2014
Traffic Safety Report

City of Fort Collins
Traffic Operations

April 2015

Cover photo credits

City staff (bike)
Coloradoan (autos and Max bus)
Muller Engineering (pedestrians)

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Executive Summary

Traffic Safety Matters

Traffic safety is an important component of a community's health and safety. Traffic crashes in 2014 within the City of Fort Collins included 257 significant injury crashes, and five resulted in a fatality. The societal cost of these crashes was in excess of $129 million dollars.

Overall Crash Trends

- Overall traffic crashes are up 18.6% in the past five years. However, the rate of increase in 2014 (5.6%) is less than ½ the rate of increase in 2013 (12.2%).
- Serious crashes (significant injury or fatal) are down, both across five years (3.3%) and from 2013 to 2014 (2.6%).
- When comparing the fatality crash rate per population, Fort Collins ranks relatively favorably when compared to other Colorado Cities, and is second best among 13 peer cities across the nation.

Crash Locations

- More than 70% of all crashes occur at intersections and/or driveways.
- Almost ½ of all crashes (46%) occur at signalized intersections.

Crash Types

- Rear-end crashes make up nearly half of all crashes, but many of them (97%) are minor crashes.
- DUI crashes represent 4% of all crashes, more than 10% of serious crashes, and about 20% of incapacitating or fatal crashes. 48% of all serious fixed object crashes involve alcohol.
- For serious crashes (those involving non-incapacitating injury, incapacitating injury or fatality), 88% are the result of one of six types of crashes :
    - Bicycle (24%)
    - Rear-End (17%)
    - Right Angle (15%)
    - Approach Turn (14%)
    - Fixed Object (9%)
    - Pedestrian (9%)

Bicycle Crashes

- Bicycle crashes have generally trended upwards. 2014 was the first year with a reduction in crashes since 2006.
- 80% of bike crashes occur at intersections or driveways
- 30% of all bike crashes involve wrong way riding by the cyclist.

Rear End Crashes

- Less than 3% of all rear end crashes result in a serious injury or fatality
- 64% of rear end crashes occur at signalized intersections

Right Angle and Approach Turn Crashes

- Almost 2/3 of right angle crashes involve a failure to yield after stopping.
- 71% of approach turn crashes occur at signalized intersections.

Fixed Object

- 17% of all fixed object crashes involve alcohol.
- This number increases to 48% of all serious fixed object crashes involve alcohol.

Pedestrian Crashes

- Reported pedestrian crashes tend to be serious crashes with 86% involving some level of injury or fatality.
- For the serious pedestrian crashes, motorists failing to yield account for only 15% of crashes.

High Crash Locations

Staff is using the approach detailed in the national Highway Safety Manual (HSM) to identify locations that have higher than expected crash frequency. The table listed on page 33 shows the 15 intersections in Fort Collins with the largest value of excess crash costs. Each of these intersections will be reviewed during 2015 to look for specific types or trends in crashes and identify potential countermeasures.

Implementing Safety Measures

A number of low cost improvements have been completed with significant results. In the four example projects listed on page 34, over a three year period, the number of crashes was reduced between 20 and 92% at each location.

In addition to low cost projects, the crash information in this report is integrated into various planning, engineering, neighborhood, school and other projects.

Education and Enforcement

This report will continue to inform both education and enforcement components of traffic safety. This includes cooperative work with Safe Routes to School and Police Services.

Looking Forward

Traffic operations staff has identified a few areas of focus for traffic safety in 2015. These include a targeted effort to address certain **types** of crashes in addition to high crash locations. Of special interest are approach turn crashes as well as bike and pedestrian crashes.

Section 1 - Introduction

In the past year, there were more than 4,000 traffic crashes in Fort Collins. On average, that is more than 10 crashes per day. Almost 800 of the crashes involved some level of injury (minor injury or more serious injury), and five involved a fatality. In 2014 alone, the annual societal costs of these crashes was in excess of $129 million dollars .

Traffic Safety Matters

In 2014, there were 262 crashes involving a serious injury or fatality in Fort Collins

This Traffic Safety Report is a compilation of traffic crash and safety information related to crashes on public streets within Fort Collins. It summarizes basic crash information and analyzes specific types of crashes in more detail. It also identifies high crash locations and provides an overview of on-going safety efforts.

This document is intended to be used as an informational and education piece as well as a benchmarking tool to track progress on efforts to reduce the number and severity of crashes . Finally, the document is intended to serve as a tool to help determine strategies and countermeasures to achieve crash reduction goals.

Explanation of Data

The source for crash information is the City of Fort Collins Traffic Operations Department traffic crash database. The department works cooperatively with Fort Collins Police Services to obtain electronic copies of reports for all crashes on public streets. This includes all crashes investigated and reported by Fort Collins Police Services plus those crash reports submitted after the fact to Police Services by involved parties.

Traffic Operations staff reviews each crash report for accuracy prior to input into the database to ensure that data is as complete, accurate and consistent as possible. Crashes that go unreported (or crashes on private property) are not represented in this analysis.

The City Planning Department provided demographic data used in this report. The Colorado Department of Revenue provided data showing the number of licensed drivers by age in Fort Collins.

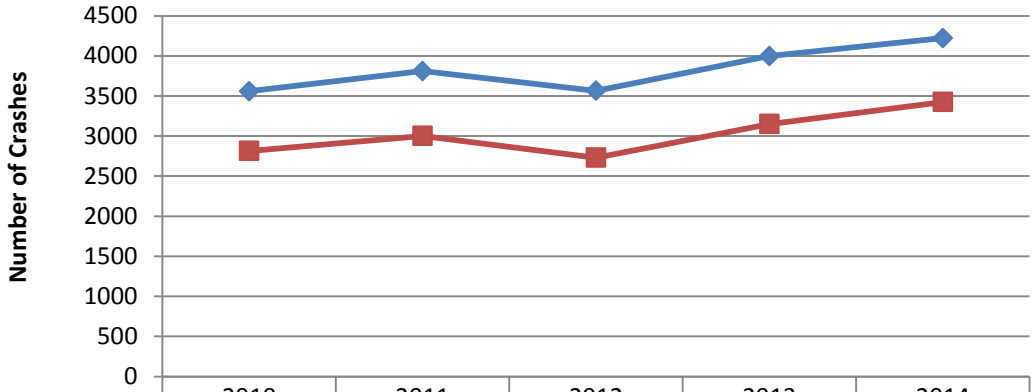
Most of the analysis represents five years of data, from 2010 – 2014.

Section 2 – General Crash Information

The total number of crashes per year for the past five years is shown below. There has been an 18.6% increase in total crashes between 2010 and 2014. The overall change in serious injury crashes is lower by 3.3%.

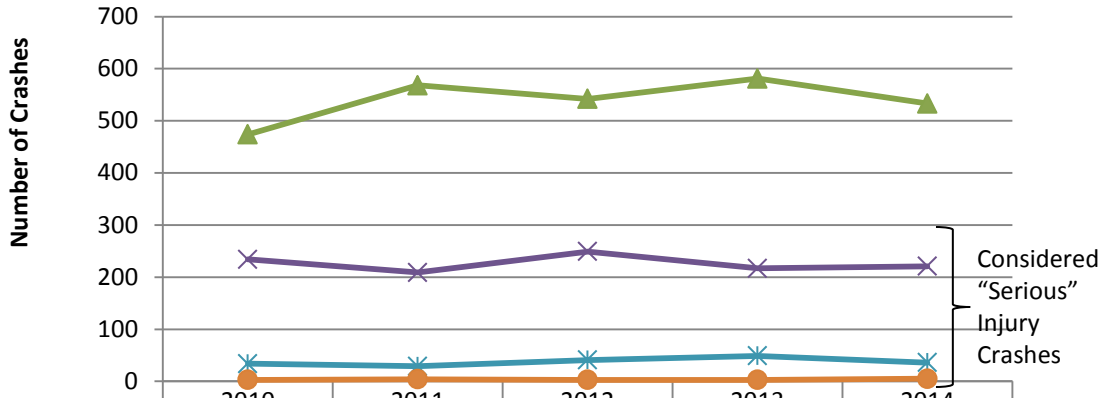
Increase in traffic crashes 2010-2014: 18.6%

Total Number of Crashes



	2010	2011	2012	2013	2014
Number of Crashes	3559	3811	3565	3999	4221
Property Damage Only	2814	3001	2730	3149	3426
% change in total crashes from previous year	-0.6%	7.1%	-6.5%	12.2.%	5.6%

Number of Crashes With Some Level of Injury

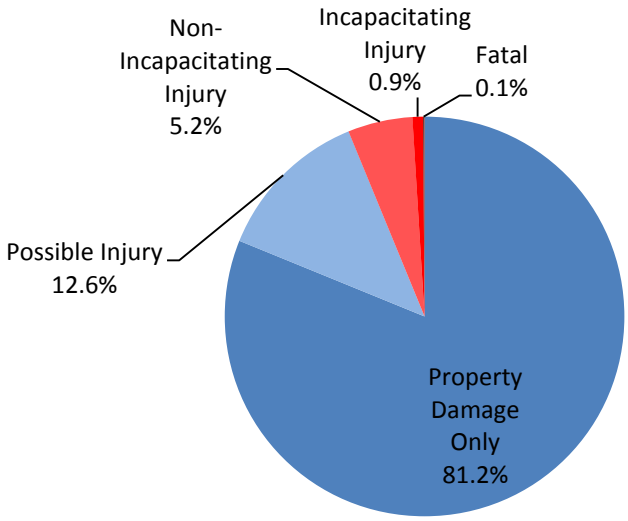


	2010	2011	2012	2013	2014
Possible Injury Crashes	474	568	542	581	533
Non-Incapacitating Injury Crashes	234	209	249	217	221
Incapacitating Injury Crash	34	29	41	49	36
Fatal Crash	3	4	3	3	5
% change in serious injury crashes from previous year	8.0%	-10.7%	21.1%	-8.2.%	-2.6%

2014 Crash Severity

The chart below shows the overall severity for crashes in 2014. The percent of all injury crashes has not been below 20% in more than five years, and is down from a high of 23.4% in 2012.

Decrease in serious crashes 2010-2014: **3.3%**



2014 Economic Impact of Crashes

Using figures determined by the Federal Highway Administration and published in the *Highway Safety Manual*, an estimation of economic costs associated with crashes in Fort Collins can be made. The crash costs shown are adjusted to reflect 2014 values. Crash costs include monetary losses associated with medical care, emergency services, property damage, and lost productivity. They also include costs related to the reduction in the quality of life related to injuries.

Societal cost of crashes in 2014: **$ 129 million**

The National Highway Traffic Safety Administration (NHTSA) completed a study on the costs of crashes. The NHTSA study not only concentrated on the costs of crashes, but also who pays the costs. The study found that society at large pays for about 75% of all costs incurred for traffic crashes. Those costs are passed on to the general public through insurance premiums, taxes, direct out of pocket payments for goods/services, and increased medical costs.

Crash Severity	Number of Crashes	Cost Per Crash	Cost
Property Damage Crashes	3,426	$10,000	$34,260,000
Possible Injury Crashes	533	$61,300	$32,672,900
Non-Incapacitating Injury Crashes	221	$108,500	$23,978,500
Incapacitating Injury Crashes	36	$296,900	$10,688,400
Fatal Crashes	5	$5,575,200	$27,876,000
Total			**$129,475,800**

Comparison with Other Cities

The most consistent way to compare the City's crash frequency with that of other entities is to compare the fatal crash rate (crashes per 100,000 population). The charts below are sorted by fatal crash rate and compare Fort Collins to other cities in Colorado with similar population (between 85,000 and 200,000) and also compare to other peer cities nationwide. The nationwide peer cities are participants in an annual benchmarking survey that Fort Collins Police Services participates in.

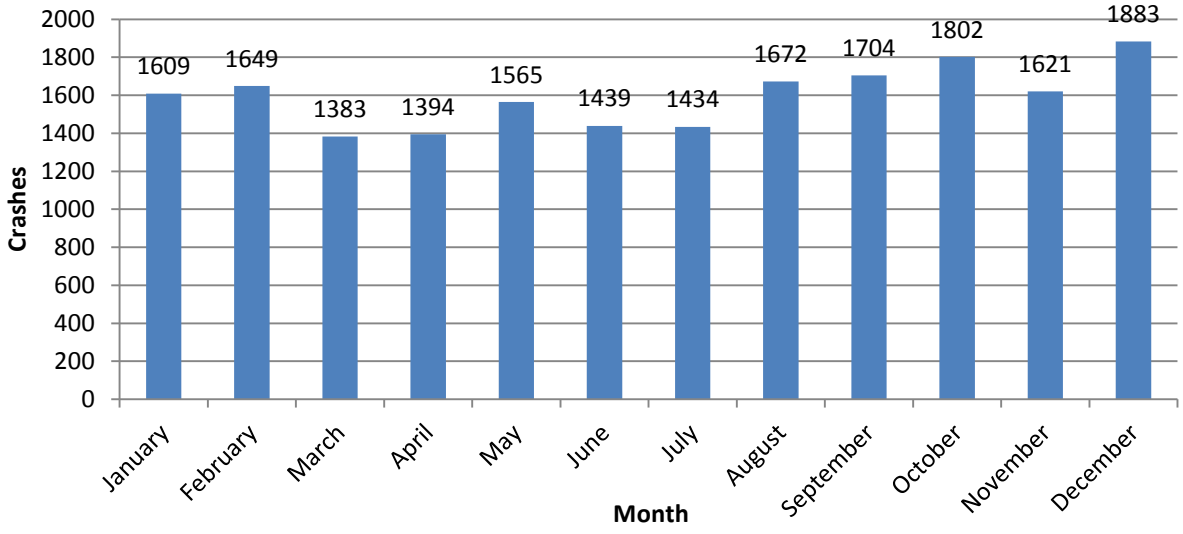
Colorado Cities							
City	**Population**	**Fatal Crashes, 2010 - 2013**					**Fatal Crash Rate *(Crashes/100,000 Population)***
		2010	2011	2012	2013	**Avg.**	
Pueblo	108,249	9	9	11	6	8.8	**8.1**
Lakewood	147,214	13	10	9	6	9.5	**6.5**
Greeley	96,539	5	3	7	5	5	**5.2**
Thornton	127,359	5	3	5	4	4.3	**3.4**
Fort Collins	**152,205**	**3**	**4**	**4**	**3**	**3.5**	**2.3**
Arvada	111,701	0	3	3	4	2.5	**2.2**
Longmont	89,919	2	2	2	2	2	**2.2**
Boulder	103,166	1	4	3	0	2	**1.9**
Total Colorado Cities	936,352	38	38	44	30	37.6	**4**

Peer Cities							
City	**Population**	**Fatal Crashes, 2010 - 2013**					**Fatal Crash Rate *(Crashes/100,000 Population)***
		2010	2011	2012	2013	**Avg.**	
Boca Raton, FL	89,407	8	3	12	12	8.8	**9.8**
Springfield, MO	164,122	18	10	19	13	15	**9.1**
Broken Arrow, OK	103,500	1	9	11	7	7	**6.8**
Coral Springs, FL	126,604	9	5	5	10	7.3	**5.8**
Norman, OK	118,197	6	5	8	8	6.8	**5.8**
San Angelo, TX	97,492	5	3	4	6	4.5	**4.6**
Richardson, TX	104,475	6	2	5	3	4	**3.8**
Overland Park, KS	181,260	7	6	8	4	6.3	**3.5**
Olathe, KS	131,885	4	1	4	8	4.3	**3.3**
Cedar Rapids, IA	128,429	5	2	7	2	4	**3.1**
Bellevue, WA	133,992	1	4	5	4	3.5	**2.6**
Fort Collins	**152,205**	**3**	**4**	**4**	**3**	**3.5**	**2.3**
Naperville, IL	144,864	4	1	2	1	2	**1.4**
Total Peer Cities	1,676,432	77	55	94	81	77	**4.8**

Crash data for other communities was obtained from the National Highway Traffic Safety Administration's Fatal Accident Reporting System which contains data through 2013. Population estimates are for 2013 and are from the U.S. Census.

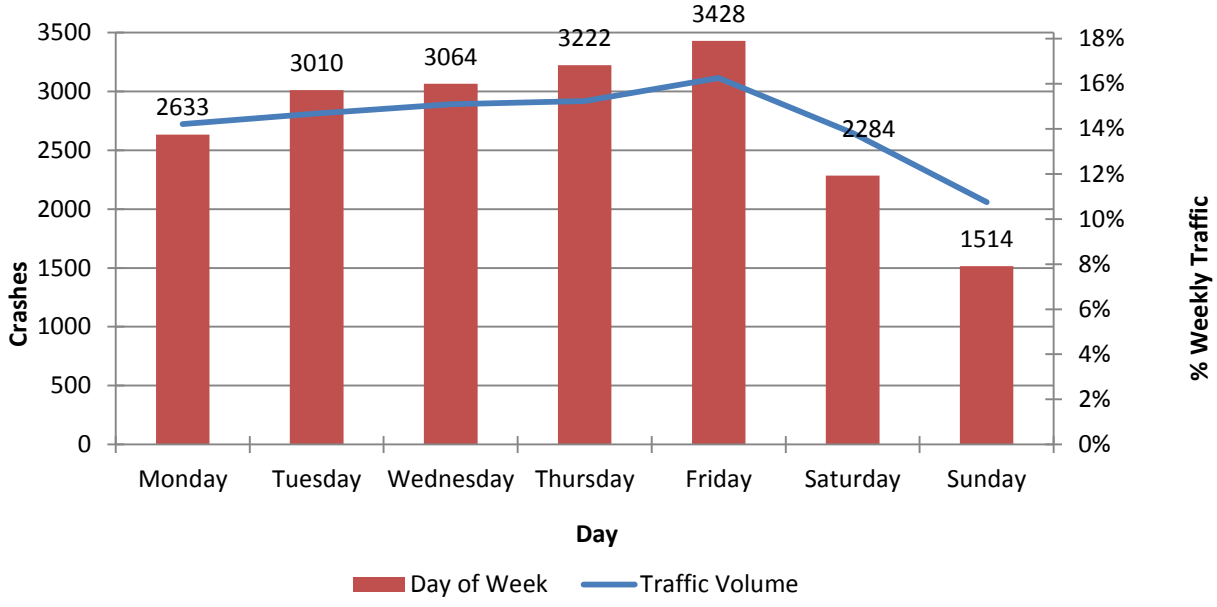
Crashes By Month 2010-2014

The variation of crashes by month is shown below. The number of crashes varies by as much as 35% with more crashes occurring in the fall/winter than in the spring/summer. Inclement weather and a higher student population at those times likely contribute to the increase seen during the colder months.



Crashes By Day of Week 2010-2014

The chart below shows that more crashes occur on Fridays than on other days of the week. Daily variation in crashes tracks closely with daily variation in traffic volumes (blue line).

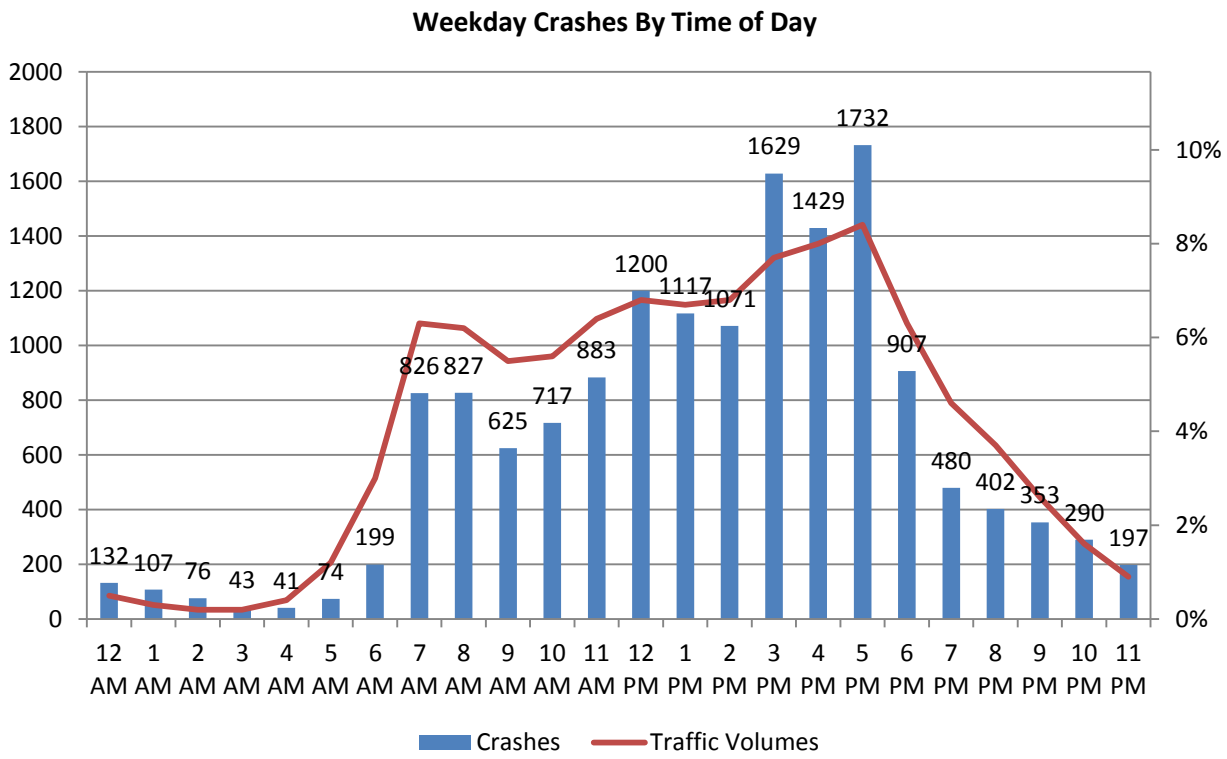


Crashes By Time of Day 2010-2014

The graph below and on the following page show crashes by time of day for weekdays, Saturdays and Sundays respectively. The charts also show the percentage of daily traffic by hour (red line).

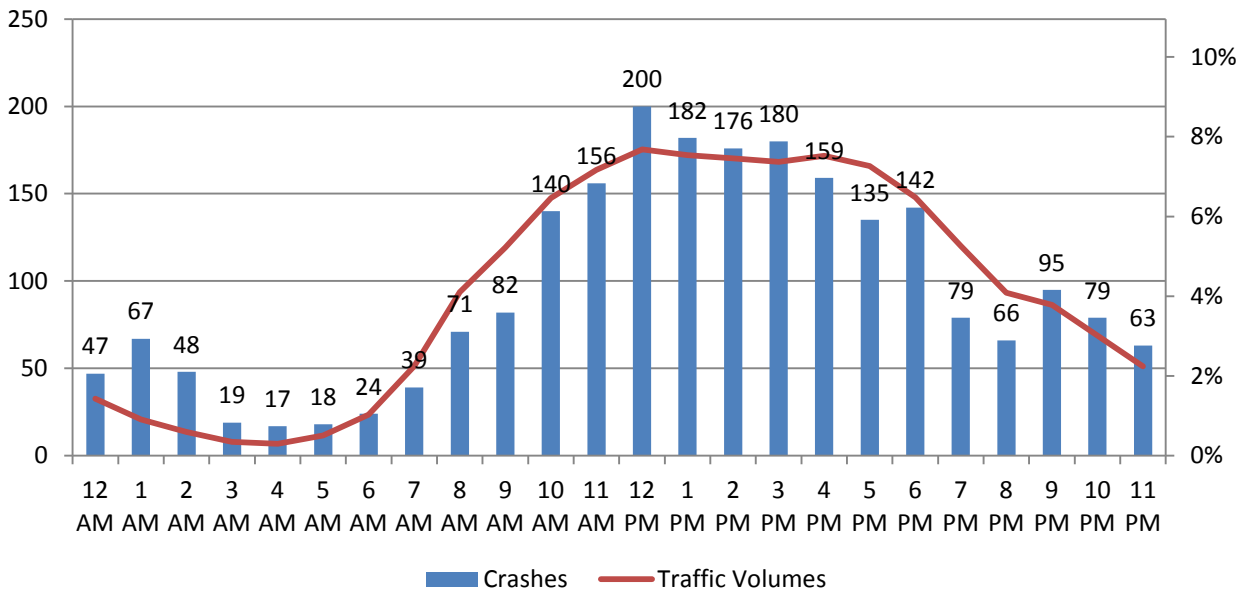
On weekdays (Monday-Friday), crashes are overrepresented during the afternoon hours, particularly the 3 p.m. and 5 p.m. hours. That is, there are more crashes than expected given the amount of traffic on the streets at those times.

On weekends, early morning hours on Saturdays and Sundays are significantly overrepresented. Around 1 a.m. to 2 a.m. on Saturdays and Sundays, there are about three times as many crashes as would be expected given the traffic volumes at those times. This data suggests that evening activities and alcohol use on weekends may contribute to a high number of crashes. See page 11 for more data on alcohol related crashes.

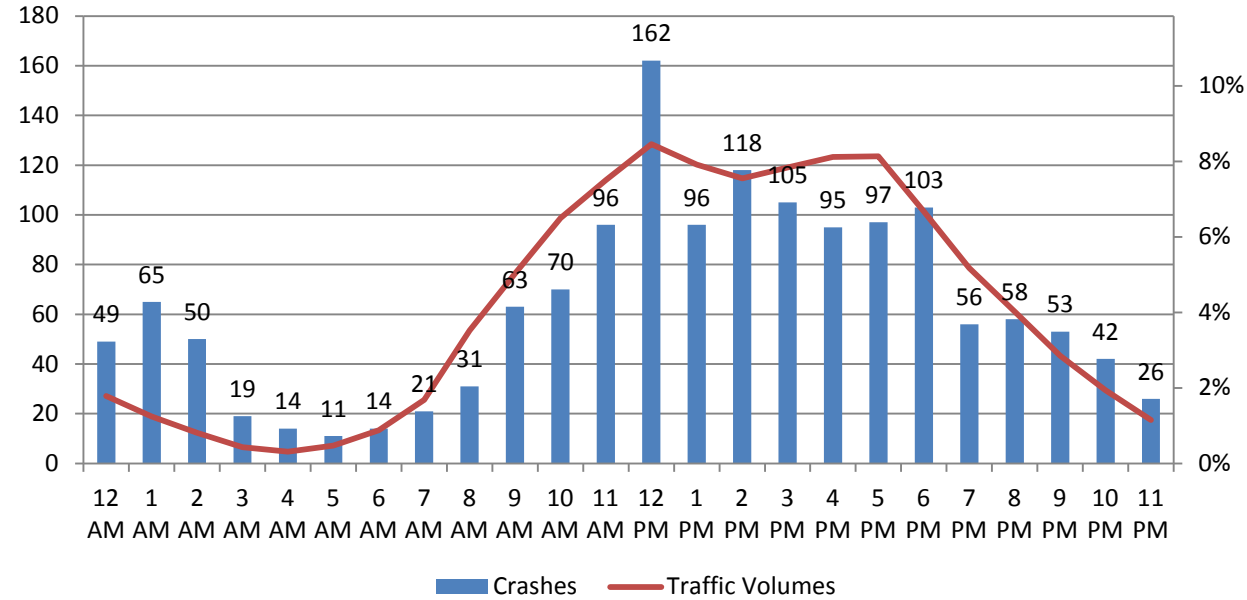


Crashes By Time of Day 2010-2014, cont.

Saturday Crashes By Time of Day



Sunday Crashes By Time of Day

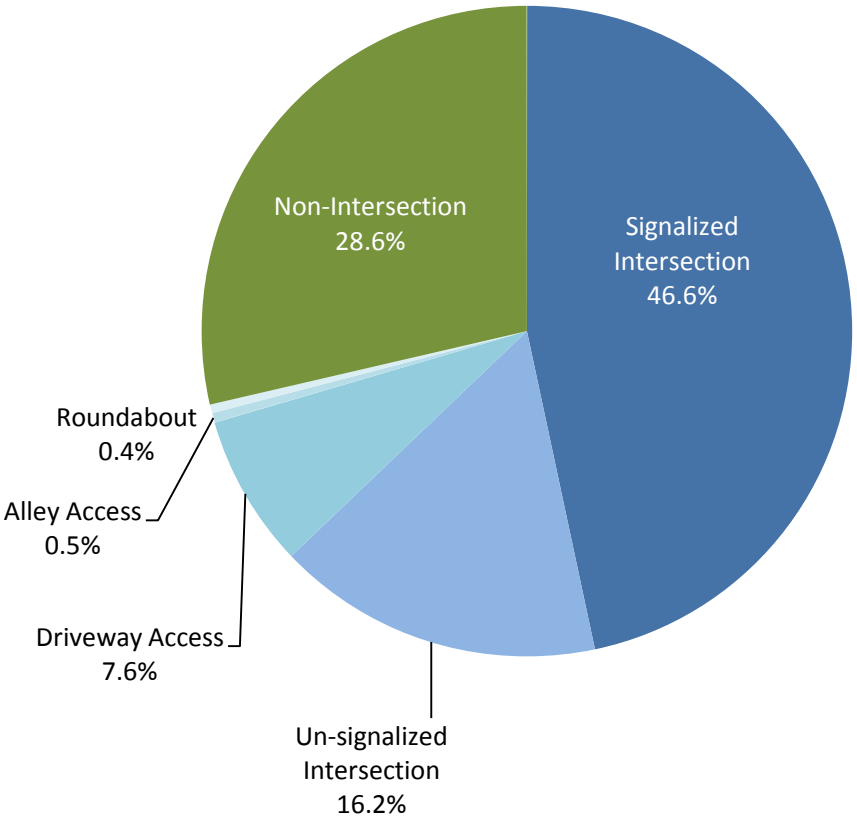


Location of Crashes 2010-2014

The chart below shows the location of crashes in Fort Collins. Crashes at intersections or driveways account for 71% of all crashes.

This illustrates the importance of minimizing driveways and accesses and focusing the traffic safety program on intersections.

More than **70%** of all crashes occur at an intersection or driveway



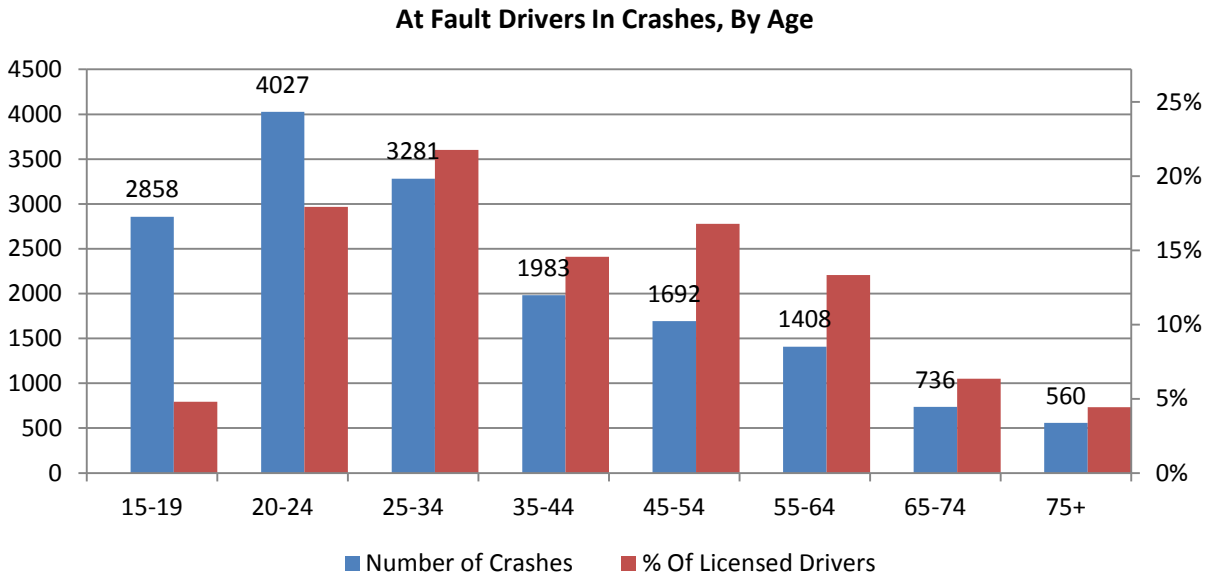
At Fault Drivers By Age 2010-2014

The chart below compares the number of crashes by age of an at-fault driver with the percent of licensed drivers in that age category.

Drivers aged 15–19 are more than **three** times as likely to be involved in a crash as would be expected given the number of licensed drivers in that age group. Twenty to 24 year-old drivers are about 1.4 times as likely to be in a crash as expected. All other age groups are underrepresented in crashes.

While these statistics are not unique to Fort Collins, they do indicate that driver inexperience is likely a key factor in crashes and countermeasures to deal with this problem would be appropriate at the local level.

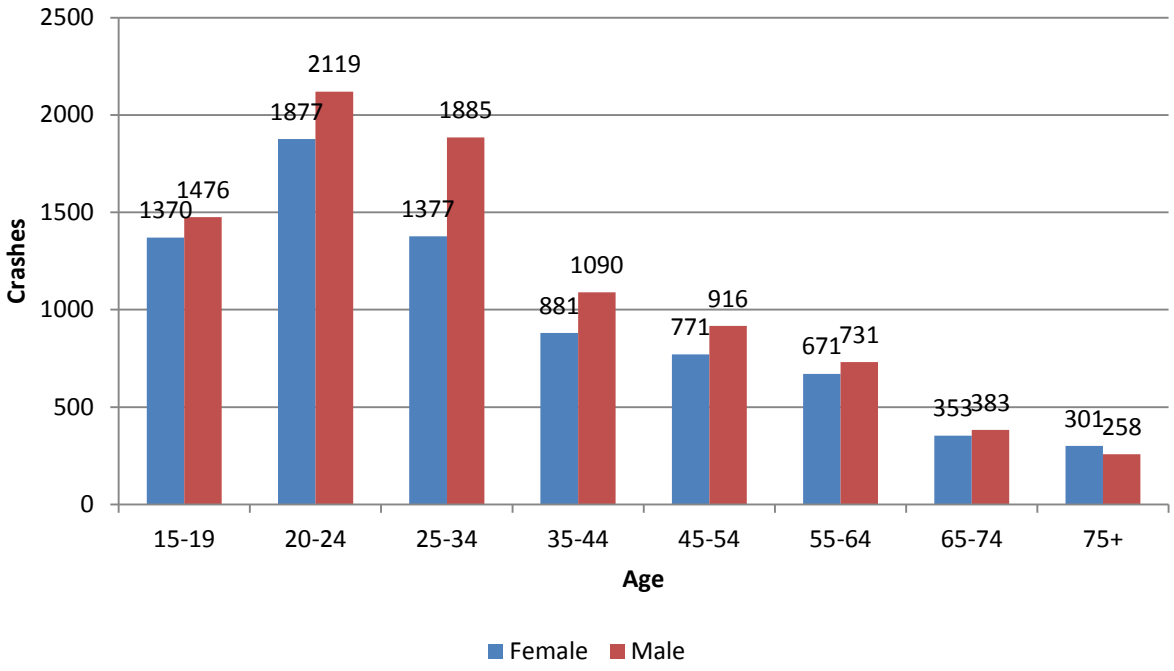
Teenagers represent **4.8%** of all drivers but are responsible for **17.3%** of all crashes.



Crashes by Age and Gender 2010-2014

The graph below shows crashes by age and gender (some crashes aren't included if gender information wasn't provided in the report).

Overall, male drivers are involved in more crashes than female drivers. Younger male drivers (20 – 34) in particular are more likely to be involved in crashes than their female counterparts. It should be noted that male drivers tend to drive more vehicle-miles per year.

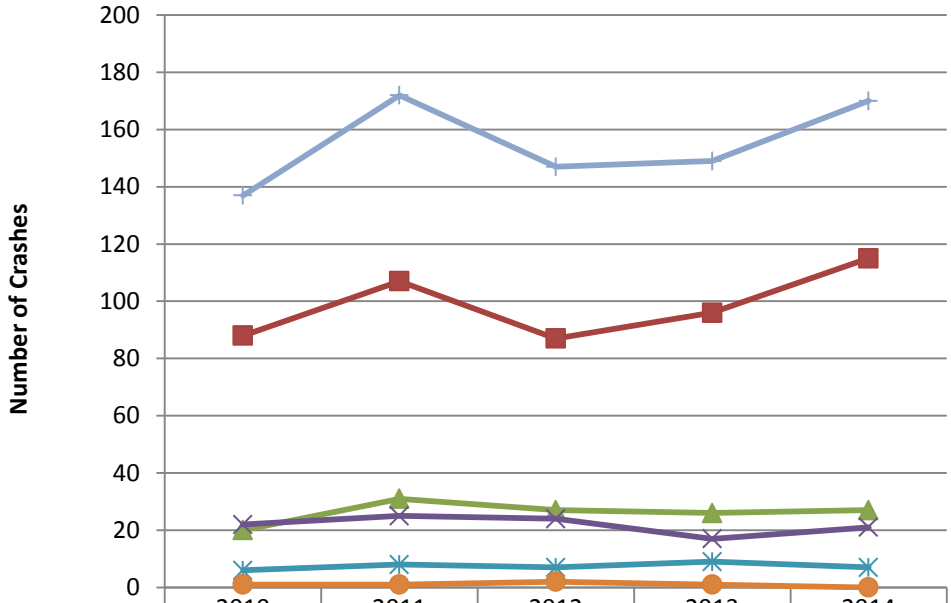


Driving Under the Influence (DUI Crashes) 2010-2014

The graph below shows the number of DUI (driving under the influence) crashes over the past five years. The DUI crashes represent about 4% of all crashes. However, they account for more than 10% of serious crashes, and about 20% of incapacitating or fatal crashes. This suggests that alcohol related crashes are more likely to result in serious injuries.

Trends for DUI crashes do not reflect a consistent pattern. DUI crashes are up 14% between 2013 and 2014, but the number of crashes in 2014 is very similar to the number of crashes in 2011.

Crashes involving DUI represent **4%** of all crashes but **>10%** of serious crashes.



	2010	2011	2012	2013	2014
Property Damage Crashes	88	107	87	96	115
Possible Injury Crashes	20	31	27	26	27
Non-Incapacitating Injury Crashes	22	25	24	17	21
Incapacitating Injury Crashes	6	8	7	9	7
Fatal Crashes	1	1	2	1	0
Total	137	172	147	149	170

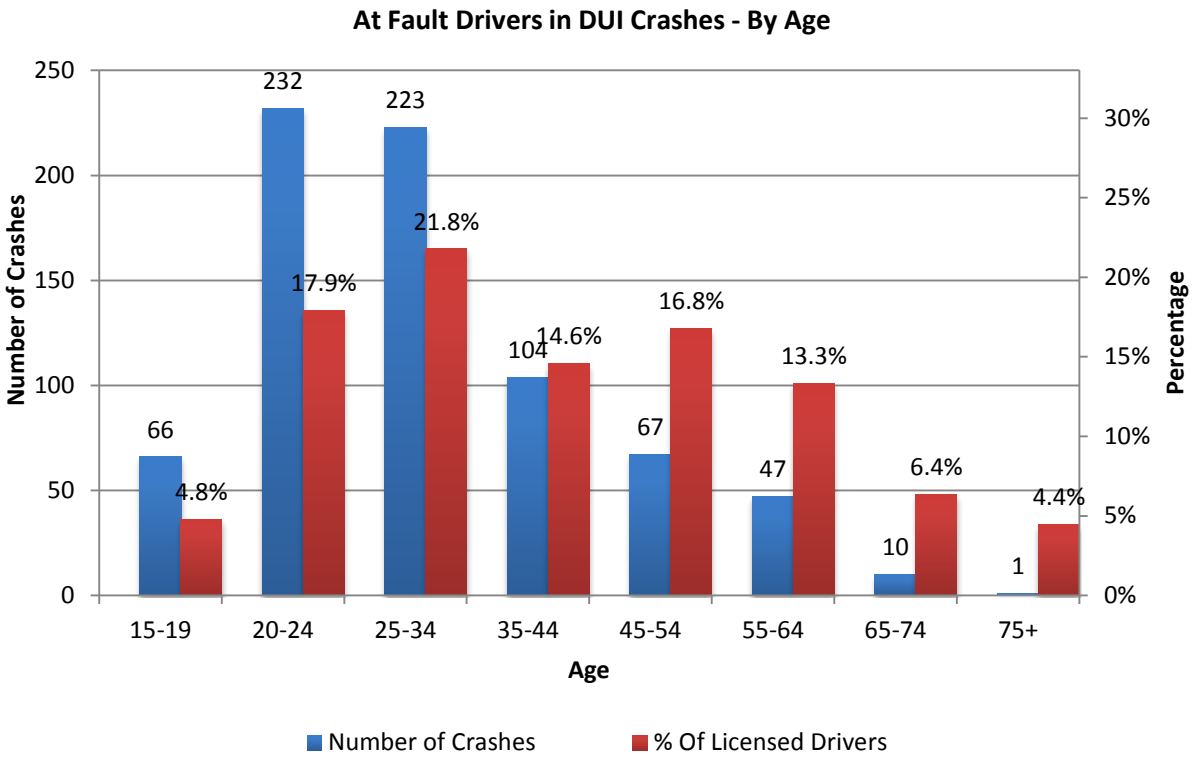
Year

DUI Crashes By Age 2010-2014

Crashes in the past five years that involve Driving Under the Influence (DUI) are shown below by age of at fault drivers.

Drivers 20-24 years old are about twice as likely as expected to be at fault in alcohol related crashes given the number of licensed drivers in that age group. Perhaps more surprisingly, drivers 15 – 19 years old are also overrepresented (more than twice as likely as expected) despite the fact that they have not reached legal drinking age.

Drivers under the age of 25 represent **23%** of licensed drivers but cause **40%** of DUI crashes.

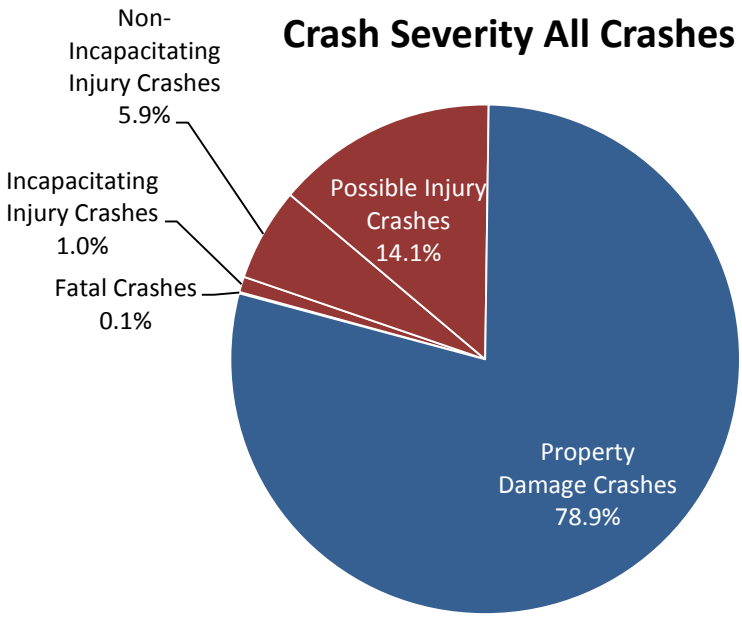


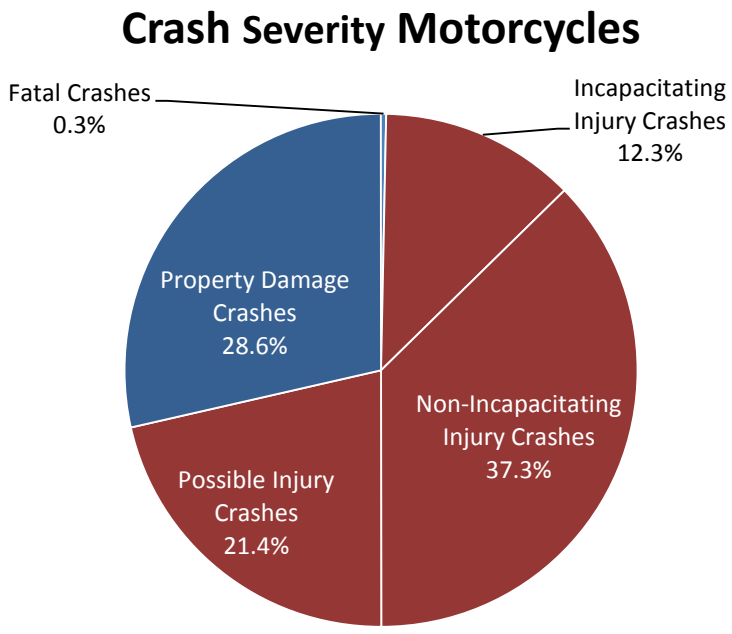
Motorcycle Crashes 2010-2014

From 2010 - 2014 there were a total of 339 reported motorcycle crashes. While motorcycle crashes generally follow the same patterns as other crashes they tend to be more severe as shown in the charts below.

Overall, only 21% of crashes result in in some type of injury while 71% of motorcycle crashes result in injury.

In a crash, motorcyclists are more than **three** times as likely to be injured or killed than motorists in vehicles.



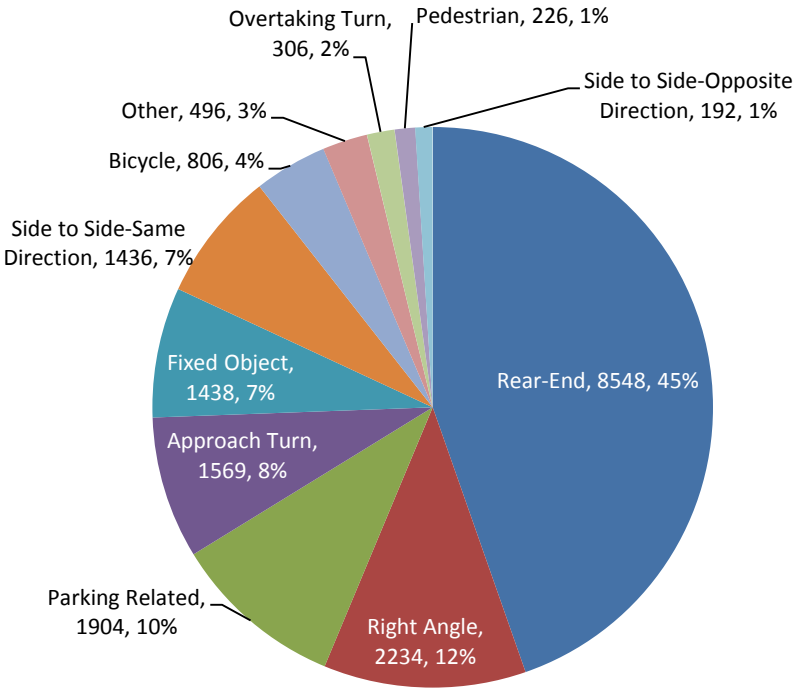


Section 3 - Detailed Review of Specific Types of Crashes

Crashes are categorized into a variety of types. The charts below show the number and percentage of crashes by type for all crashes, and again for severe crashes.

Crashes By Type 2010-2014 All Crashes

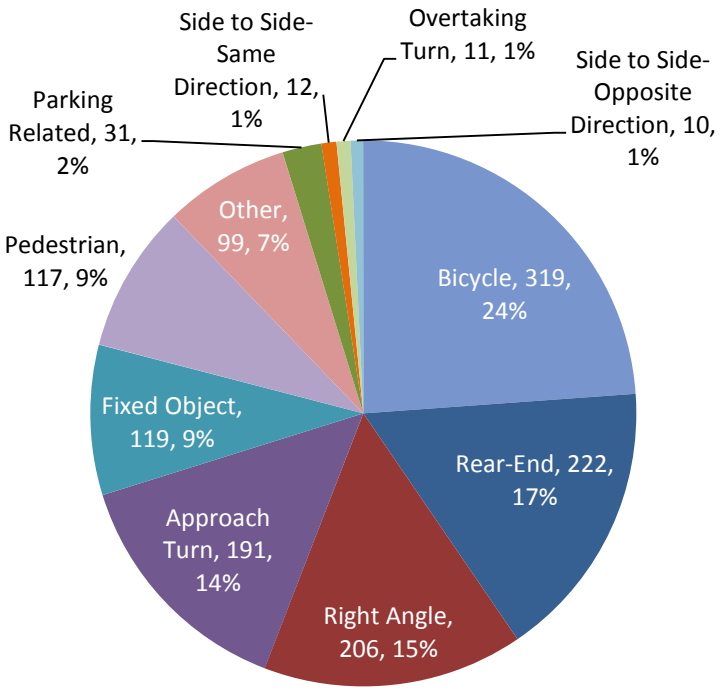
Rear end crashes make up nearly half of all crashes. Right angle, parking related, approach turn and fixed object crashes are the next most common types of crashes in Fort Collins



Crashes By Type 2010-2014 Severe Crashes (Serious injury/fatal)

While all traffic crashes are of concern, severe crashes (those involving non-incapacitating injuries, incapacitating injuries or fatalities) are of special concern. Bicycle, Pedestrian, Right Angle, Approach Turn, Fixed Object, and Rear End crashes account for 88% of the severe crashes in Fort Collins.

Note that while bicycle and pedestrian accidents make up only about 5% of total crashes they make up more than a third (35%) of severe crashes.



Description and Explanation of Crash Type

Each of various crash types is listed below with an explanation and/or description.

Approach Turn – Two vehicles traveling in opposite directions, one turns left (or attempts a U-turn) in front of the oncoming vehicle and is struck.

Bicycle – Any crash that involves a bicyclist.

Fixed Object – A single vehicle crash where a fixed object other than a parked vehicle is struck.

Overtaking Turn – Two vehicles traveling in the same direction, the front vehicle turns right or left and is hit as the following vehicle tries to pass on the right or left.

Parking Related – Any crash involving a parked vehicle or a vehicle entering/leaving a parking space.

Pedestrian – Any crash that involves a pedestrian.

Rear End – Two vehicles traveling in the same direction, leading vehicle struck by following vehicle.

Right Angle – Two vehicles traveling on perpendicular streets one fails to yield or passes a traffic control device and strikes the other.

Sideswipe Opposite Direction (also side to side opposite) – Two vehicles traveling in opposite directions, one veers into the wrong lane and strikes the side of the other car. This often occurs where a vehicle waiting at a STOP sign or traffic signal is struck by a vehicle turning right from a perpendicular road onto the road of the stopped car.

Sideswipe Same Direction (also side to side same) – Two vehicles traveling the same direction, one vehicle veers into the other striking it in the side (usually due to improper lane changes).

Other – Other crashes that do not fit into any other category.

Bicycle Crashes

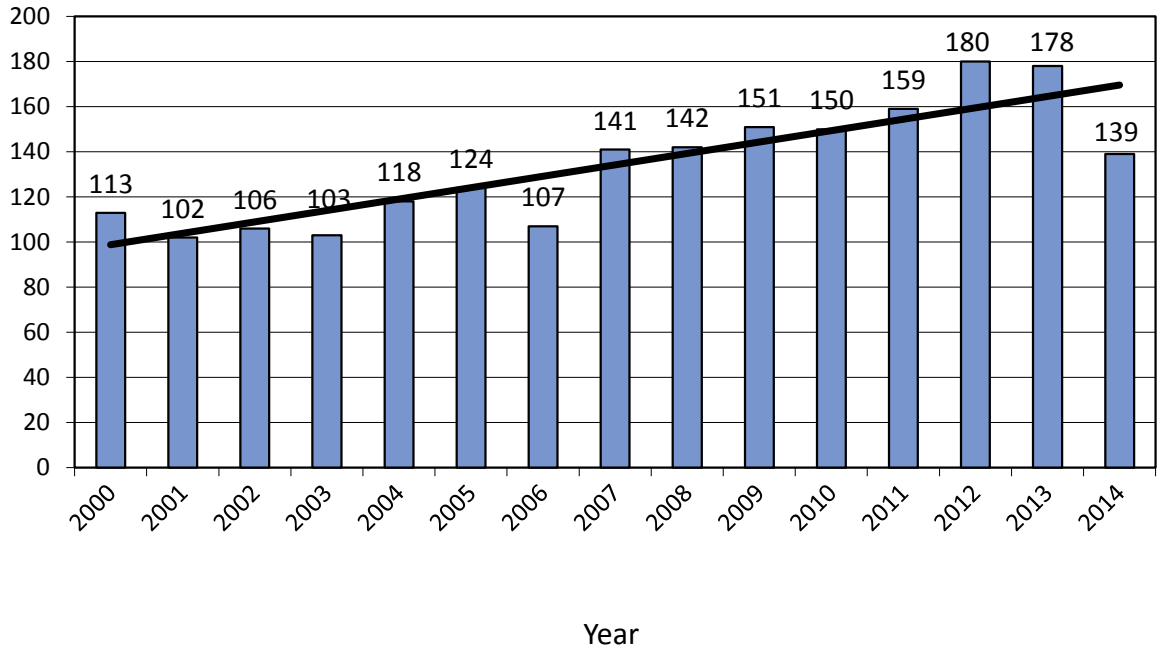
The City of Fort Collins is well known for its bike culture, and there is a strong focus on encouraging increased riding. Bike safety is an important component of supporting these efforts.

The chart below shows the historical trend of number of bicycle crashes in Fort Collins. Although 2014 saw a reduction in crashes over previous years, the general trend has been upwards.

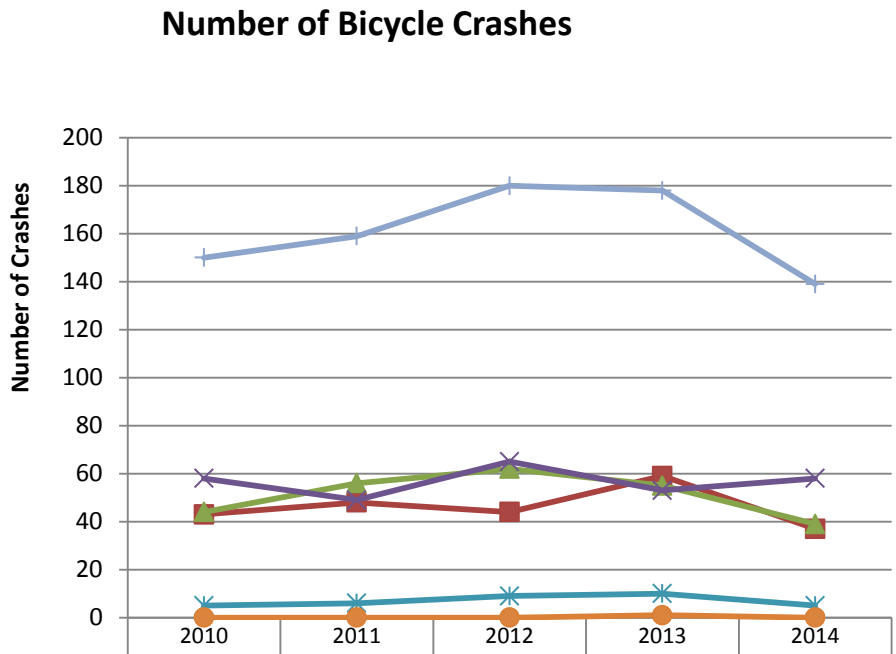
Overall bike crashes account for about 4% of all crashes in the City of Fort Collins.

2014 saw a reduction in bike crashes although the general trend has been upwards.

Number of Bike Crashes – Historical Data



The chart below shows the number of bicycle crashes in Fort Collins by severity. Total bike crashes are down by more than 20% in the past year. It is unclear whether this is an anomaly or a trend.

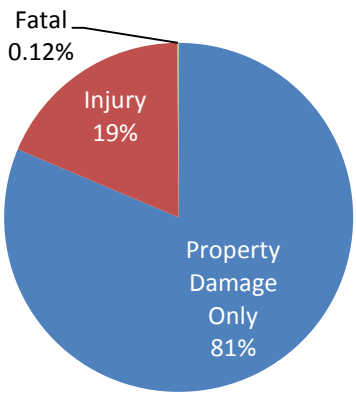


	2010	2011	2012	2013	2014
Property Damage Crashes	43	48	44	59	37
Possible Injury Crashes	44	56	62	55	39
Non-Incapacitating Injury Crashes	58	49	65	53	58
Incapacitating Injury Crashes	5	6	9	10	5
Fatal Crashes	0	0	0	1	0
Total Crashes	150	159	180	178	139
% change in total crashes from previous year	-0.7%	6.0%	13.2%	-1.1%	-21.9%
% change in serious crashes (non-incapacitating injury, incapacitating injury or fatal) from previous year	-3.1%	-12.7%	34.5%	-13.5%	-1.6%

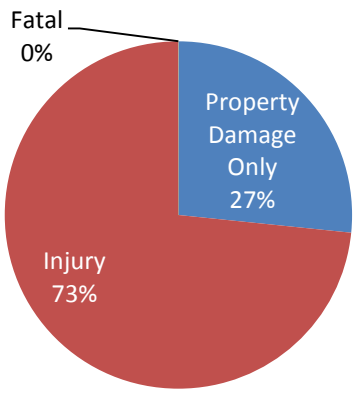
Bicycle Crash Severity

As noted on the previous page, bike crashes account for about 4% of total crashes. However, they account for 14% of combined injury and fatal crashes, and almost 25% of the most severe crashes (non-incapacitating injury, incapacitating injury and fatal crashes). This illustrates that bike crashes, when they do occur tend to be more serious than motor vehicle crashes.

Crash Severity All Crashes

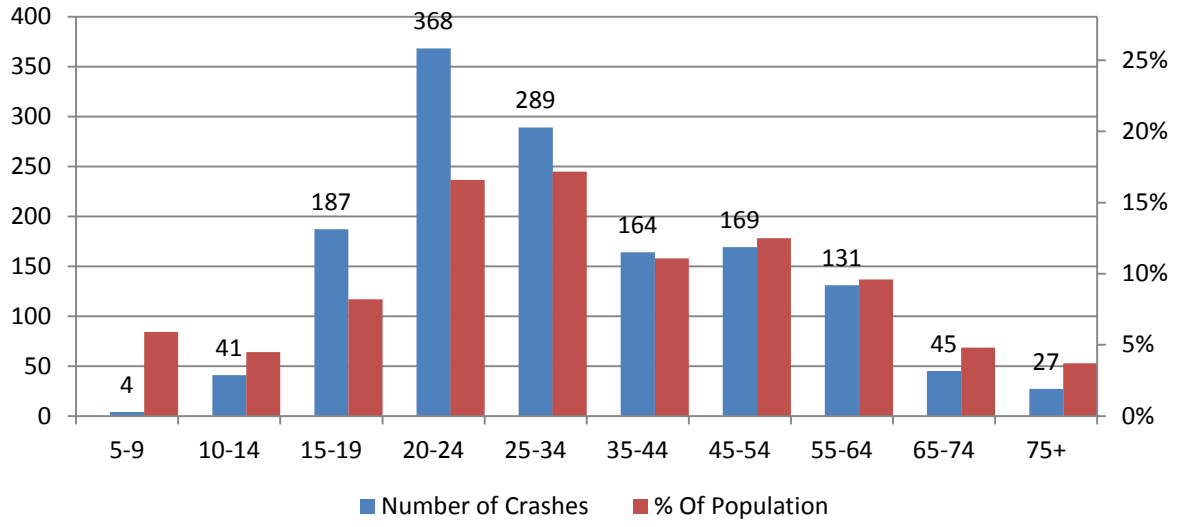


Crash Severity Bike Crashes



Bicycle Crashes By Age

The chart below shows the age of bicyclists involved in crashes in Fort Collins as well as the percentage of population by age. Bicyclists aged 15 - 34 years old are all overrepresented in crashes. Bicyclists aged 15-24 are about twice as likely as expected to be involved in a crash when compared to population.



Bicycle Crashes – Types and Locations

Bicycle crashes can be further classified by type of collision. The chart below and the table on the following page detail the type of crashes in the past five years.

Crashes at intersections , alleys or driveways account for more than 80% of all bike crashes.

Right angle crashes are by far the most common type of bike crash. And represent more than ½ of all bike crashes.

Significant contributing circumstances in bike crashes include wrong way riding on the sidewalk or street (30% of all crashes).

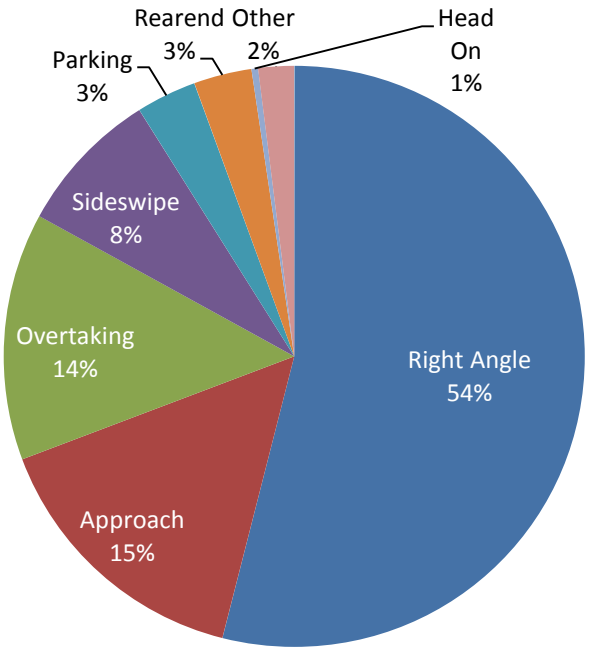
Only 11% of all bike crashes involve a sideswipe or rear-end.

Parking related crashes (i.e. "door zone" crashes) account for just 3% of all crashes. In the past five years, there have been nine serious injury crashes (one of which was an incapacitating injury).

80%
of all bike crashes occur at intersections or driveways.

30%
of all bike crashes involve wrong way riding

Bike Crashes by Type 2010-2014

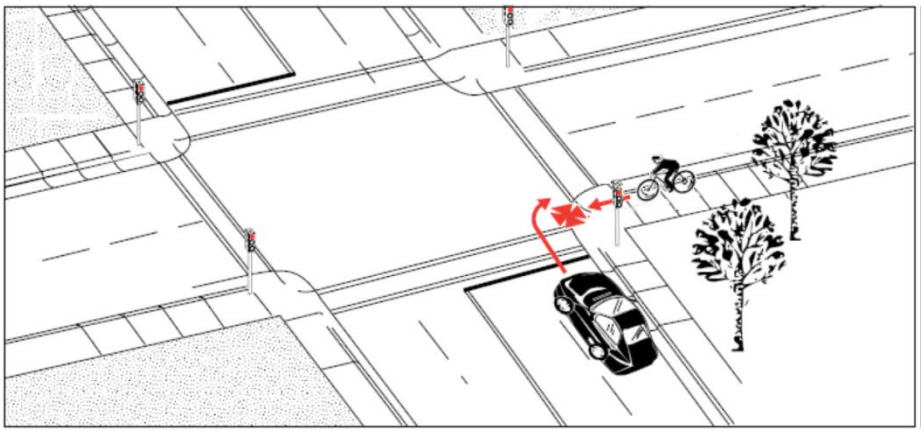


Graphic Depiction of Typical Bicycle Crashes

Right Angle Crash

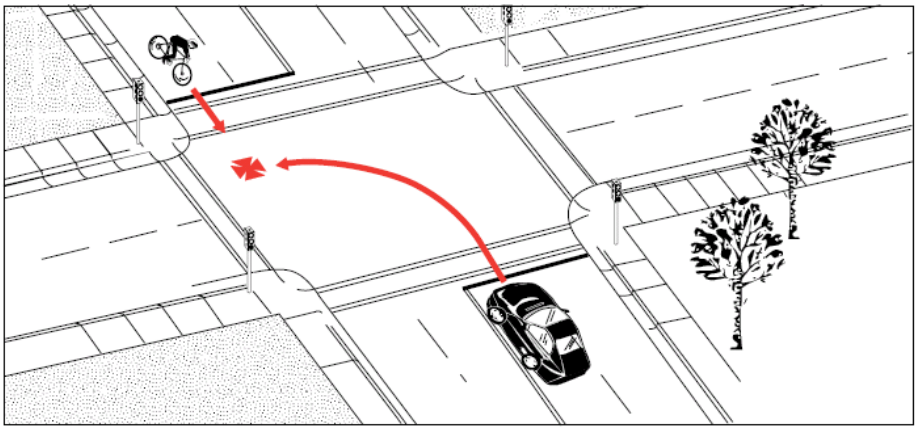
Right angle crashes are by far the most common type of bike crash., representing more than ½ of all bike crashes.

50% of right angle crashes involve a bike riding against traffic on the sidewalk or street.



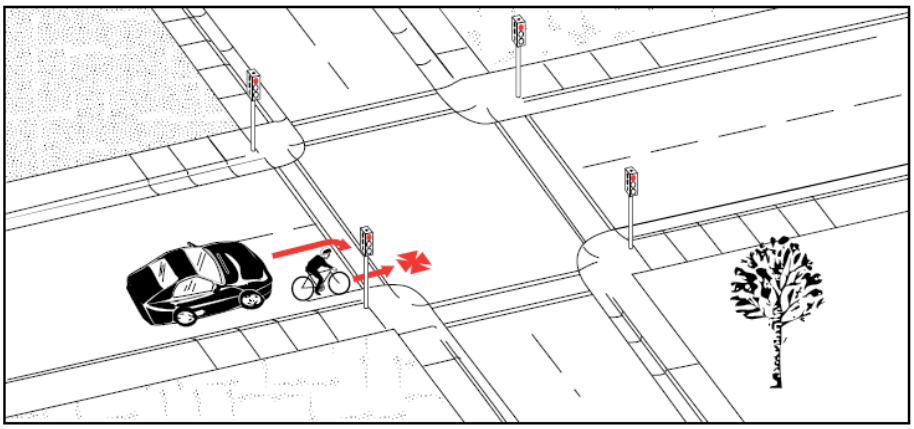
Approach Turn Crash

This type of crash represents about 15% of all crashes. Almost ½ of approach turn crashes result in a serious injury.



Overtaking Turn Crash

Also known as the ***"right hook"*** crash. This represents 14% of all bike crashes.



Detailed Bicycle Crash Tabulation by Type (2010-2014)

Type of Crash	Total	Injury/Fatal
1 Right Angle		
Bike riding with traffic on street	114	54
Bike riding against traffic on street	53	20
Bike riding against traffic on sidewalk/crosswalk	162	54
Bike riding with traffic on sidewalk/crosswalk	49	17
Bike Crossing the street mid-block	13	6
Unknown location of bike	44	8
1 Right Angle Total	**435**	**159**
2 Overtaking Turn		
Bike riding with traffic on street	83	25
Bike riding against traffic on street	3	1
Bike riding against traffic on sidewalk/crosswalk	6	3
Bike riding with traffic on sidewalk/crosswalk	16	8
Bike Crossing the street mid-block	1	1
Unknown location of bike	2	0
2 Overtaking Turn Total	**111**	**38**
3 Approach Turn		
Bike riding with traffic on street	95	45
Bike riding against traffic on sidewalk/crosswalk	6	3
Bike riding with traffic on sidewalk/crosswalk	20	11
Bike Crossing the street mid-block	1	0
Unknown location of bike	1	1
3 Approach Turn Total	**123**	**60**
4 Sideswipe		
Bike riding with traffic on street	52	29
Bike riding against traffic on street	4	2
Bike riding with traffic on sidewalk/crosswalk	2	1
Bike Crossing the street mid-block	2	1
Unknown location of bike	5	1
4 Sideswipe Total	**65**	**34**
5 Parking Related		
Bike riding with traffic on street	24	9
Bike riding against traffic on street	1	1
Unknown location of bike	2	0
5 Parking Related Total	**27**	**10**
6 Rear-End		
Bike riding with traffic on street	25	9
Unknown location of bike	1	0
6 Rear-End Total	**26**	**9**
7 Head-On		
Bike riding with traffic on street	2	2
Bike riding against traffic on street	1	1
7 Head-On Total	**3**	**3**
8 Other, Objects, Non Collision or No Information	**16**	**6**
Grand Total	**806**	**319**

Rear End Crashes

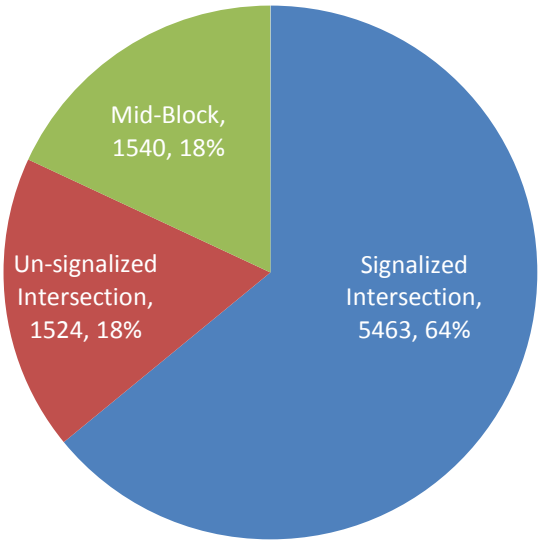
Only 2.6% of all rear end crashes result in a serious injury or fatality in Fort Collins. However, because of the sheer number of these types of crashes, they are an important element to consider in safety reviews.

Rear end crashes are typically the result of motorist inattention often combined with unexpected stops in the traffic stream. The graph below shows the number of rear end crashes by location. As can be seen, the majority (64%) of rear end crashes occur at signalized intersections. Inattention along with the onset of a yellow light combined with heavy traffic and/or high speeds can result in increased rear end accident potential.

<3%
of all rear end crashes result in a serious injury or fatality.

64%
occur at signalized intersections

Rear End Crashes By Location (2010-2014)



Care must be taken to avoid increasing rear end crash potential by implementation of countermeasures intended to reduce other types of crashes.

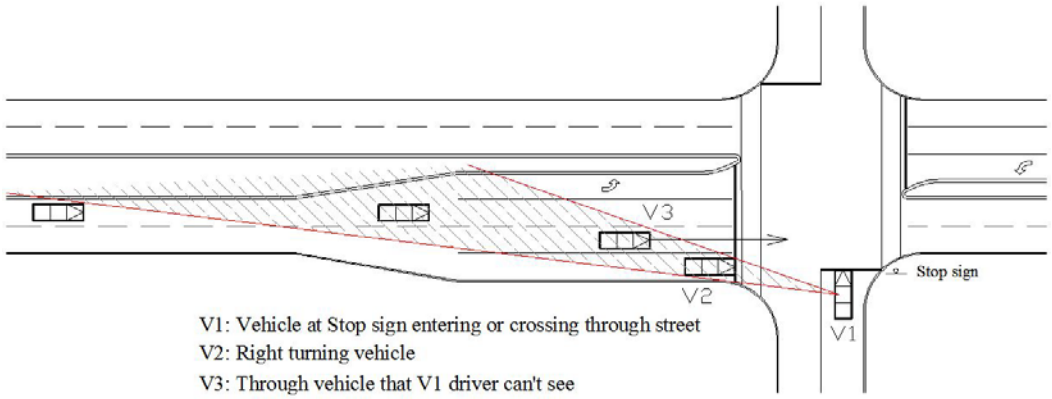
For example, installation of traffic signals, addition of protected only left turn signal phasing at traffic signals, and red light camera enforcement are all countermeasures that may be used to reduce right angle or left turn crashes. However, they also tend to increase the potential for rear end crashes.

Since right angle and left turn crashes tend to be more severe it might make sense to implement these countermeasures at locations with a history of these types of crashes. It may not be appropriate to use these countermeasures at locations where there is not a history of these sorts of crashes because of the increased risk of rear end crashes.

Right Angle Crashes

Right angle crashes occur at intersections when vehicles arrive on perpendicular roads and collide. There are two main types of right angle crashes:

1) Failure to yield after stopping –Typical contributing factors to these crashes include sight obstructions such as fences, trees, shrubs, parked cars, or approaching vehicles that prevent the stopped driver from seeing conflicting traffic. The illustration below shows an example where right turning traffic on the main street limits visibility for motorists stopped at a STOP sign or signal on the side street, effectively hiding approaching traffic in the through lanes.

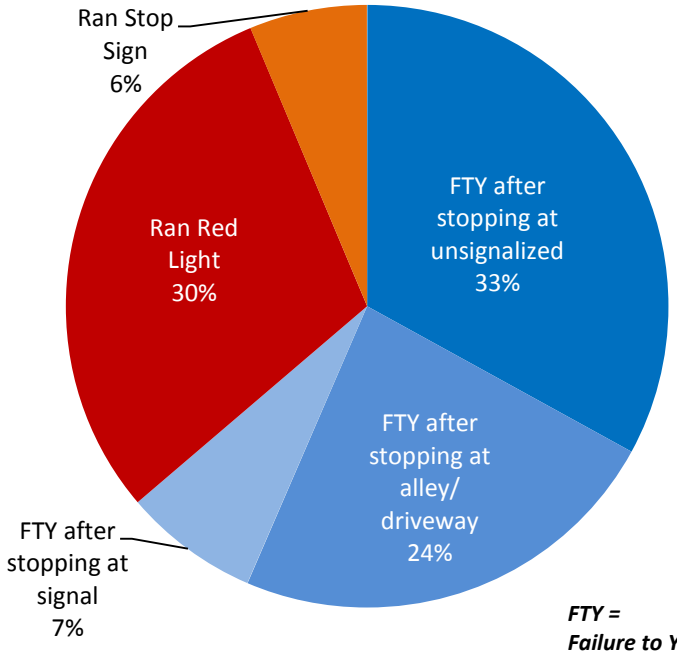


2) Passing a signal/STOP sign without stopping - Typical contributing factors to these crashes include inattention, wide streets (that make STOP signs less visible), "busy" areas where numerous distractions tend to make traffic control devices blend in or become less obvious, and icy roads.

Right Angle Crashes by Type and Location

As shown, almost 2/3 (64%) of right angle crashes occur where someone stops but then proceeds into oncoming traffic. (shades of blue in the chart).

The remaining crashes (36%) are the result of a motorist running a red light or stop sign (shades of red/orange).

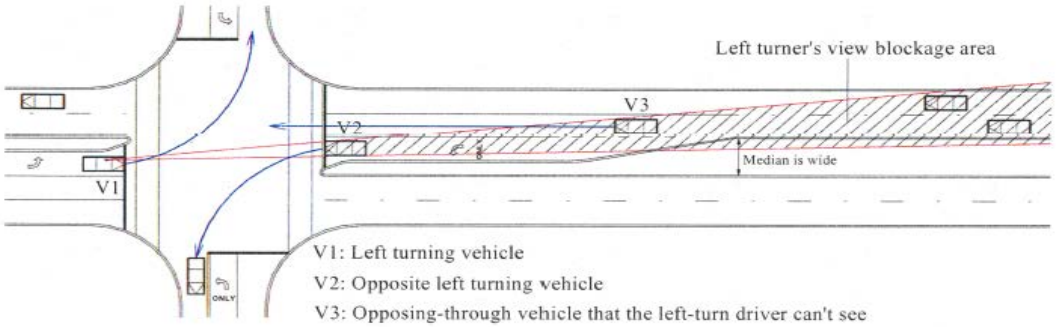


FTY = Failure to Yield

Approach Turn Crashes

Approach turn crashes occur when someone turns left in front of oncoming traffic without yielding the right of way. There are two main causes of approach turn crashes:

1) Poor estimation of distance and/or speed of approaching through traffic -- These accidents occur at both signalized and unsignalized intersections. Poor visibility can contribute to these accidents. Offset left turn lanes can result in vision obstructions as shown in the illustration below. Note that this offset created between opposing left turn lanes is a disadvantage of raised medians at intersections.

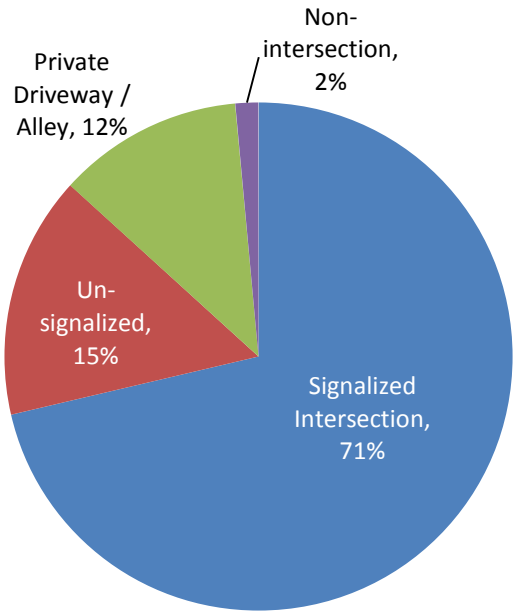


2) Inappropriate response to the onset of the yellow or red signal display – This situation can occur at signalized intersections where permissive left turns are allowed. A driver waiting to turn left on a green ball at a signalized intersection is required to yield the right- of-way to opposing through traffic. When the traffic signal turns yellow and/or red, some left turning drivers assume that oncoming traffic will stop. This causes them to turn in front of oncoming traffic that may not be able (or willing) to stop.

Approach Turn Crashes by Location

The chart at right shows both the number and percentage of approach turn crashes by location and type of intersection for the past five years.

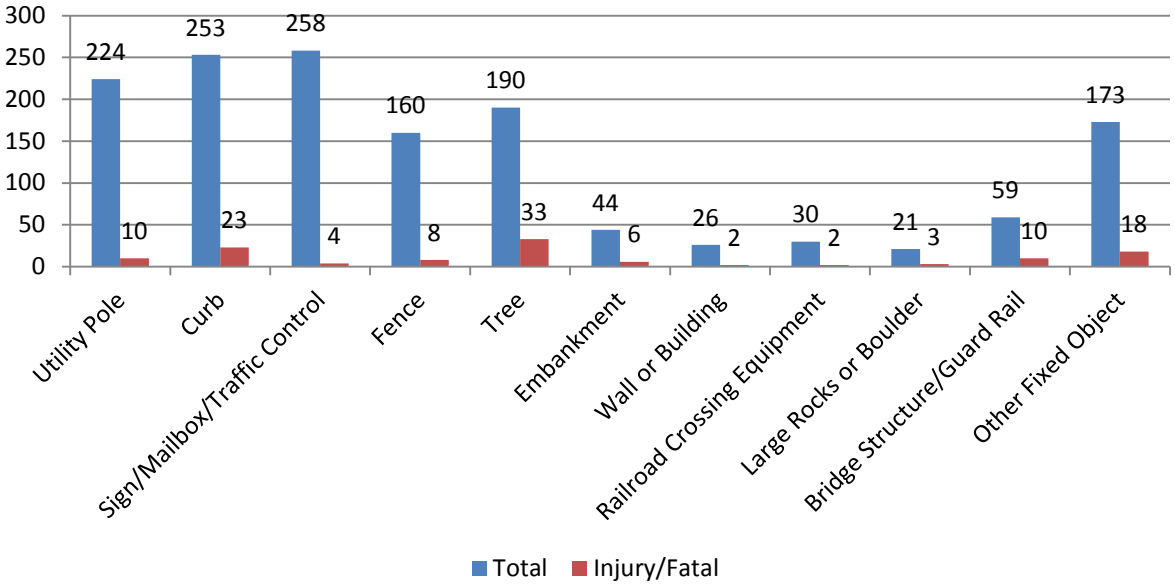
The majority of approach turn crashes (more than 70%) happen at signalized intersections. The combination of increased complexity and higher turning volumes along with the issue of turning on the yellow/red explain this trend.



Fixed Object Crashes 2010-2014

Fixed object crashes are single vehicle crashes where a driver collides with a fixed roadway feature such as a curb or a median or runs off the road and hits a roadside feature such as a tree or utility pole.

The chart below shows fixed object crashes by type of object struck.



Alcohol is a major contributing factor in fixed object crashes. More than 17% of all fixed object crashes involve alcohol. For serious crashes (involving severe injury or fatal) the percentage related to alcohol goes up to almost 48%.

17%
of all fixed object crashes involve alcohol.

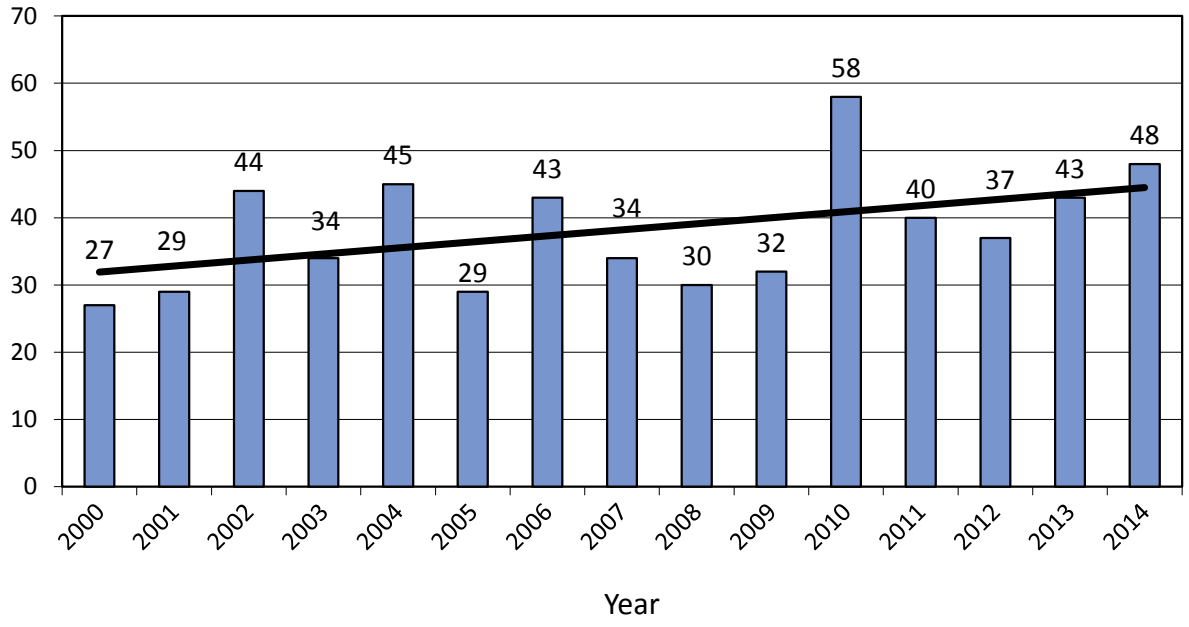
48%
of all serious fixed object crashes involve alcohol

Pedestrian Crashes

Pedestrian crashes account for only 1% of all crashes, but 9% of serious crashes. The chart below shows the historical trend of number of pedestrian crashes in Fort Collins. Although there is significant variation from year to year, generally the trend has been upward.

Pedestrian crashes are trending upward.

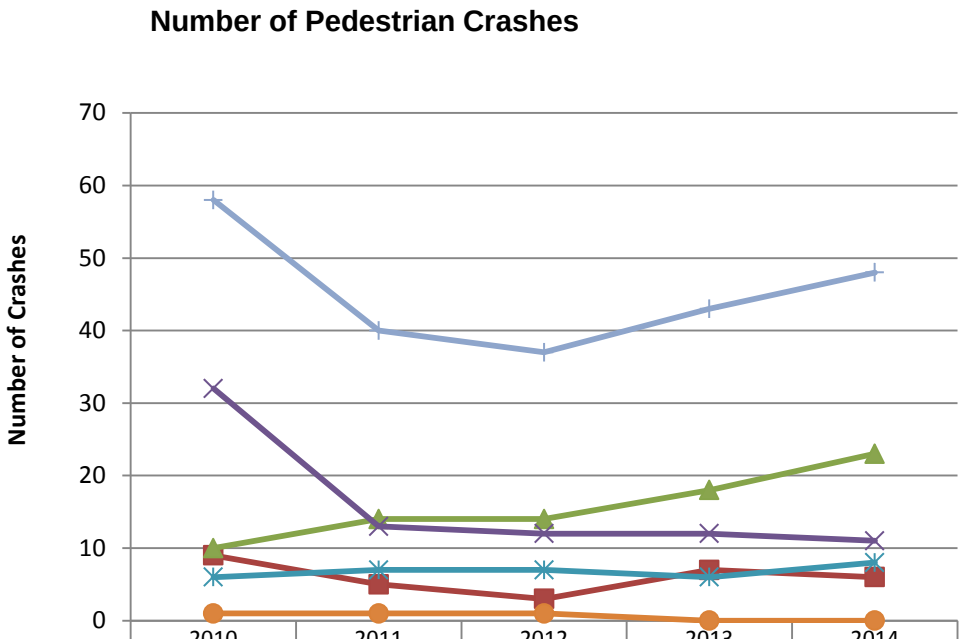
Number of Pedestrian Crashes – Historical Data



The chart below shows the number of pedestrian crashes in Fort Collins over the last five years by severity.

Pedestrian crashes tend to be serious crashes, although there may be some non-injury crashes that are not reported.

86%
of all reported pedestrian crashes involve some level of injury or fatality.



	2010	2011	2012	2013	2014
Property Damage Crashes	9	5	3	7	6
Possible Injury Crashes	10	14	14	18	23
Non-Incapacitating Injury Crashes	32	13	12	12	11
Incapacitating Injury Crashes	6	7	7	6	8
Fatal Crashes	1	1	1	0	0
Total Crashes	58	40	37	43	48
% change in total crashes from previous year	81.3%	-31.0%	-7.5%	16.2%	11.6%
% change in serious crashes (non-incapacitating injury, incapacitating injury or fatal) from previous year	143.8%	-46.2%	-4.8%	-10.0%	5.6%

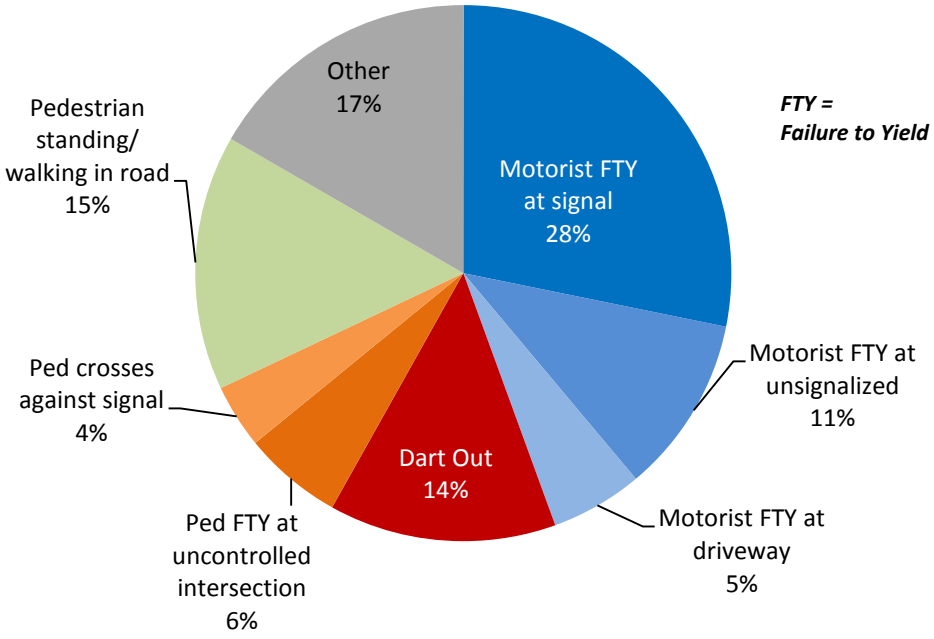
Pedestrian Crashes

Categorizing pedestrian crashes by type helps to understand contributing factors. A detailed explanation of crash type is shown on the next page and the chart below shows the percentage of crashes by type for pedestrians in the past five years.

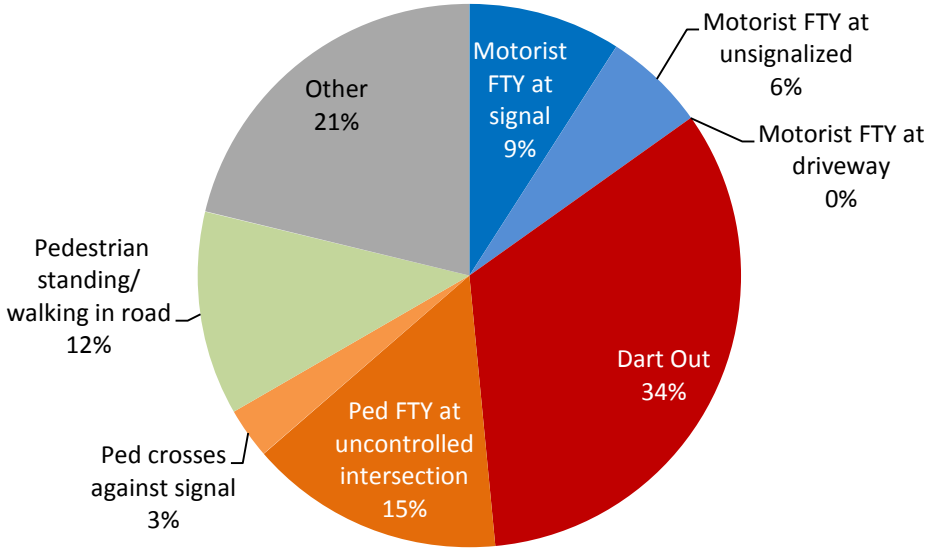
In general, about 45% of all pedestrian crashes are the result of a motorist failing to yield (shades of blue in the chart). In serious crashes, this percentage is less than 15%.

The pedestrian is determined to be at fault (shades of red/orange) in about 25% of all pedestrian crashes, but more than 50% of serious crashes.

Pedestrian Crash Types - All Crashes

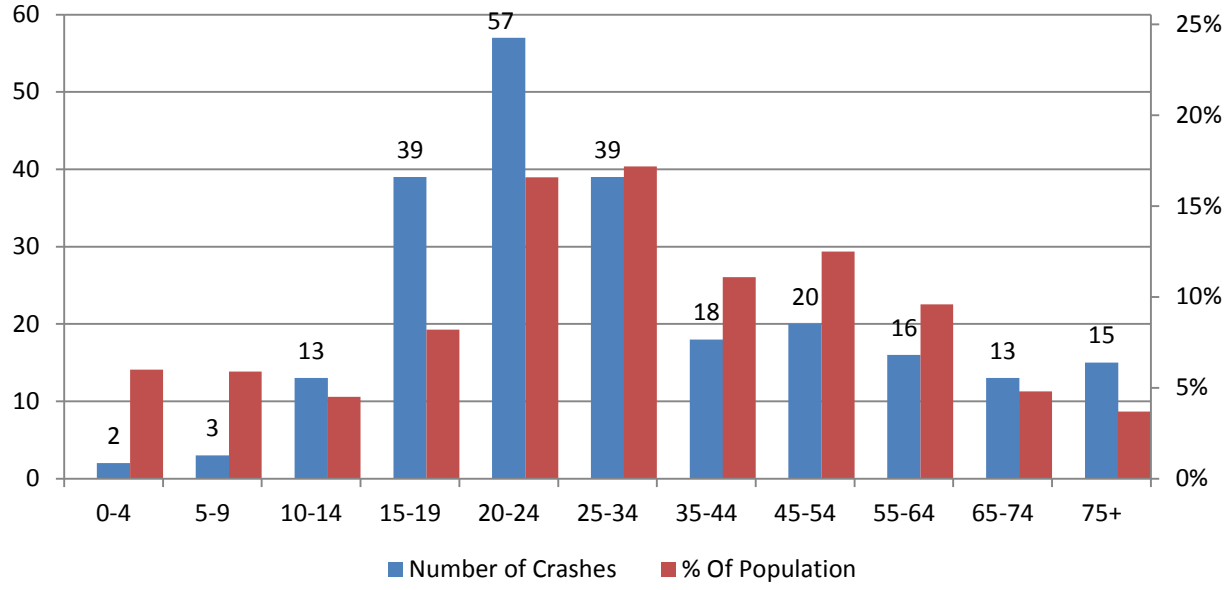


Pedestrian Crash Types - Serious Crashes



Pedestrian Crashes By Age

The chart below shows the age of pedestrians involved in crashes . Pedestrian that are age 10-34 years old are overrepresented in crashes.; and 15 – 19 year old pedestrians in particular were about twice as likely as expected to be in a crash considering the population in this age range.



Type of Pedestrian Crashes

Some common types of pedestrian crashes are described below:

Motorist Fails to Yield at Signalized Intersection – Crashes at signalized intersections where a pedestrian legally crossing the street is hit by a motorist. These crashes typically involve a turning driver whose attention is diverted.

Motorist Fails to Yield at Unsignalized Intersection – Crashes where a pedestrian legally in the street is hit by a driver who does not yield the right of way. These crashes typically involve a turning driver whose attention is diverted.

Motorist Fails to Yield while Exiting a Driveway – Crashes that involve motorists crossing a sidewalk in the process of exiting a driveway to a public street and striking a pedestrian on the sidewalk crossing the driveway.

Dart Out - Crashes where a pedestrian enters the street in front of an approaching driver who is too close to avoid a collision. An example of this type of crash is a child chasing a ball into the street running out in front of a car.

Pedestrian Crosses Against Signal – Crashes at signalized intersections resulting from a pedestrian crossing against the signal indication.

Pedestrian Fails to Yield at Uncontrolled Locations - At non-crosswalk locations pedestrians must yield to motorists prior to crossing. These crashes involve pedestrians who attempted to cross without waiting for a safe break in traffic. Most of these crashes occur at night when pedestrians are less visible to motorists.

Pedestrian Standing/Walking in Road – Pedestrian walking on the road but not attempting to cross is struck by a motorist.

Crashes shown as "Other" include many different types of crashes including pedestrians hanging onto the outside of vehicles, pedestrians eluding the police, suicide attempts, pedestrians exiting parked vehicles and pedestrians who fell off the sidewalk into the street.

Detailed Pedestrian Crash Tabulation by Type (2010-2014)

Type of Accident	Total	Injury/Fatal
Motorist Fail to Yield at Signalized Intersection		
Motorist Turning Left on Green	37	15
Motorist Turning Right on Green	4	1
Motorist Turning Right on Red	21	10
Motorist Going Straight	4	1
Total Motorist Fail to Yield at Signalized Intersection	**66**	**27**
Motorist Fail to Yield at Unsignalized Intersection	**25**	**11**
Dart Out	**32**	**25**
Pedestrian Fail to Yield at Uncontrolled Location	**14**	**11**
Pedestrian Crosses Against Signal	**9**	**7**
Pedestrian Standing/Walking in Road	**36**	**21**
Motorist Fail to Yield Exiting Driveway	**13**	**3**
Other	**39**	**20**
Total	**234**	**125**

Section 4 – High Crash Locations

The majority of this report is a summary of the numbers, types, and patterns of crashes. That information can be used to identify overall mitigation and safety efforts throughout the City. Another important element is to use the crash data to identify specific locations for potential improvements through implementation of specific countermeasures.

Crash density maps are included at the end of the report and help identify the locations where the most crashes occur. While helpful information, because volumes and other elements at specific locations vary widely, its difficult to draw relevant conclusions just from the maps.

In addition to crash density information, Traffic Operations staff conducts detailed analysis to identify intersections where there are more crashes than expected taking into account traffic volumes, roadway geometry, type of traffic control etc.

Traffic crashes are at least partially deterministic (i.e. factors affecting crash potential can be controlled). At the same time crashes are, to some extent, random events. This random nature of crashes makes it difficult to determine if a location is truly a problem versus a location where normal variations lead to a high crash frequency during the observation period. In order to identify locations that truly warrant further investigation it is helpful to use a methodology that accounts for the somewhat random nature of crashes.

In 2010 the Transportation Research Board (TRB) and the American Association of State Highway and Transportation Officials (AASHTO) published the *Highway Safety Manual* (HSM). The HSM includes a statistical approach used to account for regression to the mean bias in order to identify locations that have a high crash frequency even after accounting for random variation. That approach is applied to intersections in Fort Collins.

The method utilizes a calibrated model to predict the number of crashes at a location given the traffic volumes, the roadway geometry, and the type of intersection control. This prediction is then compared to the actual number of crashes at the location (adjusted to account for regression to the mean). The more the actual adjusted number of crashes exceeds the number of crashes predicted by the model the more likely it is that a location has an unusually high number of crashes.

The table on the following page shows the results of the statistical evaluation of intersections in Fort Collins using data for the years 2012 - 2014. These 'top' 15 locations shown are those where the actual adjusted number of crashes or injury crashes was higher than what occur at 85% of similar locations. Or, in simpler terms, 85% of similar locations have a better safety record than the listed locations.

In the table, locations are ranked by excess crash costs. Since injury crashes tend to have higher crash costs associated with them, the ranking method gives more weight to locations with more injury crashes compared to locations with only "fender benders". Intersections with greater than $60,000 in excess crash costs are shown.

Each of these intersections is reviewed in more detail to look for specific types and trends of crashes. Staff works to identify potential countermeasures to address recurring patterns if present. Note that when considering possible safety projects the cost of specific improvements needs to be considered in order to determine if the benefit will outweigh the cost.

The results of that effort is used in the implementation of safety measures discussed in the next section.

Intersection Excess Crash Costs 2012-2014

Intersection		Model Predicted Crashes/ Year	Model Predicted FI Crashes/ Year*	Adjusted Actual Crashes/ Year	Adjusted Actual FI Crashes/ Year*	Excess PDO Crashes /Year **	Excess FI Crashes /Year*	Excess Crash Costs/ Year
College	Horsetooth	44.3	9.1	55.1	11.6	8.3	2.5	$355,551
Boardwalk	Harmony	25.9	5.6	29.6	8.4	1.0	2.7	$312,194
College	Monroe	11.4	2.8	26.4	4.4	13.5	1.6	$307,547
Timberline	Prospect	26.7	5.9	32.5	8.3	3.4	2.4	$297,978
College	Trilby	21.9	4.9	27.7	7.2	3.5	2.3	$287,302
College	Foothills	10.5	2.6	22.0	3.4	10.6	0.8	$198,286
College	Swallow	18.1	4.2	25.0	5.2	5.9	1.0	$171,381
Taft Hill	Horsetooth	13.4	3.1	17.6	4.4	2.9	1.3	$169,301
Mason	Harmony	15.5	3.6	25.4	3.7	9.8	0.1	$111,264
College	Fossil Creek	7.7	1.9	10.0	2.7	1.4	0.8	$104,915
College	Triangle	2.8	0.5	3.5	1.5	-0.2	0.9	$100,860
Lark Bunting	Harmony	2.6	0.5	4.1	1.2	0.8	0.7	$80,309
City Park	Mulberry	2.6	0.5	5.4	1.0	2.3	0.5	$77,381
Shields	Stuart	4.3	1.0	5.2	1.7	0.2	0.7	$75,956
Timberline	Mtn Vista	1.4	0.4	2.8	0.9	0.8	0.5	$67,840

* FI = Fatal/Injury Crashes

** PDO = Property Damage Only Crashes

Section 5 – Implementing Safety Measures

The implementation of safety measures is a vital component to the work of not just the Traffic Operations Department, but a number of departments across the City. The data in this report is used to determine opportunities for low cost and longer term improvements, as well as to identify target areas for education and enforcement options.

Low Cost Improvements

Sometimes there are minor, inexpensive solutions that can be funded with maintenance budgets and provide a high benefit to cost ratio. Recently implemented examples and their results are listed below:

College and Trilby

Issue: Crash data showed a high number of approach turn crashes (generally northbound vehicles turning left at the end of the green light).

Countermeasure: Traffic signal timings were adjusted to change the arrival pattern to reduce the amount of southbound through traffic arriving when the signal changes from green to red on College.

College/Trilby	Crash History (3 years)		
	Before 2008-10	After 2012-14	% Change
Overall Crashes	21	13	38%
PM Peak Hr Crashes	11	3	73%

College and Monroe

Issue: Crash data showed a high number of approach turn crashes (generally northbound vehicles turning left at peak times when southbound queues extend from Horsetooth across Monroe).

Countermeasure: Implemented flashing yellow arrow displays and protected only (green arrow) left turn movements during peak times.

College/Monroe	Crash History (3 years)		
	Before 2008-10	After 2012-14	% Change
Overall Crashes	17	3	82%

Mulberry and Mason

Issue: Crash data showed a high number of crashes of eastbound vehicles related to red light running.

Countermeasure: Converted 8” signal displays to 12” displays and worked with the Forestry Department to trim overhanging trees.

Mulberry /Mason	Crash History (3 years)		
	Before 2008-10	After 2012-14	% Change
Overall Crashes	13	1	92%

Laurel Street Between College and Shields

Issue: Crash data showed a high number of crashes related to left turns without left turn lanes – especially at three signalized intersections (Loomis, Meldrum, and Howes).

Countermeasure: Converted striping to remove one through lane and create a center turn lane.

Laurel (College to Shields)	Crash History (3 years)		
	Before 2007-09	After 2012-14	% Change
Overall Crashes	153	123	20%
3 signalized int.	87	44	49%

Integrating Safety into Various City Projects and Programs

In addition to low cost improvements implemented on a case-by-case basis, safety enhancements are also incorporated through engineering efforts in other programs and/or City Departments.

Capital Projects

The Capital Improvement Projects list uses crash history as one criterion for prioritization. In addition, the Engineering Department's Arterial Intersection Prioritization Study weighs crash history heavily in their identification of potential projects. Subsequently, projects that move forward use detailed crash analysis to develop improvements targeted at specific crash types and patterns. The crash data is also used to apply for Federal Hazard Elimination and Safety (HES) funding. Upcoming construction projects include:

- Shields/Drake and Shields/Davidson: addition of turn lanes and access control improvements (funded partially through HES)
- College/Horsetooth: addition of dual left turn lanes on College

Neighborhood Traffic Mitigation Program

Traffic in neighborhoods can affect the quality of life of residents and the traveling public. With the goal of safer, calmer streets, the program uses a variety of data, including crash data to identify potential calming options.

School Safety

The department works closely with Poudre School District on all elements of transportation in the vicinity of about 40 schools.

Multi-Modal and Planning Projects

The FCMoves department utilizes crash data in developing a variety of planning documents (area plans and bike, pedestrian plans) and specific efforts such as bike pilot projects are supported through crash analysis.

Education and Enforcement

Education is an important component to a safer transportation system. This includes efforts related to Safe Routes to School, and neighborhood traffic educations programs. Police Services is the lead entity for enforcement, and can utilize crash data to identify specific types or locations of crashes to target for enhanced presence and/or enforcement.

Ongoing Monitoring

Finally, a key for the traffic safety program is to complete ongoing monitoring of both the overall transportation system, as well as locations where specific projects have been completed. This effort helps to determine the effect of the safety projects, and identify the types of projects that are most beneficial.

Section 6 – Looking Forward

The analysis in this year's report as well as the extensive data that supports the review can be used to identify areas for focused attention in the coming year(s).

- As shown on page 32, low cost improvements can have a significant safety benefit. The Traffic Operations department will continue to look for these opportunities.
- Targeting high crash locations and integrating safety into various projects have been and will continue to be a priority.

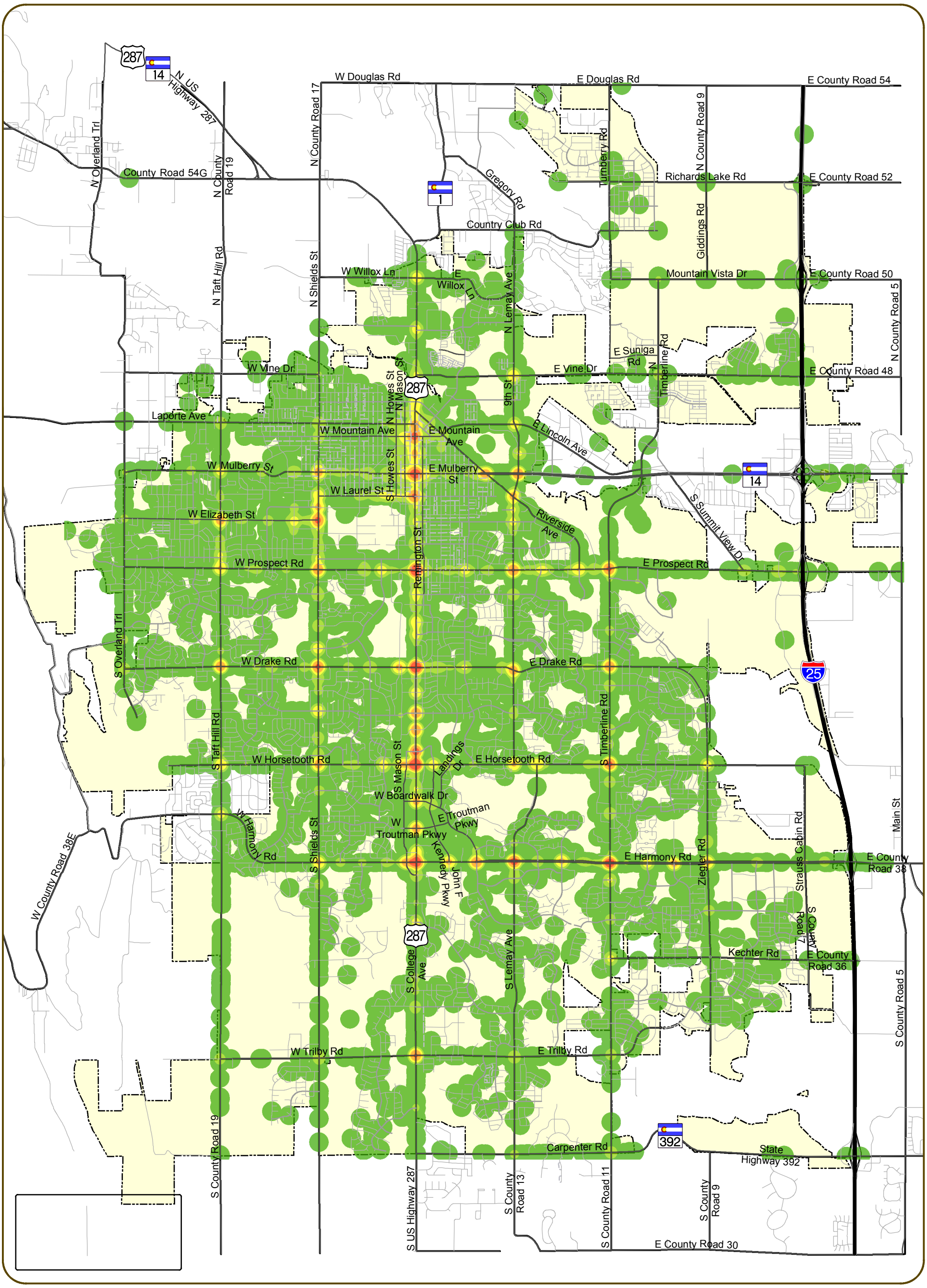
In addition to the efforts above, there are two areas that are identified as special focus areas for the coming year:

- A targeted effort in addressing certain **types** of crashes, not just certain locations. For instance, approach turn crashes may be addressed with the continued implementation of the Flashing Yellow Arrow and utilizing time of day protected turn phases.
- Bike and Pedestrian crashes, while lower in number than vehicle crashes, tend to be more severe. Targeting these crash categories through both engineering and education efforts will be a focused effort in 2015.

The ongoing efforts as well as the special focus areas will be used to continue to implement safety improvements for our transportation system. The analysis and review provided in this annual report provide the opportunity to monitor and evaluate the results, and guide the refinement of the program.

All Crash Types

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1-8 | 9-32 | 33-78 | 79-144 | 145+

N W E S

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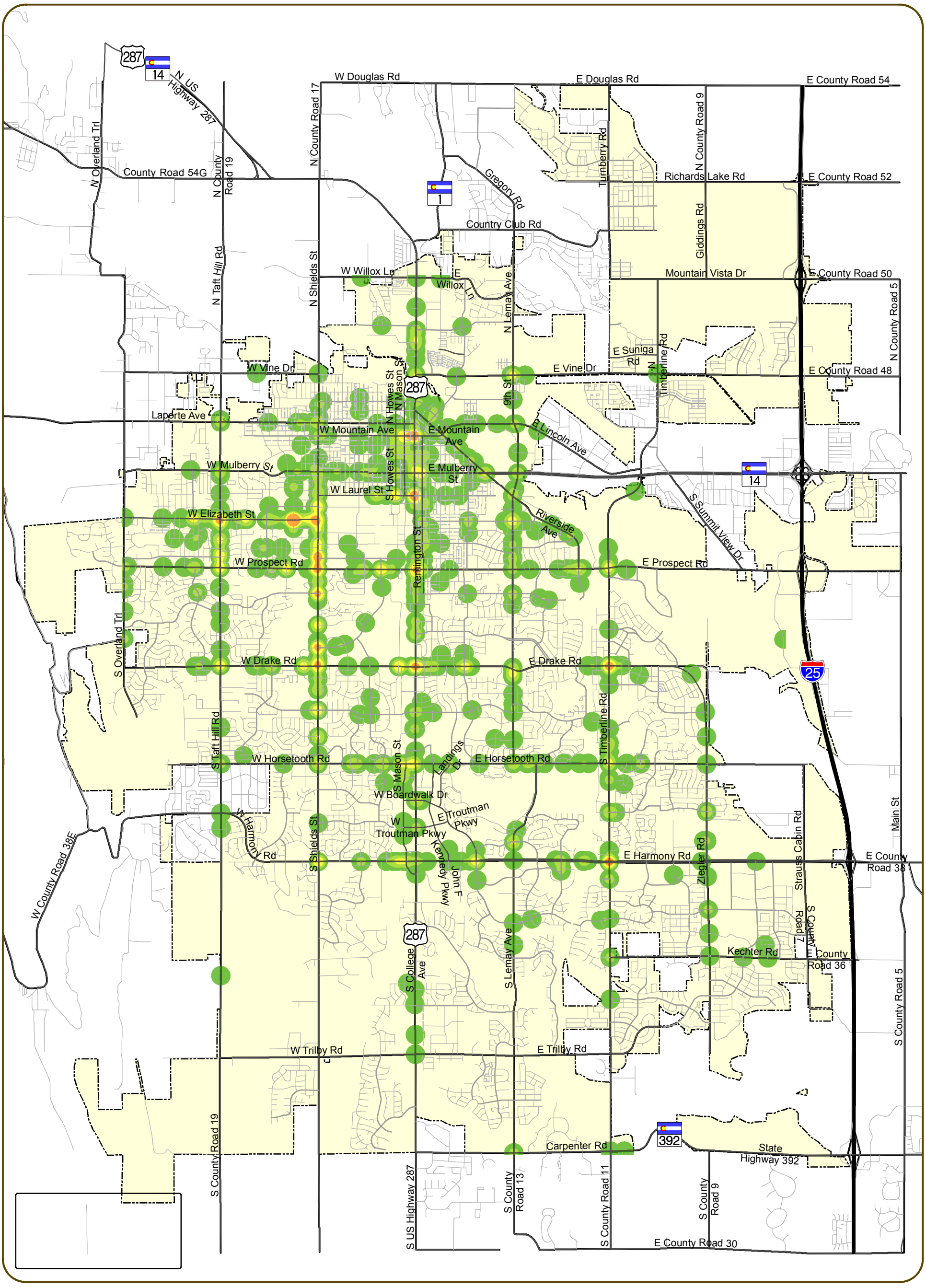
Bicycle Crashes

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1 | 2 - 3 | 4 - 6 | 7 - 10 | 11+

N W E S

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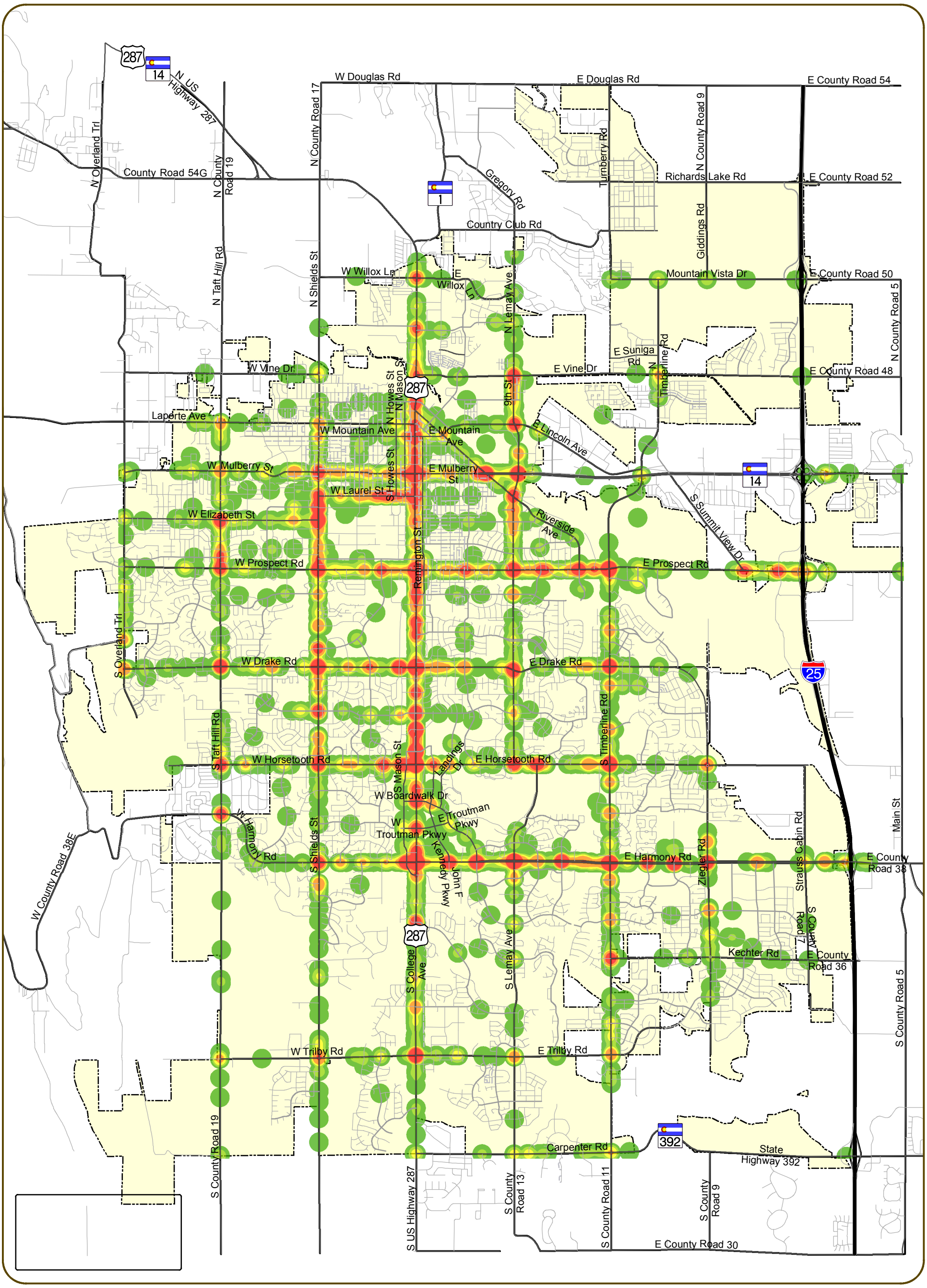
Rear-End Crashes

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1 - 8	9 - 28	29 - 54	55 - 106	107+

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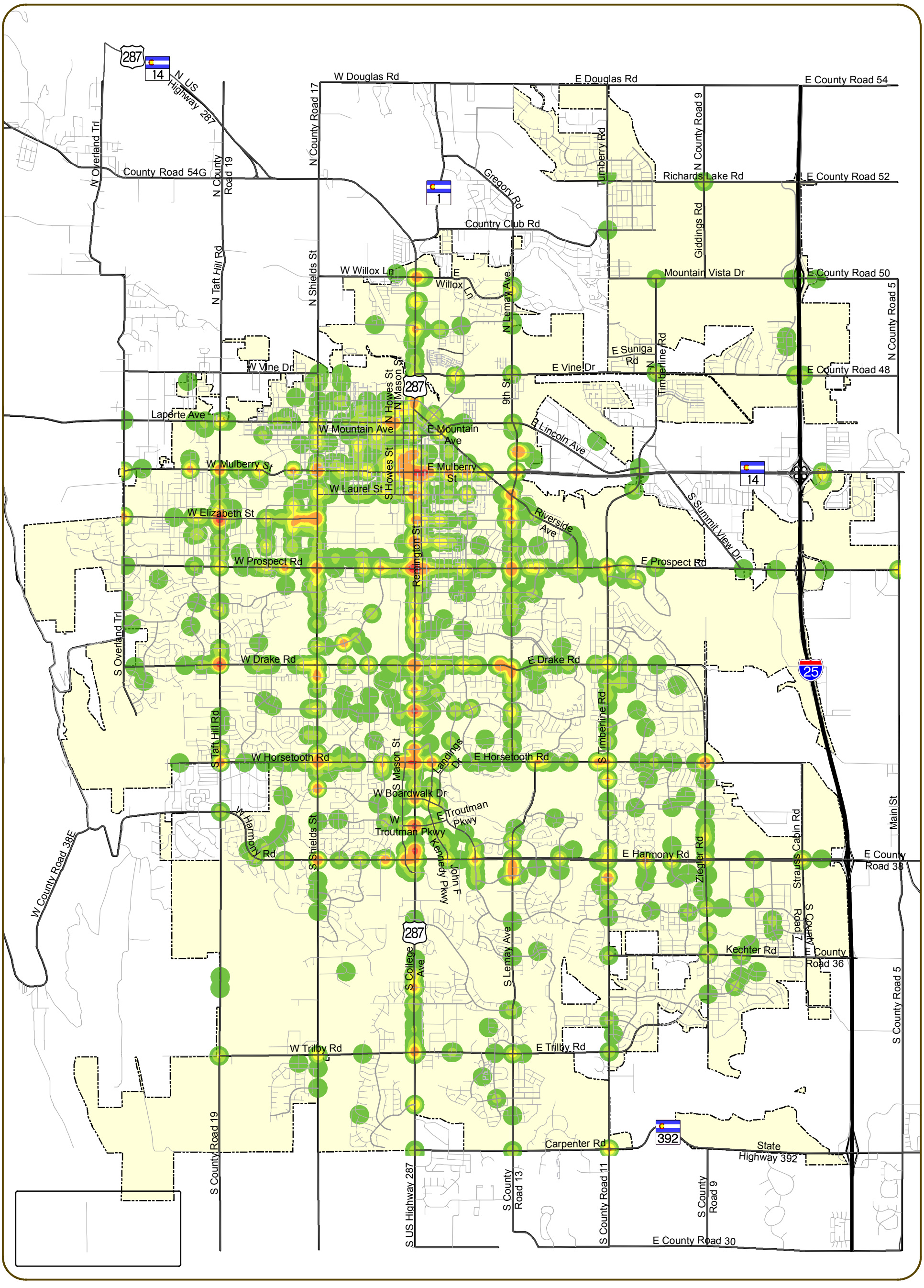
Right Angle Crashes

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1 - 2 | 3 - 5 | 6 - 9 | 10 - 14 | 15+

N W E S

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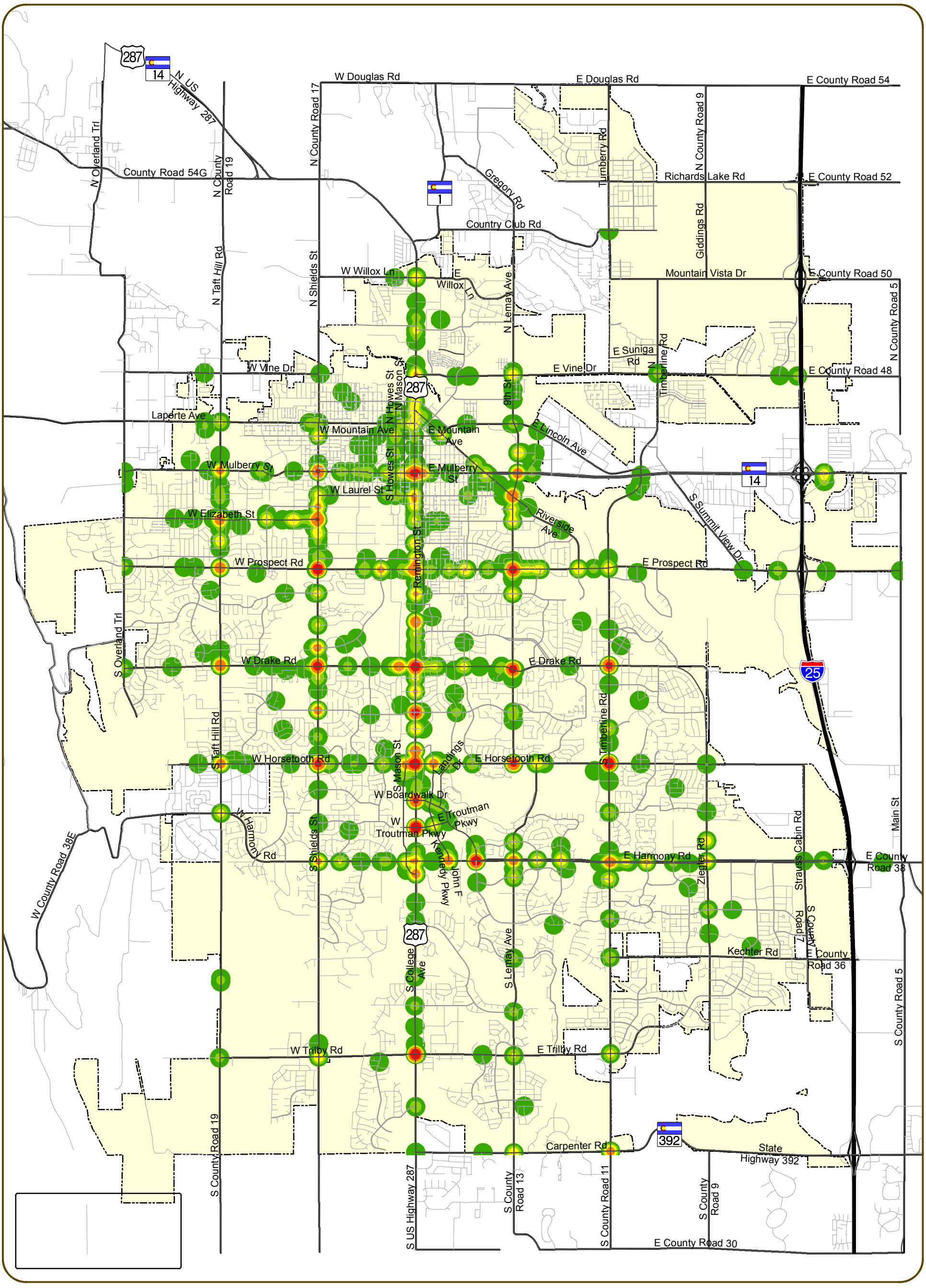
Approach Turn Crashes

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1 - 2 | 3 - 7 | 8 - 16 | 17 - 29 | 30+

N W E S

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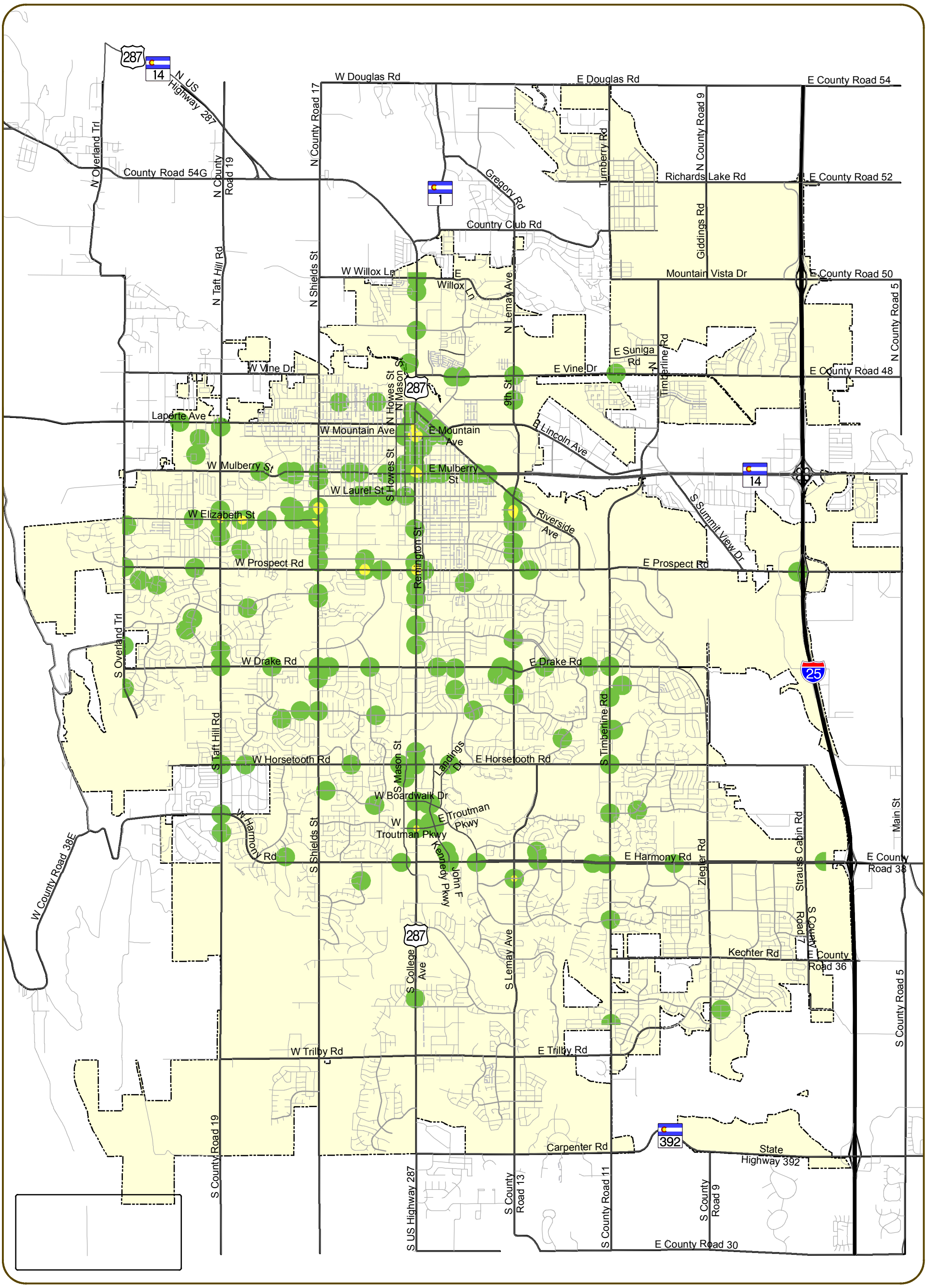
Pedestrian Crashes

1/1/2010 - 12/31/2014



Scale 1:60,000

0 0.125 0.25 0.5 0.75 1 Miles

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1 2 3

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