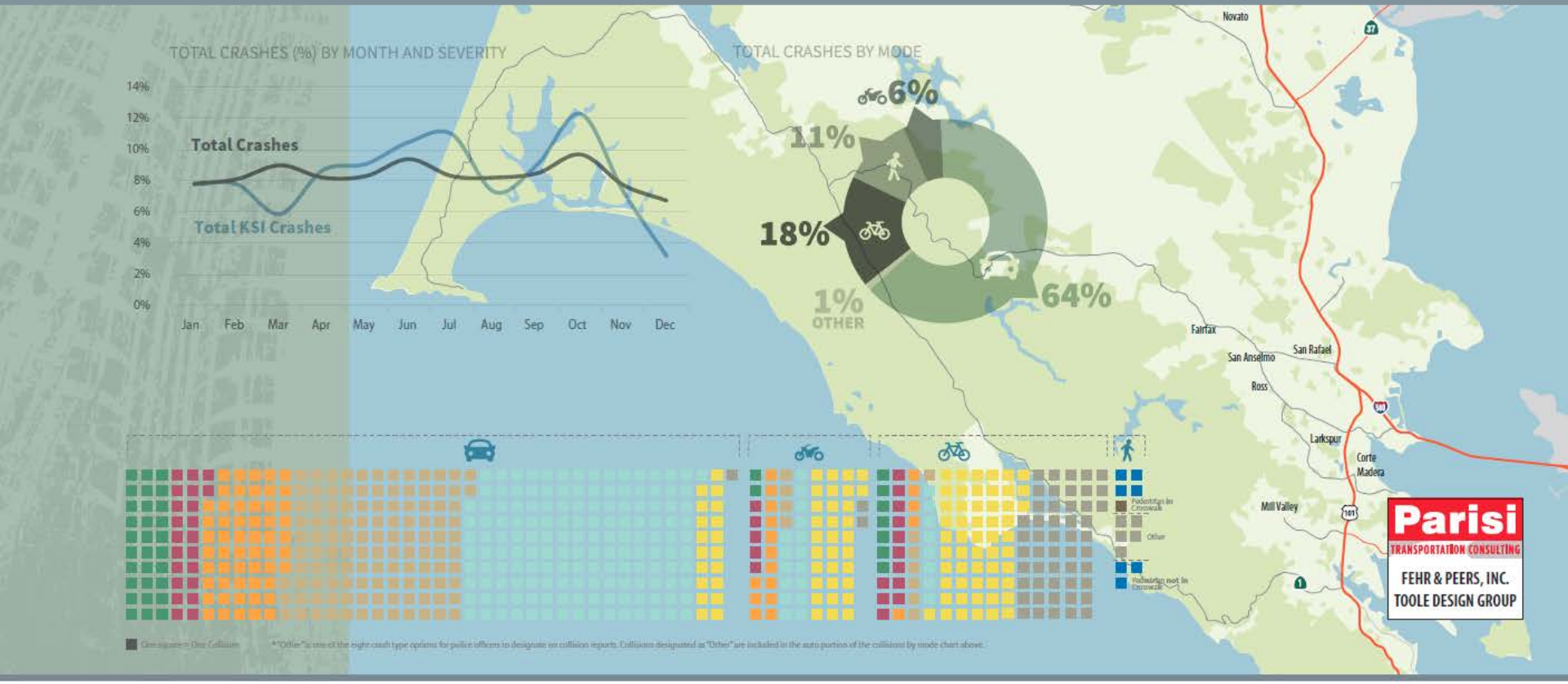
NOVEMBER 2018

2018 MARIN COUNTY TRAVEL SAFETY PLAN

Systemic Safety Analysis



COUNTY OF MARIN

THE TOWN OF CORTE MADERA

MILL VALLEY

CITY OF NOVATO CALIFORNIA

TOWN OF ROSS

THE TOWN OF SAN ANSELMO

SAN RAFAEL THE CITY WITH A VISION

CITY OF SAUSALITO MARIN CO. CALIF.

TAM Transportation Authority of Marin

Marin County Travel Safety Plan

- Setting
- Initial Action
- Characters
- Framework
- Plot
- Conflicts
- Ending
- Hook

SETTING

- North of San Francisco
- Population approximately 260,000
- Rural – Suburban
  - Low density
  - Slow Growth
- 11 cities and towns
  - Populations range 7,000 to 60,000


UNINCORPORATED
MARIN COUNTY
NOVATO
37
SAN PABLO
BAY
101
SAN ANSELMO
SAN RAFAEL
FAIRFAX
ROSS
LARKSPUR
CORTE MADERA
MILL VALLEY
TIBURON
BELVEDERE
SAUSALITO
1
N
HCN Study Corridor

Initial Action

- 44 killed or seriously injured (KSI) collisions each year
- Working collaboratively to improve safety
- Systemic Safety Analysis
- Travel Safety Plan

KSI = KILLED OR SEVERELY INJURED

Severely Injured refers to an injury, other than a fatal injury, that includes:

- Broken or fractured bones
- Dislocated or distorted limbs
- Severe lacerations
- Skull, spinal, chest or abdominal injuries that go beyond "Other Visible Injuries"
- Unconsciousness at or when taken from the collision scene
- Severe burns

CHARACTERS - ACTORS

- County of Marin
- Belvedere
- Corte Madera
- Fairfax
- Larkspur
- Mill Valley
- Novato
- Ross
- San Anselmo
- San Rafael
- Sausalito
- Tiburon
- TAM
- Marin General Hospital

FRAMEWORK
Directors - Editors

- MPWA
- TAC
- AGENCIES
  - CHP – Police
  - Fire
  - School
  - Elected official
  - Health
- BOARD OF SUPERVISORS

FRAMEWORK
Objectives

- Provide a proactive collision analysis
  - Arterial and collector roads (excluding State highways)
- Identify high risk locations and collision patterns
- Develop list of systemic countermeasures
  - Low-cost short-term
  - Higher-cost long-term

PLOT
Countywide Findings

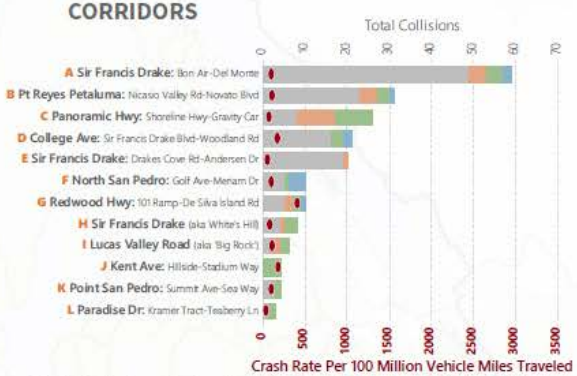
- 2,756 reported crashes in 5-year period (2012-2016)
- 8% of crashes (219) resulted in fatalities or severe injuries (“KSI”)
- 11% of crashes were with pedestrians; but 20% of KSI’s involved pedestrians
- 29% of crashes involved unsafe speed

KSI Crashes by Jurisdiction & Mode

PERCENTAGE SHARE OF KSI CRASHES BY JURISDICTION AND MODE

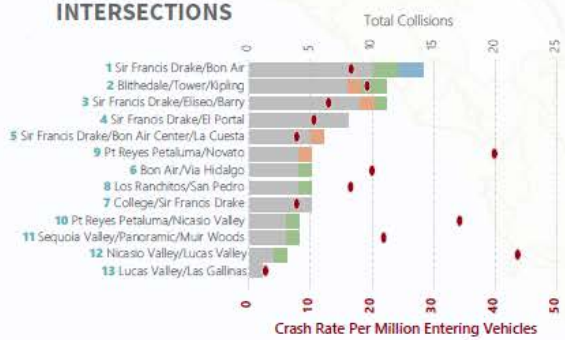
Jurisdiction	Total	Pedestrian/ Vehicle	Solo- Bicycle	Solo- Motorcycle	Solo- Motor Vehicle	Bicycle/ Vehicle	Motorcycle/ Vehicle	Multi- Vehicle	Other
Total Crashes (n=)	**219**	**44**	**28**	**25**	**29**	**38**	**22**	**30**	**3**
Unincorporated	46%	7%	71%	76%	79%	32%	55%	37%	-
San Rafael	22%	55%	7%	16%	-	24%	18%	17%	33%
Novato	15%	20%	11%	-	14%	16%	9%	27%	-
San Anselmo	4%	7%	4%	-	3%	5%	5%	3%	-
Sausalito	4%	2%	4%	-	-	8%	5%	7%	33%
Fairfax	4%	2%	-	-	-	11%	-	7%	33%
Corte Madera	2%	5%	-	4%	-	5%	-	-	-
Mill Valley	2%	-	-	4%	-	-	9%	3%	-
Larkspur	1%	2%	4%	-	3%	-	-	-	-
Ross	-	-	-	-	-	-	-	-	-
Tiburon	-	-	-	-	-	-	-	-	-
Belvedere	-	-	-	-	-	-	-	-	-

CORRIDORS



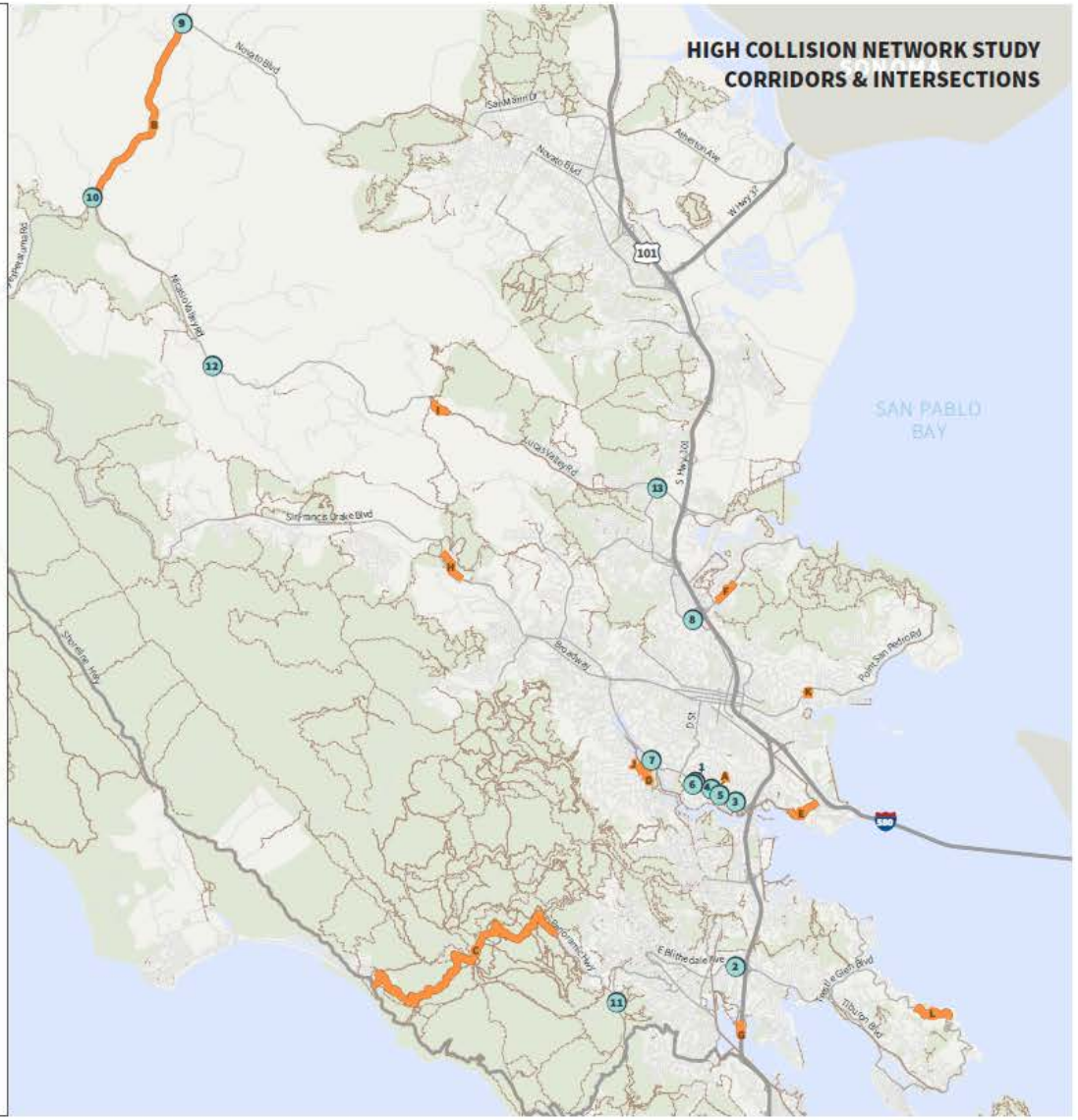
The bars in the above chart show the total number of collisions from 2012 to 2016 within the catchment area of each study corridor. The bars also illustrate, by color, a breakdown of those collisions by mode for each corridor. To normalize the collision data, the red dots in the chart show the crash rate per 100 million vehicle miles traveled for each study corridor.

INTERSECTIONS



The bars in the above chart show the total number of collisions from 2012 to 2016 within the catchment area of each study intersection. The bars also illustrate, by color, a breakdown of those collisions by mode for each intersection. To normalize the collision data, the red dots in the chart show the crash rate per million entering vehicles for each study intersection.

Motor Vehicle Collisions
Motorcycle Collisions
Bicycle Collisions
Pedestrian Collisions
Crash Rate



Jurisdictional Chapters

- Existing crash information by mode, type, and severity
- Roadways and intersections identified by “collision severity index”
- Local collision profiles, i.e., summary of crash patterns
- High Collision Network and crash comparisons
- Identified countermeasures
- Identified priority projects

This study developed crash profiles to highlight five of the top trends among collisions in Unincorporated Marin County. The collision profiles, shown at the bottom right, are based on an analysis of crash data and related environmental factors. Every profile highlights a crash pattern the study has identified as a priority concern.

The table below shows the proportion of crash types by mode. Data to the right provides a comparison of the percentage of Unincorporated Marin County collisions vs. total collisions across all of Marin jurisdictions by mode, collision type, select age and collision violation categories.

The following pages identify safety countermeasures for study corridors and intersections. These countermeasures make up a toolkit of safety interventions the Unincorporated Marin County can utilize to implement projects tailored to unique safety issues.

624 TOTAL COUNTY COLLISIONS

2,756 TOTAL MARIN COLLISIONS

2012-2016

CRASH TYPES BY MODE: RATIOS OF ALL COLLISIONS

				CRASH TYPES
8%	3%	5%		Head-On
6%	7%	8%		Sideswipe
14%	18%	3%		Broadside
29%	5%	5%		Rear End
38%	22%	6%		Hit Object
5%	43%	38%		Overturned
	3%	34%	38%	Other *
		1%	54%	Motorvehicle proceeding straight
				Motorvehicle making left turn
			8%	Motorvehicle making right turn
100%	100%	100%	100%	

** "Other" is one of the eight crash type options for police officers to designate on collision reports.*

UNINCORPORATED COUNTY VS. MARIN COLLISIONS - RELATIVE SHARE

	AGE		VIOLATION	
	Youth	Senior	DUI	Unsafe Speed
Unincorporated Marin	11.9%	19.7%	**14.9%**	**33.6%**
All Marin Collisions	13.7%	21.4%	10.5%	28.2%

	MODE				
	Auto	Motorcycle	Bicycle	Pedestrian	Other
Unincorporated Marin	63.1%	**11.2%**	**22.2%**	2.4%	**1.0%**
All Marin Collisions	63.8%	6.4%	18.1%	11.1%	0.6%

	COLLISION TYPE							
	Head-on	Sideswipe	Rear-end	Broadside	Hit Object	Overturned	Vehicle/ Pedestrian	Other
Unincorporated Marin	5.7%	6.2%	21.2%	13.0%	**25.4%**	**16.9%**	2.8%	8.8%
All Marin Collisions	7.1%	8.7%	24.5%	20.3%	11.8%	5.6%	11.0%	10.7%

LOCAL COLLISION PROFILES

BICYCLE COLLISIONS

California Office of Traffic Safety ranked Unincorporated Marin County 2nd of 58 California counties with high levels of bicycle collisions in 2015.

PEDESTRIAN COLLISIONS (OVER THE AGE OF 65)

California Office of Traffic Safety ranked Unincorporated Marin County 3rd of 58 California counties with high levels of pedestrian collisions involving seniors in 2015.

SPEED RELATED COLLISIONS

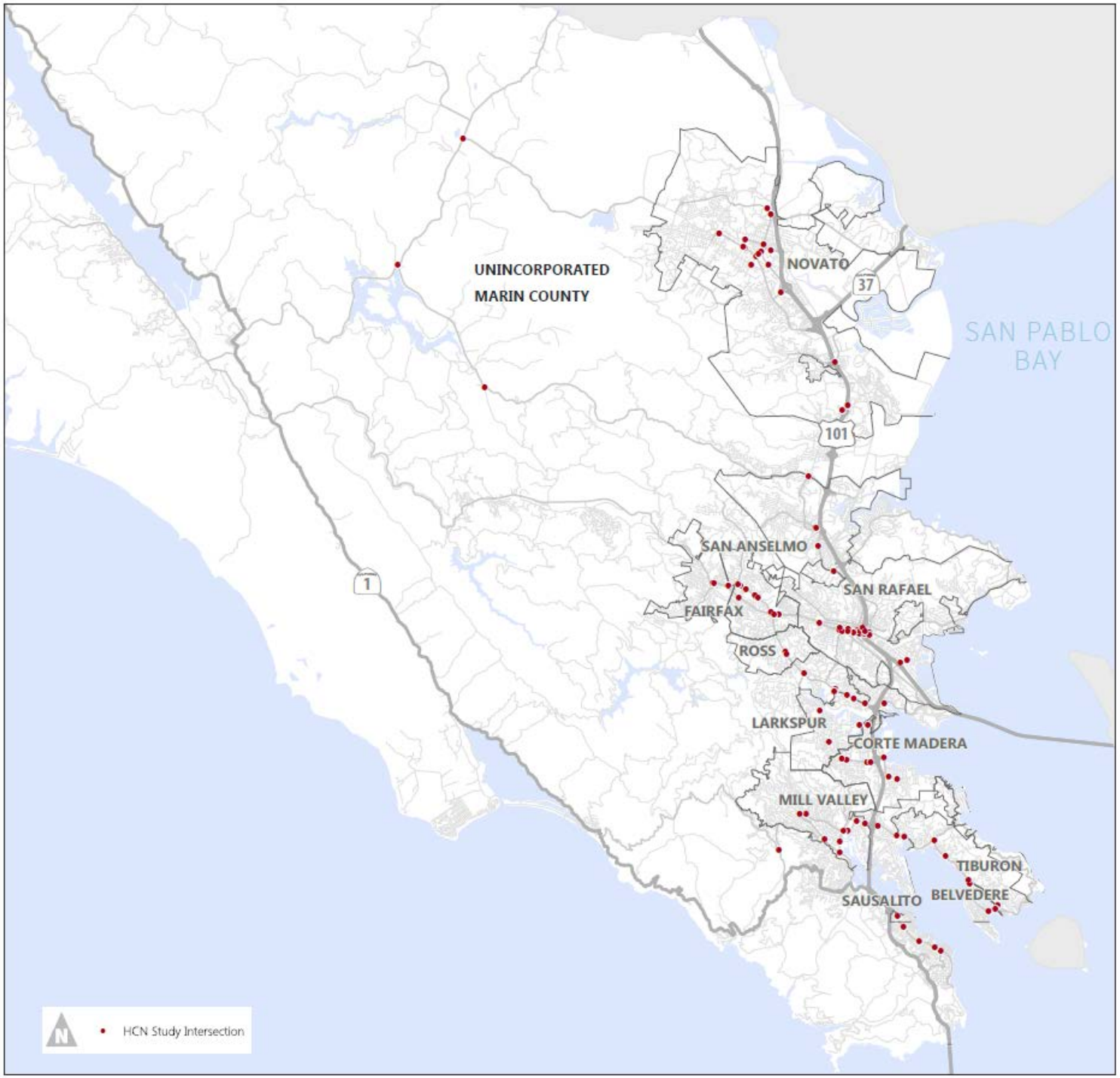
California Office of Traffic Safety ranked Unincorporated Marin County 1st of 58 California counties with high levels of speed related collisions in 2014.

MOTORCYCLE COLLISIONS

11% (69) of all collisions in Unincorporated Marin County involved motorcycles, almost double the county average.

HIT OBJECT COLLISIONS

25% (156) of all collisions in Unincorporated Marin County involved hitting fixed objects, more than double the county average.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HCN Study Intersection

Findings by Jurisdiction

- 35% of all crashes occurred in San Rafael
- 22% of all crashes occurred in Unincorporated Marin County
- 16% of crashes in Unincorporated Marin Counter resulted in fatalities or severe injuries
- The most common crash types in Unincorporated Marin County were solo-vehicle (23%), solo-bicycle (19%) and solo-motorcycle (19%)
- 55% of pedestrian KSI crashes occurred in San Rafael; 20% in Novato
- 26% of bicycle KSI crashes occurred in San Rafael

CHAPTER 14: UNINCORPORATED MARIN COUNTY

Unincorporated Marin County had an estimated population of 69,016 as of January 1, 2016, according to the California Department of Finance, representing approximately 26.2 percent of Marin County's total population. In the five-year period between 2012 and 2016, Unincorporated Marin County experienced a total of 624 reported crashes on local streets. One hundred of those crashes involved a person that was killed or severely injured, and of the 100, seven crashes involved fatalities.

Unincorporated Marin County's share of reported crashes on local streets, as a proportion of total crashes in Marin County, during the five-year period is summarized below.

- **22.6% of all county-wide crashes**
- **45.2% of county-wide crashes in which a person was killed or severely injured (KSI)**
- **1.3% of all fatal county-wide crashes**

For all crashes, Unincorporated Marin County's share of those crashes as a proportion of total crashes in Marin County was less than the jurisdiction's 26.2 percent share of the total county population. However, for crashes involving severe injuries or fatalities, Unincorporated Marin County's share of those crashes as a proportion of total crashes in Marin was greater than the jurisdiction's 26 percent of the total county population.

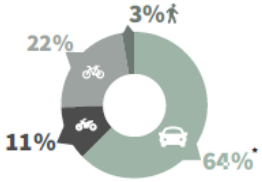
Panoramic Highway between Shoreline Highway and Gravity Car Road is one of unincorporated County's priority project locations. The corridor had 26 total reported collisions in a recent five-year period. Overturn incidents are the most common motorcycle collision type and hit objects are the most common motor vehicle collision type.

COLLISIONS 2012 TO 2016

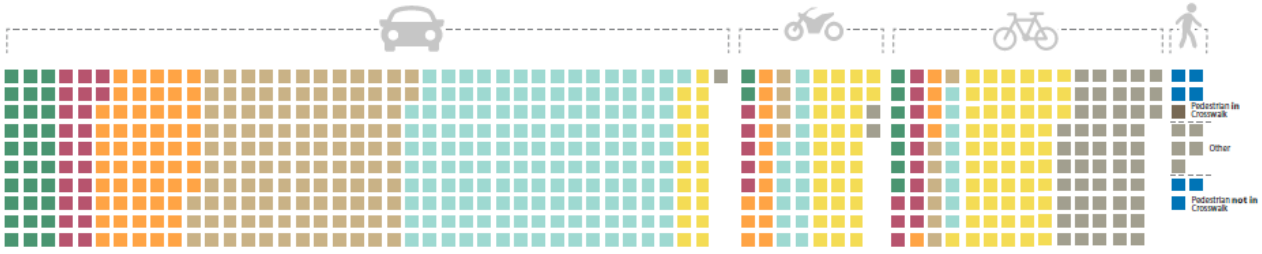
624 TOTAL COLLISIONS

16% KILLED OR SEVERELY INJURED [**1%** FATALITIES]

COLLISION BY MODE



COLLISION BY MODE



One square = One Collision

*"Other" is one of the eight crash type options for police officers to designate on collision reports. Collisions designated as "Other" are included in the auto portion of the collisions by mode chart above.

CRASH TYPES BY MODE: RATIOS OF ALL COLLISIONS

				CRASH TYPES
8%	3%	5%		Head-On
6%	7%	8%		Sideswipe
14%	18%	3%		Broadside
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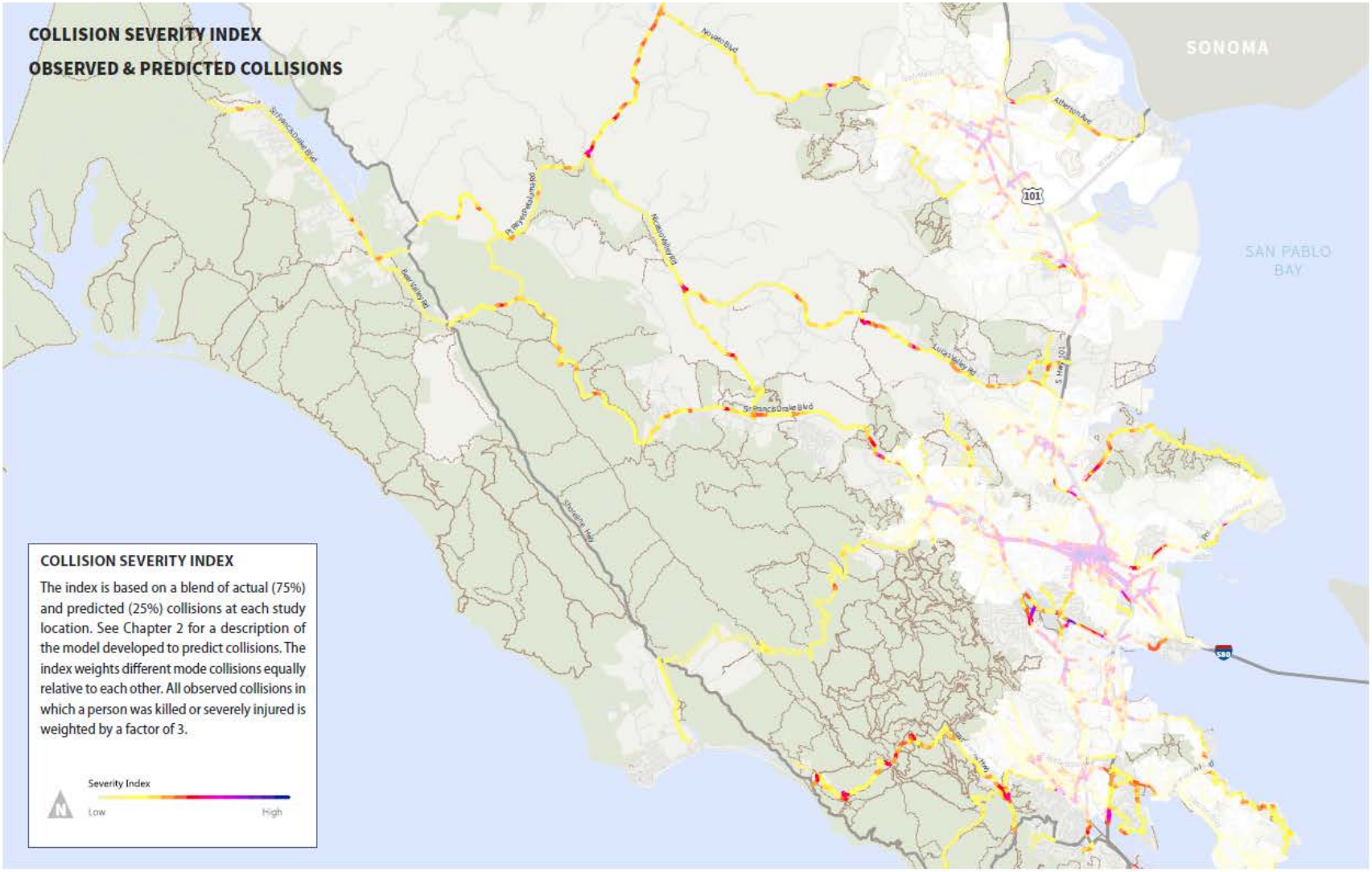
5%	43%	38%		Overturned
	3%	34%	38%	Other *
		1%	54%	Motorvehicle proceeding straight
				Motorvehicle making left turn
			8%	Motorvehicle making right turn
100%	100%	100%	100%	

Systemic Safety Assessment

- Crash prediction models were developed based on existing crash information, roadway characteristics, and multimodal volume data
- The models identify locations with current and future potential for high levels of crashes
- The High Collision Network – consisting of 68 roadway segments and 93 intersections – was further evaluated in the Travel Safety Plan


COLLISION SEVERITY INDEX
OBSERVED & PREDICTED COLLISIONS
SONOMA
SAN PABLO BAY
Nicasio Blvd
Atherton Ave
101
Sir Francis Drake Blvd
Lucas Valley Rd
Bolinas Rd
Nicasio Valley Rd
Shoreline Hwy
580
COLLISION SEVERITY INDEX
The index is based on a blend of actual (75%) and predicted (25%) collisions at each study location. See Chapter 2 for a description of the model developed to predict collisions. The index weights different mode collisions equally relative to each other. All observed collisions in which a person was killed or severely injured is weighted by a factor of 3.
Severity Index
Low
High

Measures to Improve Safety

- “Countermeasures” were considered for all High Collision Network roadway segments and intersections
- Countermeasure selection considered crash types, “crash reduction factor”, expected life, federal funding eligibility, and systemic approach opportunity

POTENTIAL COUNTERMEASURES FOR HIGH COLLISIONS NETWORK STUDY CORRIDORS AND INTERSECTIONS

	ID	NAME	COLLISIONS: MOTOR VEHICLE	MOTORCYCLE	BICYCLE	PEDESTRIAN	TOTAL	POTENTIAL HSIP COUNTERMEASURE	NON-HSIP COUNTERMEASURE
CORRIDORS	I	Lucas Valley Road (aka 'Big Rock')	2	2	2	0	6	R4, Install guardrail (where applicable) R16, Widen shoulder R30, Install dynamic/variable speed warning signs (for downhill sections)	NH7, Install 'Bikes May Use Full Lane' sign (for downhill segment)
	J	Kent Avenue: Hillside to Stadium Way	0	0	4	0	4	R36, Install bike lanes	NH5, Install wayfinding (install bicycle route signs and designate corridor as a bike route)
	K	Paradise Dr: Kramer Tract to Teaberry Lane	1	0	2	0	4	R4, Install guardrail R16, Widen shoulder R27, Install chevron signs on horizontal curves	NH7, Install 'Bikes May Use Full Lane' sign
	L	Point San Pedro: Summit Avenue to Sea Way	3	0	1	0	4	NS18, Install pedestrian crossing at uncontrolled locations with advanced safety feature (install RRFB or Flashing LED beacons)	NH7, Install 'Bikes May Use Full Lane' sign
INTERSECTIONS	1	Sir Francis Drake and Bon Air	10	0	2	2	14	S2, Improve signal hardware S3, Improve signal timing and detection S19, Check for and/or install pedestrian countdown signal heads S20, Pedestrian crossing with enhanced safety features (ADA curb ramps, tighten curb radii) NS6, Upgrade intersection pavement markings (high visibility crosswalk) NH2, Remove slip lane(s) NH8, Square up intersection	
	2	Blithedale and Tower and Kipling	8	1	2	0	11	S3, Improve signal timing and detection S20, Install pedestrian crossing (with advanced safety feature: such as curb extensions & directional ADA pedestrian ramps)	
	3	Sir Francis Drake and Ellseo and Barry	9	1	1	0	11	S2, Improve signal hardware S3, Improve signal timing and detection (to help reduce congestion) S19, Check for and/or install pedestrian countdown signal heads S20, Pedestrian crossing with enhanced safety features NS6, Upgrade intersection pavement markings (high visibility crosswalk) NS16, Install raised median / refuge island	NH2, Remove slip lane(s) NH8, Square up intersection

PRIORITY PROJECTS

Safety improvements identified for the following study locations were identified as priority projects based on an evaluation of collision data and consultation with jurisdiction staff.

Panoramic Highway: Shoreline Highway to Gravity Car | Corridor

Panoramic Highway looking west

EXISTING CONDITIONS:

Panoramic Highway is a two-lane arterial and a popular bicyclist and motorcyclist route. The corridor had 26 total reported collisions in five years, including five KSI bicycle collisions, four KSI motorcycle collisions, and four KSI motor vehicle collisions. Overturn incidents are the most common motorcycle collision type and hit objects are the most common motor vehicle collision type.

POTENTIAL IMPROVEMENTS:

Road Improvements- Roadway improvements may include widening the shoulder and installing designated turn outs where feasible, installing curve advanced warning signs, guard rails and dynamic variable speed warning signs

Bicycle Facility Improvements- Installing a wider shoulder, where feasible, could give cyclists and motorists more room to maneuver. Installing "Bikes may use full lane" signs clarifies where bicyclists are expected to ride and reminds motorists to expect bicyclists on the road. Other signage to alert motorists to bicyclist presence could also be beneficial.

College Avenue: Sir Francis Drake Boulevard to Woodland Road | Corridor

College Avenue from Sir Francis Drake Boulevard, looking west

EXISTING CONDITIONS:

College Avenue is a two-lane arterial that services the College of Marin and AE Kent Middle School. The corridor had 21 total reported collisions in five years, including one KSI pedestrian collision. Rear-end incidents are the most common motor vehicle collision.

POTENTIAL IMPROVEMENTS:

Improve Intersection- The intersection of Woodland Road and College Avenue may benefit from installation of a traffic signal or roundabout. Signalization would require a warrant study to determine if this countermeasure is appropriate

Pedestrian Crossing Improvements- A number of pedestrian crossing improvements could be considered along this corridor including some of the following: high visibility crosswalks, RRFBs, pedestrian signals or HAWKs, advanced stop bars, bulb outs, tightening curb radius, directional curb ramps and leading pedestrian intervals. These could improve pedestrian crossings by shortening crossing distances and emphasize pedestrian's presence

Bicycle Facility Improvements- Upgrading bike lanes to green bike lanes, installing green paint through conflict zones and adding bike boxes could increase the visibility of bicyclists.

North San Pedro Road: Golf Avenue to Meriam Dr | Corridor

North San Pedro looking east

EXISTING CONDITIONS:

North San Pedro Road is two-lane arterial road with a median lane that connects to Highway 101. Major destinations along this road are Venetia Valley School and the Marin County Civic Center. North San Pedro Road is also a designated bicycle route. The corridor had 10 total reported collisions in five years, including two KSI pedestrian collisions. Rear-end incidents are the most common motor vehicle collision type.

POTENTIAL IMPROVEMENTS:

Roadway Improvements- Consider installing a two-way left turn lane where applicable.

Pedestrian Crossing Improvements- A number of pedestrian crossing improvements could be considered along this corridor including some of the following: high visibility crosswalks, RRFBs, advanced stop bars, bulb outs, tightening curb radius and directional curb ramps. These could improve pedestrian crossings by shortening crossing distances and emphasize pedestrian's presence.

Bicycle Facility Improvements- Installing "Bikes may use full lane" signs clarifies where bicyclists are expected to ride and reminds motorists to expect bicyclists on the road.

UNEXPECTED ENDING
Marin County vs. Other CA Counties

Marin County has high collision rates for:

- Bicycles: 2nd highest collision rate
- Pedestrians over 65 years old: 3rd highest collision rate
- All pedestrians: 10th highest collision rate
- Speeding-related: 11th highest collision rate

Marin County vs. Other CA Counties

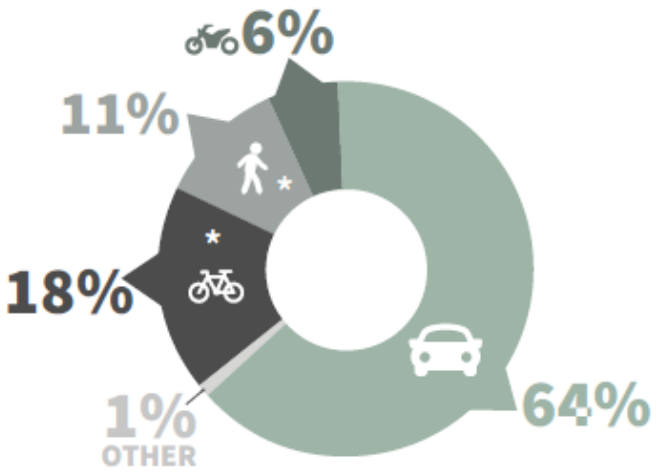
Marin County has low collision rates for:

- Alcohol-related: 56th lowest collision rate
- Night-time collisions: 55th lowest collision rate
- Pedestrians younger than 15: 46th lowest collision rate

Marin County ranks 48th in total fatal and injury collisions

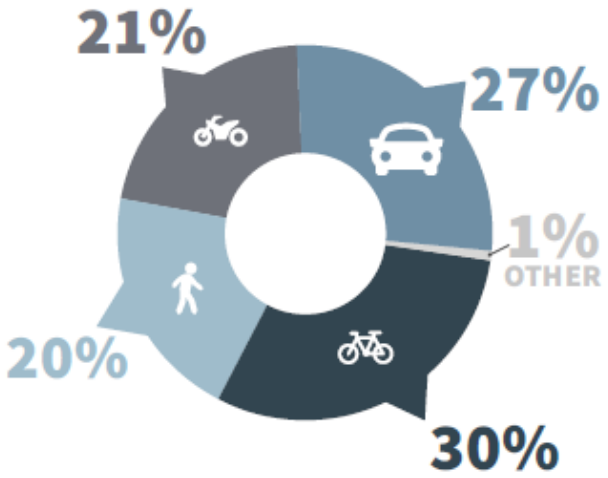
Countywide Crashes by Mode

TOTAL CRASHES BY MODE



* Most collisions with pedestrians and bicycles involved an automobile

KSI CRASHES BY MODE



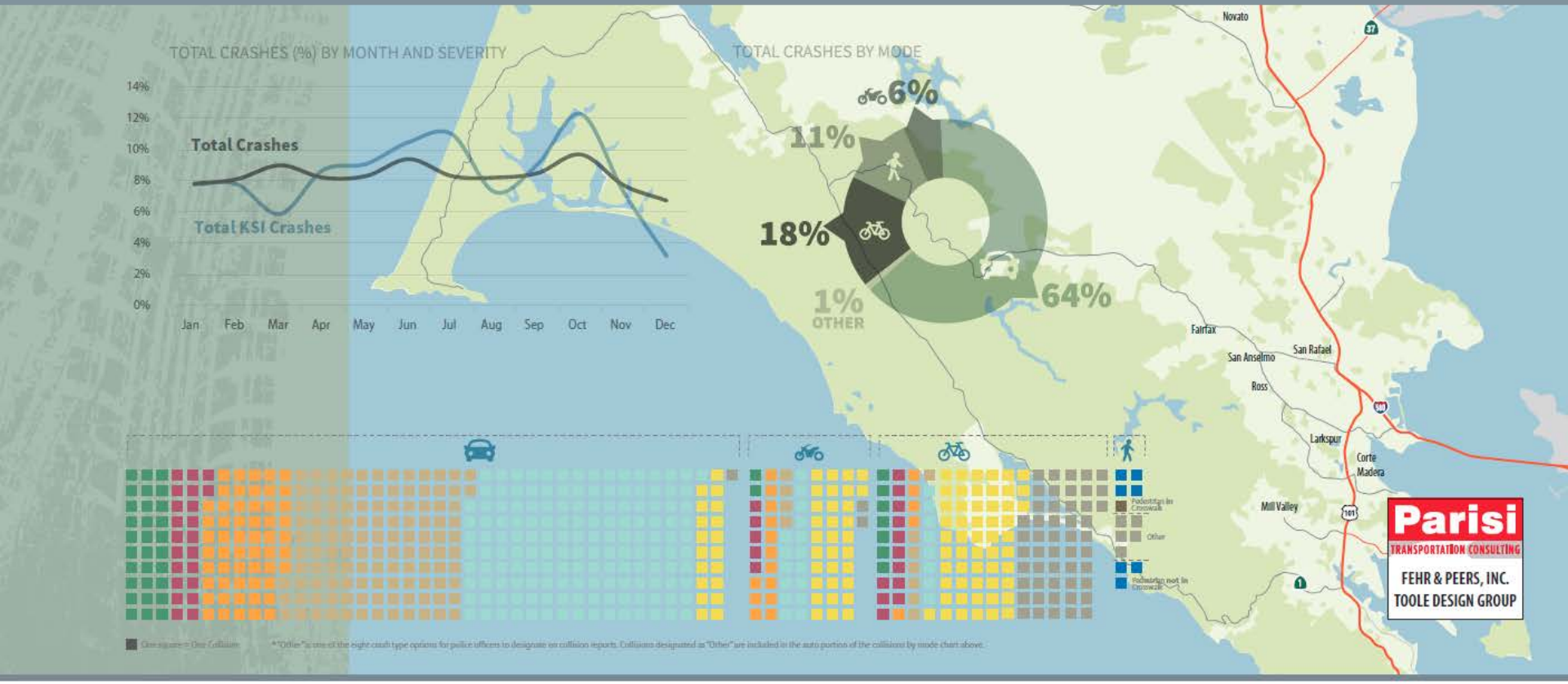
HOOK
Next Steps

- Apply for road safety improvement grants
  - 3 HSIP applications prepared and awarded
- Continue to work collaboratively
- Identify regionwide goals
- Identify individual goals for Unincorporated County
- Develop work plan and guiding policies

NOVEMBER 2018

2018 MARIN COUNTY TRAVEL SAFETY PLAN

Systemic Safety Analysis



COUNTY OF MARIN

THE TOWN OF CORTE MADERA

MILL VALLEY

CITY OF NOVATO CALIFORNIA

TOWN OF ROSS

THE TOWN OF SAN ANSELMO

SAN RAFAEL THE CITY WITH A VISION

CITY OF SAUSALITO MARIN CO. CALIF.

TAM Transportation Authority of Marin

WEBLINK

- https://www.marincounty.org/depts/pw/divisions/transportation/transportation/roadway-safety-review