BICYCLE

TRANSPORTATION & SAFETY IN SANTA CLARA COUNTY

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Santa Clara County
PUBLIC HEALTH

TSCN
TRAFFIC SAFE COMMUNITIES NETWORK

Bicycle Transportation & Safety in Santa Clara County

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Cover Photo

Bike Share at San Jose Diridon Station
Image courtesy of Christina Oshinsky with permission from Bay Area Bike Share

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Introduction

Active transportation, which includes bicycling, is increasing in popularity for recreation, health, and transportation. It helps to reduce greenhouse gas emissions, air pollution, traffic congestion, and increases levels of physical activity while improving health. Current and emerging federal, state, and local policies and initiatives encourage people to bicycle because of these benefits. The following examples illustrate the breadth of policies, initiatives, and programs supporting bicycling: 1) the California Department of Transportation's (Caltrans) Strategic Management Plan[1] calls for tripling bicycle use between 2012 and 2020 while simultaneously decreasing bicyclist fatalities by 10% each year, 2) the California Department of Public Health Wellness Plan[2] seeks to increase the percentage of commuters who use active transportation (including bicycling) to travel to work from 9.1% to 11% in an effort to decrease chronic disease and promote health and wellness, 3) the Santa Clara County Community Health Improvement Plan[3] identifies strategies to increase the number of youth and adults using safe and active transportation to school and work by 5% by 2020, 4) city-level transportation goals strive to increase bicycle mode share and safety, and 5) Safe Routes to School programs are providing bicycle education to young people and families in schools and communities.

This report compiles existing data for cities and agencies in Santa Clara County to make evidence-based decisions on how best to direct their efforts to increase bicycle transportation and improve bicycling safety. While significant gaps in bicycle data exist, the report utilizes information from a variety of sources to provide as complete a picture of transportation and safety as possible. Bicycle data was obtained from local and national surveys, emergency department and trauma center reports, and from a statewide database of police reports.

Each area of the report includes a discussion section which provides additional information based on the collective knowledge and experience of local stakeholders, but may not be reflected in the available literature or data. Recommendations on strategies to address findings in the report are highlighted at the end of the document using the six E's of traffic safety programming: education, enforcement, engineering, encouragement, evaluation, and engagement. The report concludes by acknowledging efforts that are creating Bicycle Friendly Communities throughout the county.

Key Findings

- From 2009 to 2013 commuting by bicycle increased by 21% overall in the county; the bicycle commute rate for Santa Clara County was 1.7% of workers ages 16 and over in 2013. Palo Alto (8.6%), Mountain View (5.0%), and Los Altos (2.5%) had the highest percentage of bicycle commuters in the county.
- In 2013-14, 9% of Santa Clara County residents rode their bicycles for trips other than their regular commute. Recreational bicycling is higher among the ages 35 to 44 and 25 to 34 than all other age groups.
- The percentage of active school commutes (which include walking and biking) are higher locally than the national average.

- Of the 2,610 reported collisions between motor vehicles and bicycles, motorists were at fault in more than half (55%) of the crashes.

- The rate of emergency department visits for bicycle-involved collisions in Santa Clara County increased between 2009-2013 while the rate for injuries treated at trauma centers remained stable from 2010-2014

- Solo-bike crashes accounted for over 50% of the bicyclists treated in trauma centers for four out of five years from 2010-2014.

- Among bicycle-involved trauma injuries from 2010 to 2014, less than half (47%) were wearing a helmet.

- The major causes of bike collisions in the county are due to:
  - Wrong-way biking
  - Right of way violations when drivers or bicyclists enter a road
  - Improper turning by car drivers, and
  - Non-compliance with traffic signs and signals by both drivers and bicyclists

- New data collection methods as well as improved and consistent data collection on bicycling rates, crashes, and injuries would provide a more comprehensive understanding of bicycle transportation and bicycling safety in Santa Clara County.

Adult Bicycle Data

Data on the use of bicycles by adults were obtained from the Santa Clara County Public Health Department's Behavioral Risk Factor Survey[4] and the U.S. Census Bureau's American Community Survey[5]. These surveys provide age and demographic information on bicycle usage and can distinguish between bicycle commuting and recreational bicycling, but they do not provide information on routes, destinations, or distances.

Bicycle Commuting

In Santa Clara County, among workers ages 16 and older, the percentage of bicycle commuters increased from 2009 to 2013 (Table 1). The percent change during that time was an increase of bicycle commuters by 21% for Santa Clara County; the most notable increases were Mountain View (56%), Los Altos (47%), and Palo Alto (21%). In 2013, Palo Alto (8.6%), Mountain View (5.0%), and Los Altos (2.5%) had the highest percentage of bicycle commuters in the county. Although significant strides have occurred, only 1.7% of the workers in the county age 16 and older used bicycling as their primary mode of transportation to work in 2013. These data do not include those people who combine bicycles and transit to commute. In those cases, transit is typically counted as the primary mode. These data exclude trips made outside of commute to work trips, such as a trip to a grocery store or school, which are more difficult to track.

Table 1

Percentage of workers ages 16 and older who commute to work by bicycle overall and by city, 2009-2013

Jurisdiction	2009	2010	2011	2012	2013
Santa Clara County	1.4	1.4	1.6	1.7	1.7
Campbell	0.9*	1.8	2.1	2.0*	1.8
Cupertino	0.8*	0.9*	0.9*	0.9*	0.7*
Gilroy	0.5*	0.7*	1.0*	0.9*	0.7*
Los Altos	1.7	1.5	1.3	1.8	2.5
Los Altos Hills	1.0*	1.0*	0.2*	1.8*	1.8*
Los Gatos	0.7*	0.7*	0.8	0.7*	0.7*
Milpitas	0.6*	0.3*	0.1*	0.1*	0.2*
Monte Sereno	0.6*	0.6*	0.5*	0.6*	0*
Morgan Hill	0.3*	0.4*	0.6*	0.8*	0.9*
Mountain View	3.2	3.4	3.8	4.2	5.0
Palo Alto	7.1	6.8	8.4	8.5	8.6
San Jose	0.8	0.8	0.9	0.9	0.9
Santa Clara	1.1	1.2	1.3	1.6	1.2
Saratoga	0.4*	0.5*	0.5*	0.5*	0.5*
Sunnyvale	1.0	1.1	1.3	1.3	1.5

Note: * indicates estimate is statistically unstable due to a relative standard error of greater than 30%. These estimates should be viewed with caution and may not be appropriate to use for planning or policy purposes. The city listed is the city of residency of the respondent.

Source: U.S. Census Bureau, American Community Survey, 2005-2013 American Community Survey 5-year estimates, Table B08301; using American FactFinder; <http://factfinder.census.gov>; (May 2015)

Recreational Riding

In Santa Clara County, 9% of adults rode their bicycles for trips other than their regular job duties in 2013-2014. The percentage of recreational bicycling is higher among males than females and multi-racial and whites than other race/ethnicity groups. Recreational bicycling is higher among the ages 35 to 44 and 25 to 34 than all other age groups (Table 2).

Table 2

Percentage of adults who ride bicycles other than their regular job duties 2013-2014

Santa Clara County		9%
Gender	Male	14%
	Female	4%
Race/Ethnicity	African American	4%*
	Asian/Pacific Islander	4%
	Latino	9%
	White	12%
	Two or more races	16%
Age	18-24	8%*
	25-34	10%
	35-44	11%
	45-54	9%
	55-64	9%
	65+	4%

Note: * indicates estimate is statistically unstable due to a relative standard error of greater than 30% or less than 50 respondents in the denominator. These estimates should be viewed with caution and may not be appropriate to use for planning or policy purposes.

Source: Santa Clara County Public Health Department, Behavioral Risk Factor Survey, 2013-14

Discussion

According to the Santa Clara County Status of Latino/Hispanic Health[6] there are more automobile/bicycle collisions in neighborhoods with a higher proportion of Latinos/Hispanics compared to other parts of the county. This could occur for a variety of reasons. For instance, Latinos may be biking at higher rates overall (for commuting and other trips) or there may be a need for safer walking and biking infrastructure in Latino neighborhoods.

Within the county, the percentage of males who ride bicycles for recreation is more than three times that of females. Gender differences in bicycling behavior are also noted across the United States. Studies released by Edmong, Tang, and Handy[7] and others[8] have shown that women perceive risks differently than men and prefer to ride when there is safe bicycling infrastructure.

Youth Bicycle Data

In 2013-14, more than one-third (36%) of children ages 5 to 11 in Santa Clara County used active transportation (walked, biked or skateboarded) to get home from school at least once in the week surveyed, and one-quarter (24%) used active transportation to get home 5 days in the week surveyed (Table 3). These percentages are all higher than the national figure, which rose from 18% to 22% over the period from 2007 to 2012[9]. Locally, the rates of active transportation for youth are slightly higher among males compared to females and higher among Latino youth compared to other race/ethnicities.

In 2014, 26 elementary schools participated in the Santa Clara County Public Health Department/Traffic Safe Communities Network Safe Routes to School program. School staff surveyed students to determine how they arrived at school. The percentage of children who self-reported bicycling to school on at least one of three survey days was 4% overall and increased with grade level from 3% of kindergartners to 7% of fifth grade students**.** Table 4 highlights the number and percentage of students by grade level who self-reported that they bicycled to school.

Table 3

Percentage of children who walked, biked, skateboarded home in the past week, ages 5-11

		% Children who walked, biked, skateboarded home at least once in the past week	% Children who walked, biked, skateboarded home 5 days in past week
Santa Clara County		36%	24%
Gender	Male	38%	27%
	Female	33%	21%
Race/Ethnicity	African American	--	--
	Asian/Pacific Islander	30%	20%
	Latino	46%	34%
	White	32%	19%
	Two or more races	32%*	20%*

Note: -- indicates data are not available. * indicates estimate is statistically unstable due to a relative standard error of greater than 30% or less than 50 respondents in the denominator. These estimates should be viewed with caution and may not be appropriate to use for planning or policy purposes.

Source: Santa Clara County Public Health Department, Behavioral Risk Factor Survey, 2013-14

Table 4

Students who self-reported bicycling to school on at least one of three survey days (in schools participating in the Santa Clara County Public Health Department/Traffic Safe Communities Network Safe Routes to School program), 2014

Grade Level	Students Responding to Travel Tallies	# Students Reporting Bicycling to School on at least one day.	% Students Reporting Bicycling to School
All Students	9,854	436	4%
Kindergarten	1,407	45	3%
1st Grade	1,561	57	4%
2nd Grade	1,806	71	4%
3rd Grade	1,775	69	4%
4th Grade	1,611	70	4%
5th Grade	1,694	124	7%

Source: Santa Clara County Public Health Department, Safe Routes to School, Student Travel Tally, 2014

Discussion

Many schools and school districts in Santa Clara County, including Santa Clara Unified School District, Los Gatos Union School District, San Jose Unified School District, Palo Alto Unified School District, Campbell Union School District, Cupertino Union School District, Sunnyvale School District, and others have Safe Routes to School (SRTS) programs that encourage students to use active transportation to and from school. SRTS programs combine education, enforcement, and infrastructure changes to make school trips safer. Most of the participating schools collect data on the mode of transportation students use to get to school, but the collection methods are inconsistent, so it is not feasible to combine data from all the schools. A move to use consistent data collection techniques would allow for a comparison of active transportation rates among schools and districts, support evaluation of active transportation efforts, and provide baseline information that could help to secure funding and lead to the expansion of Safe Routes to School programs to more (or all) schools in the county.

Public Health Indicators by City

Bicycling, whether for commuting or recreation, can help meet the Centers for Disease Control and Prevention's (CDC) recommendations for aerobic physical activity which is important for good health. Engaging in regular physical activity can contribute to maintaining a healthy weight as well as reducing high blood pressure, risk for type 2 diabetes, heart attack, stroke, and some forms of cancer.[10] Research reported by Bassett, Pucher, Buehler, Thompson, and Crouter[11] shows a strong and statistically significant inverse relationship between bicycling and walking commuter rates and both high blood pressure and diabetes in the United States.

In addition, research presented in the International Journal of Behavioral Nutrition and Physical Activity[12], shows that designing environments that support active living such as walking and bicycling has a wide variety of benefits ranging from economics, environmental sustainability, increased safety, and improved mental and physical health. Bicycling also improves air quality. The most harmful pollutants are emitted within minutes of starting a car, meaning that short trips pollute more per mile and have a bigger impact on our overall health than longer trips.[13] Fifty percent of trips in the U.S. are three miles or shorter, and over 25% of trips are less than one mile. Yet as many as 69% of those short trips are taken in private motorized vehicles.[14] With a car-centric transportation system, polluted air leads to higher levels of asthma, lung cancer, heart disease, and respiratory illness.[15]

Table 5 shows the percentage of adults by city who use bicycling as their mode of transportations to work, meet the CDC guidelines for aerobic exercise in the last month, and are diagnosed with health conditions which may be associated with exercise and environmental factors.

Table 5

Public health indicators related to physical activity by city

Jurisdiction	% of workers ages 16 and older who commute to work by bicycle	% adults who met CDC for aerobic physical activity in the last month	% adults who are obese	% adults ever diagnosed with diabetes	% adults who were ever diagnosed with high blood pressure	% adults who were ever diagnosed with asthma
Santa Clara County	1.7%	58%	20%	8%	27%	14%
Campbell	1.8%	66%	23%	6%*	33%	13%*
Cupertino	0.7%*	63%	13%	5%*	19%	12%
Gilroy	0.7%*	68%*	31%	8%*	28%	17%
Los Altos	2.5%	73%	10%	2%*	15%	20%
Los Gatos	0.7%	64%	16%*	6%*	26%	19%*
Milpitas	0.2%*	58%	13%	13%*	17%	8%*
Morgan Hill	0.9%*	63%	36%	7%*	38%	27%
Mountain View	5.0%	61%	17%	6%*	23%	9%
Palo Alto	8.6%	75%	11%	5%*	36%	10%
San Jose	0.9%	53%	22%	7%	28%	14%
Santa Clara	1.2%	64%	19%	14%	25%	13%
Saratoga	0.5%*	68%	15%*	6%*	32%	23%*
Sunnyvale	1.5%	57%	20%	10%	27%	14%

Notes: *indicates estimate is statically unstable due to a relative standard error of greater than 30% or less than 50 respondents in the denominator. These estimates should be viewed with caution and may not be appropriate to use for planning or policy purposes. Data for Monte Sereno, Los Altos Hills and the unincorporated areas are excluded. The Centers for Disease Control and Prevention (CDC) suggests that adults ages 18 and older get at least 2 hours and 30 minutes (150 minutes) of moderate intensity aerobic activity (i.e., brisk walking) every week for good health; 1 hour and 15 minutes (75 minutes) of vigorous intensity aerobic activity (i.e., jogging or running); or an equivalent mix of moderate and vigorous intensity activity.

Sources: U.S. Census Bureau, American Community Survey, 2009-2013 American Community Survey 5-year estimates, Table B08301; using American FactFinder; <http://factfinder.census.gov>; (May 2015); Santa Clara County Public Health Department, 2013-14 Behavioral Risk Factor Survey

Discussion

Rates of overweight, obesity, and physical inactivity are also greater among certain groups of adults in Santa Clara County. Seventy-two percent of Latinos and 65% of adults with lower incomes ($25,000 to $34,999) are overweight or obese compared to 54% of the general adult population[4]. Fifty-eight percent of Santa Clara County adults met the Centers for Disease Control and Prevention's (CDC) recommendations for physical activity, while only 54% of Asian-Pacific Islanders and 50% of Latinos met the recommendations[3].

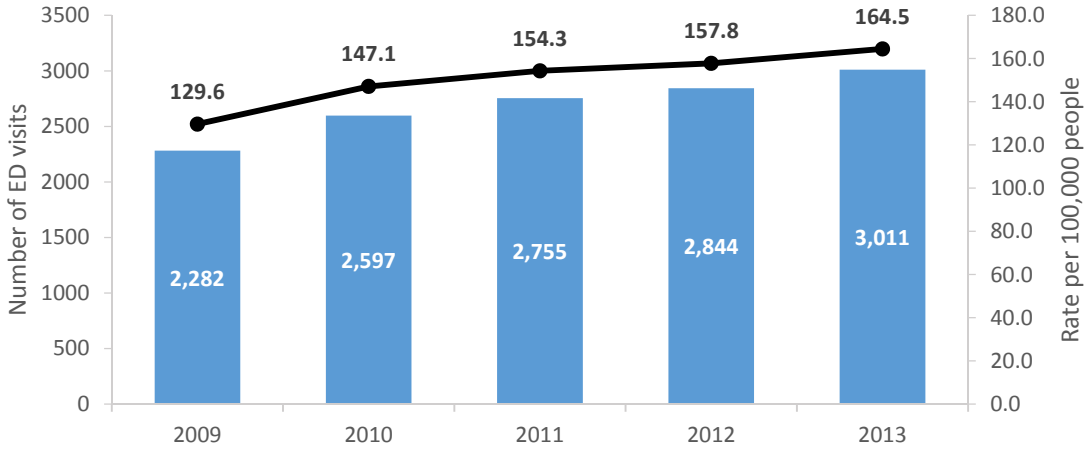
Injury Data

Injury data includes information from emergency departments and trauma centers in Santa Clara County. Patients with moderate to life-threatening injuries are treated at one of three trauma centers. The trauma center reports include both solo bicycle and bicycle vs. bicycle crashes. People who are declared dead at the scene of a crash are not taken to trauma centers but would show up in the Statewide Integrated Traffic Records System (SWITRS) database of police reports (see next section). Minor injuries are treated at an emergency department, urgent care facility or doctor's office. Only injuries treated at trauma centers and emergency departments are captured in this report.

In Santa Clara County, the number and age-adjusted rate of emergency department visits for bicycle-involved injuries has increased from 2009 to 2013 (Figure 1). However, the number and age-adjusted rate of bicycle-involved trauma injuries were stable from 2010 to 2014 (Figure 2). In 2014, the age-specific rate of bicycle-involved injuries treated at trauma centers was highest among ages 18 to 24 (36.1 per 100,000 people). The age-specific rate of bicycle-involved trauma center injuries among ages 18 to 24 declined from 2010-2014, but were consistently higher than other age groups (Figure 3).

Figure 1

Number and age-adjusted rate of emergency department (ED) visits for bicycle-involved injuries in Santa Clara County, 2009-2013

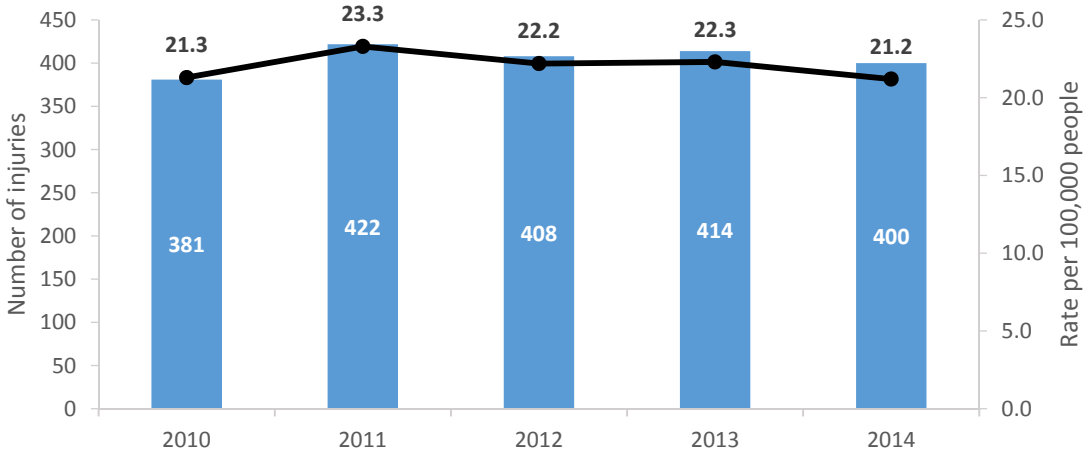


Note: The colored bars represent the number and the black line represents the age-adjusted rate per 100,000 people.

Source: Office of Statewide Health Planning and Development, 2009-2013 Emergency Department Data; State of California, Department of Finance, Race/Ethnic Population with Age and Sex Detail, 2000–2010. Sacramento, California, September 2012 (years 2009); State of California, Department of Finance, State and County Population Projection, 2010-2060. Sacramento, California, January 31, 2013 (years 2010-2013)

Figure 2

Number and age-adjusted rate of bicycle-involved injuries treated at trauma centers in Santa Clara County, 2010-2014

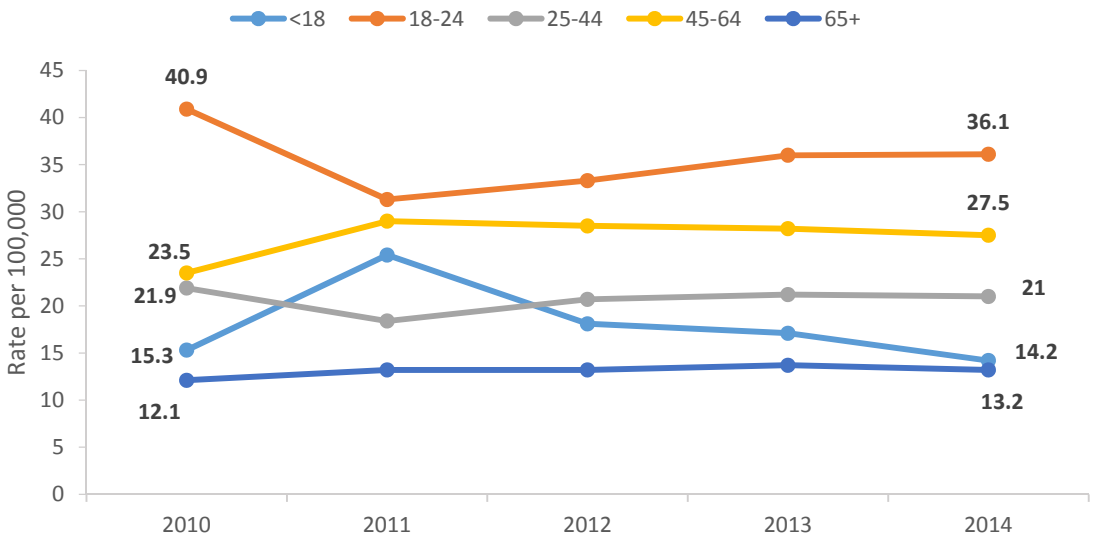


Note: The colored bars represent the number and the black line represents the age-adjusted rate per 100,000 people.

Source: Santa Clara County, Emergency Medical Services Agency, 2010-2014 Trauma registry; State of California, Department of Finance, Race/Ethnic Population with Age and Sex Detail, 2000–2010. Sacramento, California, September 2012 (year 2009); State of California, Department of Finance, State and County Population Projection, 2010-2060. Sacramento, California, January 31, 2013 (years 2010-2013)

Figure 3

Age-specific rate of bicycle-involved injuries treated at trauma centers in Santa Clara County, 2010-2014



Source: Santa Clara County, Emergency Medical Services Agency, 2010-2014 Trauma registry; State of California, Department of Finance, Race/Ethnic Population with Age and Sex Detail, 2000–2010; Sacramento, California, September 2012 (year 2009); State of California, Department of Finance, State and County Population Projection, 2010-2060. Sacramento, California, January 31, 2013 (years 2010-2013)

Table 6 includes information from the trauma centers regarding motor vehicle involvement in incidents that led to bicyclist injuries. It is not entirely clear from the trauma registry whether a particular crash was a solo crash or a bicycle-bicycle collision, only that no motor vehicle was involved. These outnumber motor vehicle-involved collisions for most years, however motor vehicle-involved collisions do make up nearly half of the injuries in 2013 and 2014.

Table 6

Bicycle-involved trauma center injuries by collision involvement, 2010-2014

Year	Solo or other bicyclist	Motor vehicle traffic	Non-motor vehicle traffic/Other
	%	%	%
2010	63%	35%	1%
2011	59%	40%	1%
2012	61%	39%	0%
2013	48%	50%	2%
2014	53%	46%	1%

Source: Santa Clara County, Emergency Medical Services Agency, 2010-2014 Trauma Registry

Among bicycle-involved injuries treated in trauma centers from 2010 to 2014, less than half (47%) of the bicyclists cared for were wearing a helmet (Table 7). The percentage of helmet use was lowest among ages 18 to 24 (27%) and ages less than 18 (34%). As noted, there are a large number of cases for which the helmet status was not reported, mostly in the age 18-24 category, so some caution needs to be used when viewing these results. Also, these numbers are for trauma center arrivals and may not be representative of helmet use among all riders.

Table 7

Percentage of patients by age treated in trauma centers who used helmets at the time of their crash in Santa Clara County, 2010-2014

Age	% of patients using helmets at time of crash
Overall	47%
<18	34%
18-24	27%
25-44	49%
45-64	58%
65+	66%

Note: The percentage of cases missing helmet use information ranged from 5-10% by age category.

Source: Santa Clara County, Emergency Medical Services Agency, 2010-2014 Trauma registry

A bicyclist who suffers serious injuries will be admitted to the hospital for further treatment, while one suffering less serious injuries will be discharged directly from the emergency department. In 2014, nearly 1 out of 2 (45%) of the bicycle-involved trauma injuries were admitted to the hospital. The percentage of admitted bicycle-involved trauma injuries increased

with age. The lowest admittance percentages was among ages 18 to 24 (35%) and ages less than 18 (33%) and was highest among ages 65 and older (68%). As mentioned above, bicyclists with very minor injuries may go to urgent care centers or hospitals that are not trauma centers, and are not represented here.

Discussion

Although motor vehicle-involved bicycle crashes make up nearly half of the injuries in 2013 and 2014, solo bicycles crashes are a substantial portion of all injuries and their causes should be investigated in more detail. Solo crashes may be caused by pavement defects (potholes, cracks, gaps, seams, steps), debris (glass, rocks, sand, gravel, sticks), mechanical issues (flat tire, bad brakes, clothing or straps caught in spokes), loss of control, or bicyclist inattention or error. Solo crashes can also be caused directly or indirectly by motor vehicles. For example, a bicyclist may be forced to swerve to avoid a car or be unable to avoid an obstacle because the presence of a car prevents it.

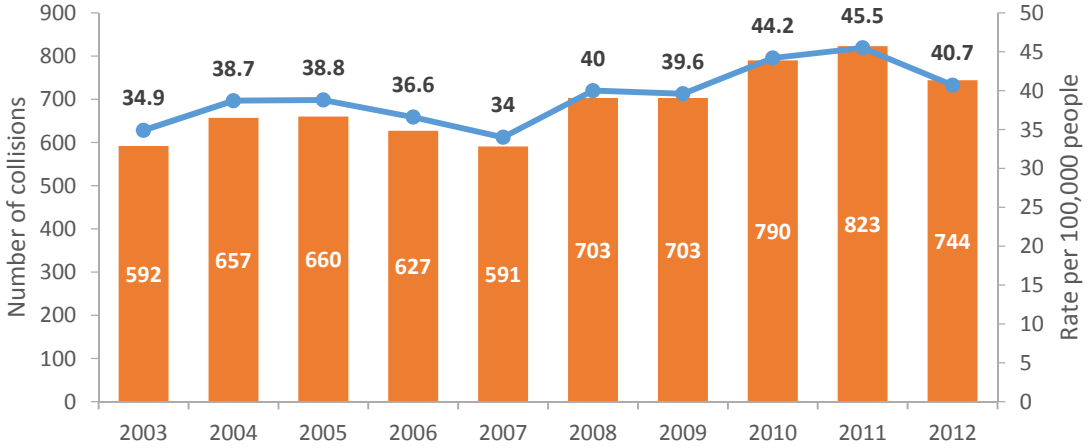
California has a law that requires helmets to be worn by bicyclists under the age of 18, but compliance is generally poor for patients who require treated at trauma centers. Table 7 shows that the percentage of patients treated at trauma centers, who were helmeted at the time of their crash, increases with age beginning with the 25 to 44 age group. This does not indicate that helmet use increases with age among riders.

Traffic Collision Data

Data on traffic collisions were obtained from the Transportation Injury Mapping System (TIMS)[16], which is an interface to the Statewide Integrated Traffic Records System (SWITRS)[17] database maintained by the California Highway Patrol. This database includes all collisions in California for which there was a police report and excludes unreported collisions. Collision location is reported for most crashes so they can be mapped by city and intersection. The reports usually indicate which portion of the California Vehicle Code (CVC)[18] was violated, and the following information refers to these CVC sections, which can be referenced online. Figure 4 shows the number and rate of bicycle-involved collisions increased overall from 2003 to 2012, but saw a decline from 2011-2012. SWITRS data for 2013 are provisional, and are not included.

Figure 4

Number and rate of bicycle-involved collisions in Santa Clara County, 2003-2012



Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS), 2003-2012; State of California, Department of Finance, Race/Ethnic Population with Age and Sex Detail, 2000–2010. Sacramento, California, September 2012 (years 2003-2009); State of California, Department of Finance, State and County Population Projection, 2010-2060. Sacramento, California, January 31, 2013 (years 2010-2012).

The top four Primary Collision Factors (PCFs) countywide are listed for collisions of a motor vehicle and a bicycle, along with those for which the bicyclist was considered to be at fault. These numbers should be viewed with some caution as it can be very difficult to determine the party at fault and the PCF if there are no witnesses. The PCF information is missing or unknown for nearly one-fifth (19%) the collisions.

Table 8 shows the top four PCFs and percentages for the county for motor vehicle collisions involving a bicycle. If examined city-by-city, the top PCFs are generally the same for all cities, although the exact percentages and ranking order may vary. For some cities the numbers are small and the statistics are not reliable, so only the countywide data is presented here.

Table 8

Top primary collisions factors among motor vehicle-involved bicycle collisions in Santa Clara County, 2009-2012

Primary collision factor	% of all primary collision factors	% of bicyclists at fault	Most common vehicle code violations
Wrong side of road	23%	94%	21650 (76 %), 21202 (19%)
Right of way	22%	31%	21804 (41%), 21801 (32%), 21802 (16%)
Improper turning	15%	21%	22107 (90%)
Traffic signals and signs	10%	67%	21453 (57%), 22450 (43%)

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.

In nearly one quarter (23%) of motor vehicle-involved bicycle collisions, travelling on the wrong side of the road was cited as the PCF. The majority (76%) of violations under this category were for a violation of California Vehicle Code (CVC) 21650[18] which requires vehicles, including bicycles, to be driven on the right side of the road (except for one-way roads). Most bicyclists (94%) were considered at fault in the collisions where the wrong side of the road was the primary collision factor.

Among motor vehicle-involved bicycle collisions, 22% listed right of way as the PCF. The right of way category includes a number of types of violations, but the two most common account for 73% of the collisions in this category. The most common violation is failure to yield to traffic when entering a road from a driveway or parking lot (CVC 21804[18]). The next most common violation within this category occurs when making left or U-turns (CVC 21801[18]). Nearly one third (31%) of bicyclists who were involved in motor vehicle collisions where right of way was the primary collision factor were considered at fault.

Fifteen percent (15%) of motor vehicle-involved bicycle collisions mentioned improper turning as the PCF. Most (90%) of the Improper Turning collisions were the result of violating (CVC 22107[18]), which requires the use of turn signals and only permits turning when it is safe to do so. One-fifth (21%) of bicyclists who were involved in motor vehicle collisions where improper turning was the primary collision factor were considered at fault. Half (50%) of the drivers in these collisions were turning right, while only 18% of the drivers were turning left. This implies that half of all the improper turning collisions are the "right hook" scenario where a driver turns right across the path of a bicyclist.

In one in ten (10%) motor vehicle-involved bicycle collisions, failure to obey traffic signs and signals was cited as the PCF. Of these collisions, 57% were for failure to obey red lights (CVC 21453[18]) and 43% were for stop sign violations (CVC 22450[18]). Two-thirds (67%) of bicyclists who were involved in motor vehicle collisions where traffic signs and signals was the primary collision factor were considered at fault. Among red light violations in motor vehicle-involved bicycle collisions, 72% of bicyclists were considered at fault. Among stop sign violations in motor vehicle-involved bicycle collisions, 60% of bicyclists were considered at fault.

Overall, forty-four percent (44%) of bicyclists in motor vehicle-involved collisions were considered at fault. Of the bicyclists considered at fault in motor vehicle-involved collisions, 43% listed wrong side of the road as the PCF, followed by traffic signals and signs (14%), automobile right of way (14%) and unsafe speed (7%). Unsafe speed does not necessarily mean that the bicyclist was exceeding the speed limit, only that the bicyclist was unable to stop before the collision.

Discussion

Bicycling the wrong way is by far the leading cause of crashes for bicyclists when they are at fault. Possible explanations as to why this occurs include: 1) bicyclists being taught to do so in order to see traffic coming towards them, and drivers are not generally looking for wrong-way traffic, and 2) bicyclists riding on the wrong side of the road to avoid having to cross a busy street to get to their destination. Education and changes in infrastructure could reduce the crashes, but areas where wrong-way riding occurs frequently should be thoroughly examined to identify solutions to prevent this behavior as well. Enforcement is also needed, and when

combined with education, can help bicyclists understand that observing traffic laws improves their safety and well-being. Implementation of "Bicycle Wrong Way" signs[19] can also be instrumental in educating people who bike and helping to prevent this behavior.

When red light violations were the PCF in motor vehicle- bicycle crashes, bicyclists were at fault a majority (72%) of the time. The inability for bicyclists to trigger a green light at a stop light may be a contributing factor. Many inductive loop detectors are only sensitive to cars or require bicyclists be in a particular location to be triggered. If loop detectors are used, their most sensitive location should be marked with a bike logo; video or microwave detection can detect a bicyclist in any position and are preferred. California Vehicle Code Section 21450.5(b)[18] requires that when installing new traffic-actuated signals or replacing loop detectors they be installed and maintained to detect bicycles. In addition, Caltrans has a Traffic Operations Policy Directive[20] to "provide Bicycle and Motorcycle Detection on all new and modified approaches to traffic-actuated signals in the state of California," and apply to new or modified installations. Given the time it will take to make these suggested changes in technology, it may be many years before bicycle detection is achieved at all signals. The CVC section expires in 2018 unless renewed.

Collisions by Cities

As in the section above, the data in this section were obtained from the Transportation Injury Mapping System (TIMS[16]), which is an interface to the Statewide Integrated Traffic Records System (SWITRS[17]) database maintained by the California Highway Patrol. The dataset includes reported collisions between a motor vehicle and a bicycle between 2009 and 2012. Overall for the county there were 2,610 motor vehicle-involved bicycle collisions during that time frame which resulted in 15 fatalities[17].

From 2008 to 2012, San Jose had the highest annual average number of bicycle-involved collisions (346), followed by Palo Alto (86), and Sunnyvale (47). During the same timeframe, Palo Alto had the highest rate of bicycle-involved collisions (133.5 per 100,000 people), followed by Los Altos Hills (126.2), and Los Gatos (69.4) (Table 9). These numbers should be viewed in the context of population and bicycling rates. For example, San Jose has the highest population in the county and Palo Alto has the highest percentage of bicycling commuters.

This section also provides, for each city, a "heat map" of reported motor vehicle-bicycle collisions for the period 2009-2012, overlaid on a base map showing bike routes (depicted by green lines). The number of collisions is represented by color, with green being the fewest, progressing to yellow and red for more collisions. Note that not all collisions have enough location information to allow them to be mapped.

Included is a list of the top-ranked intersections for motor vehicle-bicycle collisions for the same period. For most cities, those intersections with two or more collisions are listed. Cities with less than two collisions at intersections have individual crash locations listed.

Table 9

Average number and rate of bicycle involved collisions, 2008-2012

City	Annual average # of collisions (rounded)	Rate per 100,000 people
Campbell	21	54.4
Cupertino	33	56.6
Gilroy	16	32
Los Altos	15	52.5
Los Altos Hills	10	126.2
Los Gatos	20	69.4
Milpitas	19	29
Monte Sereno	1	35.9
Morgan Hill	7	17.4
Mountain View	41	55.4
Palo Alto	86	133.5
San Jose	346	36.6
Santa Clara	41	35.4
Saratoga	14	47.5
Sunnyvale	47	33.3

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS), 2008-2012; U.S. Census Bureau, 2010 Summary File, Table QT-P2 Single Years of Age and Sex: 2010

Discussion

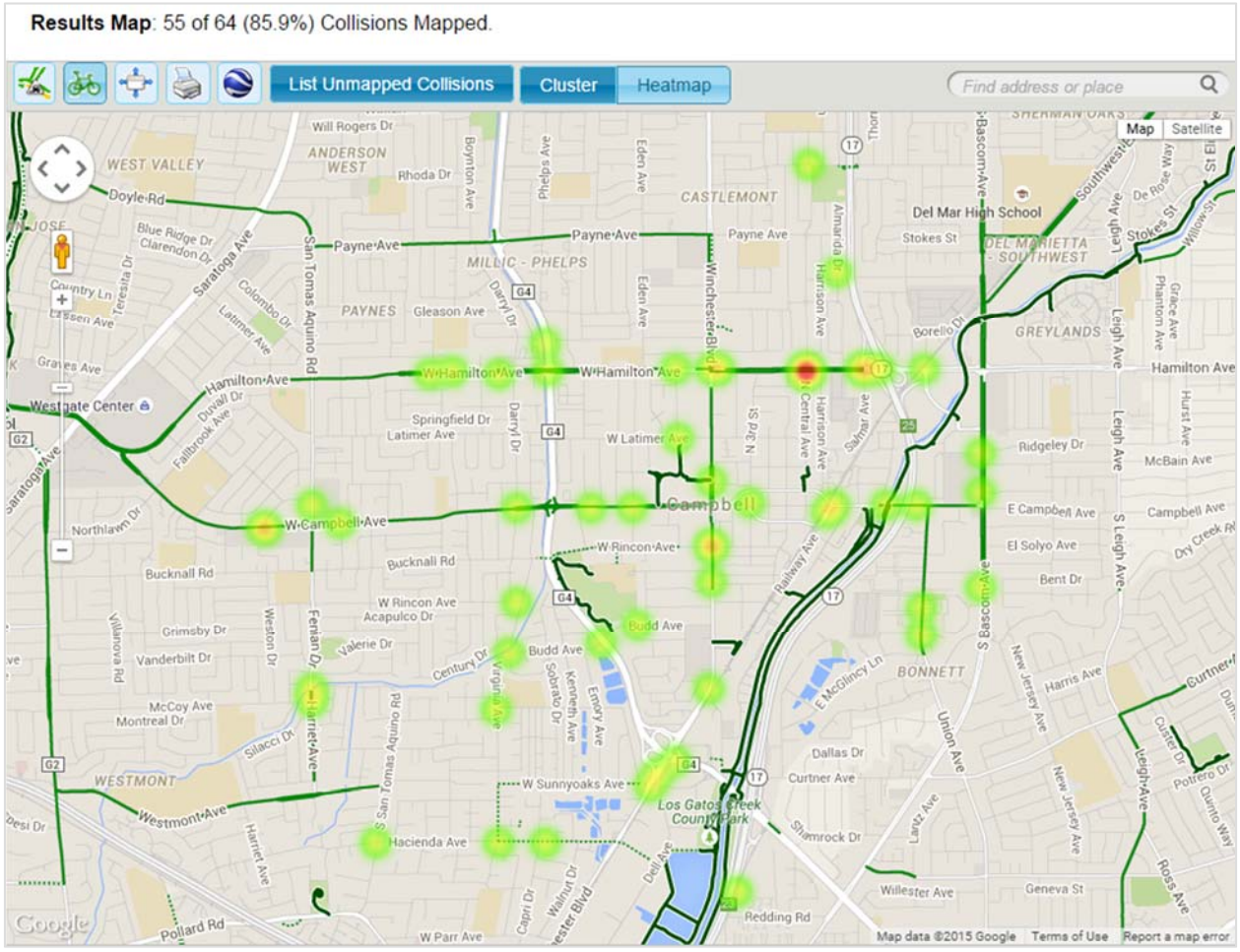
The number and rates of bicycle collisions per capita and by city are provided. Collision data is determined by crash location rather than a bicyclist's city of residence. Collision rates based on the number of bicyclists are difficult to determine because accurate data on the number of bicyclists per city is not available outside of commute trips and self-reported recreational riding data. Until more accurate bicycle count and route information is available by city, the crash rate per bicyclist cannot be determined.

During the period of 2009-2011, Palo Alto had an average bicycle commuting rate that was almost 9 times as high as San Jose. Recreational riding may also be higher in Palo Alto, so the collision rate *per bicyclist* in Palo Alto could be one of the lowest rates in the county rather than the highest. More detailed data on the number of bicyclists and the miles biked in each city would be helpful in calculating city-by-city safety data.

The maps and tables are useful to cities that want to perform data-driven prioritization of safety improvement efforts. Some caution needs to be applied, however, because the data go back seven years and bicycle infrastructure may have changed since that time. Furthermore, more collisions may not indicate a problem intersection but just a popular one. For example, the highest-ranked intersections in Palo Alto are Oregon Expressway at Bryant and at Cowper. Both of these intersections are heavily used by adult bicycle commuters and by students going to middle and high schools, so the sheer volume of bicyclists could lead them to have a high

ranking. Both were modified significantly in 2014, when all of Oregon Expressway was improved, so those intersections will probably not rank as high in the future. It would not make sense to apply further improvement efforts to those intersections at this time, even though the data here indicates that they were problematic in the period from 2009 to 2012.

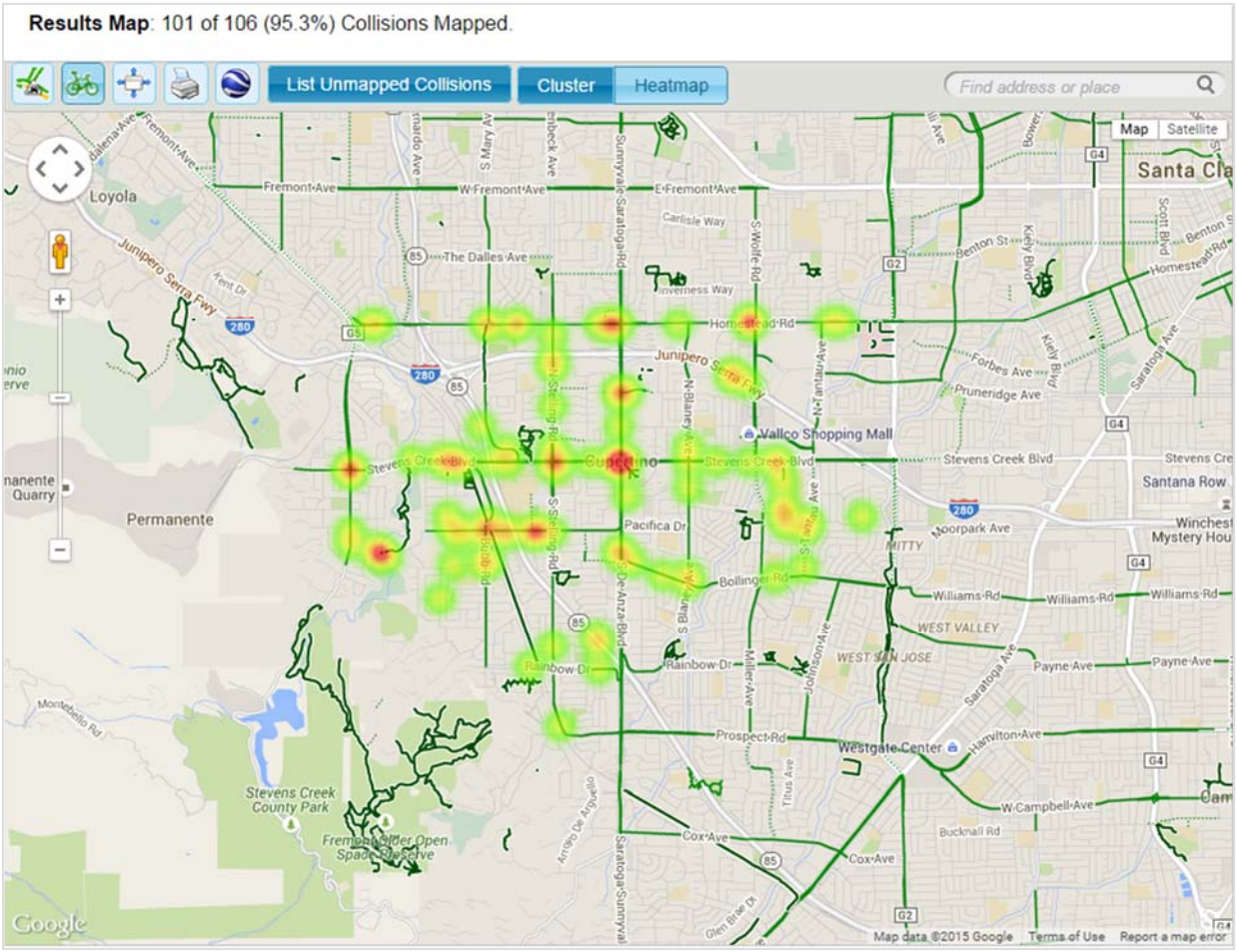
Campbell



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	CENTRAL AVE & HAMILTON AVE	4
2	CAMPBELL AVE & LA PRADERA DR	2
2	HAMILTON AVE & SALMAR AVE	2
2	RINCON AVE & WINCHESTER BLVD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

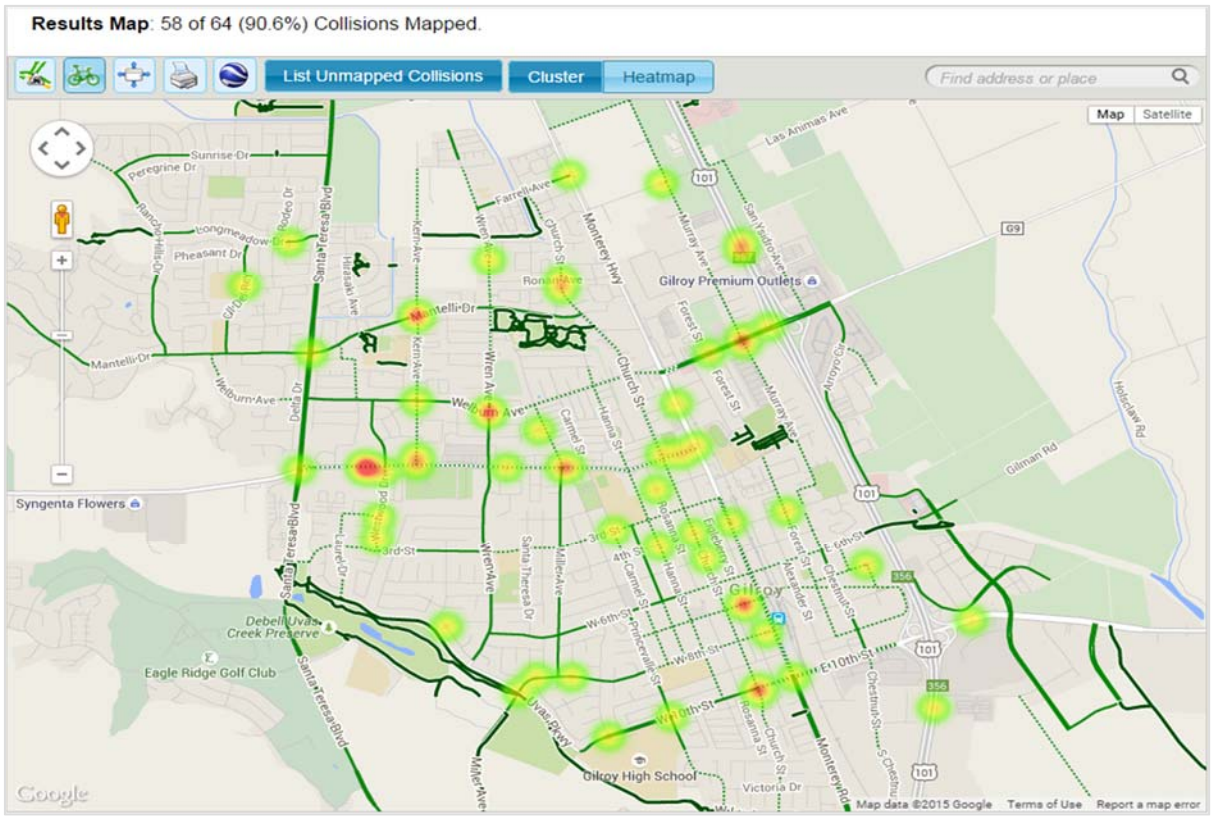
Cupertino



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	CLUB HOUSE LN & MCCLELLAN RD	3
1	FOOTHILL BLVD & STEVENS CREEK BLVD	3
1	DE ANZA COLLEGE PKY & MCCLELLAN RD & ROSE BLOSSOM DR	3
4	BUBB RD & HYANNISPORT DR	2
4	BUBB RD & MCCLELLAN RD	2
4	BUBB RD & SHANNON CT	2
4	DE ANZA BLVD & MARIANI AVE	2
4	DE ANZA BLVD & KIRWIN LN	2
4	GOLDEN ASPEN WAY & HOMESTEAD RD	2
4	HOMESTEAD RD & KENNEWICK DR	2
4	MCCLELLAN RD & SEPTEMBER DR	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

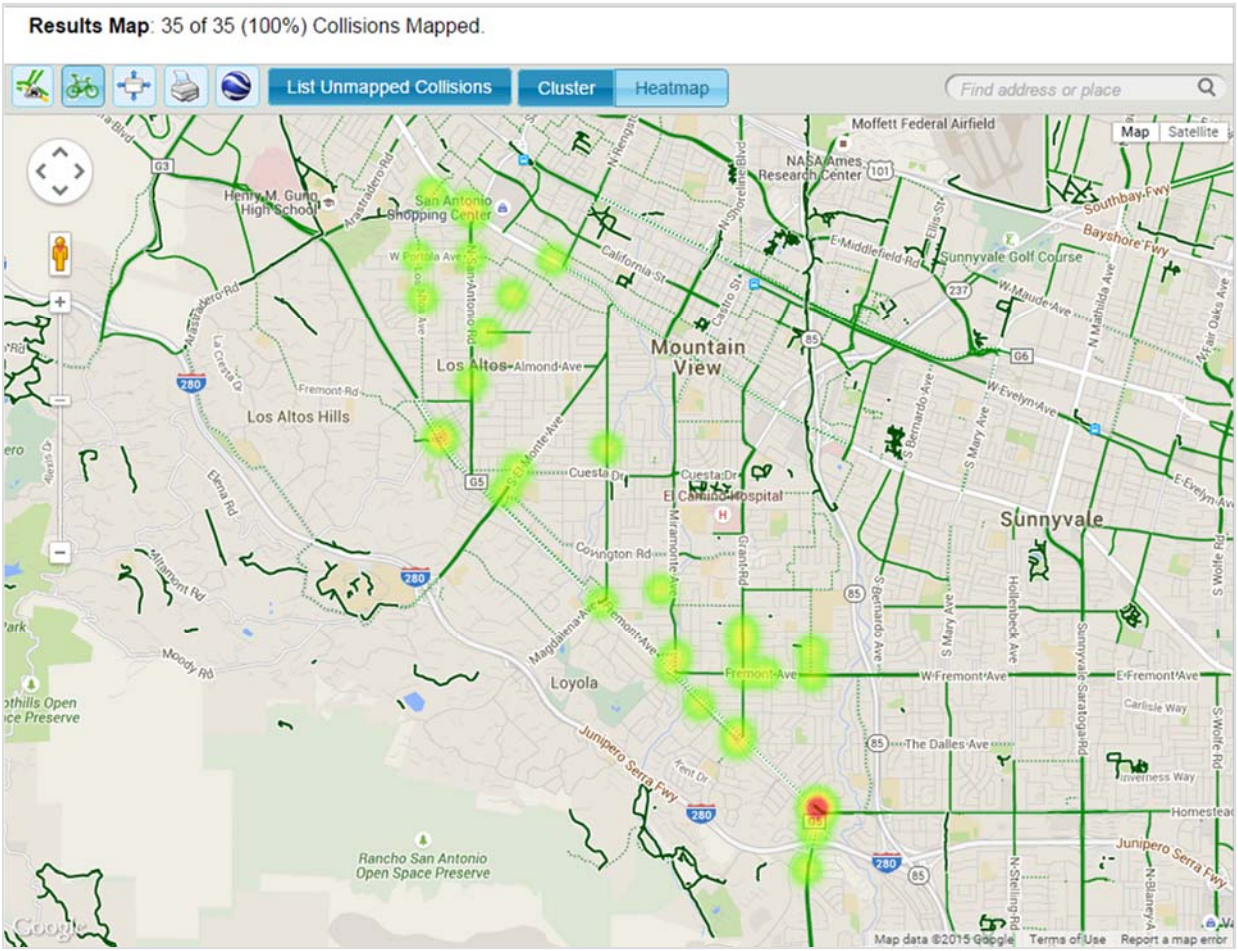
Gilroy



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	1ST ST & KERN AVE	1
1	1ST ST & EIGLEBERRY ST	1
1	1ST ST & PRINCEVALLE ST	1
1	4TH ST & MONTEREY ST	1
1	FARRELL AVE & MONTEREY RD	1
1	FOREST ST & LEAVESLEY RD	1
1	HOWSON ST & MONTEREY HWY	1
1	LEAVESLEY RD & MURRAY AVE	1
1	MANTELLI DR & SANTA TERESA BLVD	1
1	MONTEREY HWY & MONTEREY RD	1
1	1ST ST & HECKER PASS RD & SANTA TERESA BLVD	1
1	1ST ST & MILLER AVE & WAYLAND LN	1
1	1ST ST & MONTEREY HWY & MONTEREY ST	1
1	MONTEREY HWY & MONTEREY ST & SR 152	1
1	10TH ST & HECKER PASS HWY & MONTEREY RD & SR 152	1

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

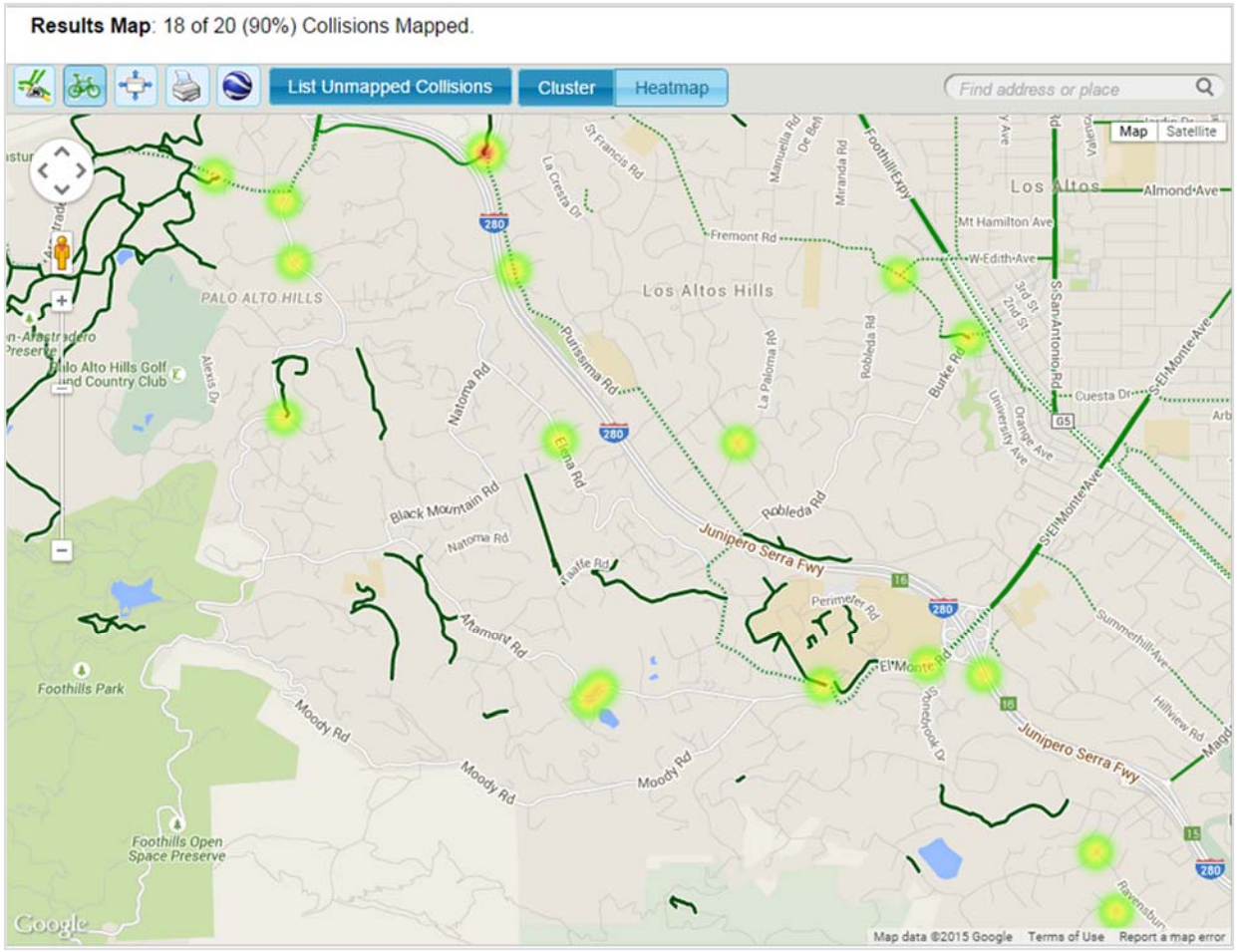
Los Altos



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	EL SERENO AVE & GRANT RD & HOMESTEAD RD	4
2	FOOTHILL EXPY & MAIN ST	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

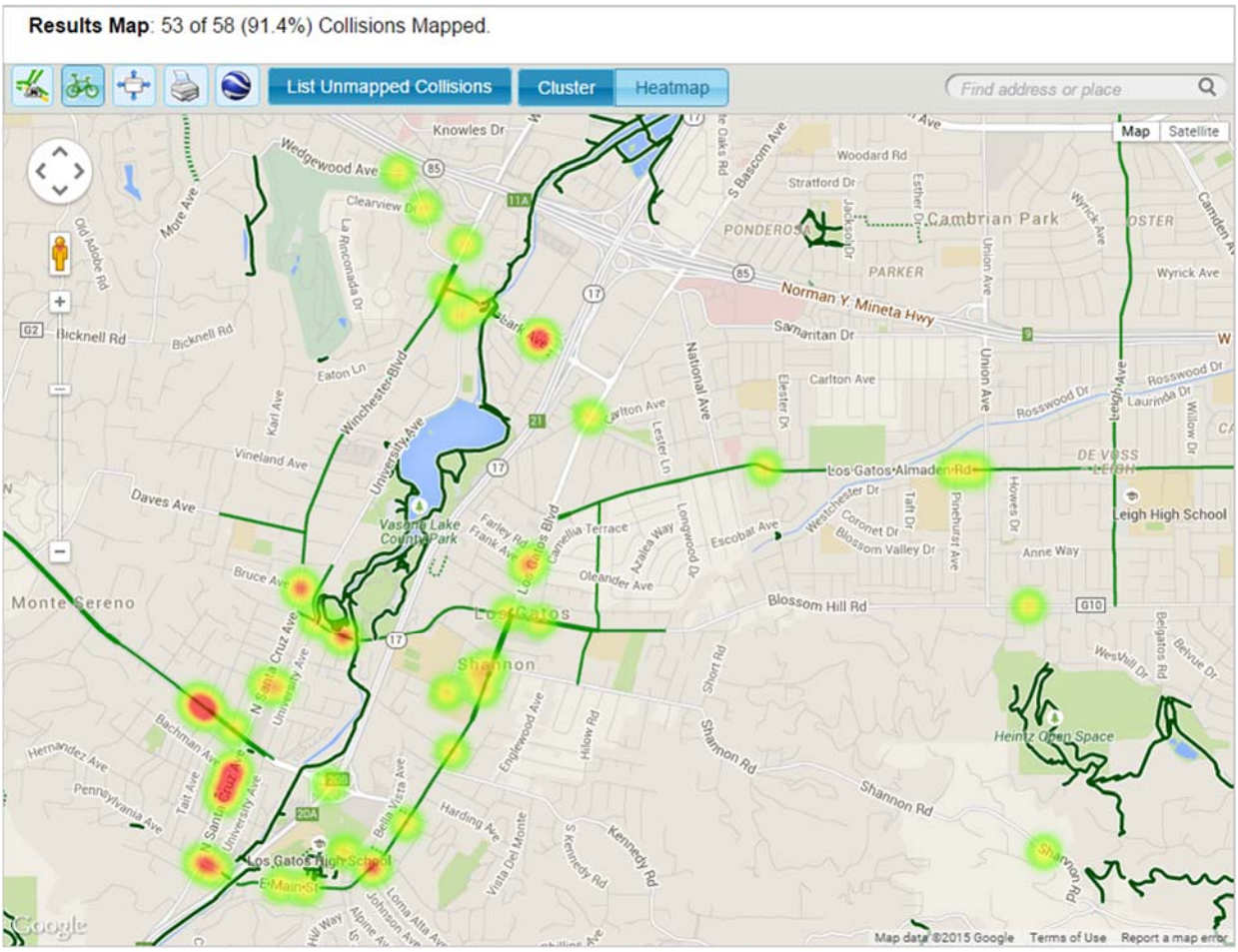
Los Altos Hills



Top-ranked intersection for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	ARASTRADERO RD & PURISSIMA RD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

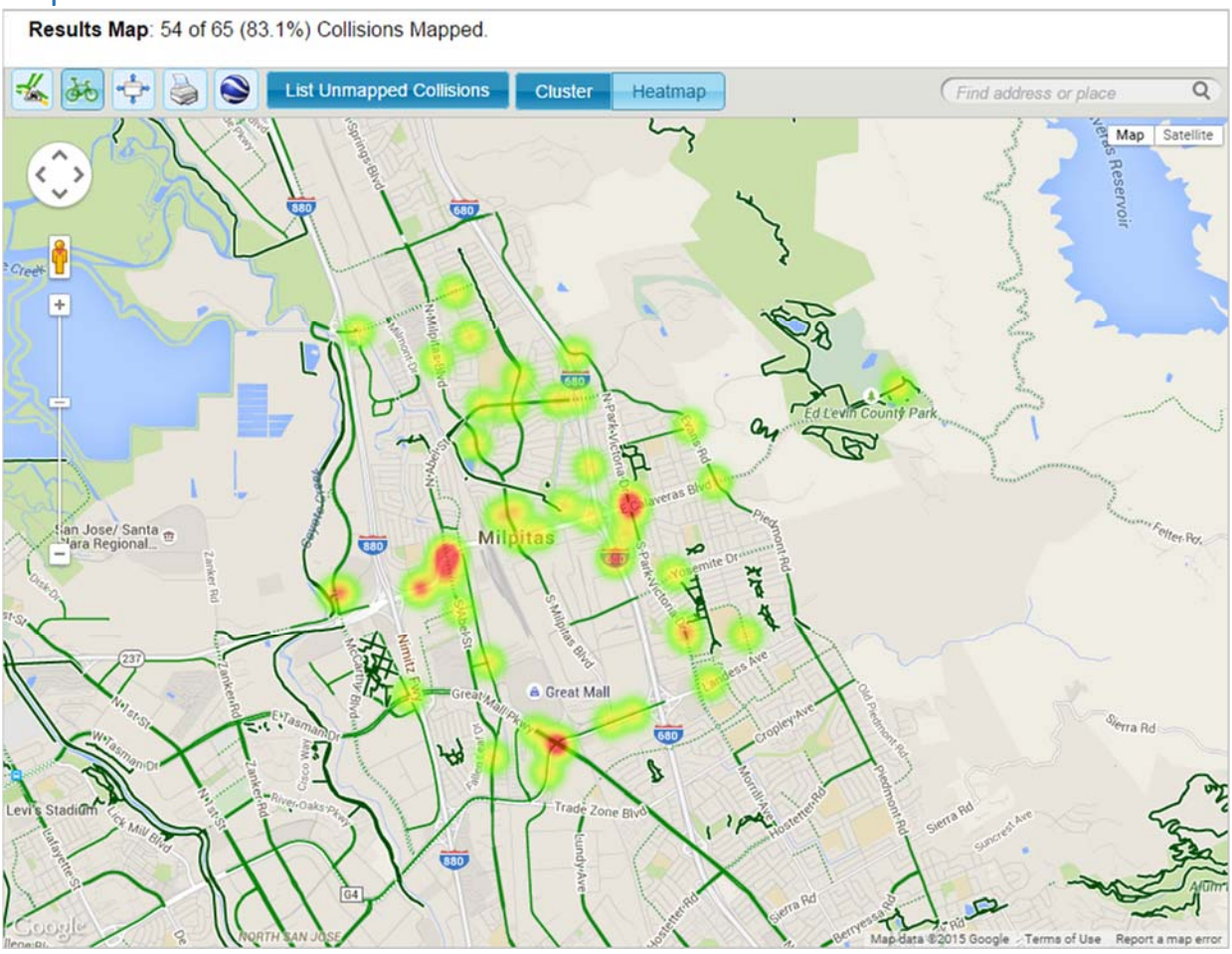
Los Gatos



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	GARDEN HILL DR & LARK AVE	3
1	LOS GATOS SARATOGA RD & MONTGOMERY ST	3
3	BACHMAN AVE & SANTA CRUZ AVE	2
3	BLOSSOM HILL RD & OAK MEADOW DR	2
3	LOMA ALTA AVE & LOS GATOS BLVD	2
3	MAIN ST & STATION WAY	2
3	NICHOLSON AVE & SANTA CRUZ AVE	2
3	ROYCE ST & SANTA CRUZ AVE	2
3	BRUCE AVE & SANTA CRUZ AVE & WINCHESTER BLVD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

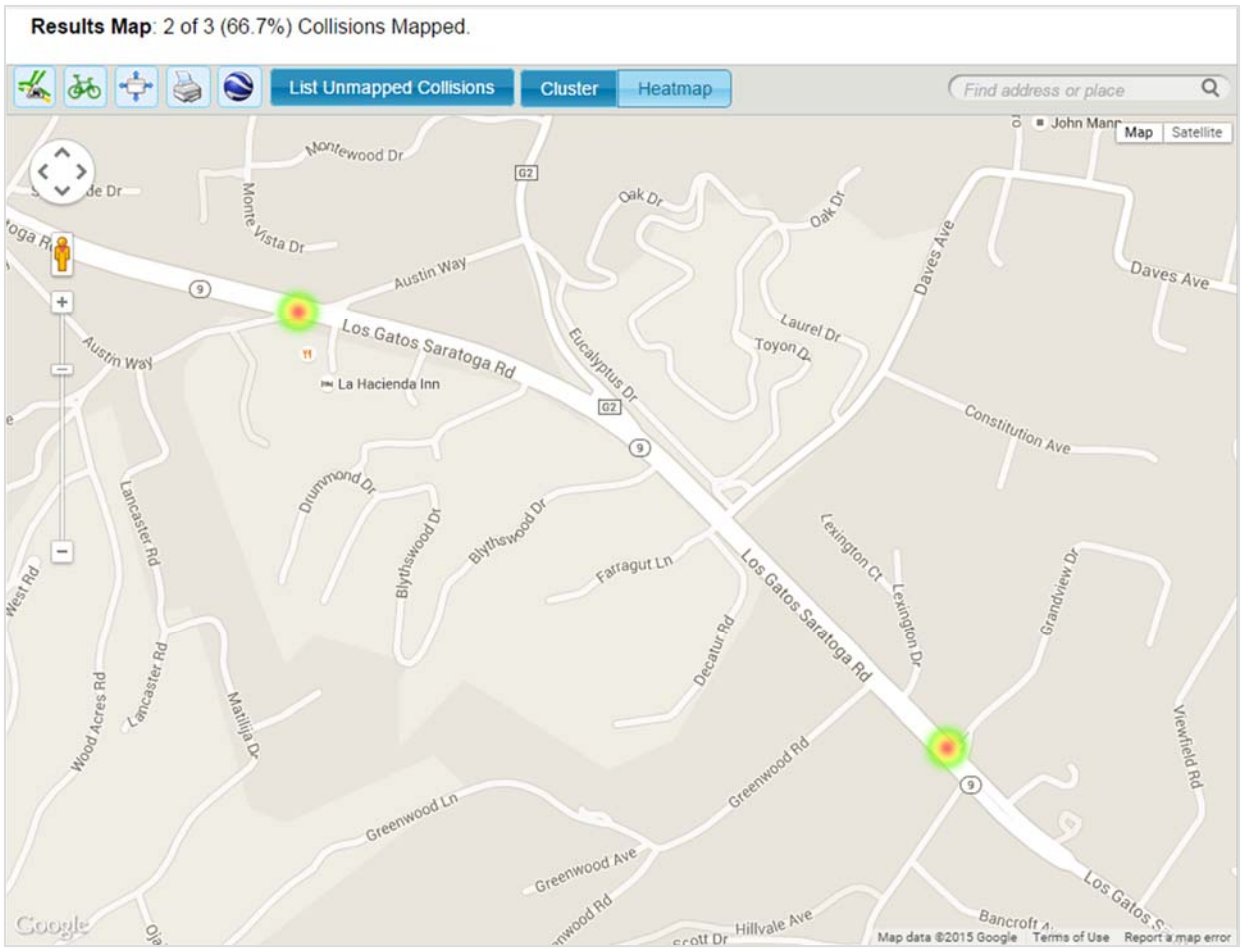
Milpitas



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	ABEL ST & SR 237 W	4
2	ABEL ST & SR 237 E	3
2	GREAT MALL PKY & MONTAGUE EXPY	3
4	CALAVERAS BLVD & PARK VICTORIA DR	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

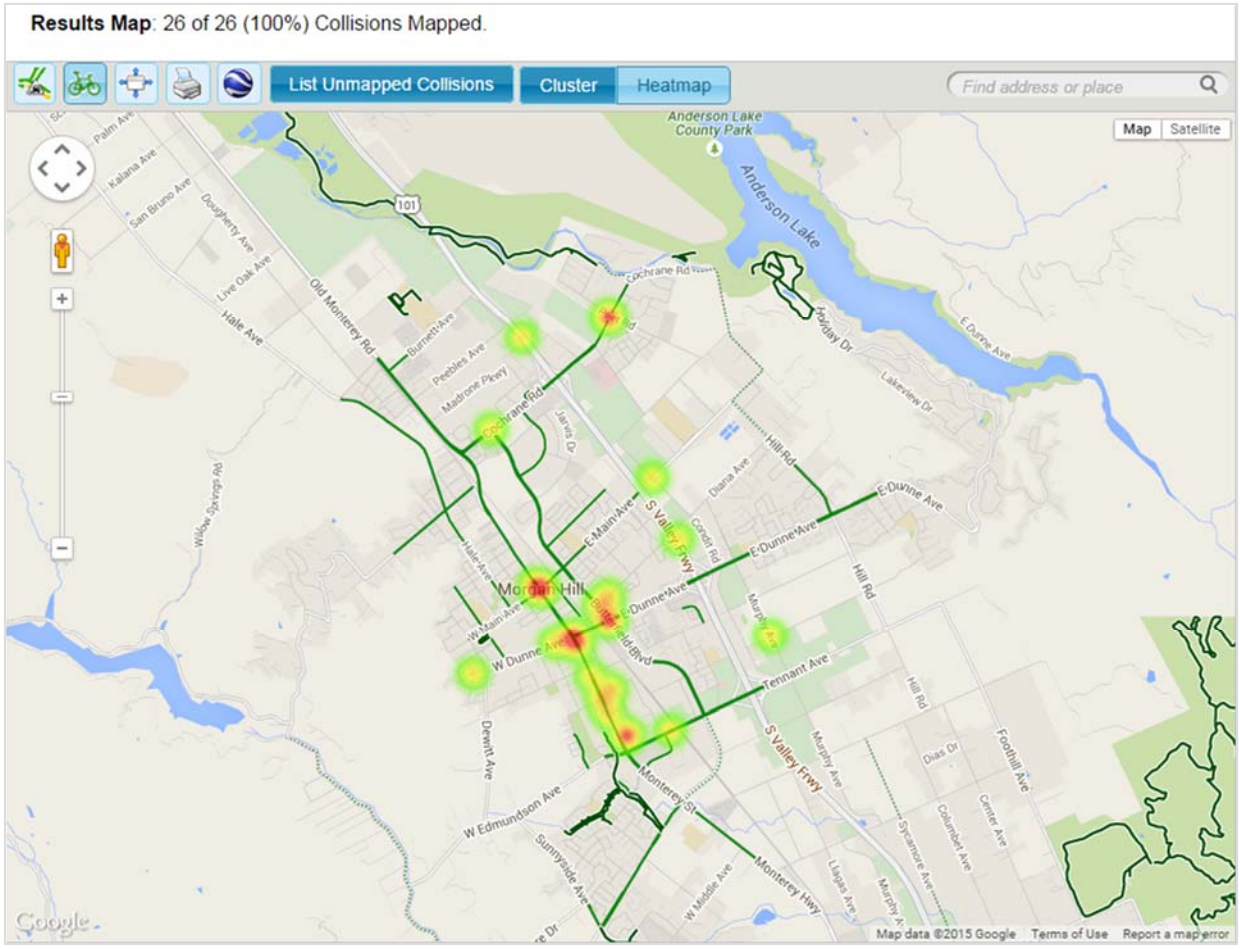
Monte Sereno



Top-ranked intersection for motor vehicle-bike collisions (2009-2012)		
Rank	Intersection	Collisions
1	GRANDVIEW AVE & SARATOGA LOS GATOS RD	1

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

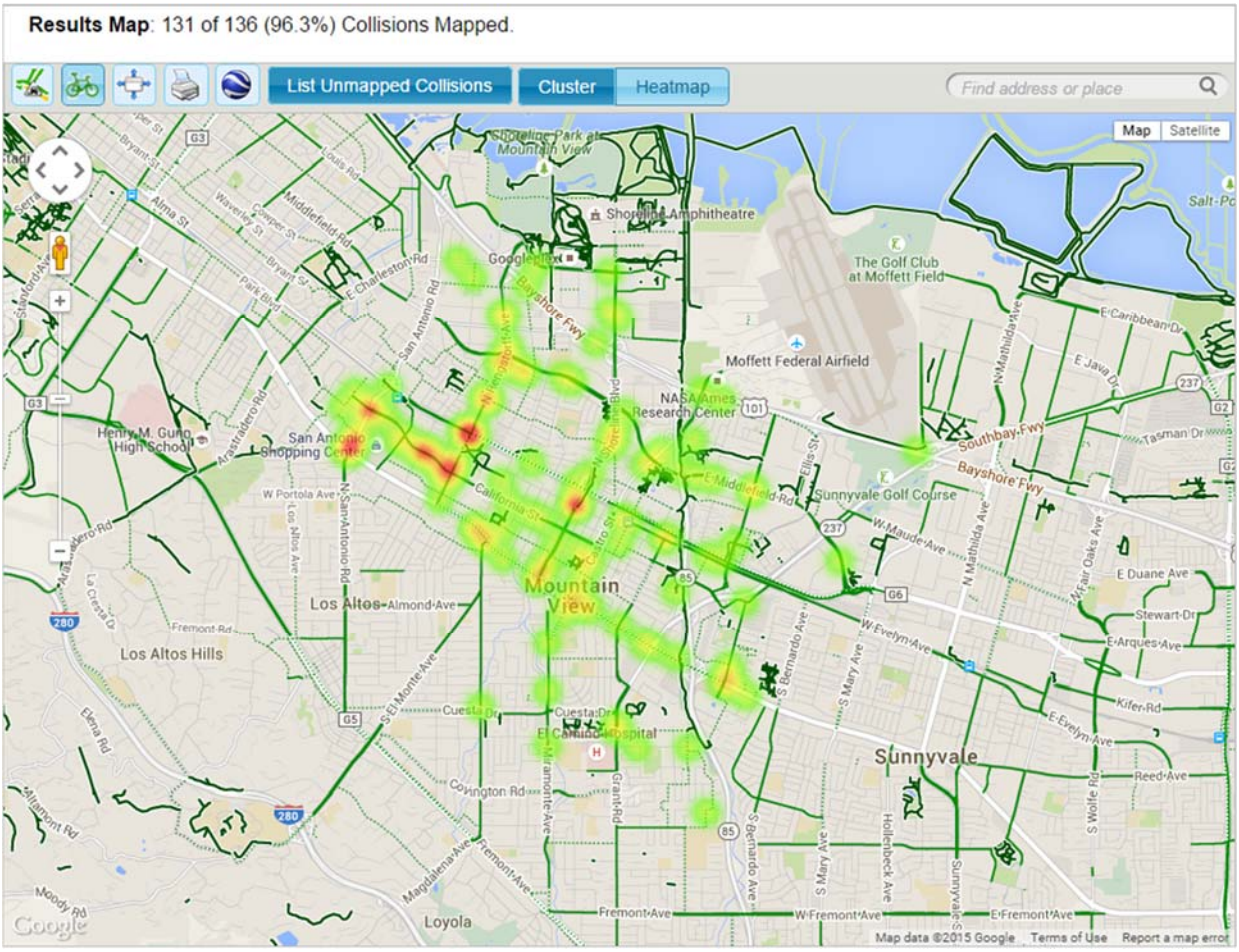
Morgan Hill



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	BUTTERFIELD BLVD & DUNNE AVE	2
1	DUNNE AVE & MONTEREY HWY	2
1	DUNNE AVE & MONTEREY ST	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

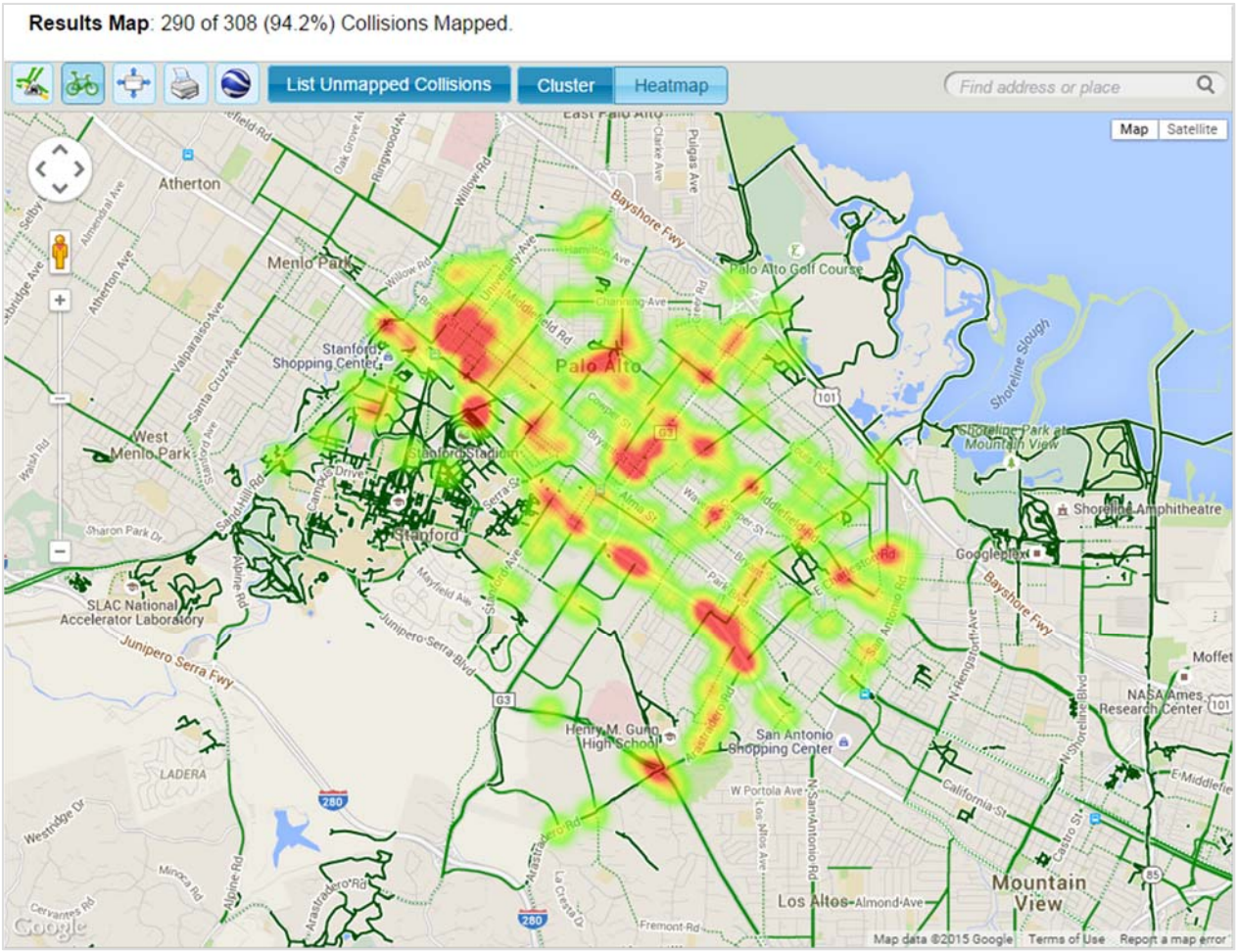
Mountain View



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	CENTRAL EXPY & RENGSTORFF AVE	4
1	SHORELINE BLVD & VILLA ST	4
3	CALIFORNIA ST & SAN ANTONIO RD	3
3	JEWELL PL & RENGSTORFF AVE	3
3	MONTECITO AVE & RENGSTORFF AVE	3
6	CALDERON AVE & EVELYN AVE	2
6	CASTRO ST & SR 82/EL CAMINO REAL	2
6	EL MONTE AVE & SR 82/EL CAMINO REAL	2
6	MIDDLEFIELD RD & WHISMAN RD	2
6	RENGSTORFF AVE & UNIVERSITY AVE	2
6	COLONY ST & RENGSTORFF AVE & WINDROSE PL	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

Palo Alto



Note: there were 2 collisions on Page Mill Road near Foothills Park that are off the bottom of the map.

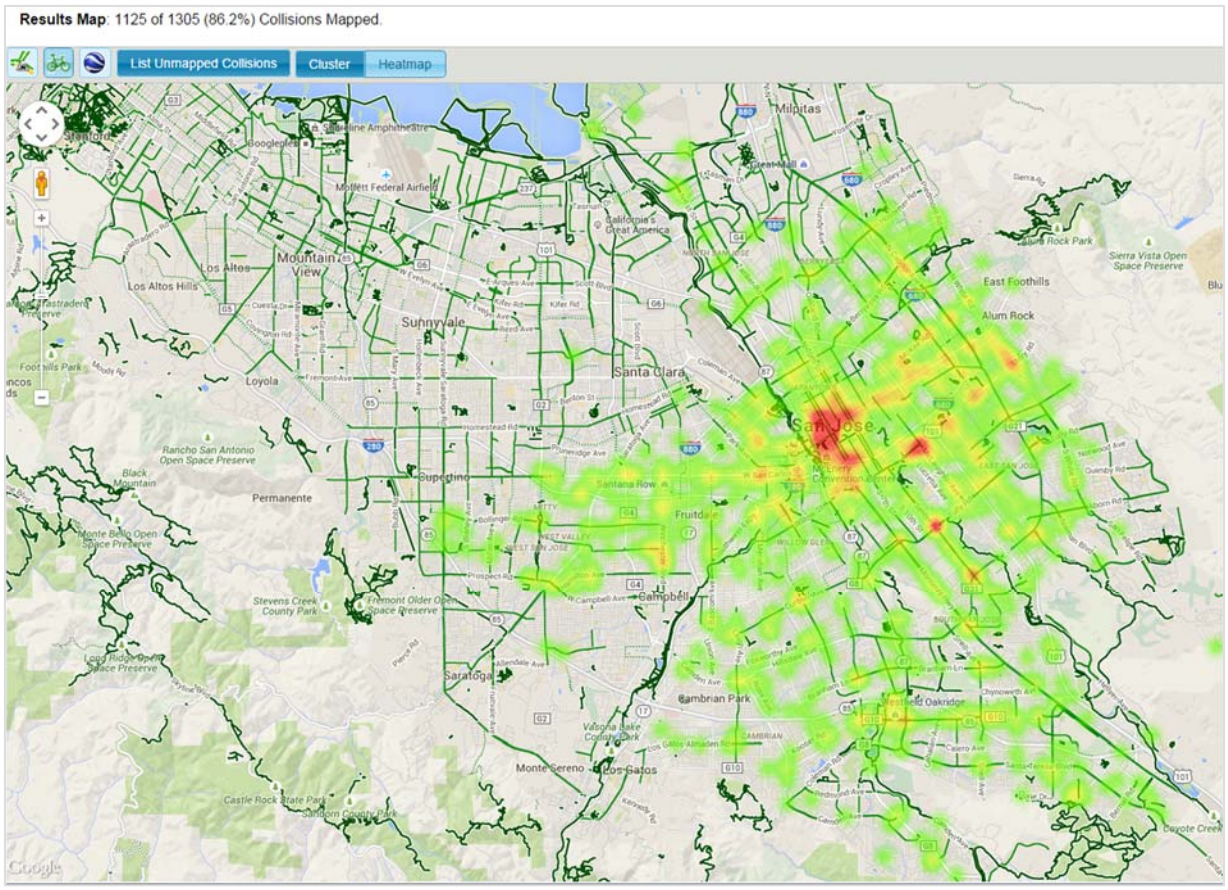
(Top-ranked intersections for motor vehicle-bike collisions are listed on the following page)

Palo Alto (continued)

Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	BRYANT ST & OREGON EXPY	4
1	COWPER ST & OREGON EXPY	4
3	ALMA ST & HOMER AVE	3
3	COLORADO AVE & MIDDLEFIELD RD	3
3	LOMA VERDE AVE & MIDDLEFIELD RD	3
3	LOMA VERDE AVE & WAVERLEY ST	3
3	LOUIS RD & OREGON EXPY	3
3	MIDDLEFIELD RD & OREGON EXPY	3
9	ALMA ST & TENNYSON AVE	2
9	ARASTRADERO RD & FOOTHILL EXPY	2
9	ARASTRADERO RD & GEORGIA AVE	2
9	ARASTRADERO RD & POMONA AVE	2
9	CALIFORNIA AVE & LOUIS RD	2
9	CHARLESTON RD & FABIAN WAY	2
9	EL CAMINO WAY & JAMES RD	2
9	EMBARCADERO RD & GUINDA ST	2
9	EMBARCADERO RD & WEBSTER ST	2
9	GREER RD & OREGON EXPY	2
9	HOPKINS AVE & NEWELL RD	2
9	MIDDLEFIELD RD & SEALE AVE	2
9	RAMONA ST & UNIVERSITY AVE	2
9	COLERIDGE AVE & EMBARCADERO RD & MIDDLEFIELD RD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

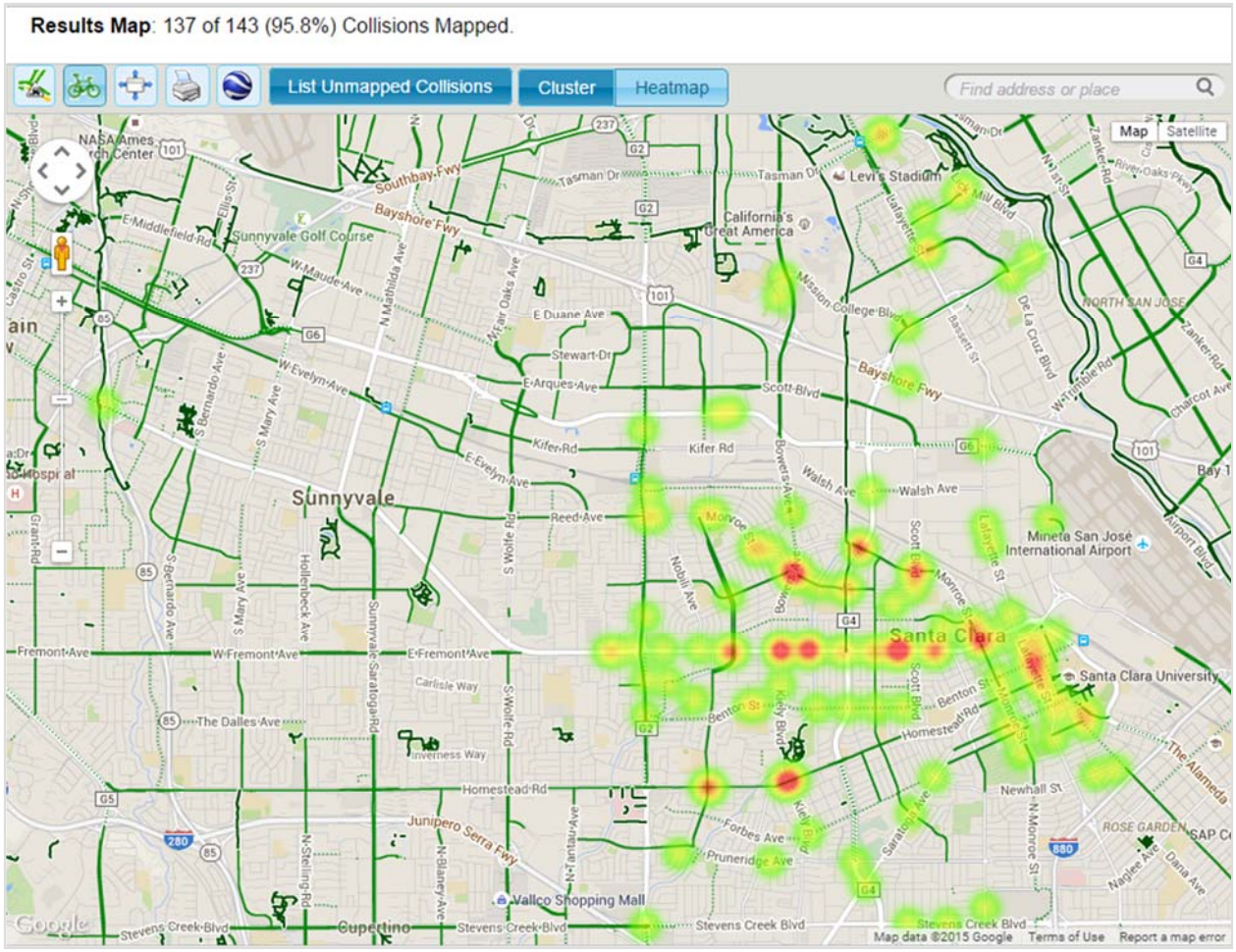
San Jose



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	4TH ST & SANTA CLARA ST	5
1	ALMADEN BLVD & SAN CARLOS ST	5
3	ALMADEN EXPY & BLOSSOM HILL RD	4
3	ALMADEN EXPY & BRANHAM LN	4
3	ALUM ROCK AVE & MCCREERY AVE	4
3	BRANHAM LN & SNELL AVE	4
7	1ST ST & SAN FERNANDO ST	3
7	8TH ST & JULIAN ST	3
7	ADRIAN WAY & STORY RD	3
7	ALUM ROCK AVE & JACKSON AVE	3
7	AUZERAIS AVE & BIRD AVE	3
7	BIRD AVE & VIRGINIA ST	3
7	BLOSSOM HILL RD & WINFIELD BLVD	3
7	BLOSSOM HILL RD & DESERT SANDS WAY	3

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012. Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php. Accessed on 5/20/2015.

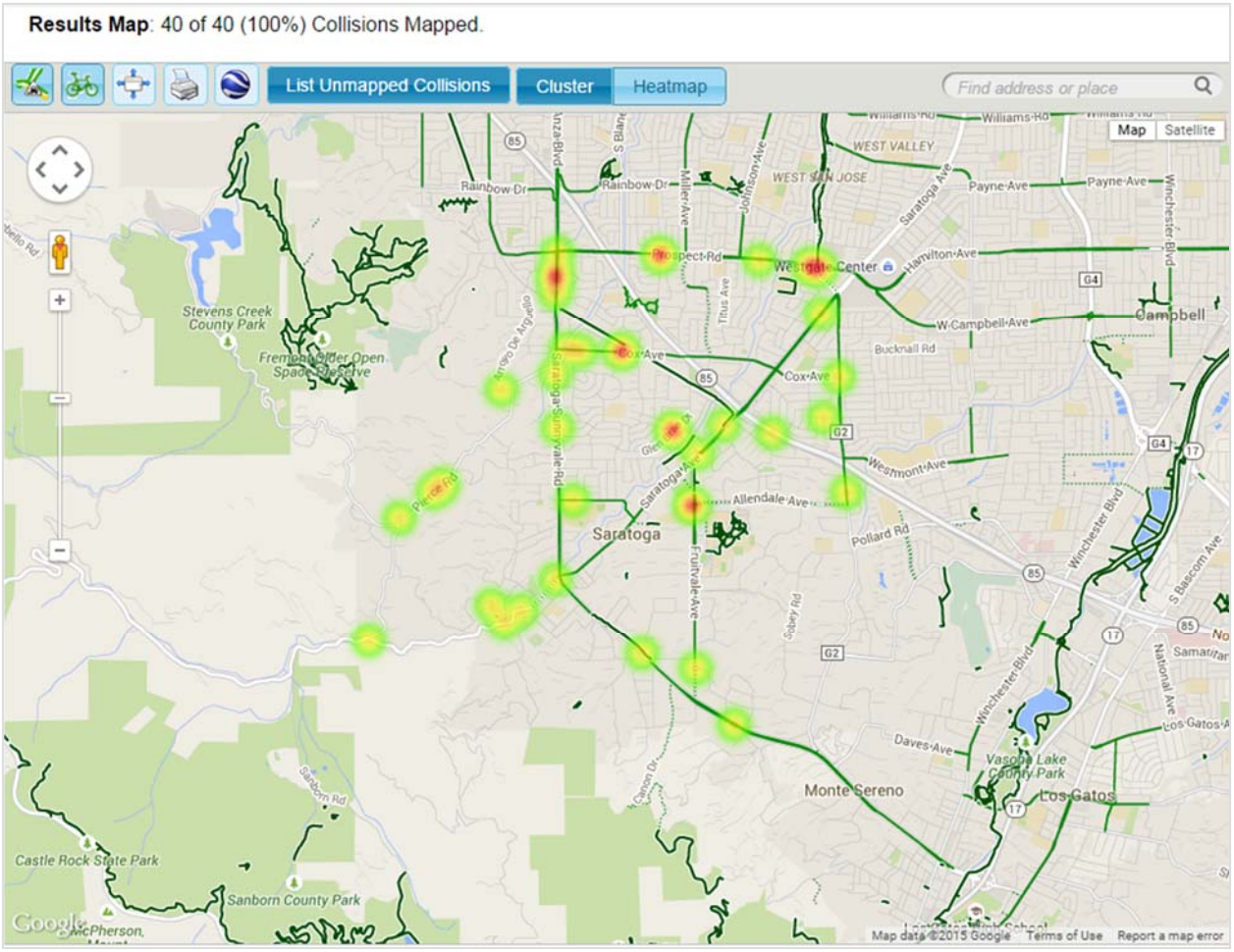
Santa Clara



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	BOWERS AVE & SR 82/EL CAMINO REAL	4
1	BOWERS AVE & KIELY BLVD & SR 82/EL CAMINO REAL	4
3	MONROE ST & SAN TOMAS EXPY	3
4	BENTON ST & LAFAYETTE ST	2
4	BOWERS AVE & CABRILLO AVE	2
4	CABRILLO AVE & SAN TOMAS EXPY	2
4	HOMESTEAD RD & KIELY BLVD	2
4	HOMESTEAD RD & POMEROY AVE	2
4	MONROE ST & SCOTT BLVD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

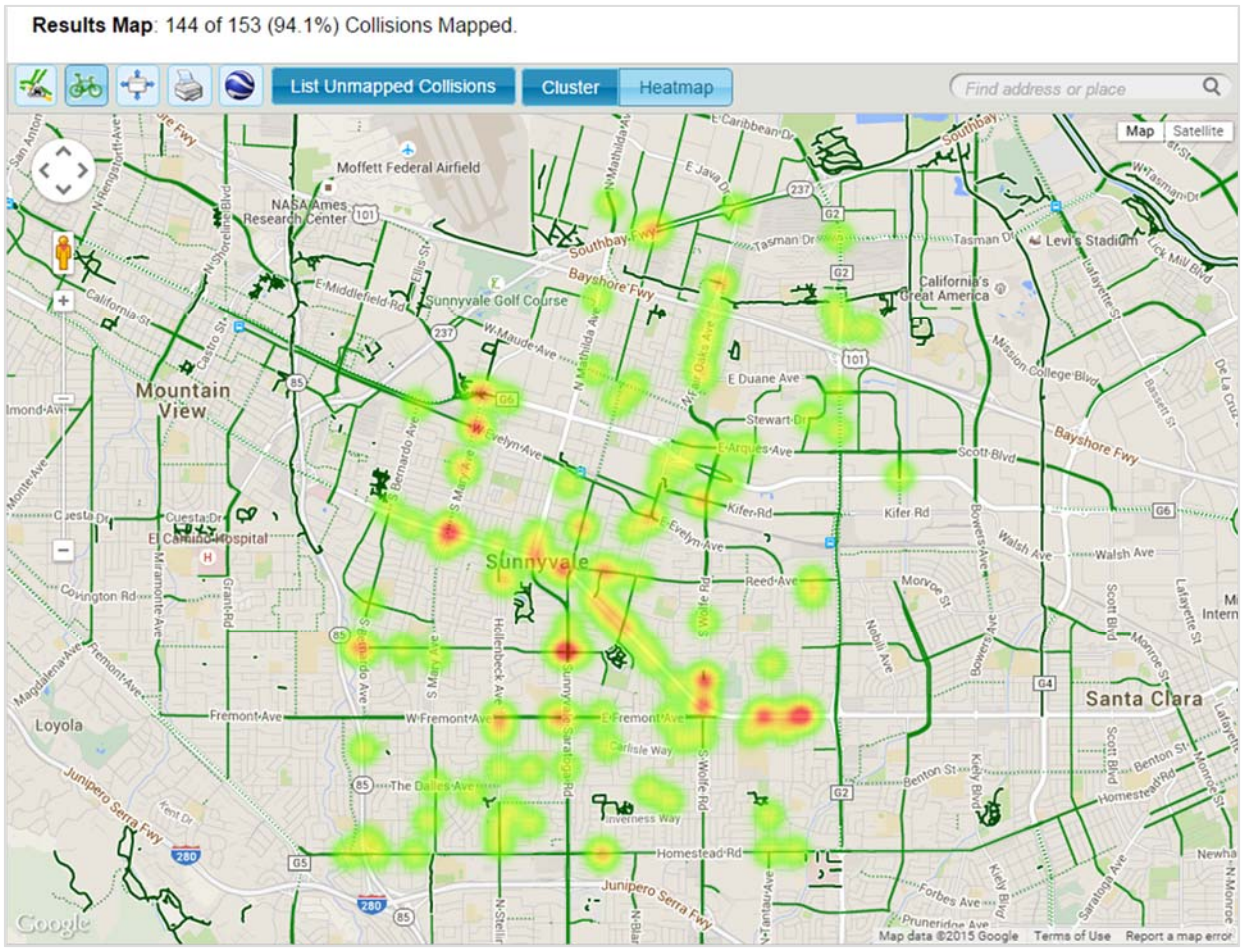
Saratoga



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	COX AVE & GLEN ARBOR CT	2
1	KIRKMONT DR & SARATOGA SUNNYVALE RD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

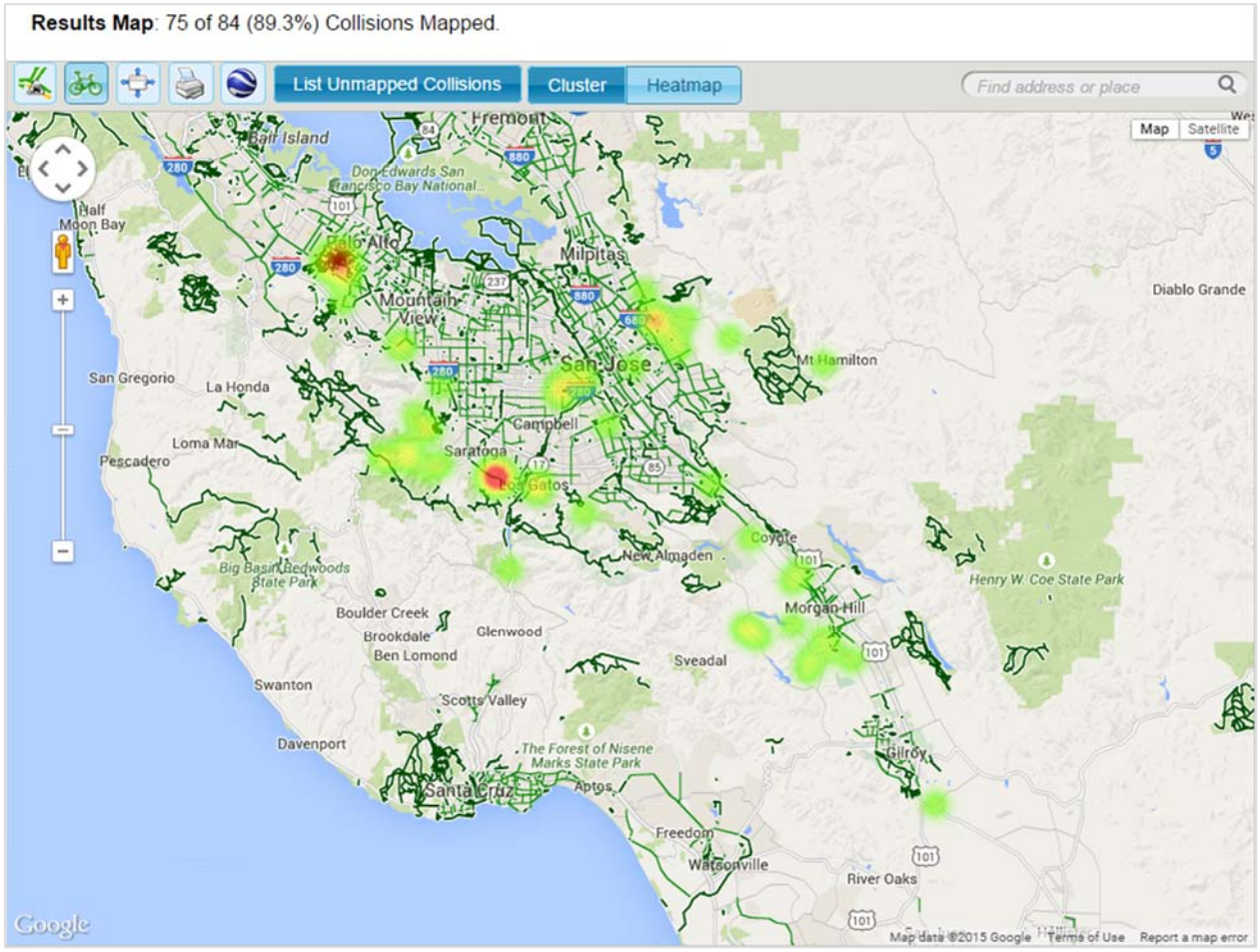
Sunnyvale



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	EVELYN AVE & MARY AVE	3
1	REMINGTON DR & SUNNYVALE SARATOGA RD	3
3	BERNARDO AVE & REMINGTON DR	2
3	SR 82/EL CAMINO REAL & MARY AVE	2
3	EVELYN AVE & FAIROAKS AVE	2
3	FAIR OAKS AVE & WEDDELL DR	2
3	FREMONT AVE & HOLLENBECK AVE	2
3	MARIA LN & WOLFE RD	2
3	MARY AVE & SR 82/EL CAMINO REAL	2
3	MARY AVE & WASHINGTON AVE	2
3	MATHILDA AVE & SR 82/EL CAMINO REAL	2
3	EL CAMINO REAL & SR 82/EL CAMINO REAL & WOLFE RD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

Unincorporated



Top-ranked intersections for motor vehicle-bike collisions with 2 or more collisions (2009-2012)		
Rank	Intersection	Collisions
1	AUSTIN WAY & SARATOGA LOS GATOS RD	2
1	BIG BASIN WAY & REDWOOD GULCH RD	2

Source: California Highway Patrol, Statewide Integrated Traffic Records System (SWITRS) 2009-2012.
Report generated by the Transportation Injury Mapping System from http://tims.berkeley.edu/index.php.
Accessed on 5/20/2015.

Recommendations

Bicycling is increasing throughout the county and may continue to increase as federal, state, and local policies, systems, and environmental changes encourage and support active living. In order to achieve significant increases in bicycling mode share, riding must be safe, as well as perceived as safe, by the general public. For example, the City of San Jose adopted a bike plan in 2009[21] with a goal of achieving a mode share of 5% of all trips being taken by bike by 2020 while simultaneously reducing the bike collision rate by 50%. In 2015, San Jose adopted a Vision Zero[22] goal, which is to eliminate deaths and major injuries on its roadways. The Vision Zero movement first began in Sweden in the 1990s and has grown throughout countries, states, and cities. Vision Zero is the idea that every traffic collision and death is preventable, whether through engineering, education, or enforcement.

A number of community partners, such as Silicon Valley Bicycle Coalition (SVBC), California Walks, and Traffic Safe Communities Network, are supporting the implementation of Vision Zero strategies. SVBC is supporting local communities through the development of a Vision Zero toolkit[23], which provides short, intermediate, and long-term objectives within the six E's of traffic safety programming: education, enforcement, engineering, encouragement, evaluation, and engagement. Many of the objectives detailed in SVBC's toolkit align with recommendations stemming from this report and are highlighted below.

Education

Using a systemic approach, education of bicyclists and motor vehicle drivers can occur at the individual, community, and organizational level. For example, bicycle safety education can begin as early as preschool by teaching children about the importance of a helmet and continue throughout the school years by engaging youth in developmentally appropriate classroom curriculum and skill building opportunities. Classroom and skill building classes should be widely available and easily accessible to youth outside of Safe Routes to School programs. Additional educational opportunities can be made available for bicyclists of all ages and abilities through local park and recreation programs or community organizations.

Broader community awareness about bicycling can be created by using public service announcements, media campaigns, and social media to educate the general public about the primary collision factors involved in bicycle crashes, how to use new and redesigned infrastructure such as green bike lanes, and changes to relevant traffic laws like the Three Feet for Safety Act. These same channels can also be used to educate motor vehicle drivers. Available resources that can educate bicyclists and motorists are the California Department of Motor Vehicles handbook and website and local and national bicycling advocacy organizations such as SVBC and the League of American Bicyclists.

Engineering

Future increases in bicycle trips should be taken into account in urban planning processes such as when infrastructure changes are made. Policies and mandates have been established to achieve this goal. In 2008 the Complete Streets Act was signed into law in California. This requires cities and counties, when making substantial revisions to the circulation element of their general plan, to ensure that those plans account for the needs of all roadway users,

including bicyclists. Since then Caltrans has expanded the "tool box" of engineering solutions available to cities and counties when it comes to accommodating bicyclists. It has allowed local agencies to use alternative design guidelines, such as those from the National Association of City Transportation Officials (NACTO)[24] rather than the Caltrans Highway Design Manual (HDM)[25], and they are working to incorporate the latest innovations into the California Manual on Uniform Traffic Control Devices (MUTCD)[26]. These provide cities and counties with a greater variety of treatments to increase safety and efficiency for bicyclists. Hastening the adoption of these new designs at the state level, and implementing them at the local level, would be beneficial to the goals of increasing bicycle usage and safety.

Cities should also ensure that the infrastructure needs of all neighborhoods are considered equitably. According to the Status of Latino/Hispanic Health Santa Clara County 2012[6], 92% of adults thought that their neighborhoods had safe walking and biking infrastructure, but only 77% of Latinos shared this perception.

Right of Way violations are especially problematic locally and accounted for 14% of the total motor vehicle-bicycle crashes. Some suggestions to reduce these collisions are to improve sight lines by removing on-street parking and keeping shrubbery trimmed, moving traffic (especially bicyclists) farther from the curb to provide more of a buffer between vehicles and bicyclists, and raising awareness through signage at troublesome locations.

Poorly maintained road surfaces can be particularly dangerous. Cities are encouraged to maintain roadways and construction zone pavement to ensure safety for all roadway users. Repaving can provide an opportunity to incorporate low cost bicycle lanes when restriping.

Enforcement

The enforcement of traffic safety laws by local police departments helps maintain safe streets for all, and consistent and accurate reporting of incidents provides critical data. Police departments are encouraged to make reports on all collisions involving bicyclists which will assist in identifying dangerous locations and behaviors in their municipality as well as countywide. Enforcement should be focused on the most dangerous behaviors, which are outlined above in the Traffic Collisions Data section.

Enforcement paired with education is preferred over enforcement alone. For example, increased enforcement efforts occurring simultaneously with a public education campaign or educational program can have greater impact than enforcement by itself. Currently, Santa Clara County Public Health Department and several police departments are implementing a Juvenile Traffic Diversion program in which youth under age 18 who are cited for non-motor vehicle offenses are invited to attend a two-hour educational class (with an adult) in lieu of paying the citation fine. The majority of the students attend the class because were cited for failing to wear a helmet while bicycling. The class educates the students on the most common bicycle and pedestrian laws and provides helmets for youth that need one. A similar program for adults would be beneficial and reach a broader portion of the community.

Evaluation

Evaluation is of great importance for determining the short, intermediate, and long-term effectiveness of programming efforts and infrastructure changes, but it cannot occur without good data collection. Throughout the report, the lack of appropriate bicycling rate data was noted as were the inconsistencies among data collected and reported among various agencies including those involved with Safe Routes to School. Since current data collection methods do not yield all of the information needed, new and/or consistent collection methodologies should be considered and coordinated at the county level. Improved and comprehensive data could better be used to set priorities and measure their effectiveness.

This report shows that solo bike crashes are a large fraction of those that cause serious injuries, and the causes should be investigated further and addressed. Since police reports are not typically filed for solo crashes, there is a lack of information about the factors in the crash. If solo crashes are as prevalent as the trauma center data implies, comprehensive police report data is needed to provide insight as to their causes.

Encouragement

Activities to promote and support bicycling can take many forms such as a bike sharing system, bikepools, Bike to Work Day, Bike to School Day, bicycle parking/lockers, community open streets programs, and workplace support and accommodations for employees who ride. To encourage long-term sustainable bicycling, encouragement should begin with youth by making bicycling fun while in a safe environment and continue with encouragement opportunities that are age appropriate throughout the lifespan. Employers can support a company program and incentivize riding.

Engagement

To comprehensively plan and implement bicycle safety programs and initiatives, input from diverse stakeholders and community members is suggested. This could include elected officials, advocates, law enforcement, city planners, public health experts, business leaders, injury prevention specialists, educators, bicycle advocates, and community members from under-served community groups. The stakeholders should have input into bicycling safety programming efforts and neighborhood design.

Bicycle Friendly Communities

The League of American Bicyclists (LAB) created the Bicycle Friendly America program[27] to acknowledge states, communities, businesses, and universities for their efforts in creating environments which encourage and support bicycling. States, communities, businesses, and universities can apply for a Bicycle Friendly award based on activities in the areas of engineering, enforcement, education, encouragement, and evaluation. There are nearly 400 Bicycle Friendly Communities in the U.S., and seven in Santa Clara County, that have been received Bicycle Friendly designations. Table 10 indicates each city's award level, and that of Stanford University, in 2015 and shows the strides that Santa Clara County has made in encouraging and supporting bicycling.

Table 10

Cities and Universities in Santa Clara County that have received Bicycle Friendly Awards from the League of American Bicyclists (2015)

City	Bicycle Friendly Award Level
Cupertino	Bronze
Los Altos	Bronze
Mountain View	Silver
Palo Alto	Gold
San Jose	Bronze
Santa Clara	Bronze
Sunnyvale	Bronze
Stanford University	Platinum

Source: League of American Bicyclists, http://www.bikeleague.org/bfa/awards

Technical Notes

Injury data are presented here as counts, age-specific rates per 100,000 people, and age-adjusted rates per 100,000 people.

Counts are the total number of events that occur in a defined period of time, such as the total number of collisions in a single year.

When comparing data between two or more populations or over a period of time, rates are often used instead of or in addition to counts, to account for differences in the size of populations. A rate is the count divided by the population at risk, and multiplied by a standard number (e.g., 100,000) to show the number affected per 100,000 people in a given population. Age-specific rates are the count in a given age group, such as the number of collisions for individuals ages 15 to 24, divided by the number of people in the population ages 15 to 24, multiplied by a standard number, e.g., 100,000.

Age-adjusted rates are a way of comparing the overall rates for indicators that are more common in some age groups than others, such as injuries. Age-adjusted rates are commonly used to compare data across subgroups (like race/ethnicity), time periods, and geographic areas like cities to account for differences in the age profile of different populations or the same population over time (i.e., the fact that there is a higher percentage of older adults in the White population than in other racial/ethnic groups in Santa Clara County). Age adjustment involves applying the age distribution of a “standard” population, in this case the 2000 U.S. population, to the rates. It is important to note that once an age adjustment is applied, results no longer represent the *actual* rates in a given population and so should be used only for the purposes of comparison. For more information on age adjustment, see http://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

References

1 . California Department of Transportation. Caltrans Strategic management Plan 2015-2020. http://dot.ca.gov/perf/library/pdf/Caltrans_Strategic_Mgmt_Plan_033015.pdf
2. California Department of Health. California Wellness Plan 2014. http://www.cdph.ca.gov/programs/cdcb/Documents/CDPH-CAWellnessPlan2014%20(Agency%20Approved).FINAL.2-27-14(Protected).pdf
3. Santa Clara County Public Health Department and Community Health Partnership. Partners for Health Santa Clara County: Community Health Assessment – Community Health Improvement Plan 2015-2020. https://www.sccgov.org/sites/sccphd/en-us/Partners/Data/Pages/Reports-and-Fact-Sheets.aspx
4. Santa Clara County Public Health Department. Behavioral Risk Factor Survey, 2013-2014.
5. U.S. Census Bureau. American Community Survey 5-Year Estimates for 2009-2013.
6. Santa Clara County Public Health Department. Status of Latino/Hispanic Health Santa Clara County 2012. https://www.sccgov.org/sites/sccphd/en-us/Partners/Data/Documents/Latino%20Health%202012/Executive_Summary_ENGLISH_oct2012.pdf Accessed July 8, 2015.
7. Emond, C., Tang, W., and Handy, S. Explaining gender differences in bicycle behavior. Presented at Active Living Research Conference February 19, 2009. UC Davis Sustainable Transportation Center of the Institute of Transportation Studies.
8. Krizek, K., Johnson, P., and Tilahum, N., University of Minnesota. Gender Differences in Bicycling Behavior and Facility Preferences. 2005. http://www.researchgate.net/publication/235909764 Accessed July 7, 2015.
9. National Center for Safe Routes to School. Trends in walking and bicycling to school from 2007 to 2012. http://www.saferoutesinfo.org/sites/default/files/Trends_in_Walking_and_Bicycling_to_School_from_2007_to_2012_FINAL.pdf Updated October 2013.
10. Centers for Disease Control and Prevention. Healthy Weight – It's Not a Diet, It's a Lifestyle. September 13, 2011. http://www.cdc.gov/healthyweight/physical_activity/index.html Accessed June 19, 2015.
11. Bassett, D., Pucher, J., Buehler, R., Thompson, D., & Crouter, S. Walking, cycling, and obesity rates in Europe, North America, and Australia. Journal of Physical Activity and Health, (2008); 5(6), 795-814.
12. Sallis, J., Spoon, C., Cavill, N., et al. Co-benefits of designing communities for active living: an exploration of literature. International Journal of Behavioral Nutrition and Physical Activity. February, 28, 2015; 12:30.
13. Federal Highway Administration. Report to the U.S. Congress on the outcomes of the nonmotorized transportation pilot program: SAFETEA-LU Section 1807. April 2012. http://www.fhwa.dot.gov/environment/bicycle_pedestrian/ntpp/2012_report/
14. U.S. Department of Transportation Federal Highway Administration. National Household Travel Survey. 2001, 2009.
15. Policylink, Prevention Institute, and Convergence Partnership. Healthy Equitable Transportation Policy Recommendations and Research. S. Malekafzali (Ed.)

http://www.aarp.org/content/dam/aarp/livable-communities/plan/transportation/healthy-equitable-transportation-policy-aarp.pdf
16. University of California, Berkeley Transportation Safe Transportation Research and Education Center. Transportation Injury Mapping System. http://tims.berkeley.edu Accessed May 20, 2015.
17. University of California, Berkeley Transportation Safe Transportation Research and Education Center. Transportation Injury Mapping System, 2009-2012. http://tims.berkeley.edu Accessed May 20, 2015.
18. California Department of Motor Vehicles. California Vehicle Code. http://www.dmv.ca.gov/portal/dmv/detail/pubs/vctop/vc/vctoc
19. U.S. Department of Transportation Federal Highway Administration. Manual on Uniform Traffic Control Devices. http://mutcd.fhwa.dot.gov/HTM/2003r1/part9/part9b.htm#section9B06
20. California Department of Transportation. Traffic operations policy directive. http://www.dot.ca.gov/hq/construc/CPDirectives/Attachment5_Traffic_Ops_Policy_Directive_09-06.pdf
21. City of San Jose. San Jose Bike Plan 2020. http://www.sanjoseca.gov/DocumentCenter/View/245
22. City of San Jose. Vision Zero San Jose. http://www.sanjoseca.gov/DocumentCenter/View/42849
23. Silicon Valley Bicycle Coalition. Vision Zero Toolkit. http://bikesiliconvalley.org/vision-zero
24. National Association of City Transportation Officials (NACTO). http://nacto.org/
25. California Department of Transportation. Caltrans Highway Design Manual. http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm
26. California Department of Transportation. California Manual on Uniform Traffic Control Devices. http://www.dot.ca.gov/hq/traffops/engineering/mutcd/ca_mutcd2014.htm
27. The League of American Bicyclists. Building a Bicycle Friendly America. http://www.bikeleague.org/bfa Accessed June 30, 2015.