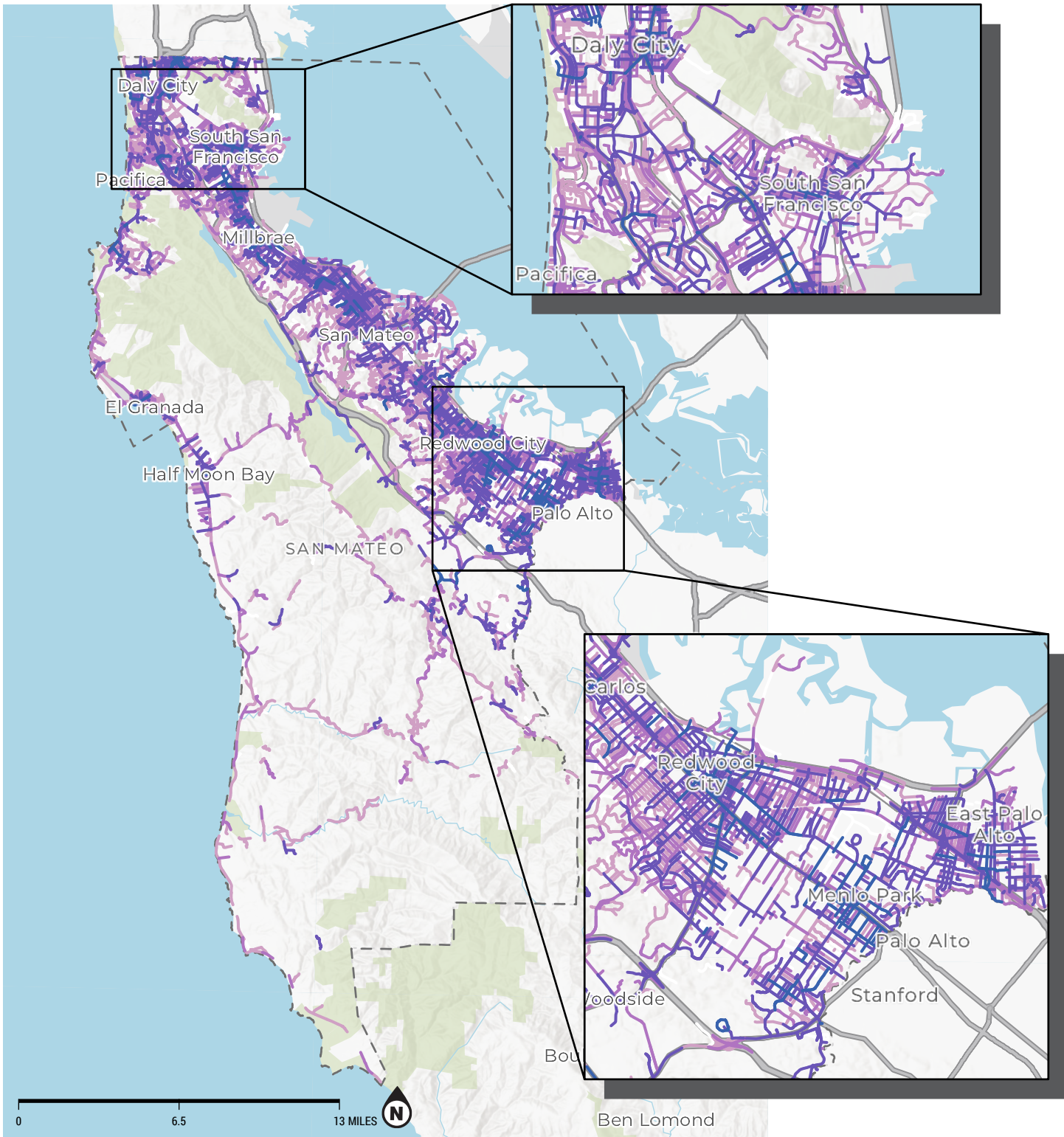
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- YOUTH WEIGHTED
COLLISION DENSITY
- High Collision Density
 - Low Collision Density

Map 3. Youth weighted collision density.





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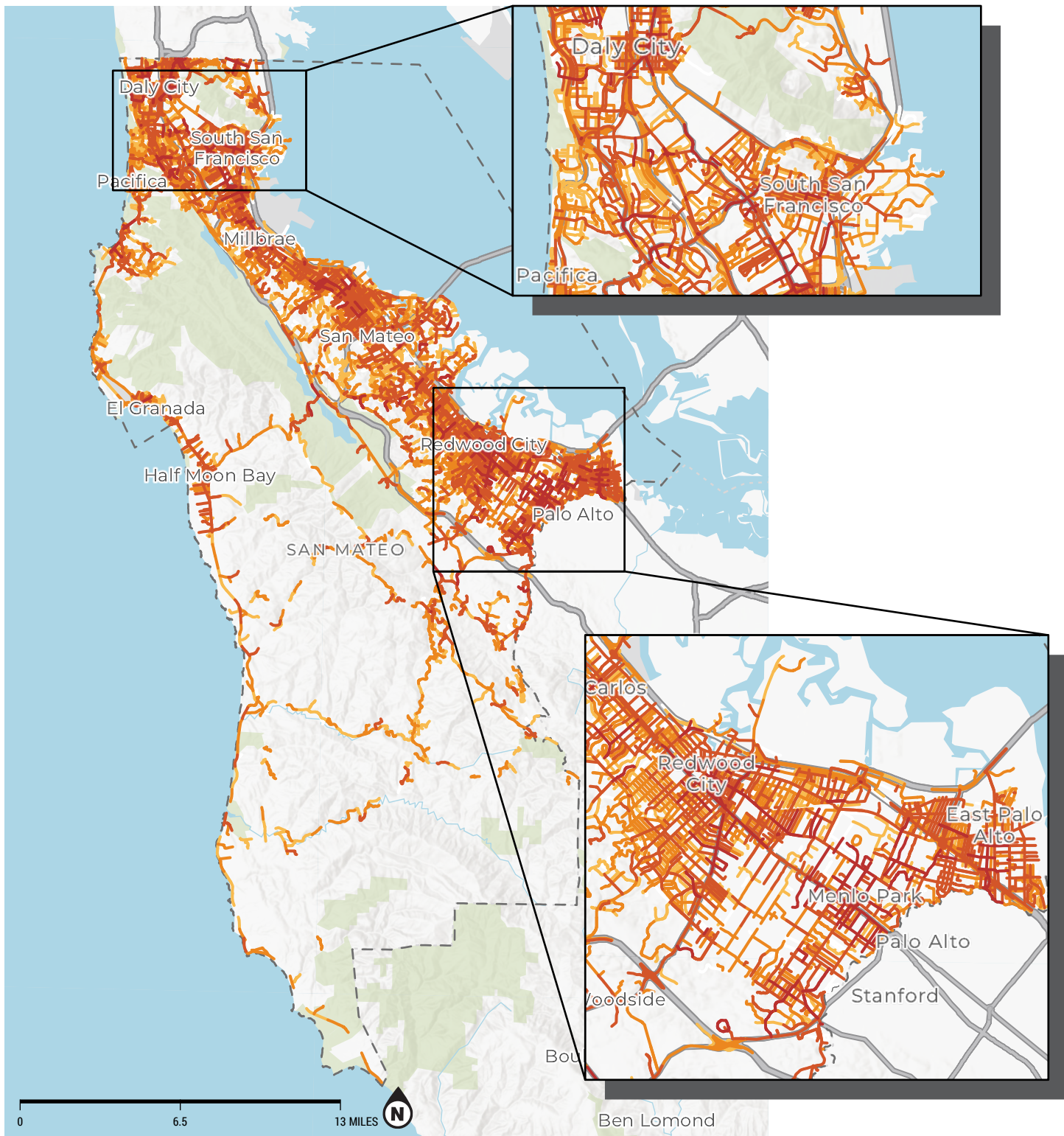
ACTIVE MODE WEIGHTED COLLISION DENSITY

ACTIVE MODE WEIGHTED COLLISION DENSITY

- High Collision Density
- Low Collision Density

Map 4. Active mode-weighted collision density





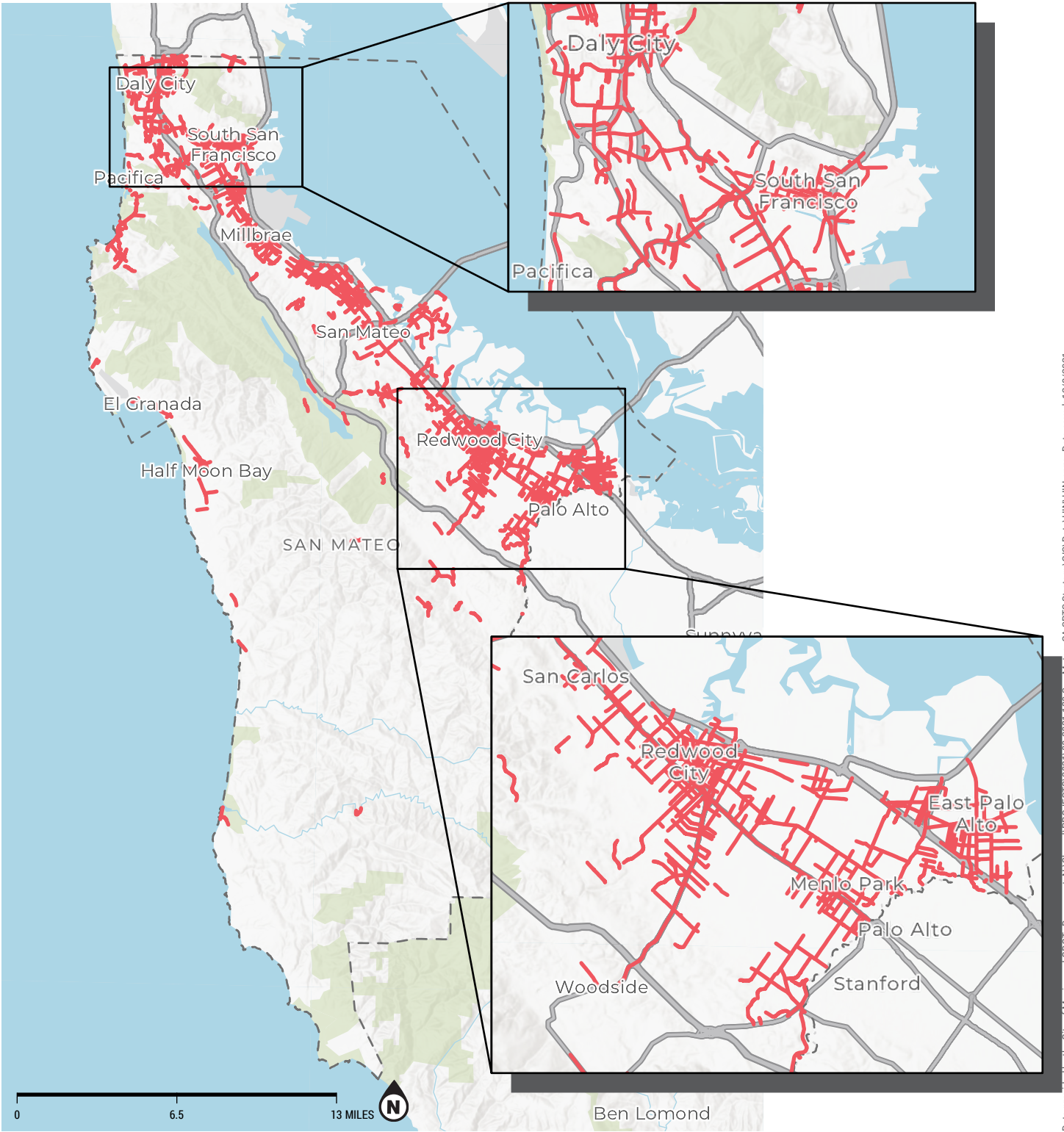
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COMBINED SAFETY
PRIORITY INDEX

- COMBINED SAFETY
 PRIORITY INDEX
- High Index Score
 -
 -
 - Low Index Score

Map 5. Combined Safety Priority Index.





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HIGH INJURY NETWORK

- ELEMENT**
- High Injury Network Corridor
 - San Mateo County

Map 6. San Mateo County HIN.

