Citywide Pedestrian Collision Analysis

City of San Diego Comprehensive Pedestrian Safety Study

Task 5 Report

DRAFT

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1.0 Introduction

This report summarizes trends and issues related to pedestrian collisions in the City of San Diego. The document serves as background to a larger effort to update the City's policies and guidelines related to pedestrian crossing treatments and safety in general. Pedestrian collision data from a 13 year period, between 1999 and 2012, was collected in conjunction with information about San Diego neighborhoods and roadway environments where the collisions occurred. Much of the analysis presented in this report relied upon the most recent five years of collision data, between 2008 and 2012. Pedestrian collision causes are also summarized to aide in the development of policies that will support the citywide reduction of pedestrian collisions. This introductory chapter presents a review of key findings and a discussion of data sources and analysis methods.

1.1 Key Findings

Several interesting findings are uncovered in this report related to the distribution of pedestrian collisions across San Diego neighborhoods, the associated roadway environments, and pedestrian collision causes.

Neighborhood characteristics such as population density, employment density, and median household income have been shown in previous research to be associated with pedestrian collisions[1,2]. The analysis of the San Diego pedestrian collision data also revealed significantly higher rates of pedestrian collisions in the denser and lower income areas of the city.

Table 1-1 shows the number of pedestrian collisions per square mile across the City of San Diego by three key neighborhood characteristics, including population density, employment density and median household income.

As shown in Table 1-1, there are clear associations between pedestrian collision rates and population density, with the highest density census blocks showing pedestrian collision rates almost twenty times higher than the lowest density census blocks (30.6 versus 1.5 collisions per square mile). Likewise, the highest employment density census blocks show pedestrian collision rates that are eleven times higher than the lowest employment density blocks (54.9 versus 5 collisions per square mile). Finally, low income census tracts show pedestrian collision rates ten times higher than high income census tracts (1.5 versus 15.4 collisions per square mile).

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[1] The Relationship of Pedestrian Injuries to Socioeconomic Characteristics in a Large Southern California County Bharath Chakravarthy, Craig L. Anderson, John Ludlow, Shahram Lotfipour, Federico E. Vaca Traffic Injury Prevention Vol. 11, Iss. 5, 2010
[2] City of Chicago 2011 Pedestrian Crash Analysis, Technical Report, Chicago Department of Transportation, 2011

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Table 1-1: Pedestrian Collision Density by Neighborhood Characteristics (2008 to 2012)

Value Range*		City of San Diego Square Miles	Percent Area of City of San Diego	Number of Collisions	Collisions per Square Mile
2010 Population Density by Census Block					
High	>20.7 persons per acre	24.8	7.5%	763	30.6
Medium	9.6 to 20.7	48.5	14.6%	487	10.0
Low	<9.6	258.7	77.9%	1,033	1.5
2009 Employment Density by Census Block					
High	>37.7 employment per acre	4.9	1.5%	273	54.9
Medium	11.9 to 37.7	19.3	5.8%	424	21.8
Low	<11.9	307.7	92.7%	1,598	5.0
2010 Median Household Income by Census Tract					
High	>$78,242	160.0	48.1%	241	1.5
Medium	$54,081 to $78,242	86.5	26.1%	722	8.3
Low	<$54,081	85.5	25.8%	1,318	15.4

Source: City of San Diego (2013); US Census (2010); Chen Ryan Associates, April 2014

Note:

* Value ranges for each neigbhorhood factor are defined in order to represent one-third of the region's population. In other words, one-third of the region's population falls within census blocks with population density over 20.7 persons per acre; one-third of the city's population live in census blocks with population density ranging from 9.6 to 20.7 persons per acre; and one-third of the regional population live in census blocks with population densities less than 9.6 persons per acre.

To simplify the assessment of pedestrian collisions in relation to roadway characteristics, roadway environments were categorized as "fast" or "slow," and as having "many lanes" or "few lanes". Fast roadways were defined as having posted speed limits of 35 miles per hour (mph) or greater; and slow roadways were defined as having posted speed limits of 30 mph or less. Roadways with 4 or more travel lanes were defined as "many lanes" and those with 3 or fewer lanes were defined as "few lanes".

A comparable percentage of pedestrian collisions occurred along roadways categorized as "fast & many lanes" as compared with roadways defined as "slow and few lanes". **Table 1-2** shows the frequency of collisions for the four roadway types (in terms of posted speeds and width) defined for the purposes of this study.

Table 1-2: Pedestrian Collision Frequency by Roadway Type (2008 to 2012)

Roadway Type	Speed Limit	Number of Lanes	Number of Collisions	Percent of Total Collisions
Fast & Many Lanes	≥ 35 mph	≥ 4 lanes	948	41.5%
Slow & Few Lanes	≤ 30 mph	≤3 lanes	906	39.7%
Fast & Few Lanes	≥ 35 mph	≤3 lanes	217	9.5%
Slow & Many Lanes	≤ 30 mph	≥ 4 lanes	212	9.3%
			2,283	100%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

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As shown, over 41 percent of total pedestrian collisions between 2008 and 2012 occurred along "fast & many lanes" roadways, while almost 40 percent occurred along "slow & few lanes" roadways. These findings will be further explored in the subsequent chapters.

Table 1-3 summarizes the frequency of pedestrian collisions by party-at-fault and location in the roadway. Party-at-fault is defined as being either the driver's or the pedestrian's fault. Of the 2,283 pedestrian collisions occuring in the City of San Diego between 2008 and 2012, about 48 percent were deemed as the driver's fault, while about 33 percent were the pedestrian's fault. Fault could not be assigned to about 20 percent of pedestrian collisions.

In relation to the location of pedestrian collisions within the roadway, Table 1-3 shows that almost 40 percent of total pedestrian collisions occurred at signalized intersections during the period from 2008 to 2012. About 37 percent occurred at mid-block locations, 21 percent at unsignalized locations, and 3 percent at driveways or alleys.

The frequency patterns associated with roadway location change, however, when the party-at-fault is considered. Approximately 60 percent of all driver-at-fault collisions occurred at signalized locations; while for pedestrian-at-fault, a majority occurred at mid-block locations (about 60 percent).

Table 1-3: Pedestrian Collision Frequency by Party-at-Fault and Location in the Roadway
(2008 to 2012)

Location in the Roadway	Total Pedestrian Collisions[1]		Driver-At-Fault		Pedestrian-At-Fault	
	Number of Collisions	Percent	Number of Collisions	Percent	Number of Collisions	Percent
At Signalized Intersection	906	39.7%	643	58.8%	197	26.5%
At Mid-Block Location	836	36.6%	118	10.8%	447	60.2%
At Unsignalized Intersection	470	20.6%	312	28.5%	92	12.4%
At Driveway/Alley/Private Property	71	3.1%	20	1.9%	7	0.9%
	2,283	100%	1,093	100%	743	100%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Notes:
1. Driver-at-fault collisions and pedestrian-at-fault collisions do not sum up to the number reported in the first column (total number of pedestrian collisions) because 447 collisions were not assigned a "fault".

Table 1-4 summarizes collision cause for all pedestrian collisions that were assigned a party-at-fault. About 447 of 2,283 collisions were not assigned fault.

Table 1-4: Pedestrian Collisions by Cause Category - Ranked by Percent of Total (2008 to 2012)

Cause Category	Party-at-Fault	Number of Collisions	Percent of Total
Improper Turn-Related	Driver	697	38.0%
Improper Mid-Block Crossing Attempt	Pedestrian	358	19.5%
Improper Intersection Crossing Attempt	Pedestrian	197	10.7%
Improper Start	Driver	140	7.6%
Other – Driver at Fault	Driver	120	6.5%
Pedestrian in Roadway *(not paying attention to traffic)*	Pedestrian	86	4.7%
Failure to Stop-Related	Driver	82	4.5%
Speed-Related	Driver	54	2.9%
Other – Pedestrian at Fault	Pedestrian	54	2.9%
Pedestrian in Roadway *(not attempting to cross)*	Pedestrian	48	2.6%
		1,836	100%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, the most frequent collision cause is an "improper turn" where the driver is at fault (38 percent of collisions). The second most frequent pedestrian collision cause is an "improper mid-block crossing" where the pedestrian is at fault (19.5 percent of collisions), followed by "improper intersection crossing attempt" where the pedestrian is at fault (10.7 percent).

Table 1-5 summarizes pedestrian collisions by cause category for driver-at-fault and pedestrian-at-fault collisions, separately. As shown, approximately 63.8 percent of driver-at-fault pedestrian collisions are caused by impropers turns. Over 48 percent of pedestrian-at-fault collisions are caused by the pedestrians attempting to improperly cross at mid-block locations.

Table 1-5: Pedestrian Collisions by Party-at-Fault and Cause Category (2008 to 2012)

Collision Cause Category	Number of Collisions	Percent of All Collisions by Fault Category
Total Driver-At-Fault	**1,093**	**100%**
Improper Turn-Related	697	63.8%
Improper Start	140	12.8%
Other	120	11.0%
Failure to Stop-Related	82	7.5%
Speed-Related	54	4.9%
Total Pedestrian-At-Fault	**743**	**100%**
Improper Mid-Block Crossing Attempt	358	48.2%
Improper Intersection Crossing Attempt	197	26.5%
Pedestrian in Roadway (not paying attention to traffic)	86	11.6%
Other	54	7.3%
Pedestrian in Roadway (not attempting to cross)	48	6.5%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

1.2   Data and Analysis Methods

The data used in this study was obtained from the City of San Diego and contains all reported pedestrian collisions occurring in the City between 1999 and 2012. The data was provided in an excel format and then geocoded in a geographic information systems (GIS) shapefile format. The excel collision file includes geographic coordinates for each of the collisions, along with their associated location within the roadway (intersection or mid-block), time of day information, the actions and movements of the parties involved in the collisions, and the key collision causes. This study primarily focuses on findings over the past five years of collisions (2008-2012).

Some additional data refinement was necessary to categorize the collisions by location type (signalized intersection, unsignalized intersection, mid-block, or alley/driveway/private property) and by roadway environment (fast or slow, few lanes or many lanes). These location types were categorized by examining collisions in relation to the Roads_All shapefile and the Traffic Signal point shapefile maintained by the City of San Diego and accessed via SanGIS. In terms of roadway environment, the collisions were manually attributed, based upon their respective locations, with posted speed limits and number of lanes by using SANDAG's hwycov shapefile.

Party-at-fault was determined by the three "cause" fields in the collision database (CAUSE_1, CAUSE_2, or CAUSE_3). Collisions were categorized as driver-at-fault if the cause fields contained "VIOLATED PEDS R/W" (violated pedestrian's right of way). Likewise, collisions were

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categorized as pedestrian-at-fault if the cause fields contained "VIOLATED VEHS R/W" (violated vehicle's right of way). When neither of those terms was listed in the cause fields, it was attributed as an unknown or unassigned fault case.

1.3   Organization of the Report

After this Introduction chapter, the following chapters are included:

- Chapter 2 compares annual pedestrian collisions for the City of San Diego, the state and the nation in order to understand how rates in San Diego compare statewide and nationwide;

- Chapter 3 examines the distribution of pedestrian collisions throughout the City by the age of the victim;

- Chapter 4 examines frequencies of pedestrian collisions throughout the City by various temporal factors, including time of day, daylight or nighttime, day of week, and month of year;

- Chapter 5 summarizes collision frequencies by City of San Diego Community Planning Areas (CPAs), and by neighborhood characteristics, such as population and employment density, and median household income;

- Chapter 6 assesses trends in pedestrian collisions by roadway conditions; and finally,

- Chapters 7 and 8 examine collision frequencies by party-at-fault and collision cause categories, for drivers and pedestrians, respectively.

2.0 City of San Diego, State and National Pedestrian Injury and Fatality Trends

This chapter presents a comparison of pedestrian collision trends at the local, state and national levels. These types of comparisons are important for understanding whether local San Diego trends are consistent with or deviate from those observed across California and the nation. **Table 2-1** presents the number of annual pedestrian injuries that occurred within the City of San Diego and the state of California over a 13 year period between 1999 and 2012, as well as the annual percent change, year to year, over that time period.

As shown in the table, over the past 13 years in the City of San Diego, the annual percent change ranges from a reduction in collisions of -12.8% (between 2007 and 2008) to an increase of 19.7% (between 2011 and 2012). In general the annual percent changes are smaller statewide, with a reduction in collisions of -4.6% between (2009 and 2010) and an increase of 0.8% between (2005 and 2006). Between 1999 and 2012, the rate of change in pedestrian injuries has fluctuated sporadically with a low of 413 collisions in 2010 and a high of 620 collisions in 1999. While the rate of change between 2011 and 2012 is unusually high at 19.7%, the number of pedestrian injuries for 2012 was only slightly higher than the increase that was seen between the years 2006 and 2007.

Table 2-1: Annual Rate of Change in Pedestrian Injuries (City of San Diego and State of California)

Year	San Diego		California	
	Number	Rate of Change	Number	Rate of Change
1999	620	n/a	n/a	n/a
2000	567	-8.5%	n/a	n/a
2001	582	2.6%	15,266	n/a
2002	575	-1.2%	15,117	-2.7%
2003	525	-8.7%	14,703	-0.8%
2004	527	0.4%	14,586	-1.9%
2005	480	-8.9%	14,304	-0.6%
2006	497	3.5%	14,218	0.8%
2007	530	6.6%	14,329	-2.0%
2008	462	-12.8%	14,047	-2.6%
2009	441	-4.5%	13,679	-2.8%
2010	413	-6.3%	13,291	-4.6%
2011	446	8.0%	12,676	-1.0%
2012	534	19.7%	n/a	n/a

Source: City of San Diego (2013); National Highway Traffic Safety Administration, 2014; Chen Ryan Associates, April 2014

Note: Red font indicates increase in pedestrian injury from the previous year.

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Chart 2-1 displays the side-by-side comparison of annual change for the City of San Diego and the State of California. The chart emphasizes the fact that statewide annual pedestrian injuries have been decreasing every year except between 2005 and 2006, when they increased by just 0.8%.

In contrast, for the City of San Diego, there was a decrease in pedestrian injuries during the periods from 2002 to 2003, and from 2008 to 2010. However, the City of San Diego, unlike the state of California, has two periods of marked increases in pedestrian injury occurring between 2006 and 2007 (from 3% to 6%) and between 2011 and 2012 (from 8% to 19.7%).

Chart 2-1: Annual Rate of Change in Pedestrian Injuries (City of San Diego and State of California)
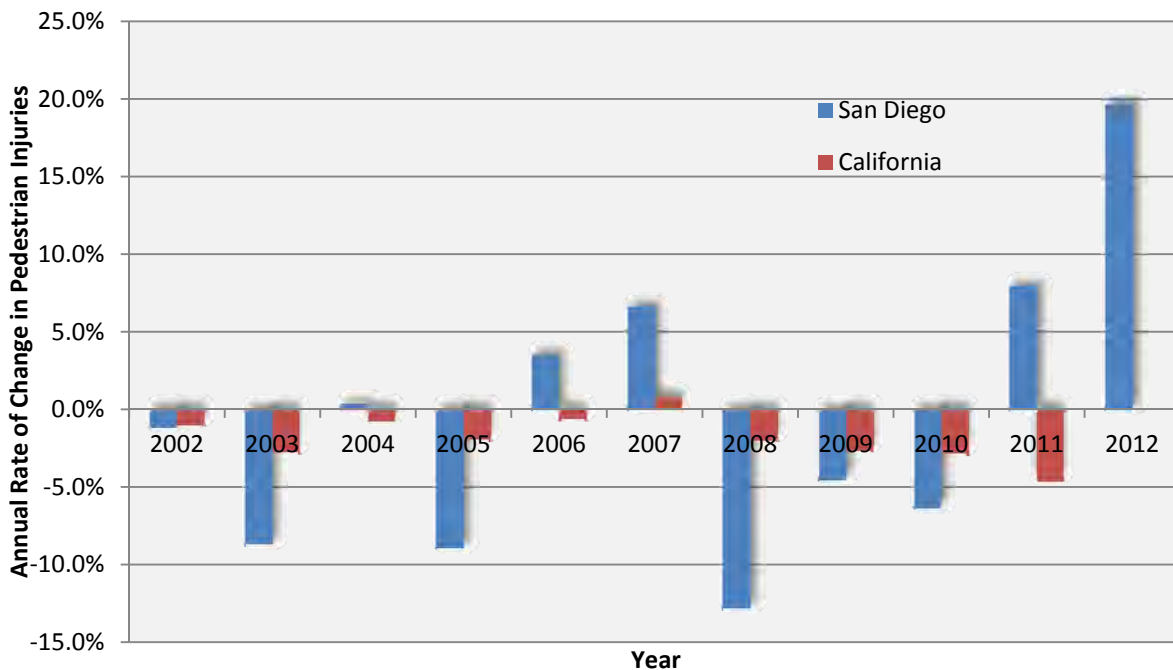
Source: City of San Diego (2013); National Highway Traffic Safety Administration, 2014;
Chen Ryan Associates, April 2014

Table 2-2 presents the number of annual pedestrian fatalities along with the number of fatalities across all modes of travel for the U.S., California, San Diego County, and the City of San Diego over the most recent 7 years of data (between 2006 and 2012). The table also shows the percent of pedestrian fatalities as part of total fatalities.

For the U.S. the data reveals that while a significant reduction in total fatalities (21% reduction) has been accomplished over the period from 2006 to 2012, the improvement for pedestrian fatalities is marginal (1% reduction). For the nation as a whole, the percent of pedestrian fatalities increased from 11% in 2006 to 14% in 2012, indicating that the share of pedestrian fatalities relative to all mode fatalities increased nationwide between 2006 and 2012.

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Table 2-2: Annual Road Fatalities for All Modes and for Pedestrians
(U.S., California, San Diego County, and City of San Diego)

Year	U.S.		California		San Diego County		City of San Diego	
	All Modes	Pedestrians (% of total)	All Modes	Pedestrians (% of total)	All Modes	Pedestrians (% of total)	All Modes	Pedestrians (% of total)
2006	42,708	4,795 (11%)	4,240	719 (17%)	303	60 (20%)	102	20 (20%)
2007	41,259	4,699 (11%)	3,995	650 (16%)	292	48 (16%)	95	11 (12%)
2008	37,423	4,414 (12%)	3,434	620 (18%)	263	61 (23%)	86	14 (16%)
2009	33,883	4,109 (12%)	3,090	567 (18%)	232	54 (23%)	73	16 (22%)
2010	32,999	4,302 (13%)	2,720	601 (22%)	186	51 (27%)	72	16 (22%)
2011	32,367	4,432 (14%)	2,816	633 (22%)	203	44 (22%)	67	11 (16%)
2012	33,561	4,743 (14%)	2,857	612 (21%)	210	51 (24%)	78	22 (28%)
% Change between 06 and 12	-21%	-1%	-33%	-15%	-31%	-15%	-24%	+10%

Source: City of San Diego (2013); UC Berkeley Transportation Injury Mapping System ; National Highway Traffic Safety Administration, 2014; Chen Ryan Associates, April 2014

A similar story is presented for California, which has enjoyed an even larger reduction in total fatalities between 2006 and 2012 (33% reduction) along with a smaller reduction in pedestrian fatalities (15% reduction). Again, the percent of pedestrian fatalities has increased from 17% to 21%, indicating that the share of pedestrian fatalities relative to all mode fatalities increased over the period from 2006 to 2012 in California

San Diego County followed a similar trend as California over the period from 2006 to 2012 with a 31% reduction in all fatalities and a 15% reduction in the percent of pedestrian fatalities relative to all mode fatalities.

The data for the City of San Diego is limited due to the smaller sample size and has demonstrated a reduction in total fatalities of 24%, and an increase in pedestrian fatalities of 10% over the period from 2006 to 2012. It is important to note that the data shows significant fluctuations for pedestrian fatalities in the City of San Diego making it difficult to draw specific conclusions about trends during this period. The doubling of pedestrian fatalities is concerning, however, it should be noted that there was a reduction in pedestrian fatalities between 2006 and 2007 by almost 50%. In addition, during the years 2007 and 2011, there were unusually low numbers of pedestrian fatalities.

Chart 2-2 shows pedestrian fatalities normalized by 100,000 population in the City and the County of San Diego. Two observations can be made: first, the rates follow very similar patterns year over year between 2006 and 2012, and second, the rate for the City of San Diego is consistently lower than for the County as whole until the year 2012.

Chart 2-2: Pedestrian Fatalities Per 100K Population between 2006 and 2012
(San Diego County and City of San Diego)

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Chart 2-3 displays a side-by-side comparison of annual fatalities across all modes and pedestrian fatalities for the U.S., California, San Diego County, and the City of San Diego. Each subplot shows a red curve for fatalities across all modes (associated with the left axis), and a blue curve for pedestrian fatalities (associated with the right axis). While the units for the different charts are not the same, the ratio of the units across the different charts is maintained. This allows us to also compare the discrepancies between the different charts and reveals insights about the overall trend in all mode fatalities relative to pedestrian fatalities.

Chart 2-3: Annual Rate Road Fatalities for all modes and for Pedestrians of Change in Pedestrian Fatalities
(U.S., California, San Diego County, and City of San Diego, California, and U.S.)
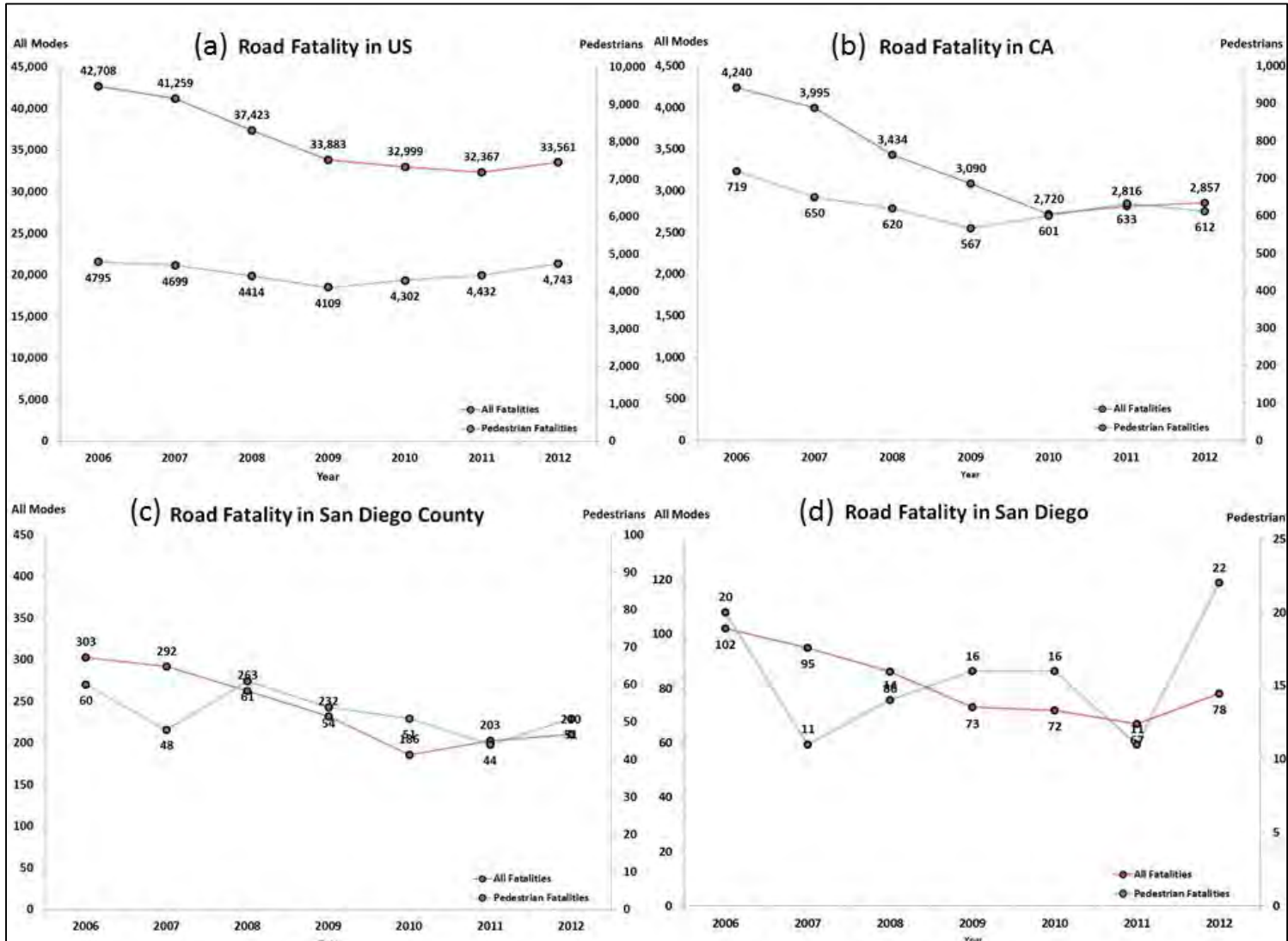
Source: City of San Diego (2013); UC Berkeley Transportation Injury Mapping System; National Highway Traffic Safety Administration, 2014; Chen Ryan Associates, April 2014
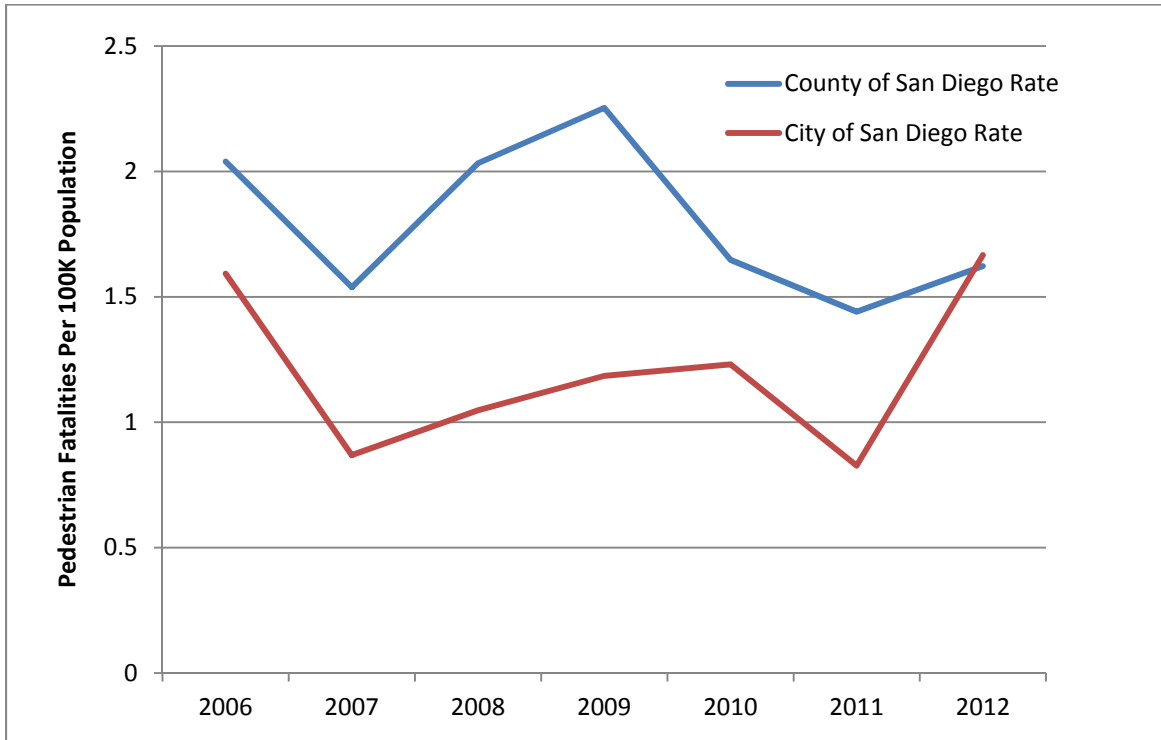
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The chart reveals that the overall fatality trend for all modes has decreased across all jurisdictions between 2006 and 2009, but flattened starting in 2010 with a possible increase in 2012. The year 2009 was also a change-point for pedestrian collisions at the national and state level and the trend switched from minor reductions to minor increases. The trend for pedestrian crashes in San Diego County and the City of San Diego fluctuates much more than the national and state trends and is probably associated with the smaller sample size.

Chart 2-4 displays a comparison of pedestrian fatalities per 100,000 population for the cities of San Diego, San Jose, San Francisco, and Phoenix for over the period from 2002 to 2010. As shown, the City of San Diego has fared better than San Francisco and Phoenix, and shows comparable rates to the City of San Jose.

Chart 2-4: Pedestrian Fatalities Per 100K Population between 2002 and 2010
(San Diego, San Jose, San Francisco and Phoenix)
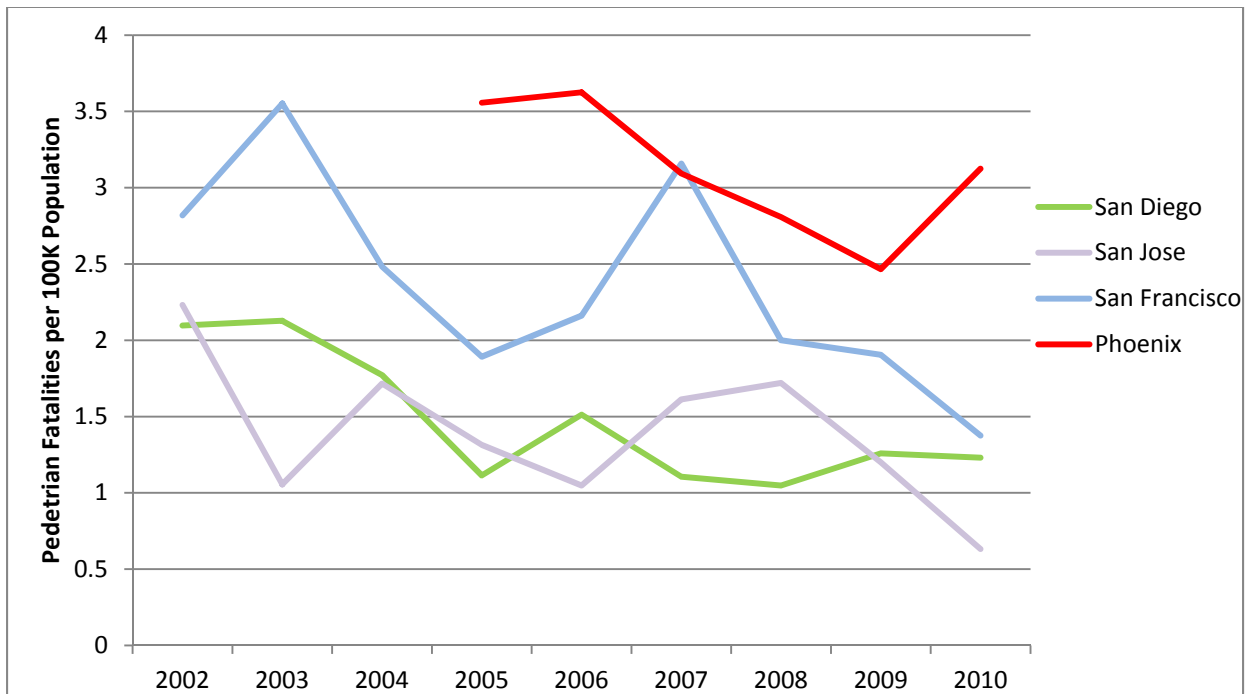
Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Figure 2-1 shows all collision locations citywide (including injury and fatalities) occurring during the period from 2008 to 2012. Collisions are concentrated in the more densely urbanized core of the city, south of Interstate 8, with the Downtown, City Heights, and Uptown communities showing a particularly heavy concentration.

Figure 2-2 shows pedestrian fatality locations citywide occurring during the period from 2008 to 2012. There are no distinct spatial patterns visible in the citywide distribution of pedestrian fatalities.

All Collisions (2008-2012)

- **5 - 12**
- **2 - 4**
- 1

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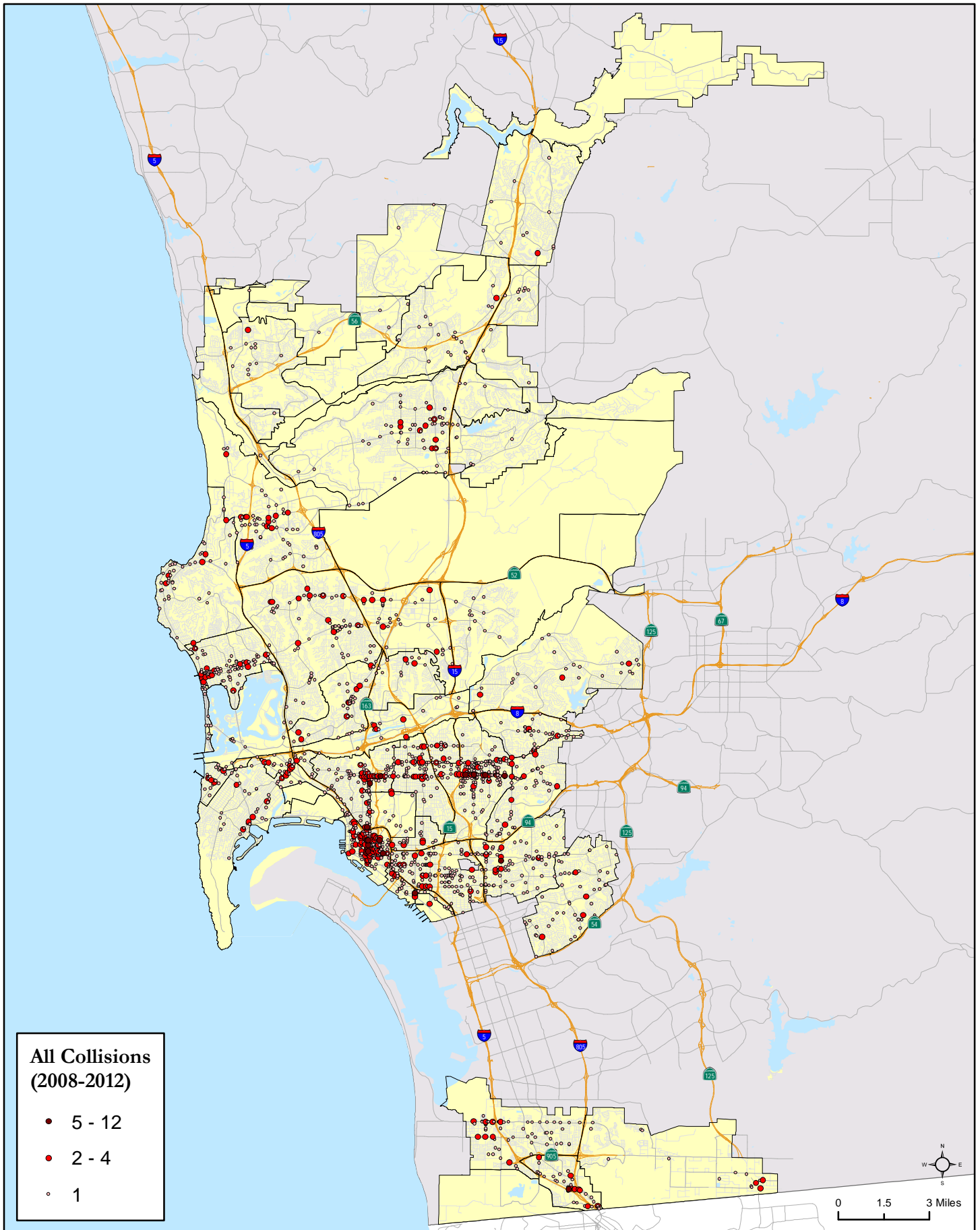
Figure 2-1
Citywide Pedestrian Collisions (2008-2012)

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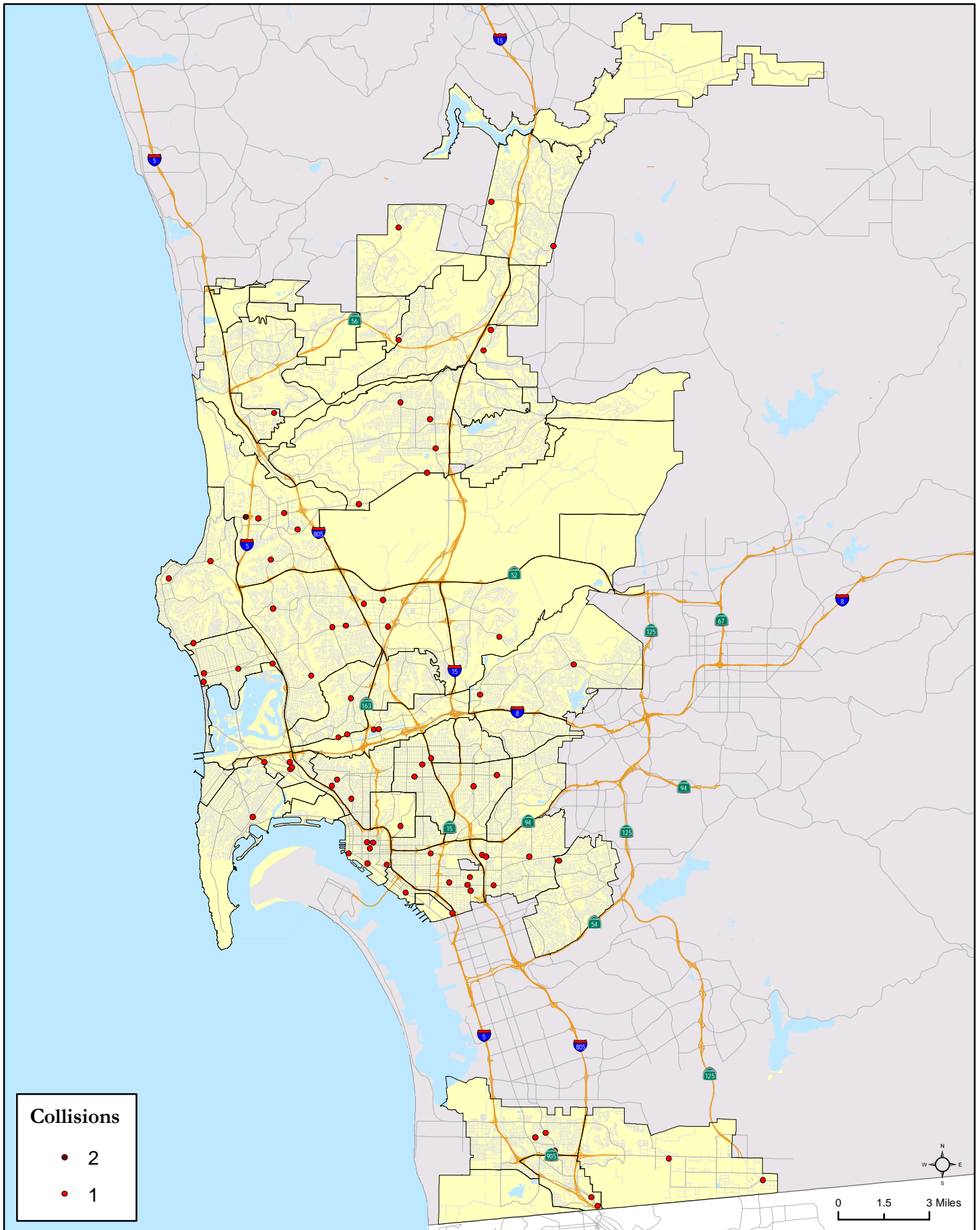
Collisions
- 2
- 1

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Figure 2-2
Citywide Map of All Pedestrian Fatalities

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3.0 Age Demographics of Pedestrian Collision Victims in City of San Diego

This chapter summarizes pedestrian collisions by age of victim in order to understand whether certain age groups experience disproportionate exposure to pedestrian risk.

Table 3-1 and **Chart 3-1** show the number of pedestrian collisions by the age of the victim occurring between 2008 and 2012.

Table 3-1: Number of Pedestrian Collisions in San Diego and Rate per 100K Population by Age (2008-2012)

Age Group	Number of Collisions in SD County (Fatal)	Percent of Total in SD County (of Fatal)	2010 Census Population (San Diego County)	SD Collisions per 100,000 per Year	CA Collisions per 100,000 per Year
Under 5	95 (5)	4.2% (6.3%)	80,792	23.5	21.0
5 to 9	96 (1)	4.3% (1.3%)	75,073	25.6	34.4
10 to 14	153 (0)	6.8% (0.0%)	75,345	40.6	56.2
15 to 19	222 (1)	9.9% (1.3%)	90,813	48.9	61.9
20 to 24	284 (7)	12.6% (8.9%)	127,987	44.4	43.4
25 to 34	344 (8)	15.3% (10.1%)	230,247	29.9	33.5
35 to 44	223 (6)	9.9% (7.6%)	183,750	24.3	33.1
45 to 54	324 (15)	14.4% (19.0%)	171,993	37.7	36.5
55 to 59	133 (7)	5.9% (8.9%)	73,490	36.2	34.3
60 to 64	100 (8)	4.5% (10.1%)	58,275	34.3	29.7
65+	273 (21)	12.1% (26.6%)	139,637	39.1	35.4
Total	2,247 (79)	100% (100%)	1,307,402	34.4	37.6

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, over this 5-year period, the three age groups between 10 and 24 experienced the highest pedestrian collision rate (over 40 collisions per 100,000 persons) in San Diego County. These three age groups also have the highest pedestrian collisions rate in California, ranging from 43.4 to 61.9 collisions per 100,000 population. These age groups accounted for about 29.3 percent of all pedestrian collisions in San Diego County, and about 10 percent of all pedestrian fatalities.

Another vulnerable age group is the senior age group (65 and over) with a crash risk of 39.1 collisions per 100,000 population in San Diego County, which accounts for about 26.6 percent of all pedestrian fatalities in San Diego County.

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Children under 5 years are experiencing the lowest pedestrian collision rate (23.5 collisions per 100,000) in San Diego County, followed by children aged 5 to 9 years old (25.6 collisions per 100,000 persons).

The average collision rate over the period from 2008 to 2012 in San Diego is 34.4 collisions per 100,000 persons, and is a bit lower than the California rate of 37.6 pedestrian collisions per 100,000 persons. The pedestrian collision rates in San Diego for children under age of 5 and for adults older than 60 are higher than the state level and may require further attention.

Chart 3-1: Pedestrian Collisions by Age Range in City of San Diego (2008 – 2012) and in California (2008-2011)
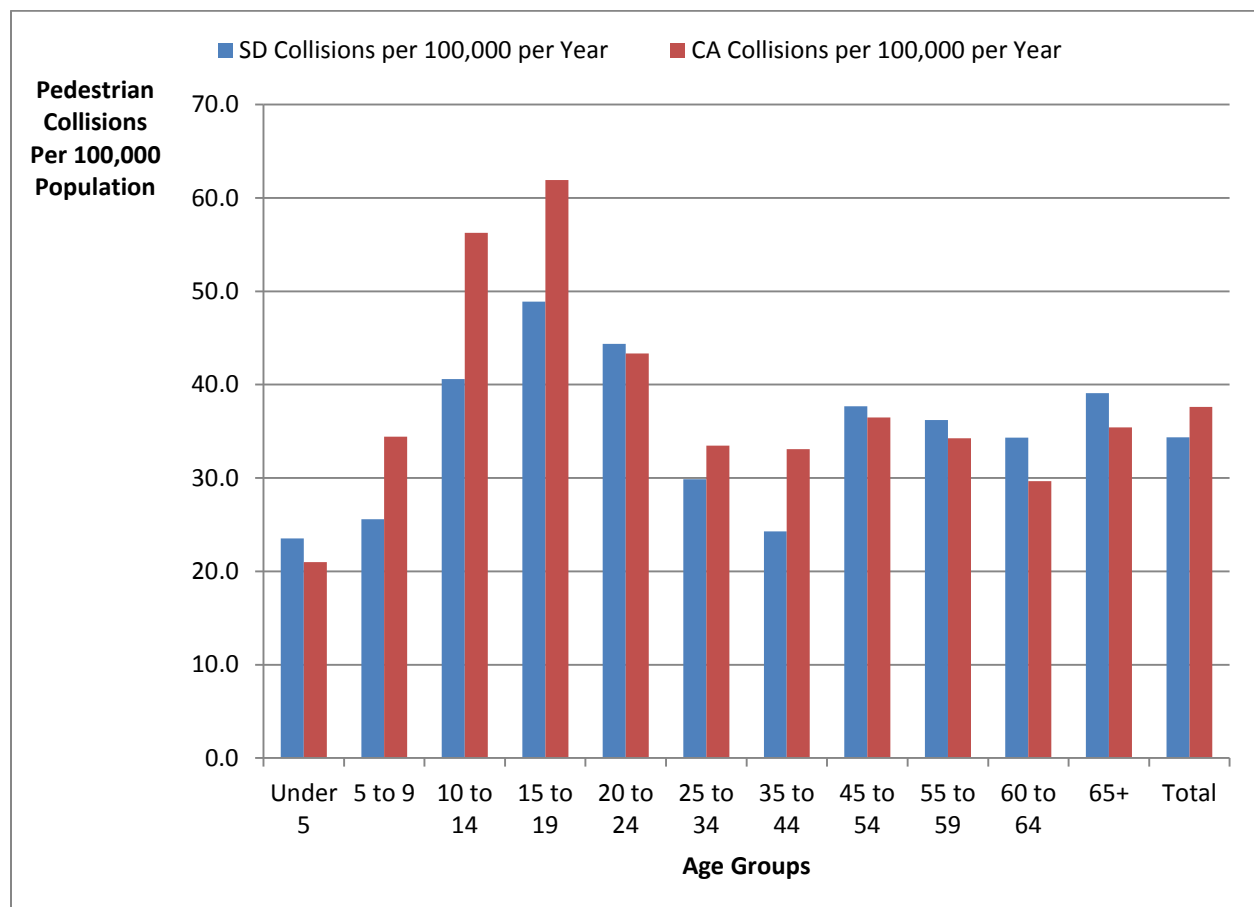
Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Figure 3-1 displays locations of collisions involving youth, ages 16 and under. As shown in the map, there is a noticeable concentration of collisions involving this age group in City Heights.

Figure 3-2 displays locations of collisions involving seniors, ages 65 and over. There are three communities, Downtown, Uptown and City Heights, with a visible concentration of collisions involving this age group.

Collisions

- ● 3
- ● 2
- ○ 1

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Figure 3-1

Citywide Map of Pedestrian Collisions Involving Youth (Ages 16 and Under)

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Figure 3-2
Citywide Map of Pedestrian Collisions
Involving Seniors (Ages 65 and Over)
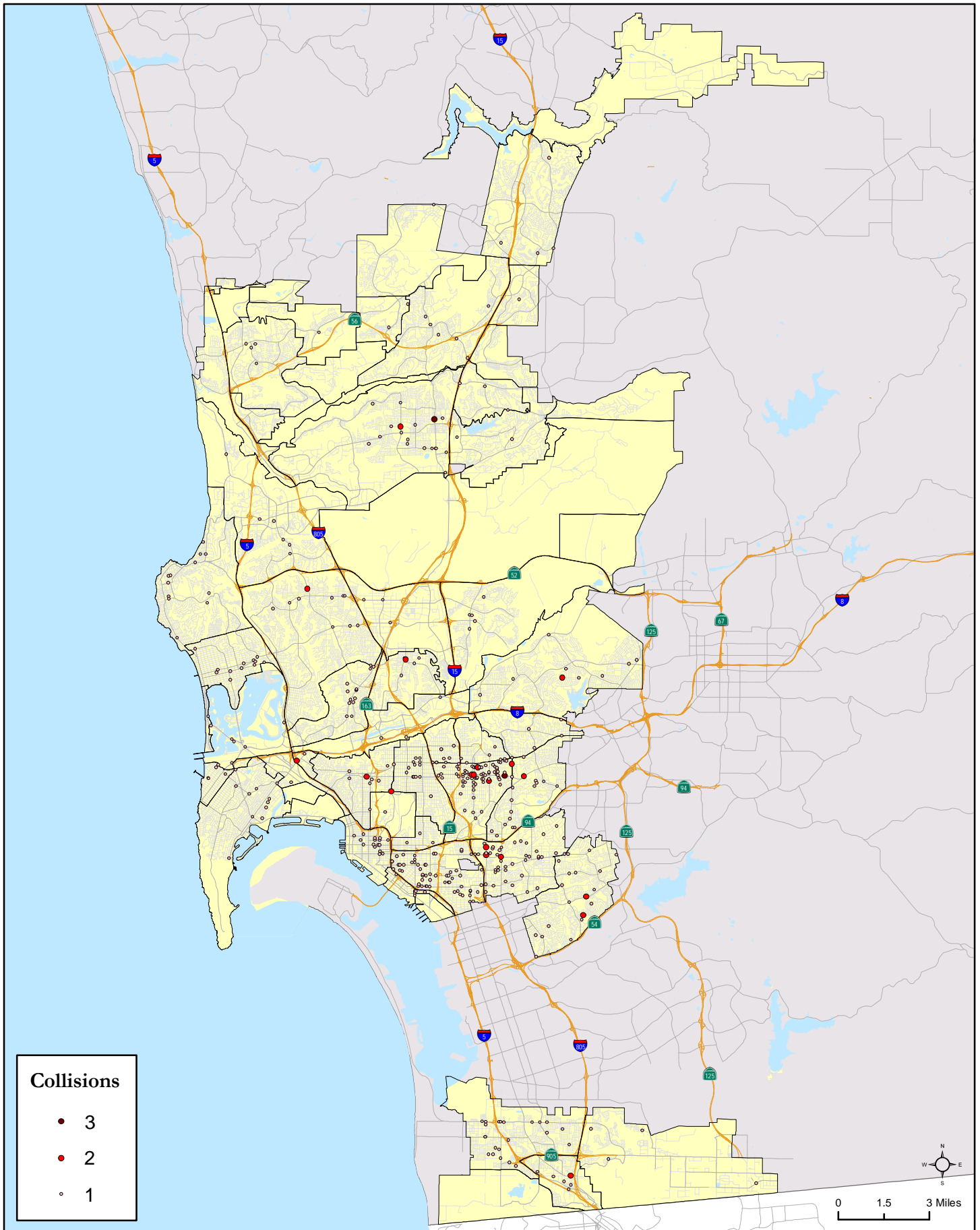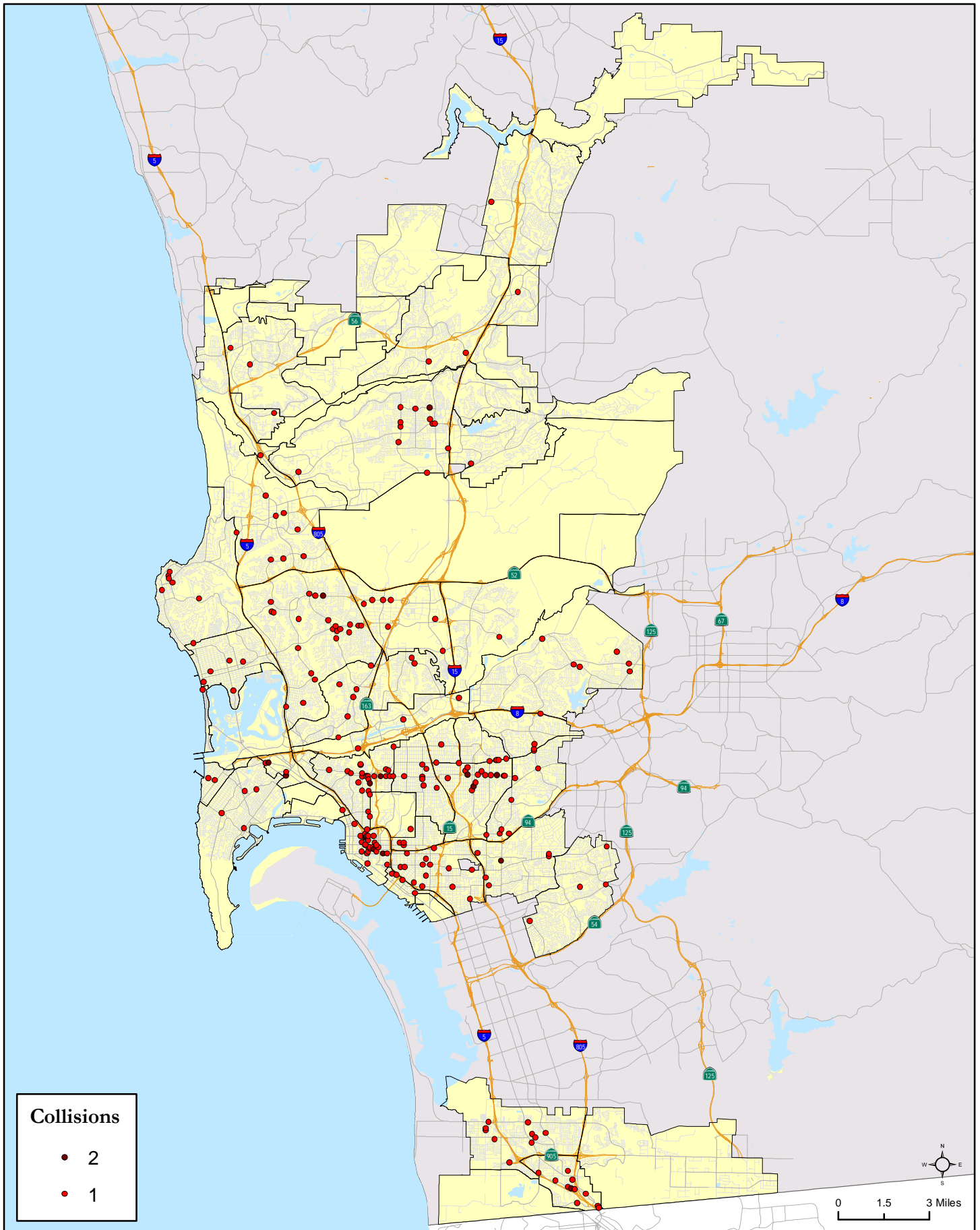
4.0 Temporal Distribution of Pedestrian Collisions in City of San Diego

This chapter summarizes the temporal distribution of pedestrian collisions by month of year and time of day over the 5-year period from 2008 to 2012.

Table 4-1 and **Chart 4-1** show the total number of pedestrian collisions occurring within the City of San Diego during each month of the year over a 5-year period between 2008 and 2012, as well as the percent of total collisions.

Table 4-1: Pedestrian Collisions by Month (2008-2012)

Month of Year	Number of Collisions	Percent of Total
January	213	9%
February	191	8%
March	195	8%
April	161	7%
May	147	6%
June	143	6%
July	174	8%
August	173	8%
September	214	9%
October	229	10%
November	206	9%
December	250	11%
Total	2,247	100%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, the two months with the highest numbers of pedestrian collisions were December (250 collisions or 11 percent of total) and October (229 collisions or 10 percent of total). The months of May and June had the lowest numbers of collisions at 147 and 143, respectively. The winter months may increase the risk for pedestrian collision since the afternoon commute typically occurs after sunset. Nighttime travel has been shown to result in increased pedestrian safety risk.

Chart 4-1: Pedestrian Collisions by Month of Year in the City of San Diego (2008 – 2012)
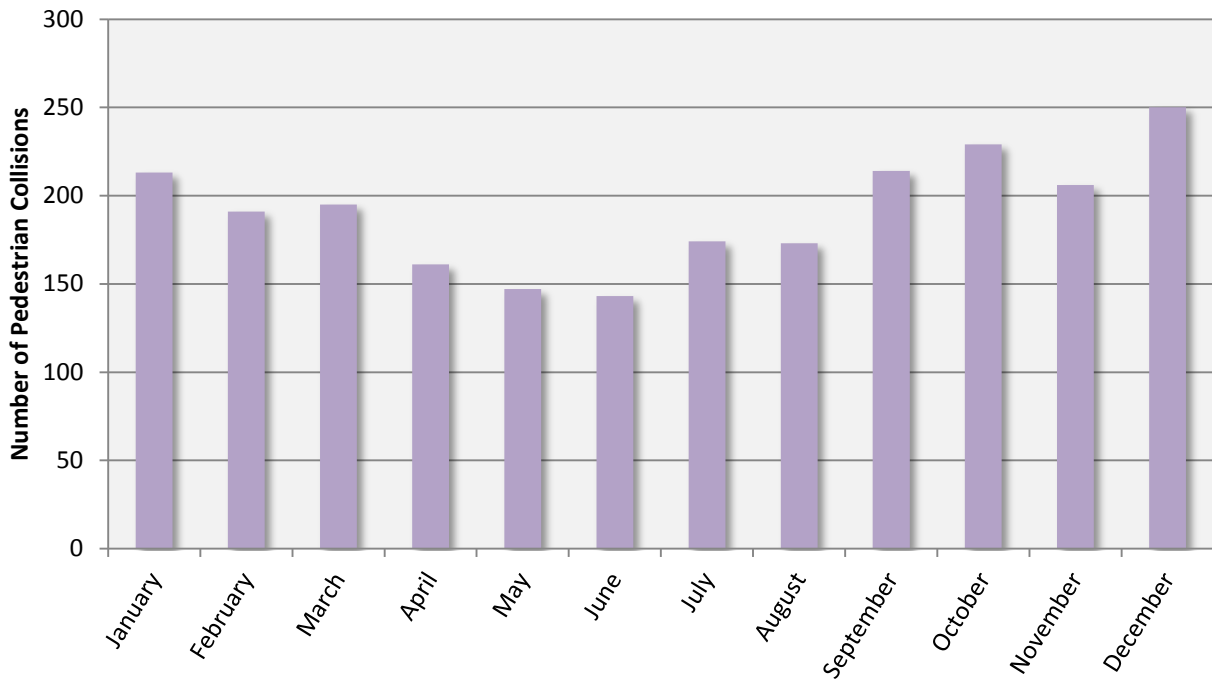
Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Table 4-2 shows the distribution of pedestrian collisions by time of day and day of week for the City of San Diego. As shown, the period from 5PM to 7PM has the two highest consecutive percentages of total hourly collisions, at 9.4 percent and 8.4 percent, respectively. **Chart 4-2** displays the hourly trends across the City of San Diego. The chart shows a clear dual peaking over the 24-hour period, reflecting the traditional commute periods from 7AM to 9AM and 5PM to 7PM.

Chart 4-3 presents the day of the week trends in pedestrian collisions over the 5-year period from 2008 to 2012 across the City of San Diego, with Friday showing the highest number of pedestrian collisions and the weekend days, especially Sunday, showing the lowest number of collisions.

Figure 4-1 displays a citywide map of pedestrian collisions during the two-hour peak period, from 5PM to 7PM. The map shows a heavy concentration of collisions in the Downtown community during this peak period. Considering the collision peak period coincides with the traditional evening commute peak period, it is not surprising that the heaviest concentration of collisions during these hours is happening in the region's densest center of employment.

Table 4-2: City of San Diego Pedestrian Collisions by Hour of Day and Day of Week (2008-2012)

Hour of Day	Number of Hourly Collisions	Percent of Total	Hourly Collisions by Daily of Week						
			Mon	Tue	Wed	Thu	Fri	Sat	Sun
	2,296	100%	348	354	350	351	366	284	243
12:00-12:59am	45	2.0%	4	6	2	4	4	14	11
1:00-1:59am	46	2.0%	5	3	1	2	8	13	14
2:00-2:59am	33	1.4%	2	4	2	2	4	10	9
3:00-3:59am	8	0.3%	0	0	1	1	1	1	4
4:00-4:59am	13	0.6%	2	0	3	3	2	0	3
5:00-5:59am	28	1.2%	6	8	2	5	4	2	1
6:00-6:59am	60	2.6%	7	11	14	17	9	2	0
7:00-7:59am	143	6.2%	22	34	29	28	23	7	0
8:00-8:59am	113	4.9%	15	21	27	19	21	7	3
9:00-9:59am	85	3.7%	15	14	18	9	9	12	8
10:00-10:59am	66	2.9%	8	14	17	8	4	9	6
11:00-11:59am	94	4.1%	11	17	12	15	12	17	10
12:00-12:59pm	91	4.0%	14	10	13	16	18	9	11
1:00-1:59pm	92	4.0%	10	11	6	16	18	14	17
2:00-2:59pm	130	5.7%	16	22	24	18	25	11	14
3:00-3:59pm	151	6.6%	25	28	14	33	22	13	16
4:00-4:59pm	147	6.4%	32	20	23	25	17	15	15
5:00-5:59pm	215	9.4%	45	30	40	29	36	18	17
6:00-6:59pm	204	8.9%	33	35	30	29	35	22	20
7:00-7:59pm	156	6.8%	21	23	24	23	26	20	19
8:00-8:59pm	138	6.0%	19	20	14	23	21	21	20
9:00-9:59pm	113	4.9%	22	13	16	15	15	21	11
10:00-10:59pm	74	3.2%	7	4	15	9	17	13	9
11:00-11:59pm	48	2.1%	6	5	3	2	15	12	5
Unknown	3	2.0%	1	1	0	0	0	1	0

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Chart 4-2: Pedestrian Collisions by Hour of Day in the City of San Diego (2008 – 2012)
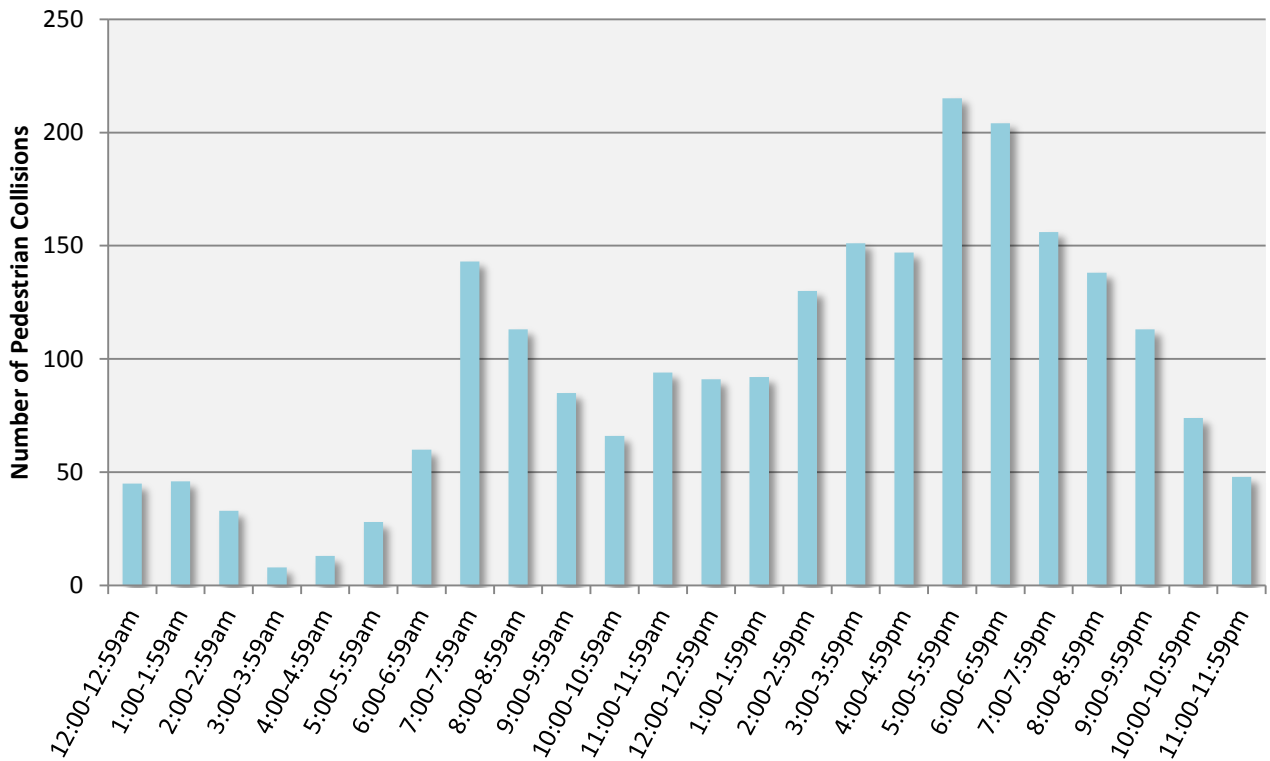
Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Chart 4-3: Pedestrian Collisions by Day of Week in the City of San Diego (2008 – 2012)

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Collisions During 5pm-7pm Peak Period

- **●** 3
- **●** 2
- **○** 1
- **▲** Schools

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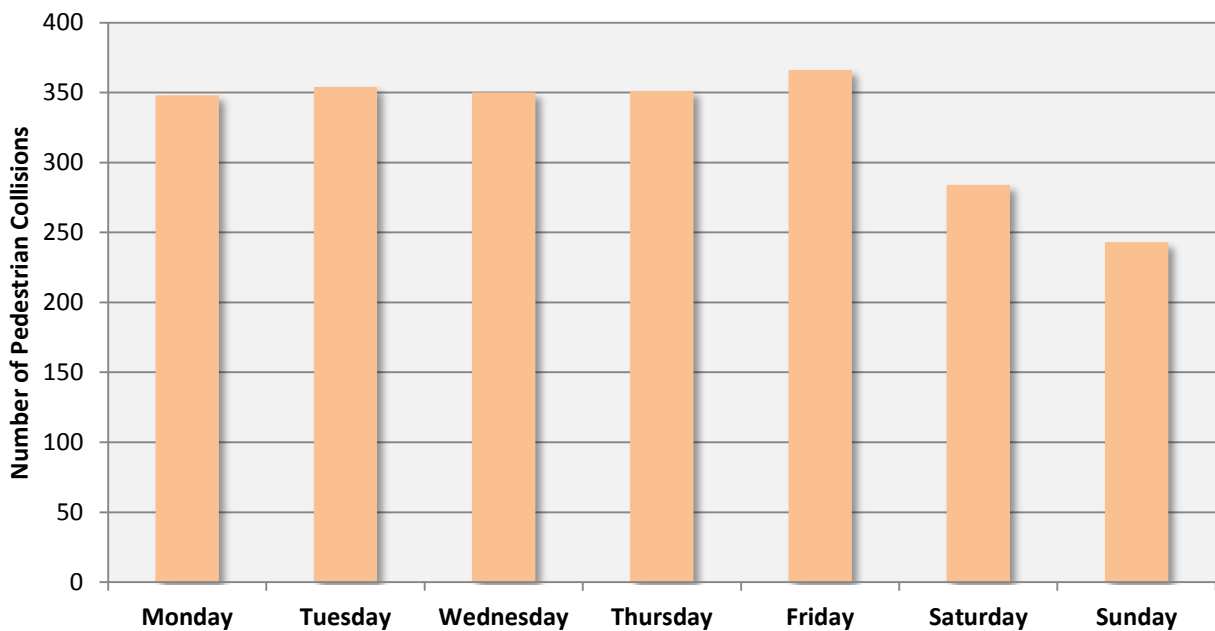
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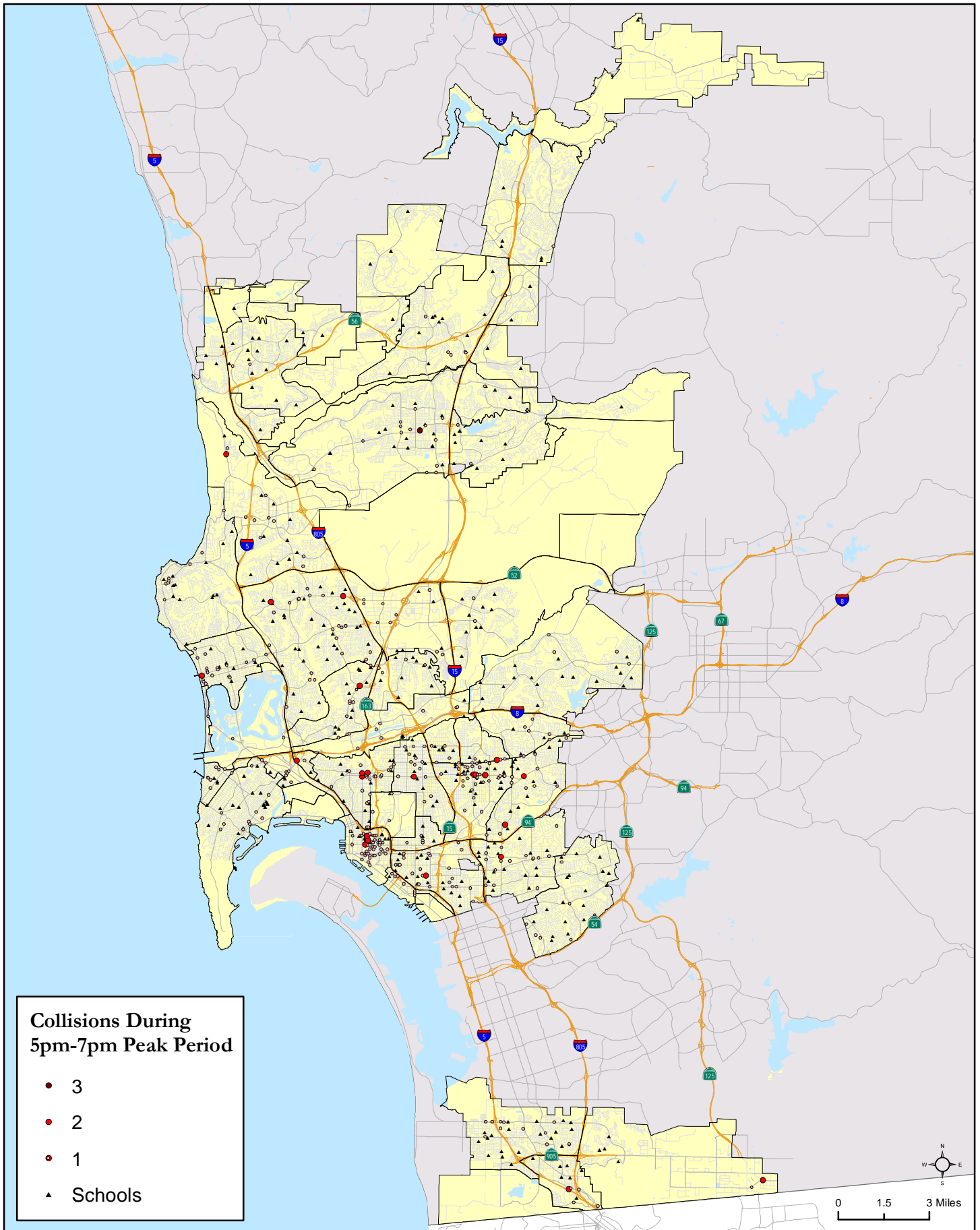
Figure 4-1
Citywide Pedestrian Collisions (2008-2012)
2-Hour Peak Period for Pedestrian Collisions (5pm-7pm)

5.0 Pedestrian Collisions by CPAs and by Neighborhood Characteristics in San Diego

This chapter examines collision frequency by City of San Diego Community Planning Area (CPAs) over the 5 year period between 2008 and 2012, along with various neighborhood characteristics such as population and employment density, and median household income.

5.1 Collisions Trends by San Diego CPA

Table 5-1 displays the number of pedestrian collisions by San Diego CPA for the past five years between 2008 and 2012. The CPAs are sorted by number of collisions, from highest to lowest. As shown, over this time period Downtown and City Heights experienced the highest absolute number of collisions with 305 and 217, respectively.

When the number of collisions is normalized by CPA population, however, the ordering of communities changes. **Table 5-2** displays the collisions per 1,000 capita, excluding communities with populations less than 1,000. When adjusted for population, Midway-Pacific Highway and Barrio Logan show the highest pedestrian collision per capita rates, at 14 and 10 collisions per 1,000 capita, respectively. Downtown has the third highest per 1,000 capita rates at 8.4 collisions per 1,000 capita.

Figure 5-1 displays the per 1,000 capita pedestrian collision rates across the City. From southeast of Mission Bay to Barrio Logan – encompassing Uptown and Downtown, there is a contiguous grouping of communities within the highest per 1,000 capita pedestrian collision category, which is greater than 4.0 collisions per 1,000 people.

Table 5-1: Number of Pedestrian Collisions by Community Planning Areas (2008-2012)

Ranking by Number of Collisions	Community Planning Area (CPA)	Number of Collisions by CPA
1	Downtown	305
2	Mid-City: City Heights	217
3	Southeastern San Diego	151
4	Uptown	149
5	Pacific Beach	123
6	Clairemont Mesa	97
7	Greater North Park	96
8	Encanto Neighborhoods	96
9	Mira Mesa	76
10	Mid-City: Eastern Area	76
11	University	74
12	Otay Mesa-Nestor	72
13	San Ysidro	59
14	Skyline-Paradise Hills	58
15	La Jolla	54

Table 5-1: Number of Pedestrian Collisions by Community Planning Areas (2008-2012)

Ranking by Number of Collisions	Community Planning Area (CPA)	Number of Collisions by CPA
16	Midway-Pacific Highway	53
17	Peninsula	53
18	Linda Vista	45
19	College Area	44
20	Barrio Logan	43
21	Kearny Mesa	40
22	Mid-City: Kensington-Talmadge	34
23	Ocean Beach	32
24	Mission Valley	30
25	Navajo	29
26	Mid-City: Normal Heights	27
27	Greater Golden Hill	21
28	Rancho Penasquitos	21
29	Balboa Park	19
30	Otay Mesa	18
31	Serra Mesa	18
32	Mission Bay Park	14
33	Carmel Valley	13
34	Military Facilities	15
35	Tierrasanta	11
36	Old Town San Diego	10
37	Mission Beach	10
38	Rancho Bernardo	10
39	Carmel Mountain Ranch	7
40	Scripps Miramar Ranch	7
41	Miramar Ranch North	4
42	Torrey Highlands	3
43	Sabre Springs	3
44	Black Mountain Ranch	2
45	NCFUA Subarea	1
46	Pacific Highlands Ranch	1
47	Torrey Hills	1
48	Torrey Pines	1
49	Reserve	1
50	Los Penasquitos Canyon	0
51	San Pasqual	0
52	Via De La Valle	0
53	Fairbanks Ranch Country Club	0
54	Del Mar Mesa	0
55	Rancho Encantada	0
56	East Elliott	0
57	Tijuana River Valley	0

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

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Table 5-2: Pedestrian Collision Per 1,000 Capita by Community Planning Areas (2008-2012)

Per Capita Ranking	Community Planning Area (CPA)	CPA Population	Number of Collisions per CPA	Collisions per 1,000 Persons by CPA
1	Midway-Pacific Highway	3,762	53	14.1
2	Barrio Logan	4,227	43	10.2
3	Downtown	36,125	305	8.4
4	Kearny Mesa	6,212	40	6.4
5	Uptown	36,515	149	4.1
6	Pacific Beach	40,593	123	3.0
7	Mid-City: City Heights	75,929	217	2.9
8	Southeastern San Diego	57,973	151	2.6
9	Ocean Beach	13,413	32	2.4
10	Mid-City: Kensington-Talmadge	14,383	34	2.4
11	San Ysidro	27,681	59	2.1
12	Mid-City: Eastern Area	37,059	76	2.1
13	Greater North Park	47,548	96	2.0
14	Encanto Neighborhoods	48,357	96	2.0
15	Mission Beach	5,096	10	2.0
16	College Area	23,841	44	1.8
17	La Jolla	31,153	54	1.7
18	Mid-City: Normal Heights	16,605	27	1.6
19	Peninsula	37,348	53	1.4
20	Linda Vista	31,860	45	1.4
21	Otay Mesa	12,938	18	1.4
22	Mission Valley	21,994	30	1.4
23	Clairemont Mesa	79,843	97	1.2
24	University	61,536	74	1.2
25	Greater Golden Hill	18,255	21	1.2
26	Otay Mesa-Nestor	63,346	72	1.1
27	Mira Mesa	76,822	76	1.0
28	Skyline-Paradise Hills	71,085	58	0.8
29	Serra Mesa	23,040	18	0.8
30	Navajo	48,978	29	0.6
31	Carmel Mountain Ranch	13,013	7	0.5
32	Torrey Highlands	6,755	3	0.4
33	Black Mountain Ranch	4,507	2	0.4
34	Rancho Penasquitos	49,069	21	0.4
35	Carmel Valley	35,328	13	0.4
36	Tierrasanta	31,077	11	0.4
37	Miramar Ranch North	11,976	4	0.3
38	Scripps Miramar Ranch	21,070	7	0.3
39	Sabre Springs	11,337	3	0.3
40	Pacific Highlands Ranch	3,988	1	0.3
41	Rancho Bernardo	42,310	10	0.2
42	Torrey Hills	5,683	1	0.2
43	Torrey Pines	7,125	1	0.1

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Note: Table 5-2 only lists CPAs with populations over 1,000 persons.

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Collisions per 1,000 Persons by Community Planning Area

- ■ > 4
- ■ 3.01 - 4
- ■ 2.01 - 3
- ■ 1.01 - 2
- ■ 1 or <
- ○ Collision Location

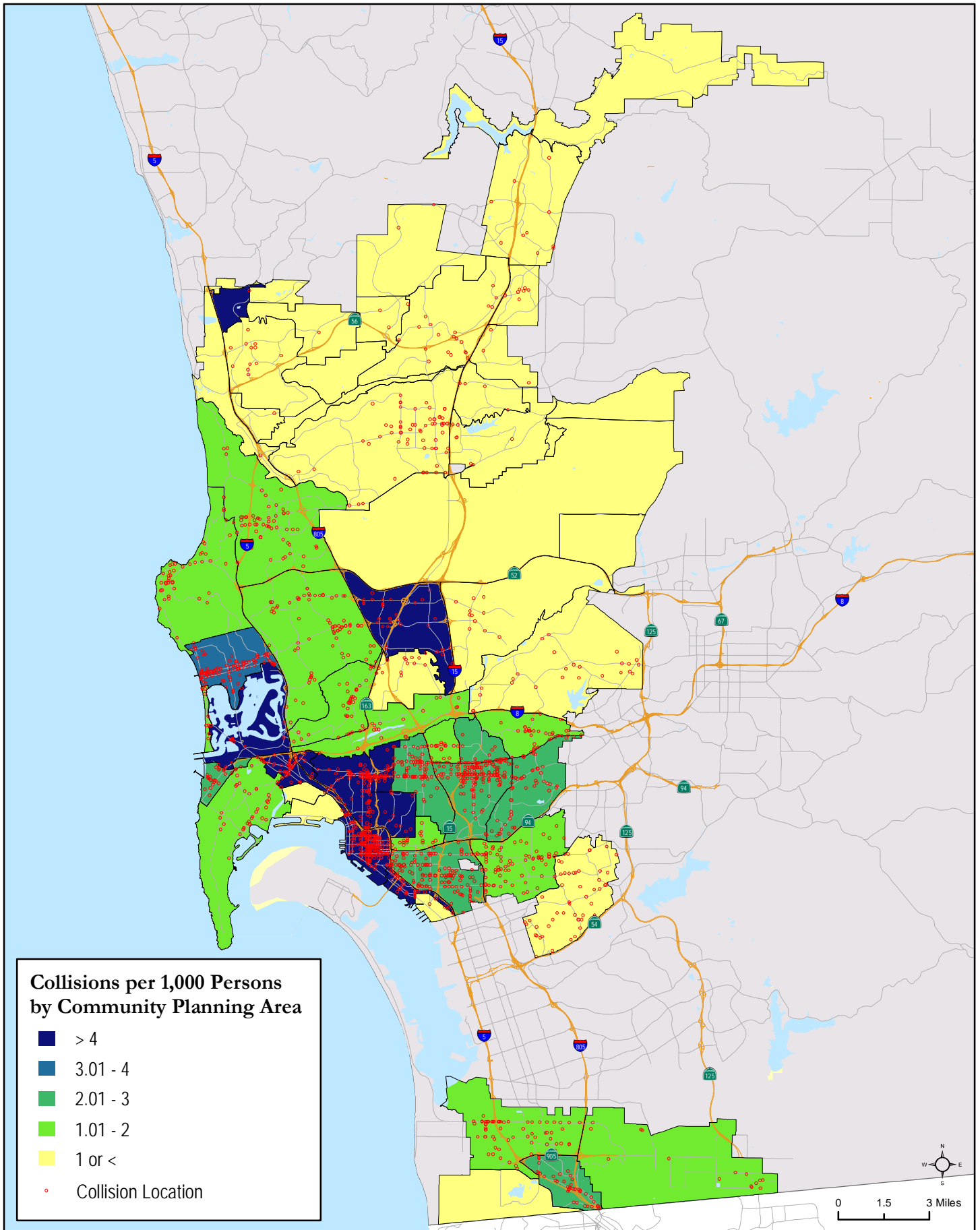*San Diego Comprehensive Pedestrian Safety Study*

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Figure 5-1
Pedestrian Collisions per Capita (2008-2012)
by Community Planning Area

5.2 Neighborhood Characteristics and Pedestrian Collision Trends

This section summarizes pedestrian collision patterns by key neighborhood characteristics, including 2010 population density, employment density and median household income. Collision rates are reported by "high", "medium" and "low" categories for each of the neighborhood characteristics. These categories were defined by assigning 33.3 percent, or one-third, of the total regional population into each category (high, medium or low), then inspecting the resulting value ranges for the respective characteristics (population density, employment density and median household income).

Table 5-3 shows population density ranges for high, medium and low categories. Several interesting trends are reflected in this table. Approximately one-third of the city's population lives in the highest density category (> 20.7 persons per acre) covering only about 7.5 percent of the land area. There were about 763 pedestrian collisions over the period from 2008 to 2012 in these highest density neighborhoods, equating to about 30.6 collisions per square mile.

Roughly one-third of the city's population lives in areas with low population density neighborhoods, or areas with population densities less than 9.6 persons per acre. In contrast to the highest density neighborhood type, low density neighborhoods cover over 77 percent of the city's land area, with 1,033 pedestrian collisions occurring over the period from 2008 to 2012, equating to only 1.5 collisions per square mile.

In summary, pedestrian collisions are occurring in high density areas at approximately twenty times the rate as in low population density areas. This underscores the need for enhanced pedestrian safety treatments as our urban areas continue to increase in density.

Table 5-3: San Diego Pedestrian Collisions by Population Density Category (2008-2012)

	Value Range*	City of San Diego Square Miles	Percent Area of City of San Diego	Number of Pedestrian Collisions	Collisions per Square Mile
2010 Population Density by Census Block					
High	>20.7 persons per acre	24.8	7.5%	763	30.6
Medium	9.6 to 20.7	48.5	14.6%	487	10.0
Low	<9.6	258.7	77.9%	1,033	1.5

Source: City of San Diego (2013); US Census (2010); Chen Ryan Associates, April 2014

Note:

*   Value ranges for each neigbhorhood factor are defined in order to represent one-third of the region's population. In other words, one-third of the region's population falls within census blocks with population densities greater than 20.7 persons per acre; one-third of the region's population lives in census blocks with population density beteen 9.6 and 20.7 persons per acres; and one-third of the region's population lives in census blocks with employment densities less than 9.6 persons per acre.

Figure 5-2 shows population density by census block along with the pedestrian collision locations for the 5-year period between 2008 and 2012.

Population Density by Census Block

- ■ > 20.7 Persons Per Acre
- ■ 9.6 - 20.6 Persons Per Acre
- ■ < 9.6 Persons Per Acre
- ○ Collision Location

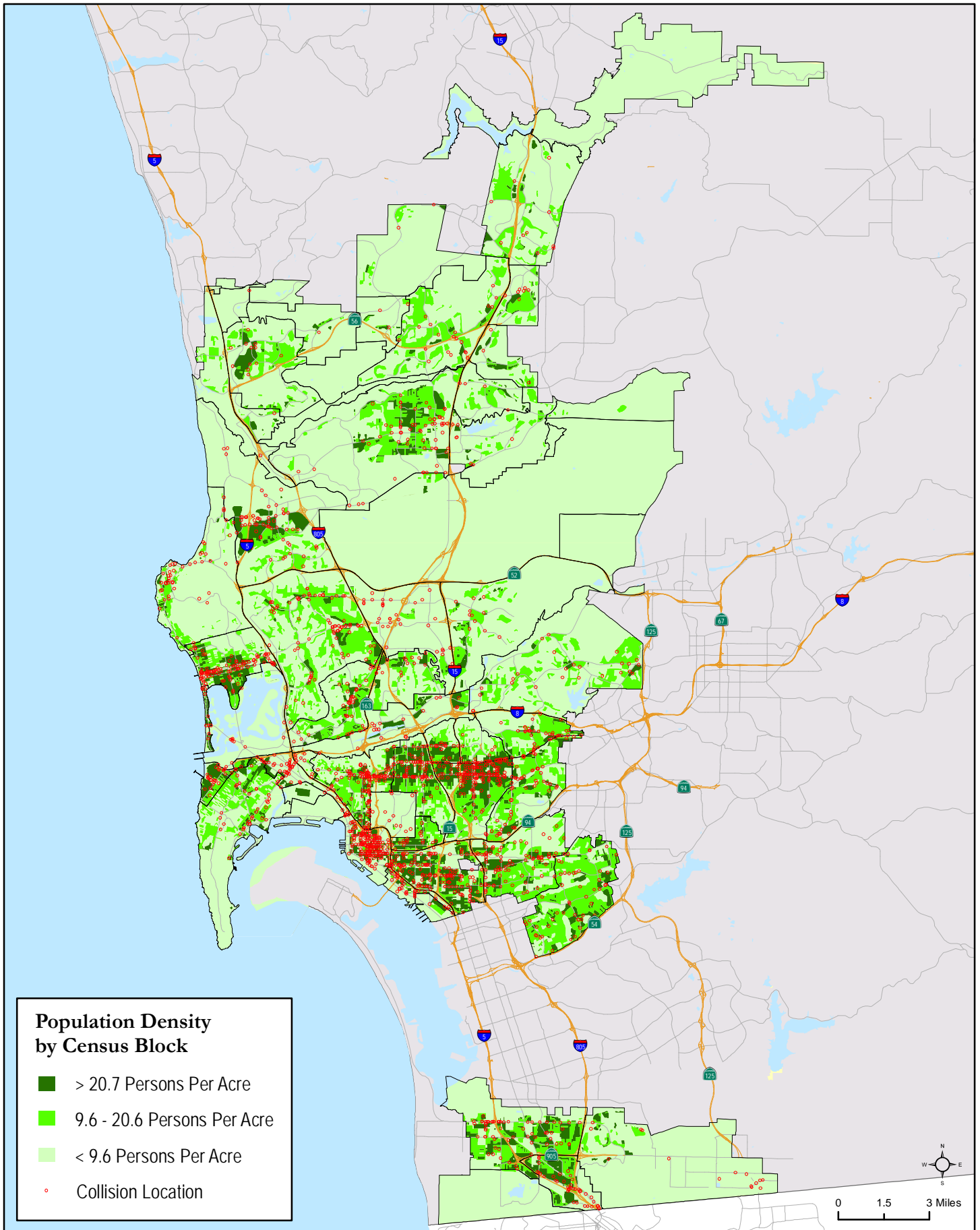*San Diego Comprehensive Pedestrian Safety Study*

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Figure 5-2
Citywide Pedestrian Collisions (2008-2012)
and 2010 Population Density

Table 5-4 shows the number of collisions within each of the employment density ranges (high, medium and low). As with population density, these categories were defined by assigning 33.3 percent, or one-third, of the total regional jobs into each category (high, medium or low), then inspecting the resulting value ranges for the employment density associated with each category.

Several interesting trends are reflected in this table. Approximately one-third of the city's jobs are located in the highest density category (> 37.7 jobs per acre) covering only about 4.9 percent of the city's land area. There were 273 pedestrian collisions over the period from 2008 to 2012 in the highest density employment areas, which equates to 54.9 collisions per square mile. Roughly one-third of the city's jobs are located low employment density areas, with employment densities less than 11.9 jobs per acre. In contrast to the highest density job areas, low density employment areas cover over 92 percent of the city's land area, with 1,598 pedestrian collisions occurring over the period from 2008 to 2012, equating to only 5.0 collisions per square mile.

In summary, pedestrian collisions are occurring in high density employment areas at approximately eleven times the rate as in low employment density areas. As with the population density findings, this underscores the need for enhanced pedestrian safety treatments as our urban areas continue to increase in density.

Table 5-4: San Diego Pedestrian Collisions by Employment Density Category (2008-2012)

	Value Range*	City of San Diego Square Miles	Percent Area of City of San Diego	Number of Pedestrian Collisions	Collisions per Square Mile
2009 Employment Density by Census Block					
High	>37.7 jobs per acre	4.9	1.5%	273	54.9
Medium	11.9 to 37.7	19.3	5.8%	424	21.8
Low	<11.9	307.7	92.7%	1,598	5.0

Source: City of San Diego (2013); US Census Longitudinal Employer-Household Dynamics (2010); Chen Ryan Associates, April 2014

Note:

*   Value ranges for each neigbhorhood factor are defined in order to represent one-third of the region's population. In other words, one-third of the region's population falls within census blocks with empliyoment densities greater than 37.7 jobs per acre; one-third of the region's population lives in census blocks with employment density bewteen 11.9 and 37.7 jobs per acres; and one-third of the region's population lives in census blocks with employment densities less than 11.9 jobs per acre.

Figure 5-3 shows the three employment density categories along with pedestrian collisions occurring over the 5-year period between 2008 and 2012.

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Citywide Pedestrian Collision Analysis
City of San Diego Comprehensive Pedestrian Safety Study

Employment Density by Census Block

■ > 37.7 Persons Per Acre

■ 11.9 - 37.7 Persons Per Acre

■ < 11.9 Persons Per Acre

○ Collision Location

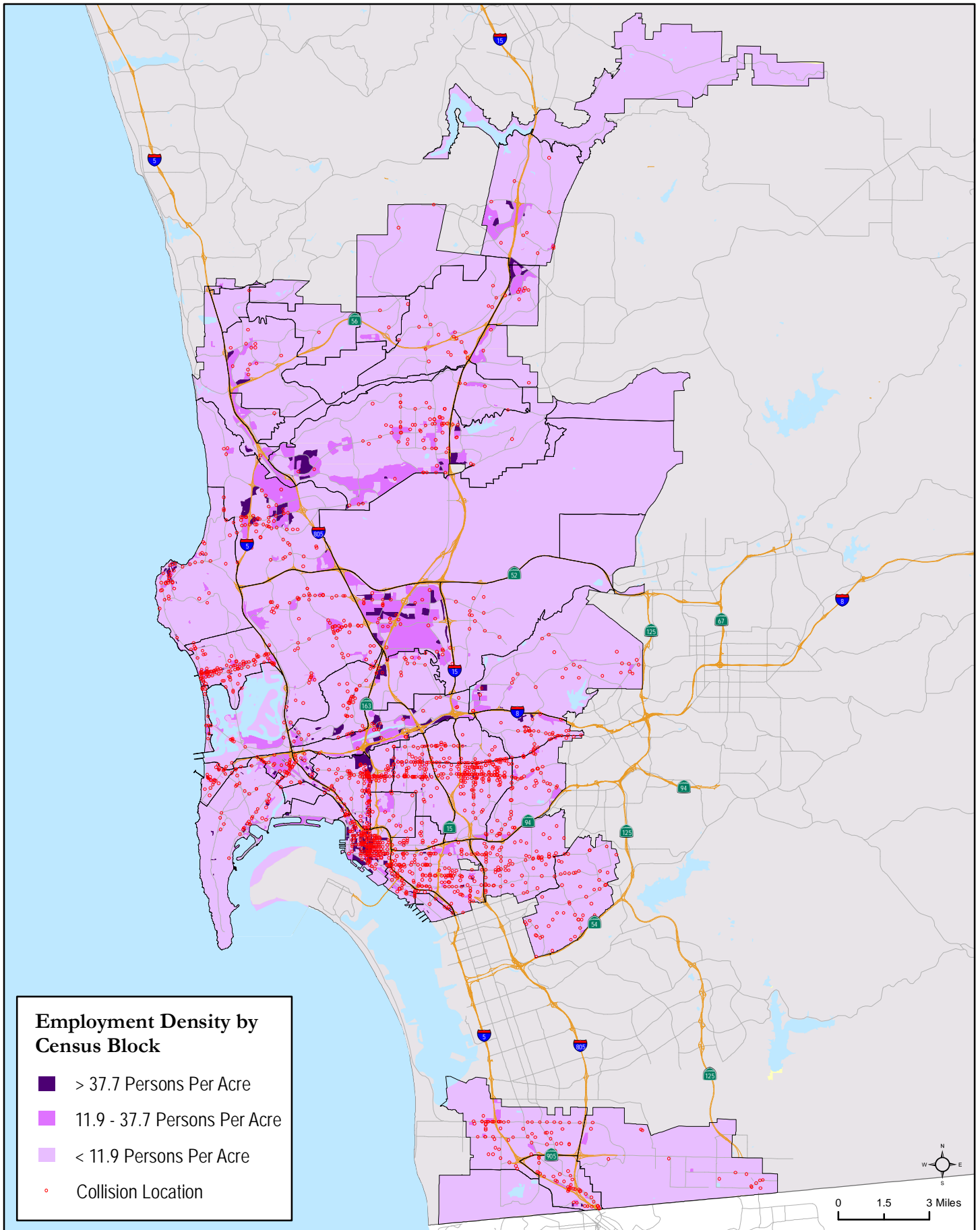*San Diego Comprehensive Pedestrian Safety Study*

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Figure 5-3
Citywide Pedestrian Collisions (2008-2012)
and 2009 Employment Density

Table 5-5 shows the number of collisions based on median household income ranges (high, medium and low). These categories were defined by assigning 33.3 percent, or one-third, of the total regional households into each category (high, medium or low), then inspecting the resulting value ranges for the median household income associated with each category.

Approximately one-third of the city's households are located in the highest income category (> $78,242) covering only about 48.1 percent of the city's land area. There were about 241 pedestrian collisions over the period from 2008 to 2012 in the highest income areas, which equates to about 1.5 collisions per square mile. Roughly one-third of the city's households fall into low income neighborhoods, within areas where median household incomes are below $54,081. In contrast to the highest income areas, low income areas cover about 26 percent of the city's land area, with 1,318 pedestrian collisions occurring over the period from 2008 to 2012, equating to approximately 15.4 collisions per square mile.

Table 5-5: San Diego Pedestrian Collisions by Median Household Income Category (2008-2012)

Value Range*		City of San Diego Square Miles	Percent Area of City of San Diego	Number of Pedestrian Collisions	Collisions per Square Mile
2010 Median Household Income by Census Tract					
High	>$78,242	160.0	48.1%	241	1.5
Medium	$54,081 to $78,242	86.5	26.1%	722	8.3
Low	<$54,081	85.5	25.8%	1,318	15.4

Source: City of San Diego (2013); US Census (2010); Chen Ryan Associates, April 2014

Note:

* Value ranges for each neigbhorhood factor are defined in order to represent one third of the region's population. In other words, one-third of the region's households falls within census tracts with median household income over $78,242; one-third of the region's households live in census tracts with median household incomes falling between $54,081 and $78,242; and one-third of the region's households live in census tracts with median household incomes less than $54,081.

As shown, pedestrian collisions are occurring in low income areas at approximately ten times the rate as in high income areas. These findings have direct implications for social equity concerns related to the distribution of pedestrian collisions and the need for enhanced pedestrian safety treatments in lower income areas. These lower income households tend to produce higher number of walk trips, on average, relative to high income households, and therefore may experience higher levels of pedestrian risk exposure.

Figure 5-4 displays the number of pedestrian collisions occurring in San Diego between 2008 and 2012 along with 2010 median household income.

Median Household Income by Census Tract

- > $78,242
- $54,081 - $78,242
- < $54,081
- Collision Location

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Figure 5-4
Citywide Pedestrian Collisions (2008-2012)
and 2010 Median Household Income

6.0 Roadway Environment Conditions

This chapter summarizes trends in pedestrian collisions by location in the roadway right-of-way and by roadway environment type.

The location of a pedestrian collision is defined as being at one of the following four points within the roadway right-of-way:

1. Signalized Intersections

2. Mid-Block Locations

3. Unsignalized Intersections

4. Driveway/Alley/Private Property

Posted speed limits and number of lanes were used to define roadway environment types. A roadway with a posted speed limit of 30 mph and below was considered a "low speed" roadway; conversely, a roadway with posted speeds of 35 mph or greater was considered "high speed." A roadway with three lanes or fewer was referred to as having "few lanes", while a roadway with four lanes or more was referred to as having "many lanes." Information on the posted speed limits and number of lanes was obtained from SANDAG's hwycov shapefile. Every collision point in the City's collision shapefile was attributed with roadway environment conditions information.

Table 6-1 shows the frequency of collisions by location in the roadway. Nearly 40% of all pedestrian-involved collisions over the 5-year period from 2008 to 2012 take place at signalized intersections.

Table 6-1: Collision Frequency by Location in the Roadway (2008 to 2012)

Location in the Roadway	Number of Collisions	Percent of Total Collisions
At Signalized Intersection	906	39.7%
At Mid-Block Location	836	36.6%
At Unsignalized Intersection	471	20.6%
At Driveway/Alley/Private Property	70	3.1%
	2,283	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

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City of San Diego Comprehensive Pedestrian Safety Study

Table 6-2 shows that a clear majority of the driver-at-fault collisions (58.8 percent) took place at signalized intersections; while a majority of pedestrian-at-fault collisions took place at mid-block (60.2 percent). A more detailed analysis of party-at-fault will take place in the following chapters about driver and pedestrian fault (Chapters 7 and 8).

Table 6-2: Pedestrian Collision Frequency by Party-at-Fault and Location in the Roadway (2008 to 2012)

Location in the Roadway	Total Pedestrian Collisions[1]		Driver-At-Fault		Pedestrian-At-Fault	
	Number of Collisions	Percent	Number of Collisions	Percent	Number of Collisions	Percent
At Signalized Intersection	906	39.7%	643	58.8%	197	26.5%
At Mid-Block Location	836	36.6%	118	10.8%	447	60.2%
At Unsignalized Intersection	470	20.6%	312	28.5%	92	12.4%
At Driveway/Alley/Private Property	71	3.1%	20	1.9%	7	0.9%
	2,283	100%	1,093	100%	743	100%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Notes:
1. Driver-at-fault collisions and pedestrian-at-fault collisions do not sum up to the number reported in the first column (total number of pedestrian collisions) because 447 collisions were not assigned a "fault".

Table 6-3 shows the frequency of collisions during the period from 2008 to 2012 based on the roadway's posted speed. There is a nearly even distribution between pedestrian collisions occurring along high speed and low speed roadways.

Table 6-3: Speed of Roadway Where Collisions Occur (2008 to 2012)

Speed of Roadway	Number of Collisions	Percent of Total Collisions
High Speed (≥ 35 mph)	1,165	51.0%
Low Speed (≤ 30 mph)	1,118	49.0%
	2,283	**100%**

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

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Table 6.4 shows the distribution of collisions during the period from 2008 to 2012 by posted speed of the roadway and by party-at-fault. As shown, a slightly high proportion of driver-at-fault collisions occur on higher speed roadways relative pedestrian-at-fault collisions on higher speed roadways (54.4 percent versus 51 percent). For both driver-at-fault and pedestrian-at-fault collisions, a greater share of collisions occurs along high speed roadways versus low speed roadways.

Table 6-4: Party-at-Fault by Speed of Roadway Where Collisions Occur (2008 to 2012)

Speed of Roadway	Percent of Total Collisions	Percent of Total Driver- At-Fault Collisions	Percent of Total Pedestrian-At-Fault Collisions
High Speed (≥ 35 mph)	51.0%	54.4%	52.8%
Low Speed (≤ 30 mph)	49.0%	45.6%	47.2%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Table 6-5 shows the frequency of collisions by roadways with "many" or "few" lanes. There are similar shares of collisions along wide and narrow roadways, with 50.7 percent occurring along wide roadways and 49.3 percent occurring along narrow roadways.

Table 6-5: Pedestrian Collisions by Roadway Width (2008-2012)

Width of Roadway	Number of Collisions	Percent of All Collisions
Many Lanes (≥ 4 lanes)	1,159	50.7%
Few Lanes (≤3 lanes)	1,124	49.3%
	2,283	**100.0%**

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Table 6-6 shows the frequency of collisions by roadway width and party-at-fault. The proportion of pedestrian-at-fault collisions by roadway width is identical to the proportions for all collisions. With driver-at-fault collisions, there is a marked trend showing higher numbers of driver-at-fault collisions along wide roadways relative to narrow roadways (56 percent versus 44 percent).

Table 6-6: Pedestrian Collisions by Roadway Width and Party-at-Fault (2008-2012)

Width of Roadway	Percent of All Collisions	Percent of Total Driver at Fault Collisions Only	Percent of Total Pedestrian at Fault Collisions Only
Many Lanes (≥ 4 lanes)	50.7%	56.0%	50.7%
Few Lanes (≤3 lanes)	49.3%	44.0%	49.3%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

Table 6-7 shows pedestrian collisions by roadway environment type in San Diego over a 5-year period between 2008 and 2012.

Table 6-7: Pedestrian Collisions by Roadway Environment Type (2008-2012)

Conditions of Roadway	Number of Collisions	Percent of All Collisions
High Speed & Many Lanes	947	41.5%
Low Speed & Few Lanes	906	39.7%
High Speed & Few Lanes	218	9.5%
Low Speed & Many Lanes	212	9.3%
	2,283	**100.0%**

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

As shown, the highest numbers of collisions occur along high speed, wide roadways, with about 42 percent of all collisions occurring in this roadway environment type. The next most frequent number of collisions occurs along low speed, narrow roadways, with about 38 percent of all collisions. Roadway environments with high speed and few lanes, as well as with low speeds and many lanes both have lower numbers of pedestrian collisions, with only about 9 percent of total collisions.

Table 6-8 displays pedestrian collisions by party-at-fault and roadway environment type.

Table 6-8: Pedestrian Collisions by Party-at-Fault and Roadway Environment Type

Conditions of Roadway	Percent of Total Collisions	Percent of Total Driver-At-Fault Collisions	Percent of Total Pedestrian-At-Fault Collisions
High Speed & Many Lanes	41.5%	44.6%	43.4%
Low Speed & Few Lanes	39.7%	34.2%	40.0%
High Speed & Few Lanes	9.5%	9.8%	9.3%
Low Speed & Many Lanes	9.3%	11.4%	7.3%

Source: City of San Diego (2013); SANDAG (2013); Chen Ryan Associates, April 2014

As shown, a greater proportion of driver-at-fault and pedestrian-at-fault collisions (almost 45 percent and 44 percent, respectively) occur along roadway environment types with high speed and many lanes.

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7.0 Pedestrian Collisions and Causes when Driver is at Fault

This chapter summarizes pedestrian collisions by the major driver-at-fault collision causes. Of the 2,283 pedestrian collisions occurring within the City of San Diego between 2008 and 2012, the driver was assigned fault in approximately 48 percent of the cases. **Table 7-1** shows the percentage of driver, pedestrian and unknown/unassigned party fault for the collisions occurring in the 5 year period.

Table 7-1: Pedestrian Collisions by Party-at-Fault (2008-2012)

Fault	Number of Collisions	Percent of Total
Driver-At-Fault	1,093	47.9%
Pedestrian-At-Fault	743	32.5%
Unknown/Unassigned Fault	447	19.6%
	2,283	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Figure 7-1 displays driver-at-fault collisions across the City of San Diego. Collisions where the driver was at fault (1,022 collisions) is the subject of this chapter, while the findings from collisions where the pedestrian was the party-at-fault are examined in Chapter 8 of this report
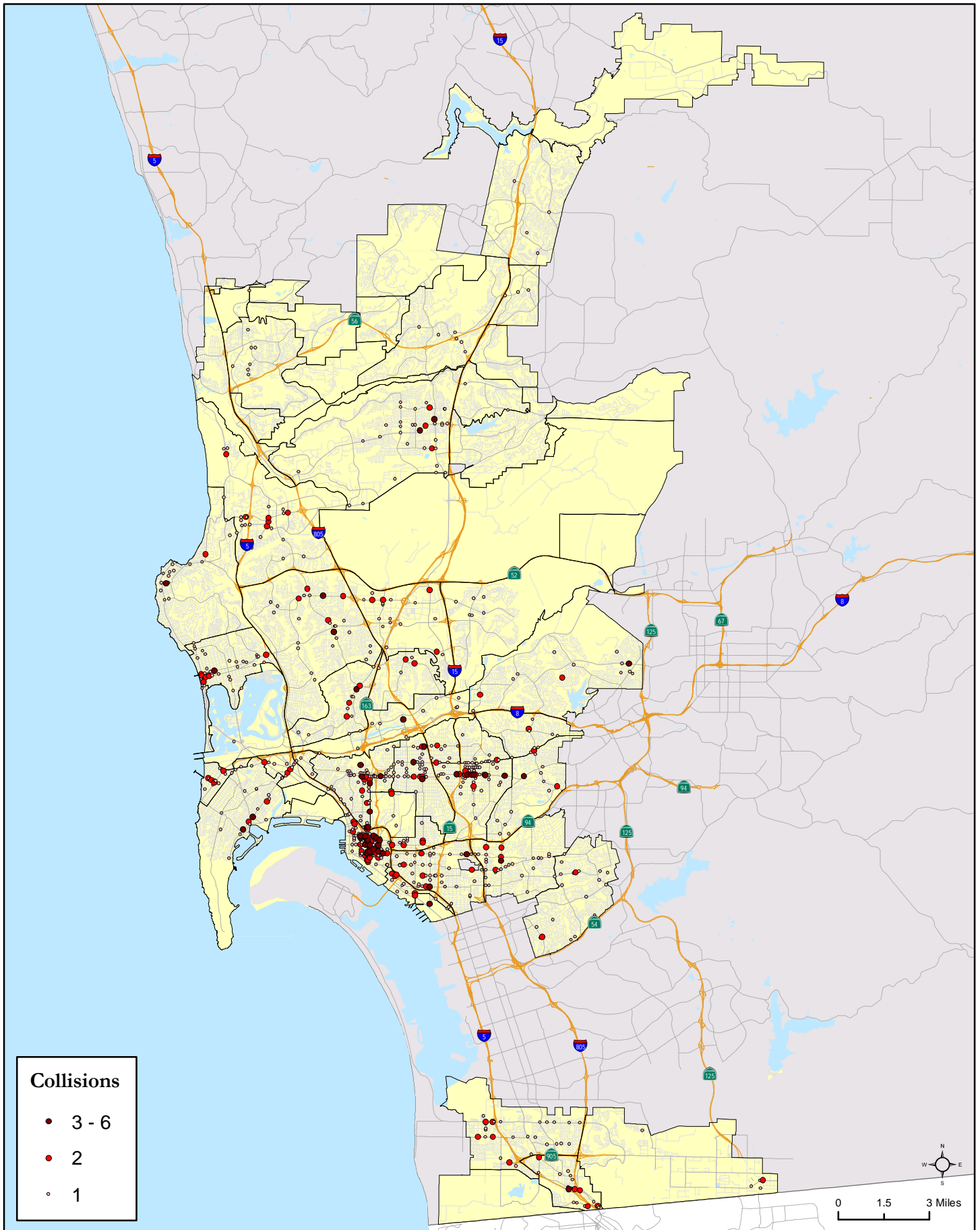
Table 7-2 shows the frequency of driver-at-fault collisions by collision cause, occurring within the City of San Diego over the 5-year period between 2008 and 2012. Collision causes include improper turn-related offences, improper start, failure to stop-related offences, and speed-related offences. Any cause descriptions which could not easily be collapsed into a larger summary category together with similar cause descriptions, or causes which did not lend themselves to a category of their own, are shown as "other".

Table 7-2: Pedestrian Collisions by Driver-At-Fault Cause Category (2008-2012)

Driver-At-Fault Collision Cause	Number of Driver-At-Fault Collisions	Percent of Total Drive-At-Fault Collisions
Improper Turn-Related Causes	697	63.7%
Improper Start	140	12.8%
Other	120	11.0%
Failure to Stop/Improper Stop-Related Causes	82	7.6%
Speed-Related Causes	54	4.9%
	1,093	**100.0%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, improper turn-related causes are by far the greatest percent of all driver-at-fault collisions, at about 64 percent of all driver-at-fault collisions.

Collisions

- 3 - 6
- 2
- 1

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Figure 7-1

Citywide Map of Pedestrian Collision Locations
Where Driver is at Fault

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The improper turn-related offence category encompasses any type of turn movement made by the motorist which violated the pedestrian right-of-way. Any record in the pedestrian collision dataset containing the word "turn" in the cause description (in addition to "violated peds R/W") was categorized as an improper turn-related offence. Some examples include "IMPROPER TURN", "LT (or RT)-TURN DIDN'T YIELD", "UNSAFE MOVEMENT – LT (or RT)". A complete list of cause codes from the city collision dataset is provided in **Appendix A**.

Table 7-3 shows the locations of collisions caused by a driver's improper turning movement occurring within the City of San Diego for the 5-year period between 2008 and 2012.

Table 7-3: Collisions Caused by Driver's Improper Turn by Location in the Roadway (2008 – 2012)

Location in Roadway	Number of Drive-At-Fault Improper Turn Collisions	Percent of Total
At Signalized Intersection	488	70.0%
At Unsignalized Intersection	155	22.2%
At Mid-Block Location	47	6.8%
At Driveway/Alley/Private Property	7	1.0%
	697	100%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, 70 percent of all driver-at-fault collisions were caused by a driver's improper turn at signalized intersections. **Figure 7-2** displays a citywide map of the locations of pedestrian collisions caused by a driver's improper turn.
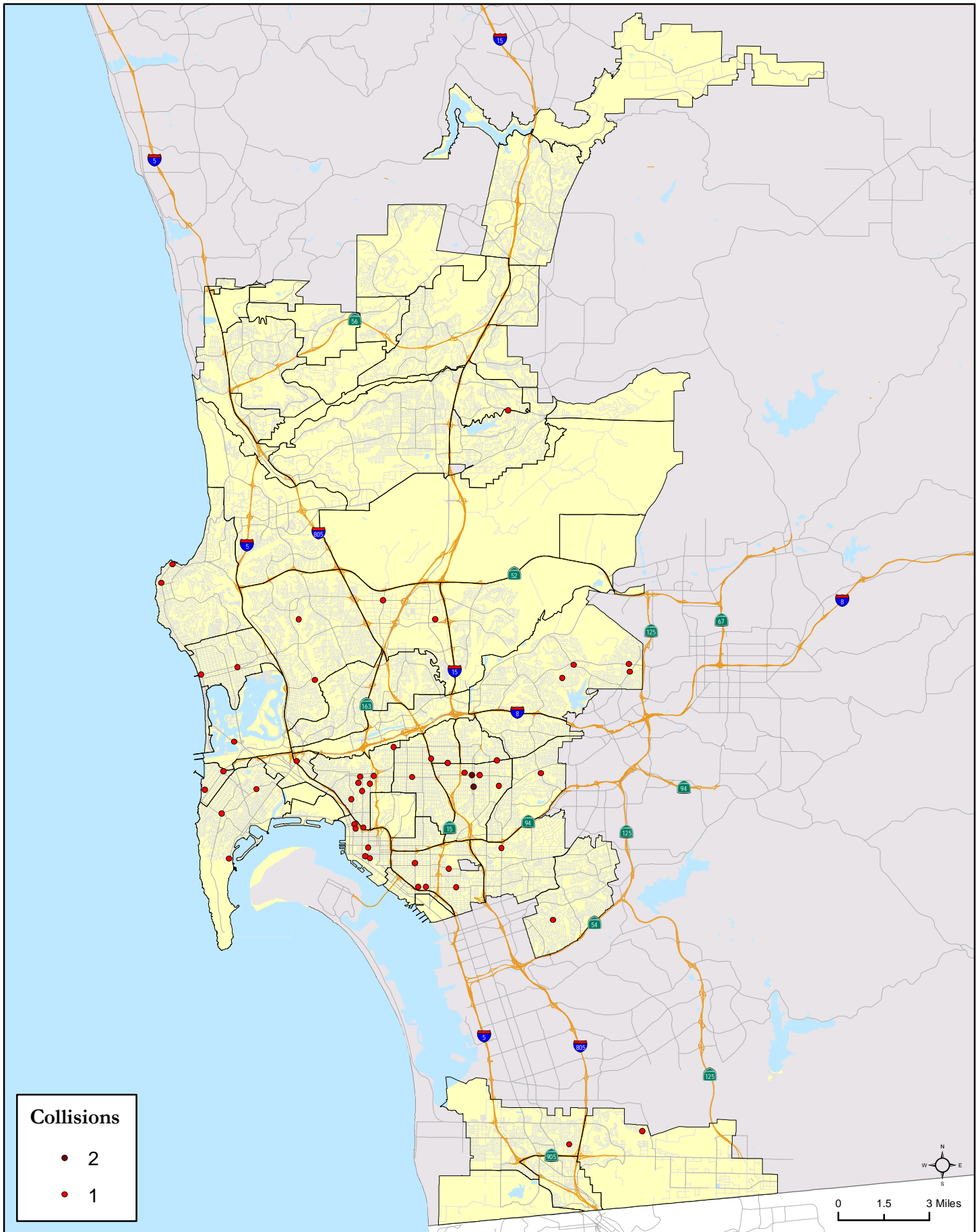
Table 7-4 shows the frequency of driver-at-fault collisions caused by an improper start by location within the City of San Diego for a 5-year period between 2008 and 2012.

Table 7-4: Collisions Caused by Driver's Improper Start by Location in Roadway (2008-2012)

Location in Roadway	Number of Driver-At-Fault Collisions	Percent of Total Drive-At-Fault Collisions
At Unsignalized Intersection	54	38.6%
At Signalized Intersection	49	35.0%
At Mid-Block Location	34	24.3%
At Driveway/Alley/Private Property	3	2.1%
	140	100%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

A driver's improper start caused 12.8% of all driver-at-fault collisions, which makes it the second most frequent collision cause. The improper start occurs most frequently at unsignalized intersection locations (nearly 39 percent of total driver-at-fault collisions), followed by signalized intersections at 35 percent. **Figure 7-3** displays the improper start pedestrian collision locations in the City of San Diego during the period from 2008 to 2012.

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Collisions

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Figure 7-2
Citywide Map of Pedestrian Collision Locations
Where Speed was Cause

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Collisions

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● 2

○ 1
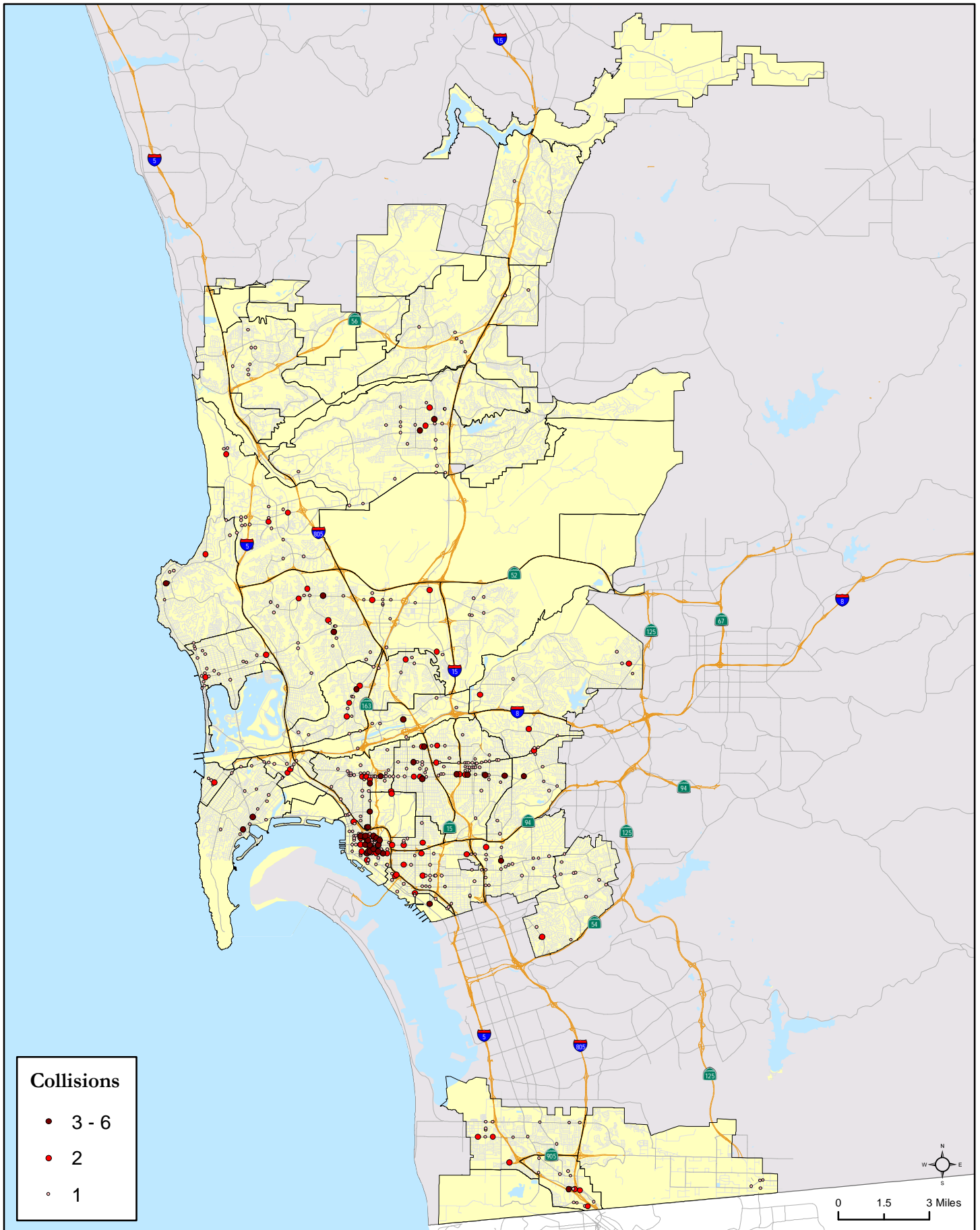
San Diego Comprehensive Pedestrian Safety Study

Figure 7-3

Citywide Map of Pedestrian Collision Locations
Improper Turn was Cause

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Table 7-5 shows the frequency of driver-at-fault collisions caused by a driver's improper stopping by location in the roadway, within the City of San Diego over a 5-year period between 2008 and 2012. This collision cause is comprised of all fault descriptions where the motorist either disobeyed traffic controls or did not safely stop (e.g. rolling past limit line). A complete list of the cause codes for this fault category can be found in Appendix A.

Table 7-5: Collisions Caused by Driver's Improper Stop by Location in Roadway (2008-2012)

Location in Roadway	Number of Driver-At-Fault Collisions	Percent of Total Drive-At-Fault Collisions
At Signalized Intersection	41	50.0%
At Unsignalized Intersection	30	36.6%
At Mid-Block Location	6	7.3%
At Driveway/Alley/Private Property	5	6.1%

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, the improper start comprised 7.6% of all collisions where the driver was at fault, which makes it the fourth most frequent collision cause for driver-at-fault collisions. The improper stop occurs most frequently at signalized intersection locations (nearly 50 percent of total driver-at-fault collisions), followed by unsignalized intersections at 37 percent. **Figure 7-4** displays the collisions of this cause category citywide.

Table 7-6 shows the frequency of driver-at-fault collisions caused by speeding by location in the roadway. All analyzed collisions occurred within the City of San Diego over a 5-year period between 2008 and 2012.
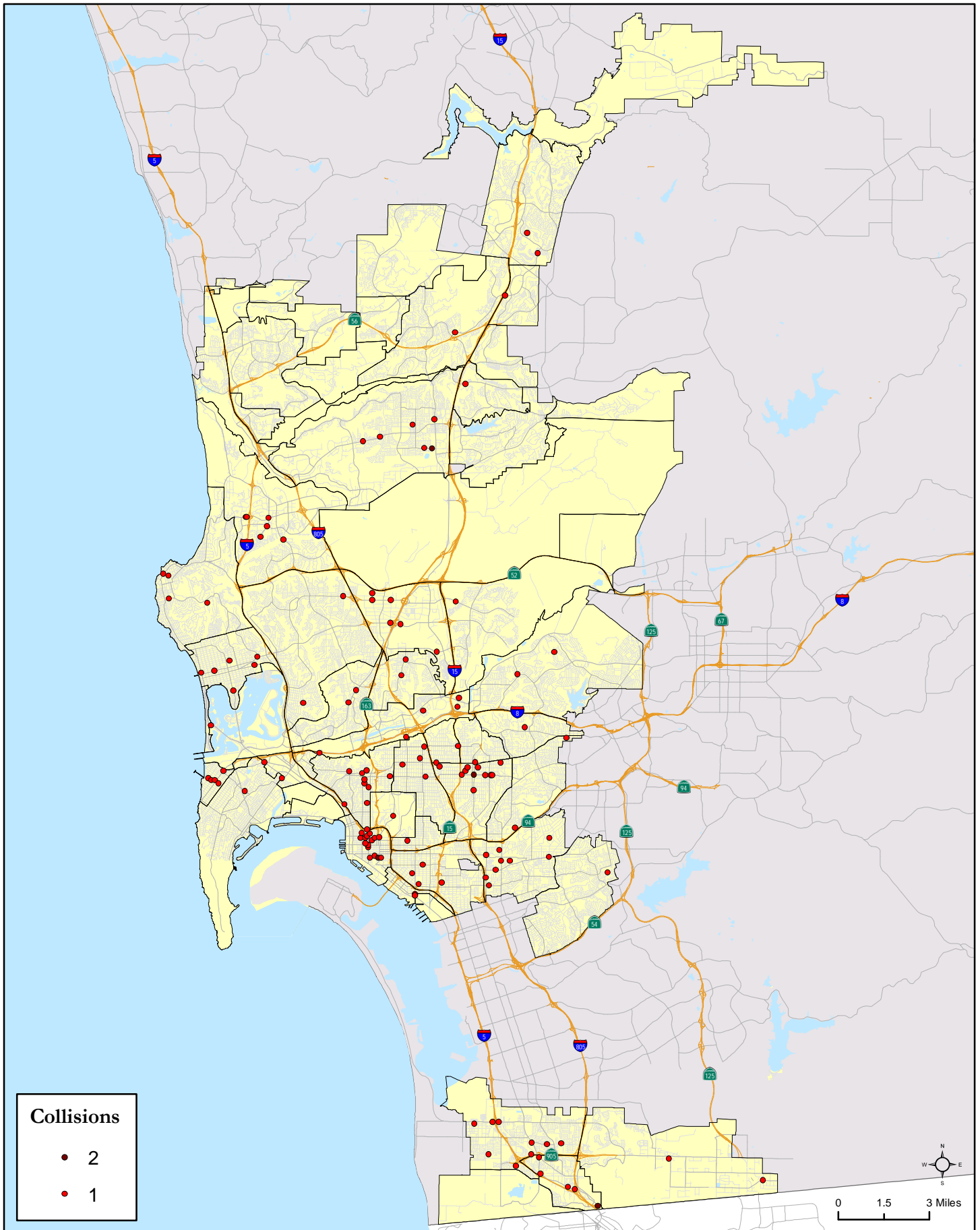
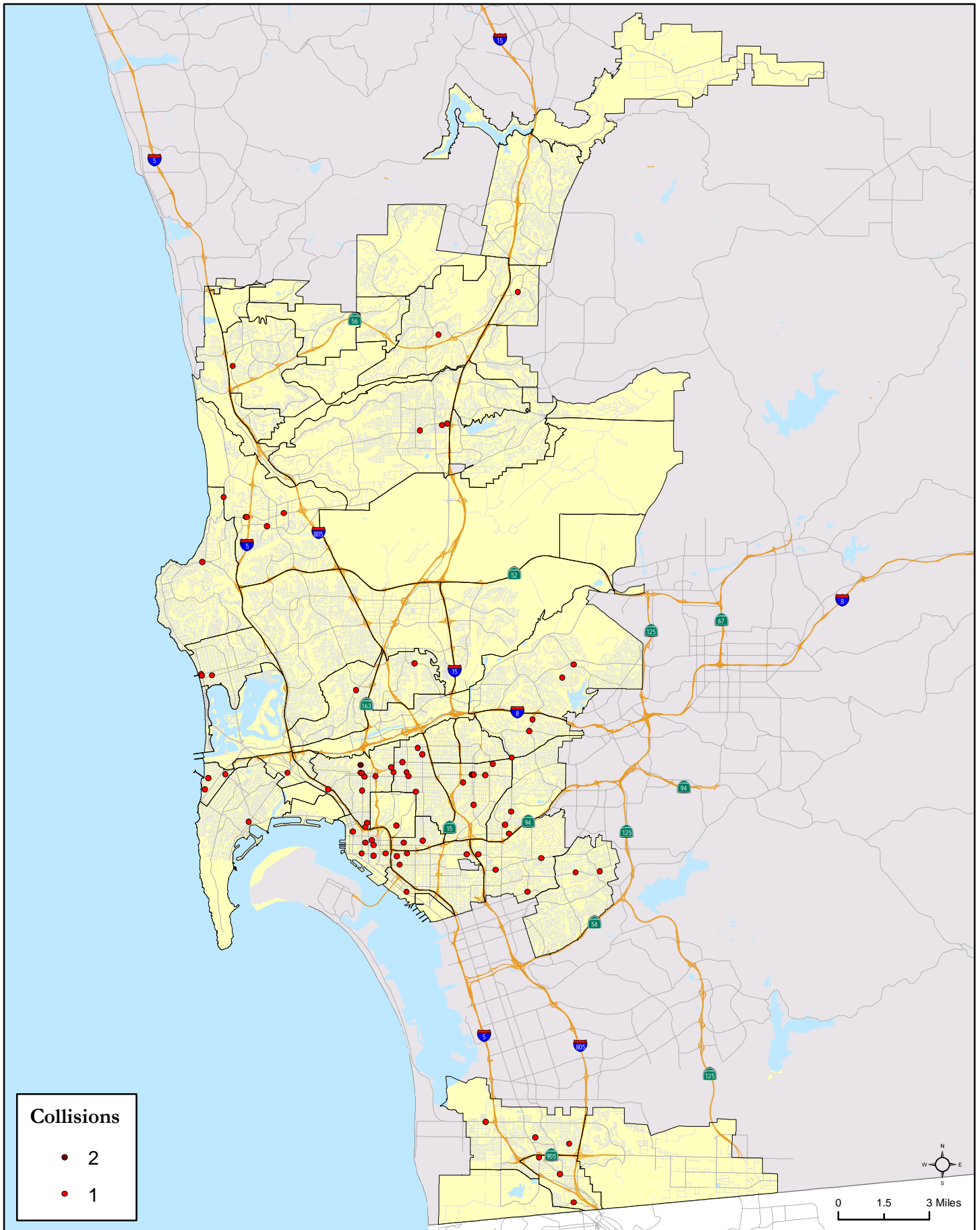**Table 7-6: Speed-Related Collisions by Location in Roadway (2008-2012)**

Location in Roadway	Number of Driver-At-Fault Collisions	Percent of Total Drive-At-Fault Collisions
At Unsignalized Intersection	20	36.7%
At Mid-Block Location	20*	36.7%
At Signalized Intersection	13	24.7%
At Driveway/Alley/Private Property	1	1.9%
	56	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Note: 15 Mid-Block collisions occurred at roadways with ≤ 3 Lanes and ≤ 30 mph posted speed

As shown, speeding caused 12.8% of all collisions where the driver was at fault, which makes it the fifth most frequent collision cause for driver-at-fault collisions. Speeding was the collision cause, at both unsignalized and mid-block locations, for roughly 37 percent of speed-related collisions. By comparison, the frequency of the mid-block location for all driver-at-fault collisions is 10.7%. **Figure 7-5** displays the collisions of this fault category citywide.

Collisions

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Figure 7-4

**Citywide Map of Pedestrian Collision Locations
Where Improper Start was Cause**

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Collisions

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- 1

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Figure 7-5

Citywide Map of Pedestrian Collision Locations
Failure to Stop was Cause

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8.0 Pedestrian Collisions and Causes when Pedestrian is at Fault

This chapter summarizes pedestrian collisions across the City of San Diego where the pedestrian was assigned fault. Of the 2,283 pedestrian collisions occurring in the City of San Diego between 2008 and 2012, the pedestrian was assigned fault in a total of 743 cases, or about 35 percent of total collisions.

Table 8-1 shows the pedestrian-at-fault collisions by cause. Four major cause categories emerged when examining pedestrian-at-fault collision records, including improper mid-block crossing attempt, improper intersection crossing attempt, pedestrian in the roadway (not paying attention to traffic) and pedestrian in the roadway (not attempting to cross). Any cause description which could not easily be collapsed into a broader category with similar cause descriptions or which did not lend themselves to a category of their own are shown as "other".

Table 8-1: Pedestrian-At-Fault Collisions by Cause Category (2008 to 2012)

Collision Cause Category	Number of Pedestrian-At-Fault Collisions	Percent of Total
Improper Mid-Block Crossing Attempt	358	48.2%
Improper Intersection Crossing Attempt	197	26.5%
Pedestrian in the Roadway (not paying attention to traffic)	86	11.5%
Other	54	7.3%
Pedestrian in the Roadway (not attempting to cross)	48	6.5%
	743	**100.0%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, improper mid-block crossing attempt accounts for 48.2 percent of all pedestrian-at-fault cause categories. Collisions at the mid-block are more likely to be the pedestrian's fault since pedestrian right-of-way is less certain at mid-block locations.

Figure 8-1 displays a map of pedestrian-at-fault collisions across the City of San Diego.

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Collisions

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Figure 8-1

Citywide Map of Pedestrian Collision Locations
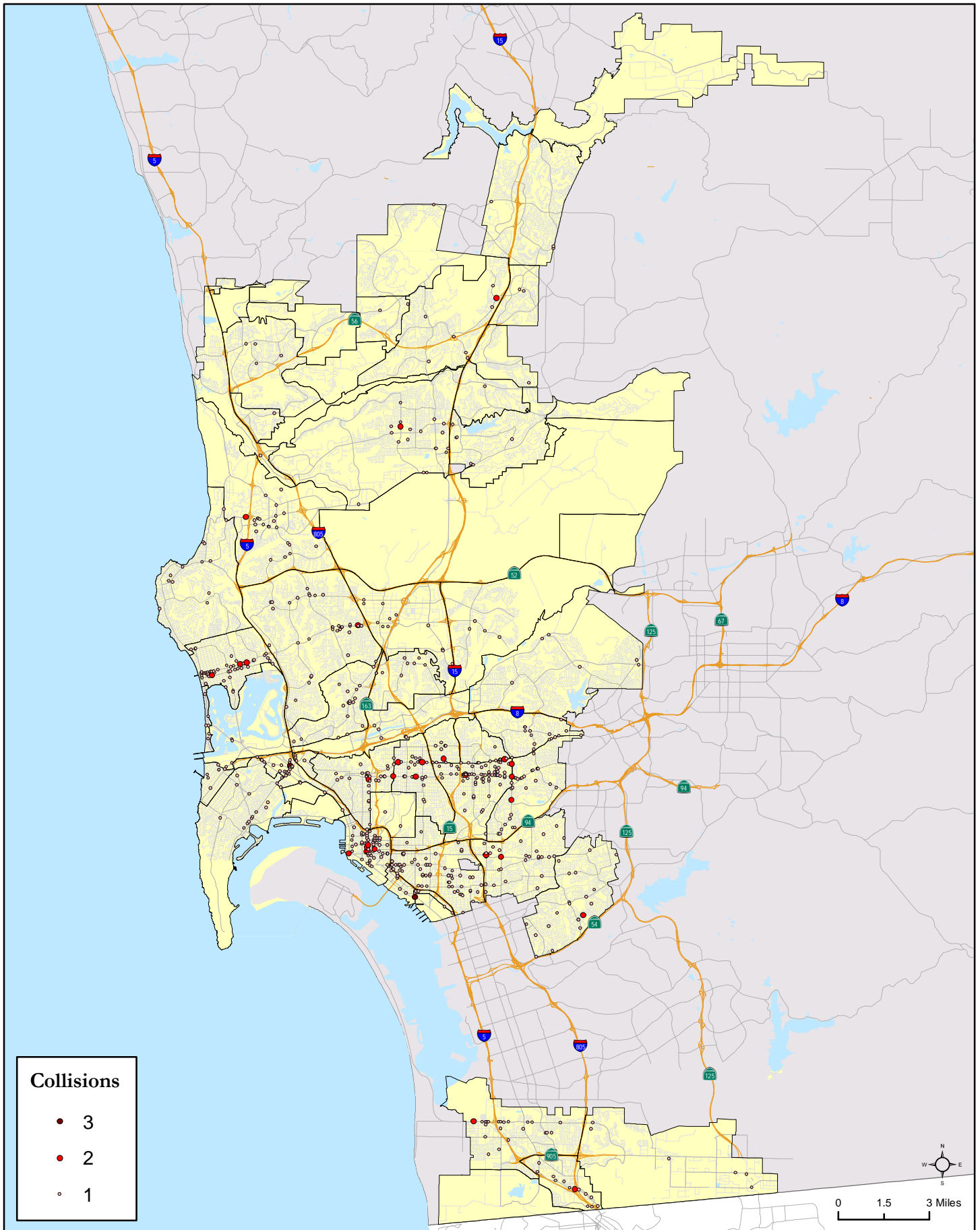**Where Pedestrian is at Fault**

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Table 8-2 shows collisions caused by pedestrians by location in the roadway, within the City of San Diego for the 5-year period between 2008 and 2012. As shown, over 60 percent of pedestrian-at-fault collisions occur at mid-block locations.

Table 8-2: Pedestrian-At-Fault Collisions by Location in Roadway (2008 to 2012)

Location in Roadway	Number of Pedestrian-At-Fault Collisions	Percent of Total
At Mid-Block Location	447	60.2%
At Signalized Intersection	197	26.5%
At Unsignalized Intersection	92	12.4%
At Driveway/Alley/Private Property	7	0.9%
	743	**100%**

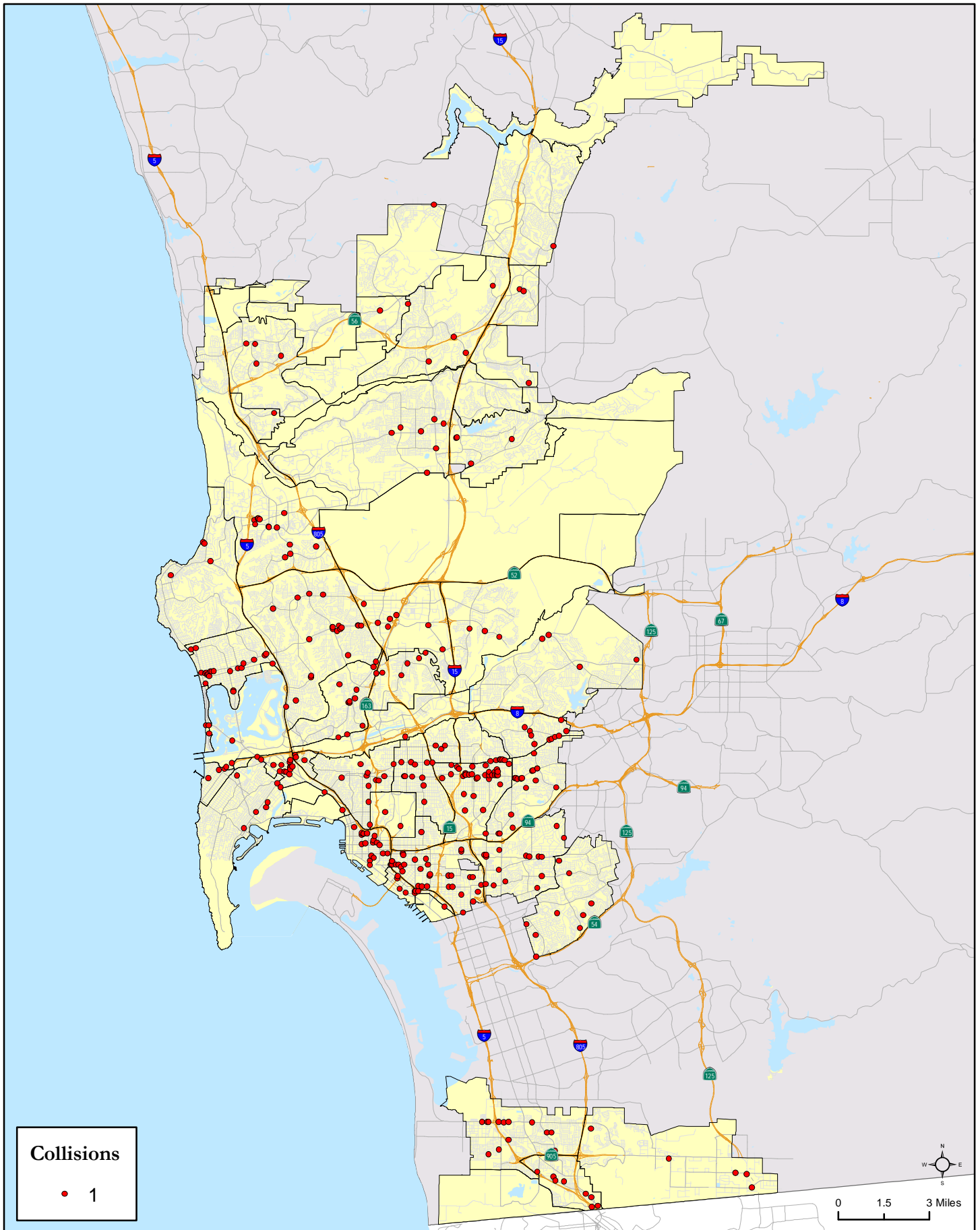Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Table 8-3 shows the collisions caused by a pedestrian's improper mid-block crossing by location in the roadway. All collisions analyzed occurred within the City of San Diego over a 5-year period between 2008 and 2012. Improper mid-block crossing attempts are any pedestrian's attempts to cross the street when the vehicle has the right-of-way, in other words, jaywalking.

Table 8-3: Improper Mid-Block Crossing Attempt Collisions by Location in Roadway (2008-2012)

Location in Roadway	Number of Pedestrian-At-Fault Collisions	Percent of Total
At Mid-Block Location	358	100%
At Signalized Intersection	0	0%
At Unsignalized Intersection	0	0%
At Driveway/Alley/Private Property	0	0%
	358	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As expected, 100% of these collisions occurred at mid-block locations. **Figure 8-2** displays a map of citywide pedestrian-at-fault collisions caused by improper mid-block crossings.

Collisions

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Figure 8-2
Citywide Map of Pedestrian Collision Locations
Where Pedestrian was Inappropriately Attempting to Cross at Mid-Block

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Table 8-4 shows the collisions caused by a pedestrian's improper attempt to cross at an intersection by location in the roadway. All collisions analyzed occurred within the City of San Diego over the 5-year period between 2008 and 2012. Improper intersection crossings are defined as attempts to cross the street at the intersection when pedestrians did not have the right-of-way at the moment of their crossing. This category also includes crossing outside of the appropriately designated crossing location.

Table 8-4: Collisions Caused by Pedestrian's Improper Intersection Crossing Attempt by Location in Roadway (2008 – 2012)

Improper Intersection Crossing	Number of Collisions (2008-2012)	Percent of Total
At Signalized Intersection	138	70.0%
At Unsignalized Intersection	55	27.9%
At Mid-Block Location	4	2.1%
At Driveway/Alley/Private Property	0	0%
	197	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

As shown, 70 percent of these collisions occurred at signalized intersection locations, while about 30 percent occurred at unsignalized locations

Figure 8-3 displays a map of improper intersection crossing collisions where the pedestrian was at fault.

Collisions
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Figure 8-3

Citywide Map of Pedestrian Collision Locations
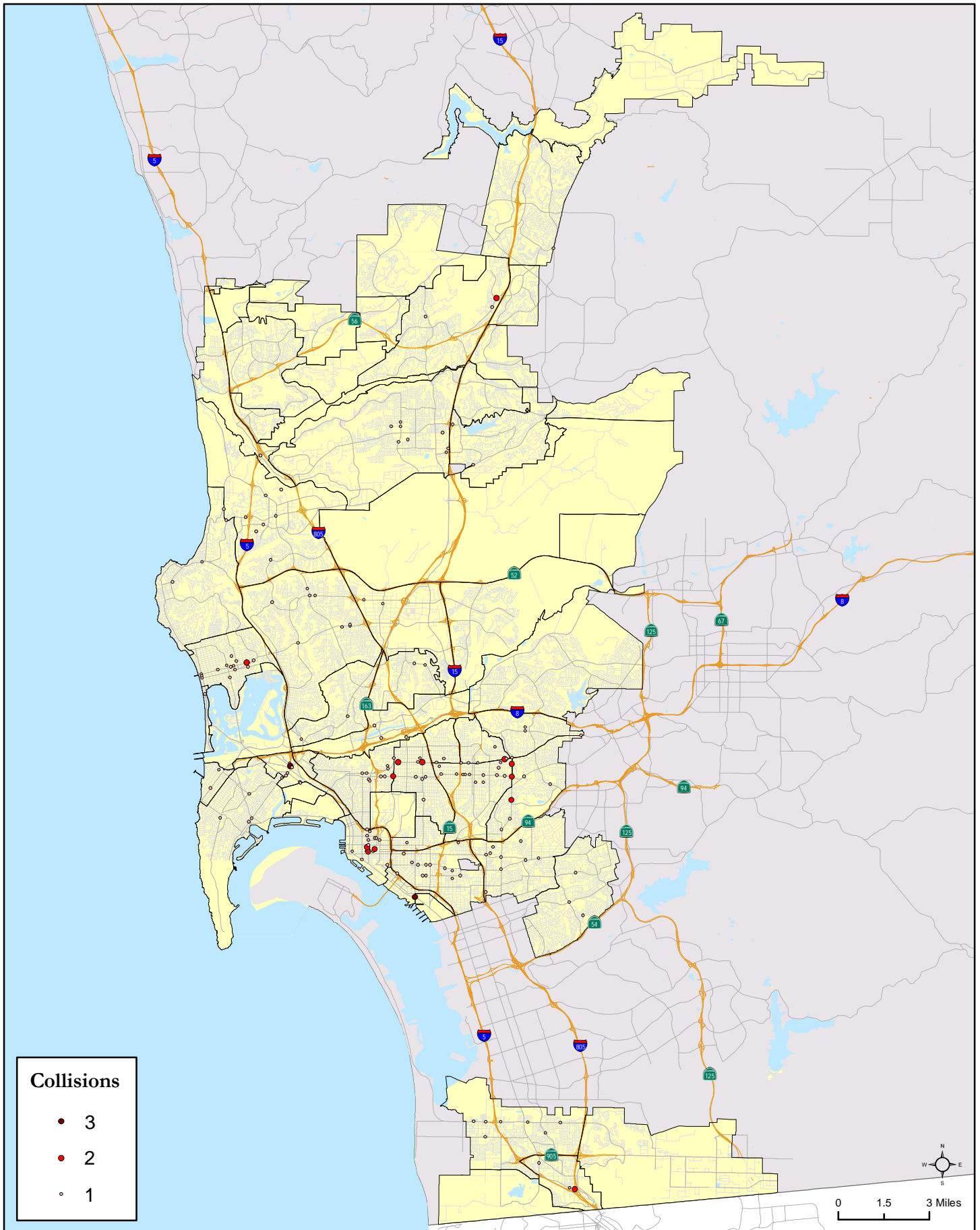Where Pedestrian was Inappropriately Attempting to Cross at Intersection

Table 8-5 shows collisions where the pedestrians entered the road while not paying attention to traffic, while **Table 8-6** shows collisions where the pedestrian is in the roadway but not performing a crossing action. All analyzed collisions occurred within the City of San Diego over the 5-year period between 2008 and 2012. The former category describes cases where the pedestrian enters the street in a distracted state. Cases falling in this category would include children playing/running into the street, pedestrians involved in a chase (for a bus, animal, ice cream truck, from law enforcement, etc.), or any other activity demonstrating lack of awareness of vehicular traffic.

The latter category describes cases where pedestrians are in the street (while they may or may not be distracted), but they are not performing any kind of distracted activity (e.g. playing or chasing). Cases falling in this category could be pedestrians walking/jogging on the side of the road (perhaps because there is no adequate sidewalk), a person standing next to or exiting a parked vehicle, a person performing vehicle repairs on the side of the road, or a person directing traffic. For a complete list of cause codes under each of these categories, refer to Appendix A.

Table 8-5: Collisions Caused by Pedestrian's in the Roadway (Not Paying Attention to Traffic) by Location in Roadway (2008 – 2012)

Location in Roadway	Number of Pedestrian-At-Fault Collisions	Percent of Total
At Mid-Block Location	48	55.8%
At Signalized Intersection	23	26.7%
At Unsignalized Intersection	15	17.5%
At Driveway/Alley/Private Property	0	0%
	86	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

Table 8-6: Collisions Caused by Pedestrians in the Roadway (Not Attempting to Cross) by Location in Roadway (2008 – 2012)

Location in Roadway	Number of Pedestrian-At-Fault Collisions	Percent of Total
At Mid-Block Location	32	66.7%
At Signalized Intersection	11	22.9%
At Unsignalized Intersection	5	10.4%
At Driveway/Alley/Private Property	0	0%
	48	**100%**

Source: City of San Diego (2013); Chen Ryan Associates, April 2014

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As shown in Tables 8-5 and 8-6, most of these collisions occurred away from the intersection at mid-block locations.

Figures 8-4 and **8-5** display citywide maps of collisions caused by pedestrian in the roadway (not paying attention to traffic), and by pedestrian in the roadway (not attempting to cross), respectively.

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Collisions

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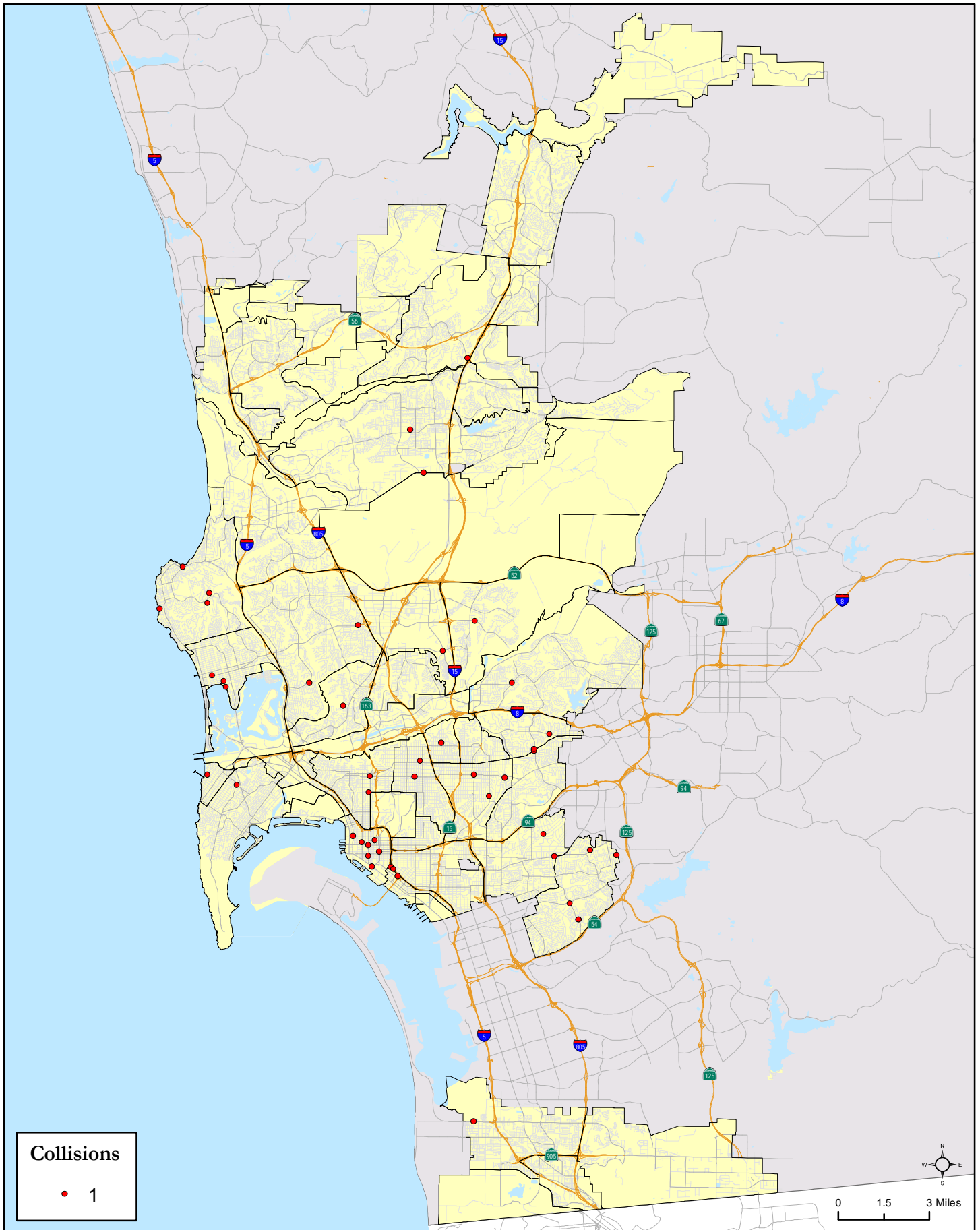
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Figure 8-4

**Citywide Map of Pedestrian Collision Locations
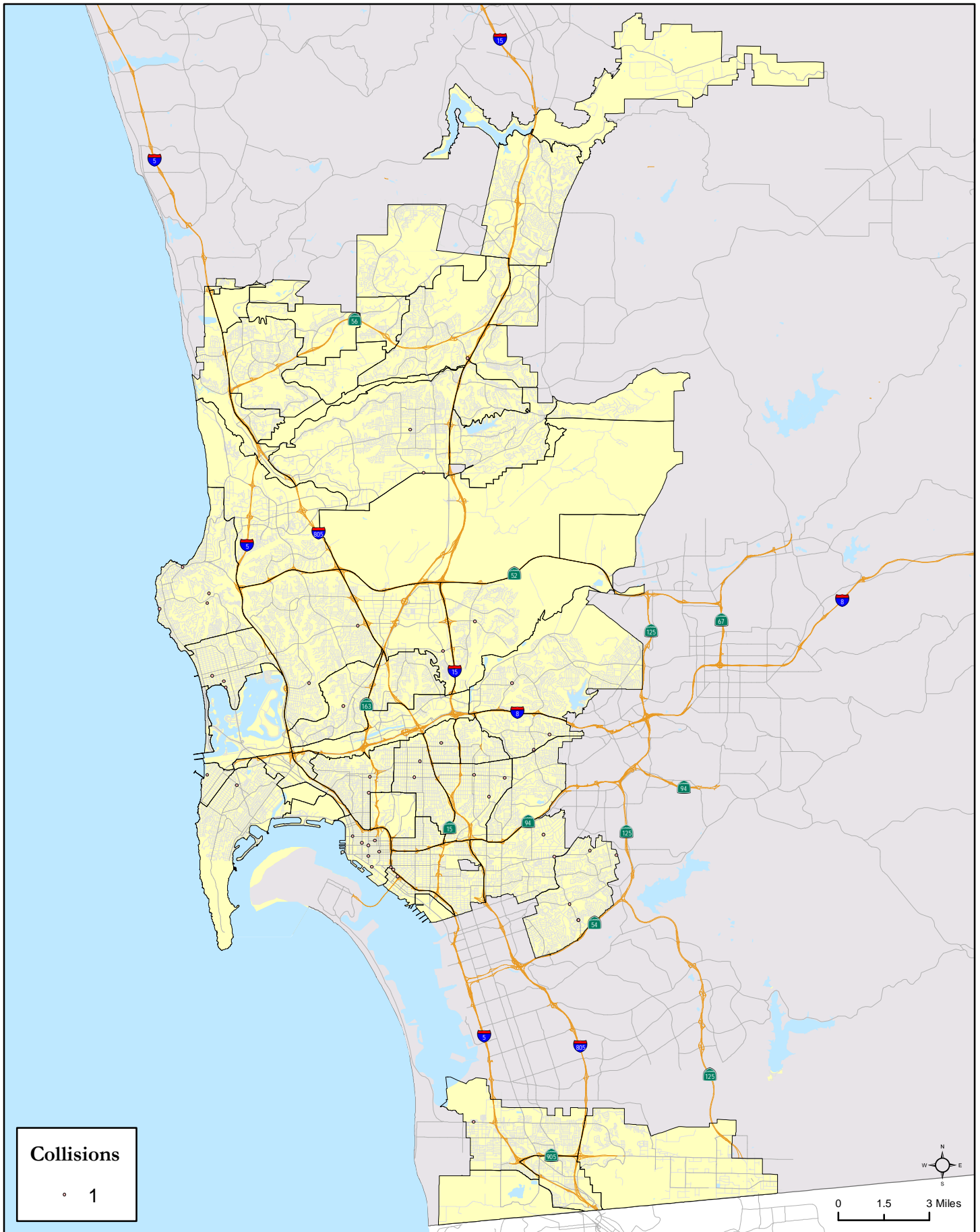Where Pedestrian Inappropriately Entered Roadway**

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Collisions
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Figure 8-5
Citywide Pedestrian Collisions (2008-2012)
Where Pedestrian Entered Roadway Not Attempting to Cross

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