City of Fort Collins
Traffic Operations

ROADWAY SAFETY IN THE CITY

Annual Report
June 2019

19-21331

...ON THE ROAD TO REDUCING FATAL AND INJURY CRASHES AND IMPROVING SAFETY FOR ALL MODES OF TRAVEL.

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Executive Summary
Roadway Safety Matters

The City of Fort Collins strives to provide a safe and efficient transportation system for people using all modes of travel. Safety for roadway users is a top priority and in 2016 the City became the first public local entity to join the Colorado Department of Transportation (CDOT) Moving Towards Zero Deaths initiative.

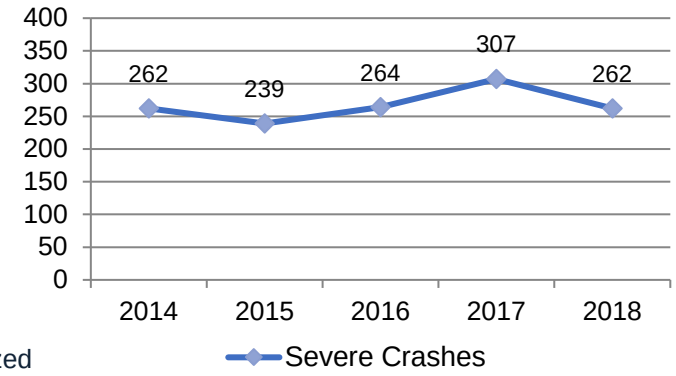
Making progress towards Zero Deaths requires a comprehensive and focused effort by multiple departments within the City, the community and individuals to be dedicated to and responsible for roadway safety. A **Vision Zero Action Plan** is a companion document to this report and is in the process of being finalized in 2019. The Action Plan outlines specific strategies to support reducing the number and severity of crashes.

This report is a detailed review of the City's roadway safety. It includes overall data, crash type analysis, specific location evaluation and trends. The report has been created for a number of years and serves to benchmark progress.

The data presented in this report shows that the City's fatal collision rate remains low when compared to similar Colorado cities, as well as peer cities nationwide. Regardless, during 2018 there were still 253 crashes involving a non-incapacitating or incapacitating injury, and 9 individuals lost their lives as a result of a traffic crash. The societal cost of these crashes was $165 million dollars.

Overall Crash Numbers

There were 3,803 reported traffic crashes in 2018. This continues a general downward trend in total crashes, and severe crashes are down 15% in the past year. Almost 80% of all crashes do not result in any injuries (property damage only).

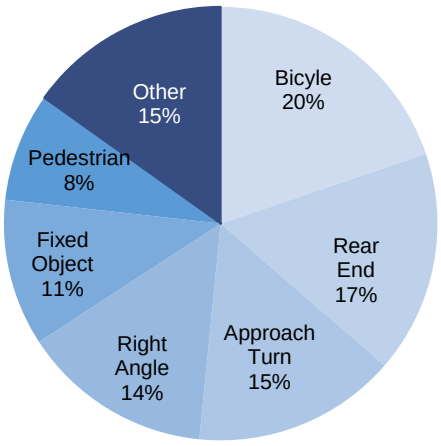


Crash Locations

Almost 75% of all crashes occur at intersections and/or driveways. Almost half of all crashes (49%) occur at signalized intersections.

Crash Types

For severe crashes, 85% are the result of one of six types of crashes as shown at right. Each crash type is reviewed in more detail in the report.



Severe crashes by type

Crash Trends

In the past year there are several encouraging trends:

- Severe crashes are **down 15%**
- Bike crashes are **down 23%**, and motorcycle crashes are **down 16%**

- Approach turn crashes are **down 25%**, and severe approach turn crashes are **down 10%**

Areas of concern include:

- Pedestrian crashes are **up 8%,** and severe pedestrian crashes **jumped 53%** in 2018 (but are still lower than in 2015 and 2016).
- DUI crashes are **up 15%**
- Severe right-angle crashes are **up 16%**

Notable Statistics

Rear end crashes make up nearly half (43%) of all crashes, but most are minor crashes (only 3% of all rear end crashes are severe crashes).

Driving Under the Influence (DUI) crashes represent 4% of all crashes, 12% of severe crashes, and 25% fatal crashes. Drivers below the age of 35 are significantly over-represented in alcohol related crashes.

Teenagers represent 5% of all drivers but are responsible for 15% of all crashes.

Eighty-nine percent (89%) of bike crashes occur at intersections or driveways, 86% of bike crashes occur at a location that involves an arterial, and 23% of bike crashes involve cyclists riding against traffic.

Eighty-five percent (85%) of all reported pedestrian crashes involve some level of injury or fatality.

Intersection Evaluations

Traffic Operations staff is using the approach detailed in the national Highway Safety Manual (HSM) to evaluate more than 250 intersections to identify locations that have higher than expected crash frequency, and those with identified crash types and/or trends. The evaluation is done every year, and the report includes a section on intersections with the greater increasing or decreasing crash frequency. The information is used to target intersection improvements.

47% reduction in total annual crashes and **82%** reduction in left turn crashes at Snow Mesa and Harmony

Improving Roadway Safety

Improving roadway safety involves both big and small initiatives and involves road users, vehicles, infrastructure, technology and emergency response. The strategies for improved safety are detailed in the Roadway Safety Report's companion document, the Vision Zero Action Plan. There are several intersections that saw significant safety improvements following large capital and smaller low-cost projects.

27% reduction in annual crashes at College / Prospect after completion of the intersection improvement project.

Section 1
Introduction

The City of Fort Collins is a vibrant city of 170,000 people nestled against the foothills of the Rocky Mountains about an hour's drive north of Denver. This outdoor oriented community is home to Colorado State University and its 30,000 students. The area is known for its high tech companies, innovation, entrepreneurialism, and beer and bike culture. The Old Town area in the city is a unique, lively downtown with residential areas, historic buildings, retail shops, museums, theatres and restaurants.

Roadway Safety

Transportation safety is always a priority for the City. In the past year, there were more than 3,800 traffic crashes in Fort Collins. On average, that is more than 10 crashes per day. Almost 950 of the crashes involved some level of injury (minor injury or more serious injury), and nine involved a fatality. In 2018 alone, the annual societal cost of these crashes was $165 million dollars.

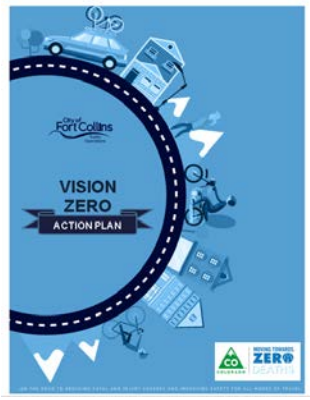
This Roadway Safety Report is a compilation of traffic crash and safety information related to crashes on public streets within Fort Collins. It summarizes basic crash information, analyzes specific types of crashes in more detail, and evaluates locations for higher than expected crashes, trends, and specific patterns that can lead to mitigation strategies.

Safety Matters

In 2018, there were 262 crashes involving a serious injury or fatality in Fort Collins

Moving Towards Vision Zero

In late 2016, the City of Fort Collins became the first public local entity to join the Colorado Department of Transportation's (CDOT) Moving Towards Zero Deaths initiative. The proclamation reflects the City's commitment to the vision of zero traffic-related deaths.



Making progress towards Vision Zero requires a multifaceted, focused effort. The first step is the creation of a Vision Zero Action Plan, which identifies the elements and specific strategies to systematically reduce the number of severity of crashes. That document is a companion to this Roadway Safety Report.

Using the Document

This document is intended to be used as an informational and educational piece as well as a benchmarking tool to track progress on efforts to reduce the number and severity of crashes. The document serves as a tool to determine strategies and countermeasures to achieve crash reduction goals, and informs the strategies in the Vision Zero Action Plan.

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.

In previous year, City Police Services also accepted reports after the fact from parties involved in non-injury crashes; those reports were forwarded to Traffic Operatins and included in the safety analysis. Starting in 2018, those reports are being made directly to the State without involvement by City Police. Therefore, these “counter” or “cold” reports are no longer being captured or included in this analysis. That is one reason why the overall crash numbers in 2018 are lower than previous years. The change in reporting does not impact the data related to injury crashes.

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), and starting this year non-injury crashes reported only to the State are not represented in this analysis.

The City Planning Department provides 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 analyses represent five years of data, from 2014 to 2018.

Section 2

General Safety Information

The total number of crashes per year for the past five years is shown below. Despite yearly variations, both total and severe crash numbers are relatively consistent with slight downward trend. (For comparison, population has increases by 10%.)

Severe crashes in the past year are down **15%**

Total Number of Crashes

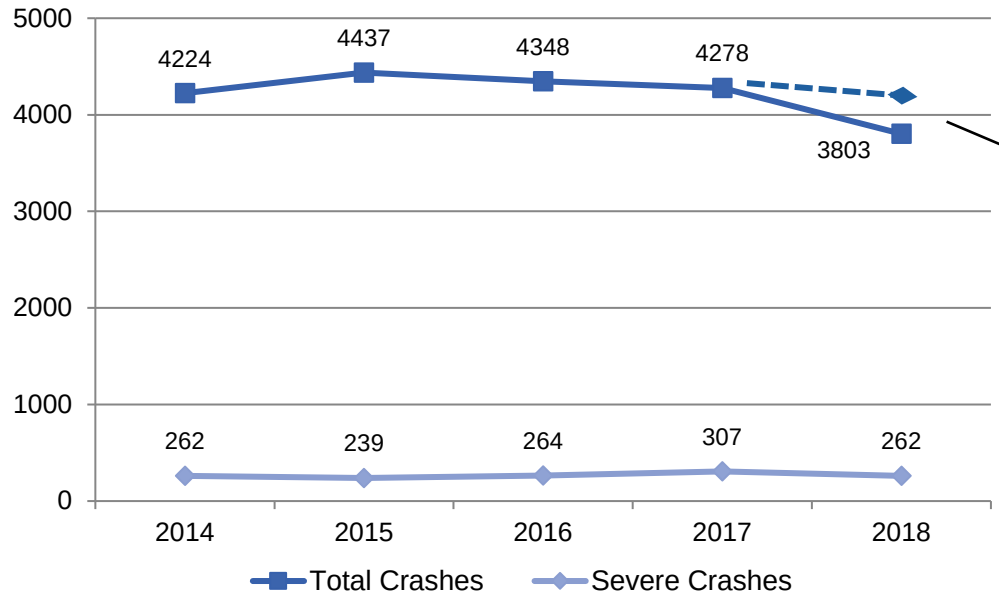


Figure 1

Total number of crashes 2014 to 2018

Note:

2018 was the first year when non-injury crashes reported after the fact by involved parties were not included (typically about 300 / year). Those reports are now going diectly to the State, and therefore no longer captured by the City.

Number of Total Crashes with Injuries

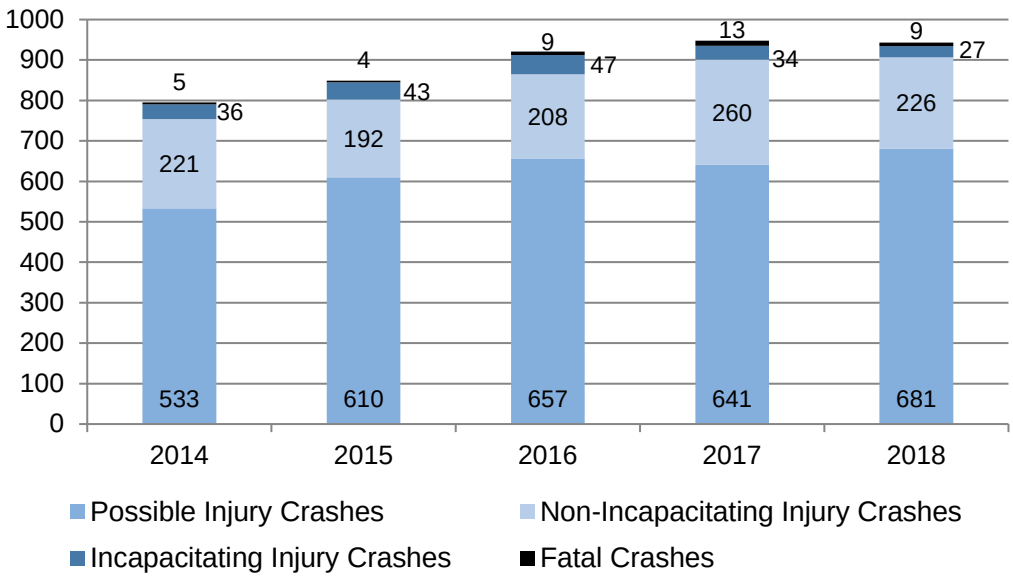


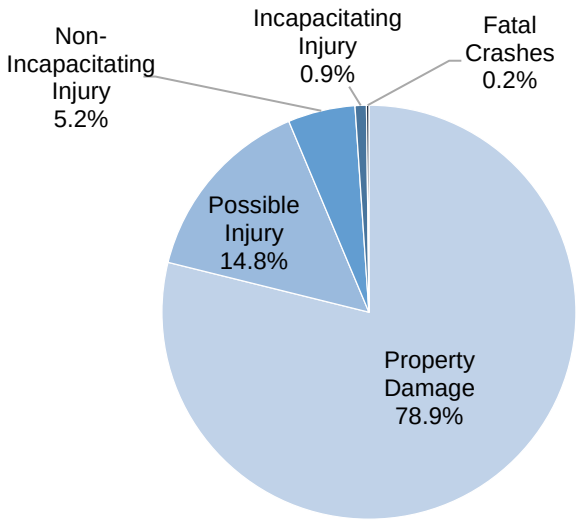
Figure 2

Crashes with possible injuries, non-incapacitating injuries, incapacitating injuries, fatal crashes

A severe crash is one that involves non-incapacitating, incapacitating, or fatal injuries

Overall Crash Severity

The chart at right shows the overall severity for crashes (2014-2018). Almost 80% of all reported crashes do not result in an injury, and only slightly more than 6% are considered severe.



Only **6.3%** of all crashes are severe.

Figure 3

Crash severity (2014-2018)

Severe Crashes by Mode

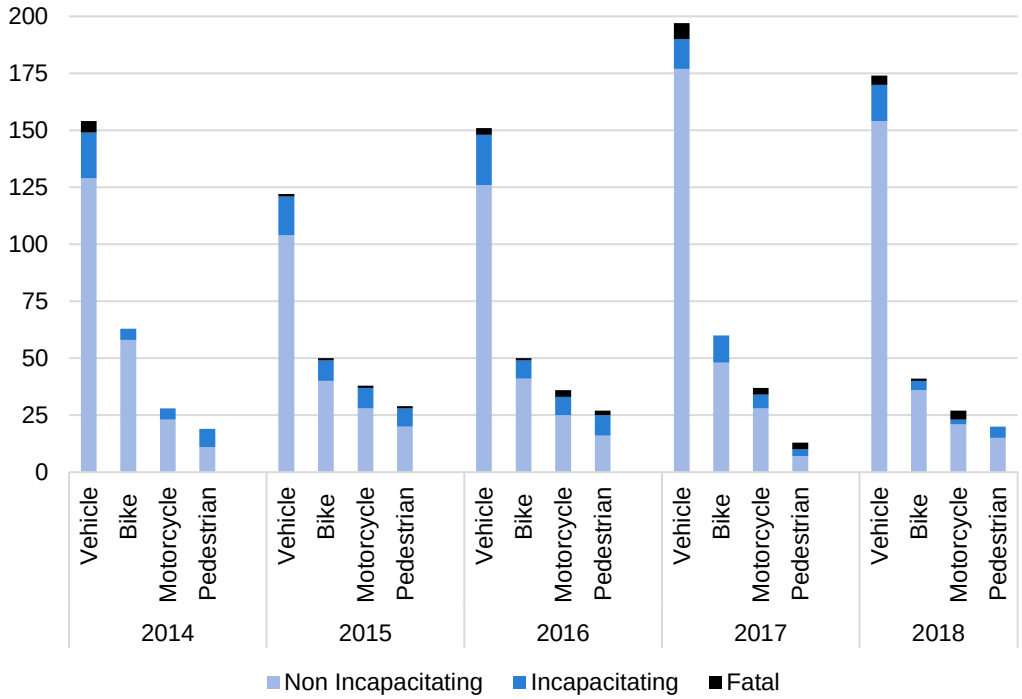


Figure 4

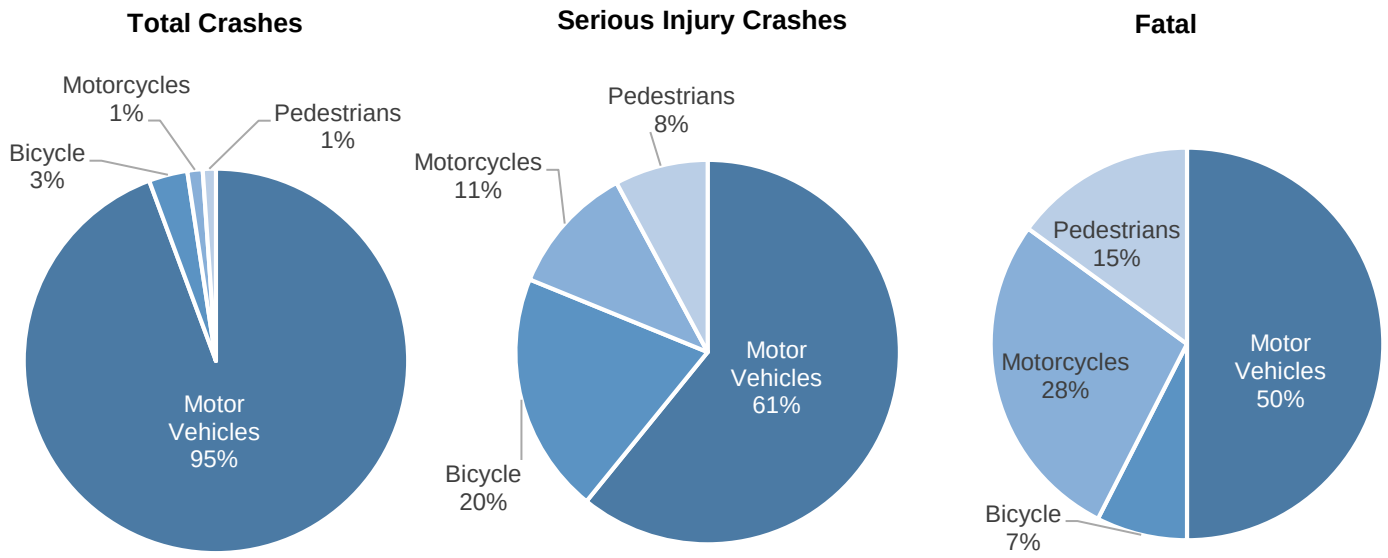
Trends for severe crash data by road user (2014-2018)

Impact on Vulnerable Road Users

When vulnerable roadway users (bicyclists, motorcyclists, and pedestrians) are in a crash, it tends to be more severe. Motor vehicle crashes remain by far the most prevalent, but account for just 50% of fatalities.

Figure 5

Severity impact on vulnerable road users (2014-2018)



Vulnerable road users make up **6%** of all crashes but **50%** of severe crashes.

Vulnerable Road User Crash Trends

The total number of crashes for vulnerable road users is shown below. More detail is provided in later sections of the report for each group of road users.

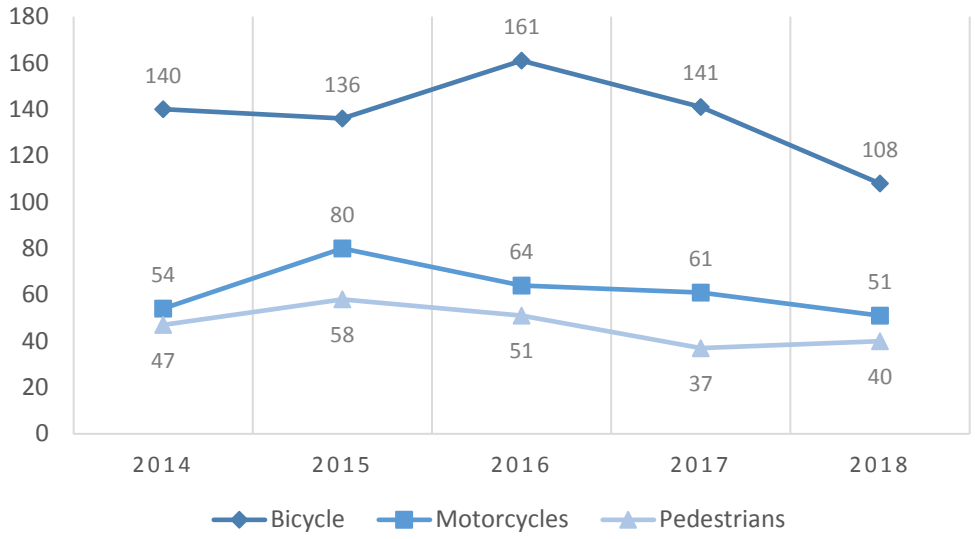


Figure 6

Total reported crashes involving bicycles, motorcycles, and pedestrians (2014 – 2018)

Crashes involving vulnerable road users are generally trending down

Severe Injury and Fatal Crashes for Vulnerable Road Users (Bicycles, Motorcycles and Pedestrians)

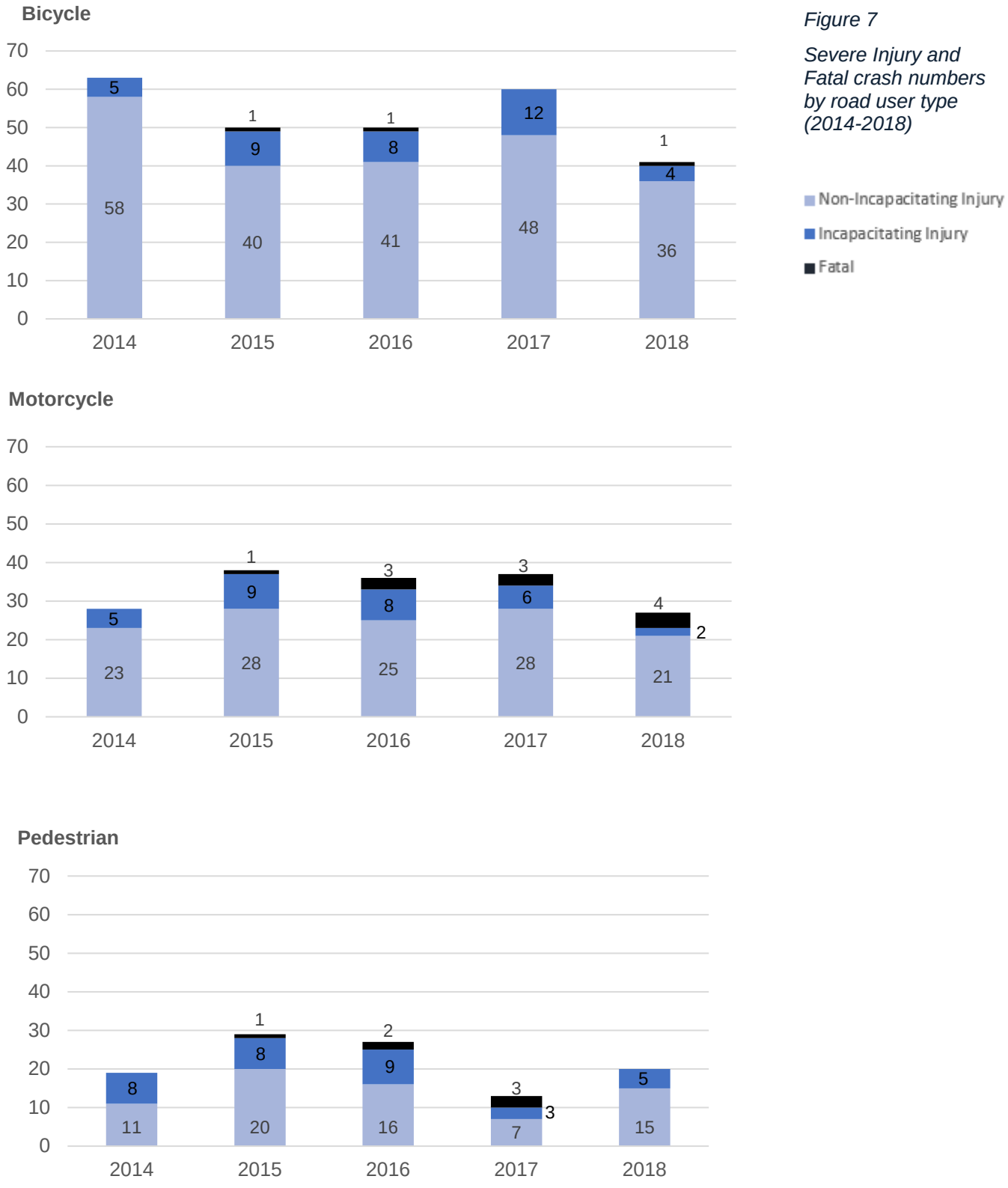


Figure 7

Severe Injury and Fatal crash numbers by road user type (2014-2018)

2018 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 2018 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 2018:
$ 165 million

Table 1

Economic impact of traffic crashes in Fort Collins in 2018

Crash Severity	Number of Crashes	Cost Per Crash	Societal Cost
Property Damage Crashes	2860	$ 10,600	$ 30,316,000
Possible Injury Crashes	681	$ 65,900	$ 44,877,900
Non-Incapacitating Injury Crashes	226	$ 117,100	$ 26,464,600
Incapacitating Injury Crashes	27	$ 320,700	$ 8,658,900
Fatal Crashes	9	$ 6,065,200	$ 54,586,800
Total	**3,803**		**$ 164,904,200**

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.

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 following tables are sorted by fatal crash rate and compare Fort Collins to other cities in Colorado with similar population and also compare to other peer cities nationwide with similar population (between 90,000 and 200,000).

Colorado Cities								
City	**Population**	**Fatal Crashes, 2014 - 2018**						**Fatal Crash Rate** (Crashes per 100,000 Population)
		2014	**2015**	**2016**	**2017**	**2018**	**Avg.**	
Pueblo	111,750	8	4	5	16	16	9.8	8.8
Lakewood	156,798	13	15	13	8	17	13.2	8.4
Greeley	107,348	8	5	7	11	9	8	7.5
Arvada	120,492	4	6	10	4	5	5.8	4.8
Longmont	96,577	4	5	2	6	6	4.6	4.8
Fort Collins	170,100	5	4	8	13	9	7.8	4.6
Thornton	136,436	4	3	11	9	1	5.6	4.1
Boulder	107,353	0	1	6	0	2	1.8	1.7
Total CO Cities	1,006,854	46	43	62	67	65	56.6	5.6

Table 2

Fatal crash rate comparison to other Colorado Cities

Colorado crash data is from CDOT. Population estimates are for 2018 and are from the U.S. Census

Peer Cities								
City	**Population**	**Fatal Crashes, 2013 - 2017**						**Fatal Crash Rate** (Crashes per 100,000 Population)
		2013	**2014**	**2015**	**2016**	**2017**	**Avg.**	
Boca Raton, FL	98,150	12	10	12	18	6	11.6	11.8
Springfield, MO	167,376	13	14	21	19	17	16.8	10.0
Coral Springs, FL	133,037	10	7	8	13	7	9.0	6.8
Norman, OK	122,843	8	7	9	6	9	7.8	6.3
San Angelo, TX	100,119	6	7	8	3	4	5.6	5.6
Richardson, TX	116,783	3	7	8	10	4	6.4	5.5
Broken Arrow, OK	108,303	7	3	8	4	7	5.8	5.4
Fort Collins, CO	167,500	3	5	4	8	13	6.6	3.9
Olathe, KS	137,472	8	2	5	7	3	5.0	3.6
Cedar Rapids, IA	132,228	2	5	1	8	5	4.2	3.2
Overland Park, KS	191,278	4	3	7	7	8	5.8	3.0
Bellevue, WA	144,444	4	3	6	3	2	3.6	2.5
Naperville, IL	147,682	1	3	0	4	2	2.0	1.4
Total Peer Cities	1,767,215	81	76	97	110	87	90.2	5.1

Table 3

Fatal crash rate comparison to similar peer cities nationwide

Note: 2017 is most current national data available

Crash data for other communities outside Colorado (peer cities) was obtained from the National Highway Traffic Safety Administration's Fatal Accident Reporting System which contains data through 2017. Population estimates are for 2017 and are from the U.S. Census.

Additional Crash Statistics

Crashes by Month 2014-2018

The variation of crashes by month is shown below. The number of crashes varies by more than 20% from month to month with more crashes occurring in the fall and winter than in the spring and summer. Inclement weather and a higher student population at those times likely contribute to the increase seen during the colder months.

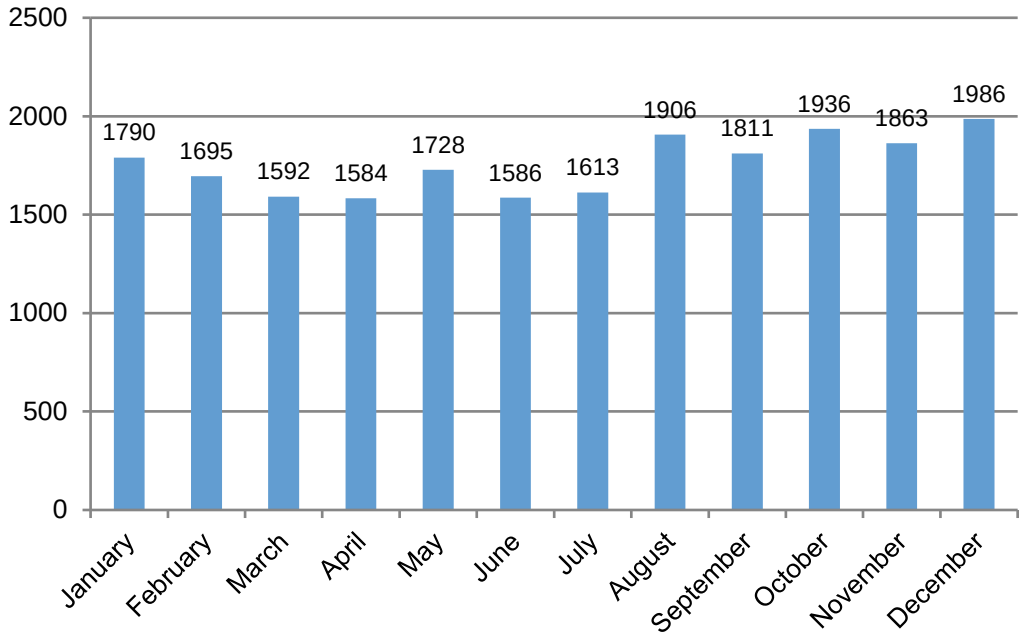


Figure 8

Crash variation by month (2014-2018)

Crashes by Day of Week 2014-2018

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 (dark blue line).

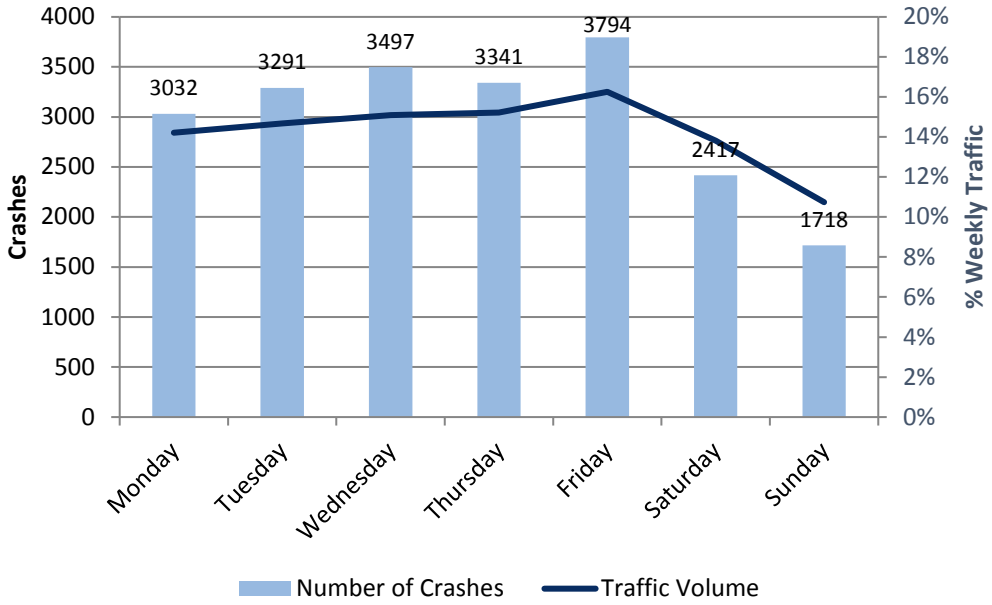


Figure 9

Crashes by day of week (2014-2018)

Crashes by Time of Day 2014–2018

The graphs below show crashes by time of day for weekdays, Saturdays and Sundays respectively. The charts also show the percentage of daily traffic by hour (dark blue line).

On weekdays (Monday-Friday), crashes are overrepresented during the afternoon peak hours from 3 p.m. to 5 p.m.. 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 overrepresented. Around 1 a.m. to 2 a.m. on Saturdays and Sundays, there are two to 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 13 for more data on alcohol related crashes.) Interestingly, the noon hour on Saturdays and Sundays is also overrepresented.

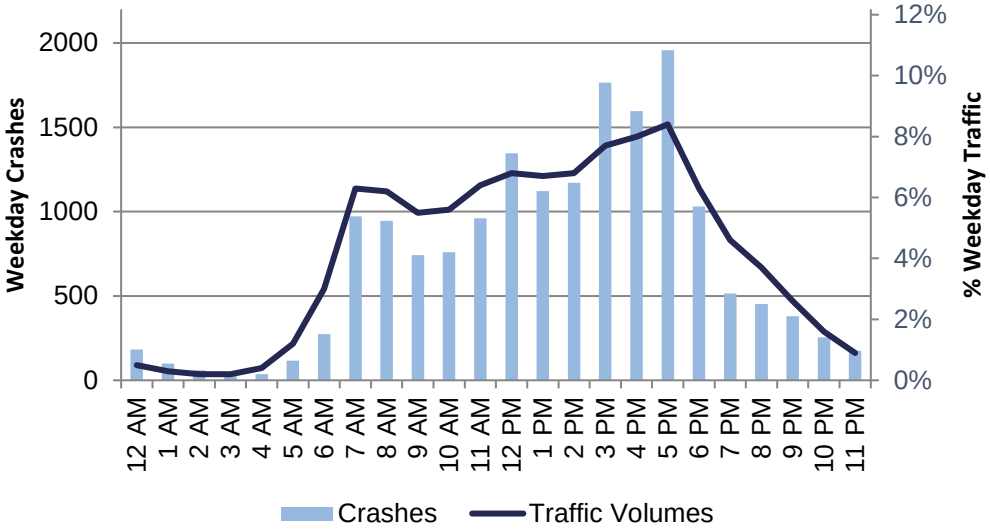


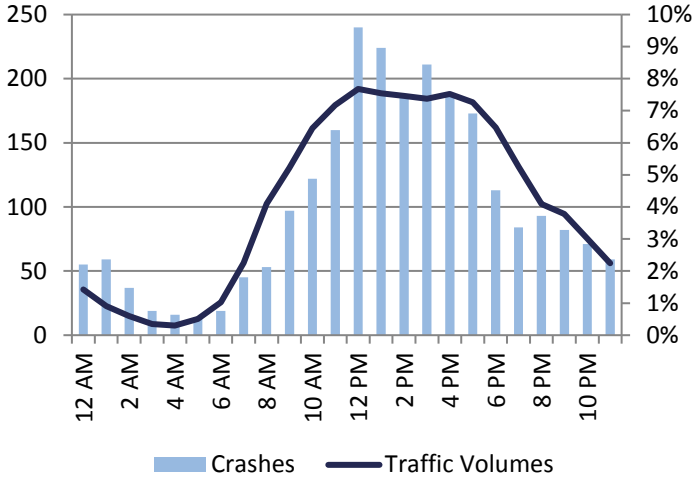
Figure 10

Weekday crashes by time of day (2014-2018)

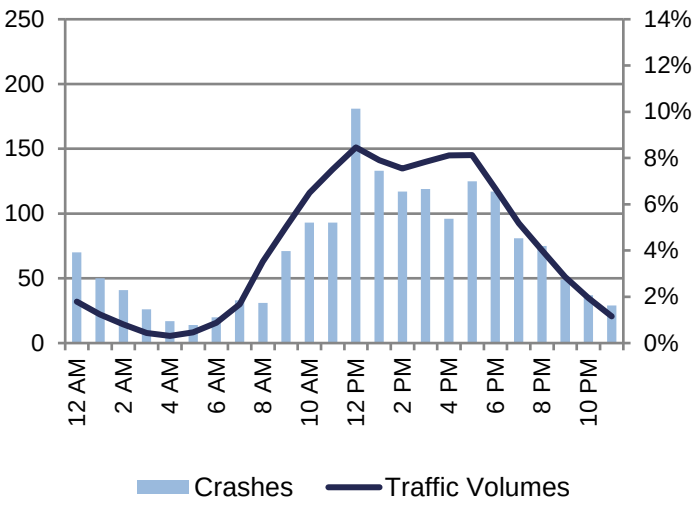
Figures 11,12

Saturday and Sunday crashes by time of day (2014-2018)

Saturday Crashes and Volumes



Sunday Crashes and Volumes



Locations of Crashes 2014-2018

The chart below shows the location of crashes in Fort Collins. Crashes at intersections or driveways account for 74% of all crashes. This illustrates the importance of reducing the number of driveways (when possible), minimizing accesses and focusing the traffic safety program at intersections.

More than **74%** of all crashes occur at an intersection or driveway

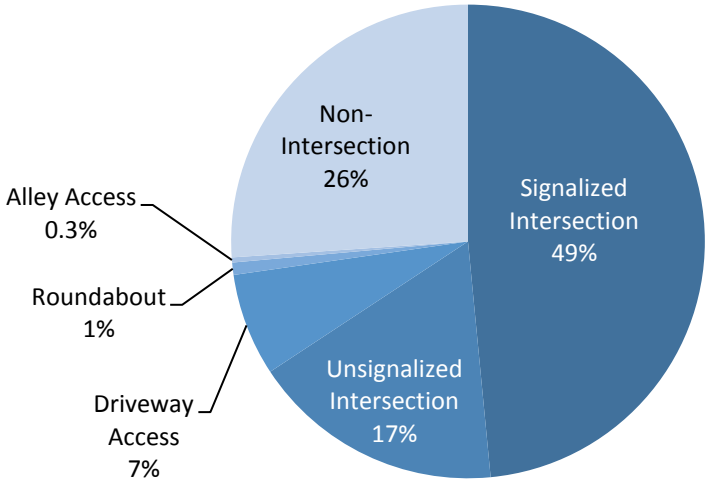


Figure 13

Crash location (2014–2018)

At Fault Drivers by Age 2014-2018

The chart below compares the number of crashes, by age, of at-fault drivers with the percent of licensed drivers in that age category. Drivers aged 15–19 are 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 also overrepresented in crashes. 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 address this challenge are appropriate at all levels (local as well as statewide and national).

Teenagers represent **5 %** of all drivers but are responsible for **15 %** of all crashes

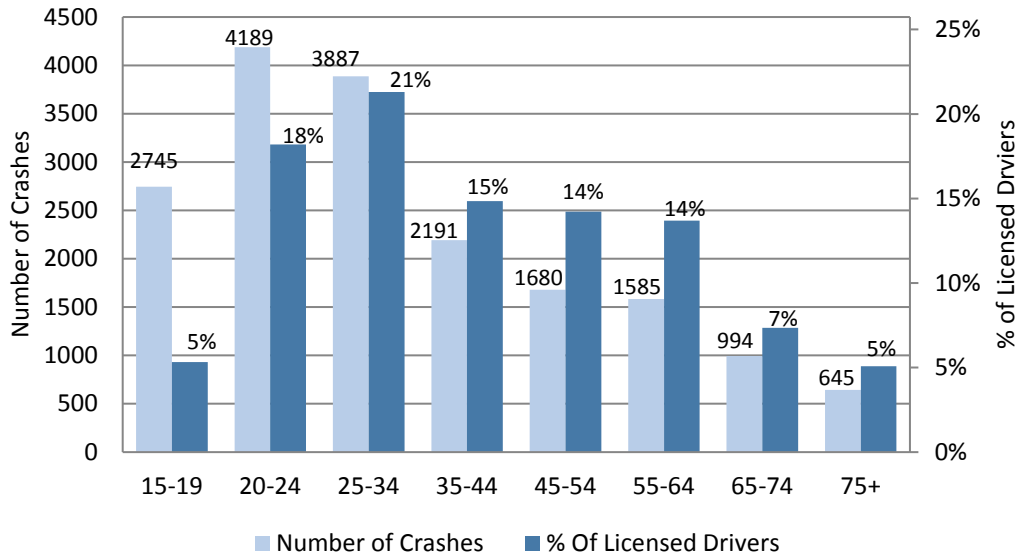


Figure 14

Crashes by age of at fault drivers (2014-2018)

Crashes by Age and Gender 2014-2018

The graph below shows crashes by age and gender (some crashes are not included if gender information was not 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.

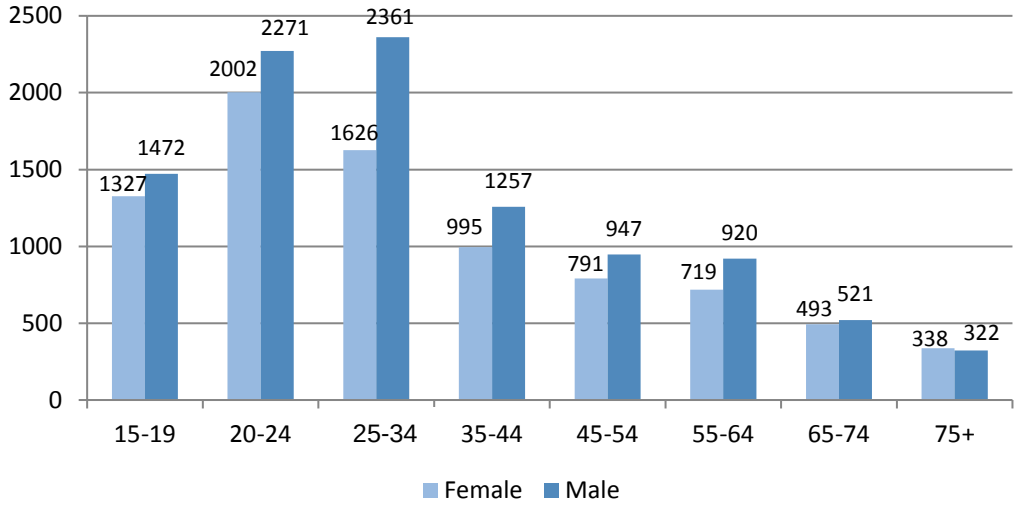


Figure 15

Crashes by age and gender of at fault drivers (2014 – 2018)

Crash Type by Driver Age 65+ 2014-2018

The graph below shows how the type of severe crashes vary for driver's aged 65+. Older drivers are significantly over represented in Approach Turn crashes. These are typically crashes involving a left turn that may require judging appropriate gaps in traffic.

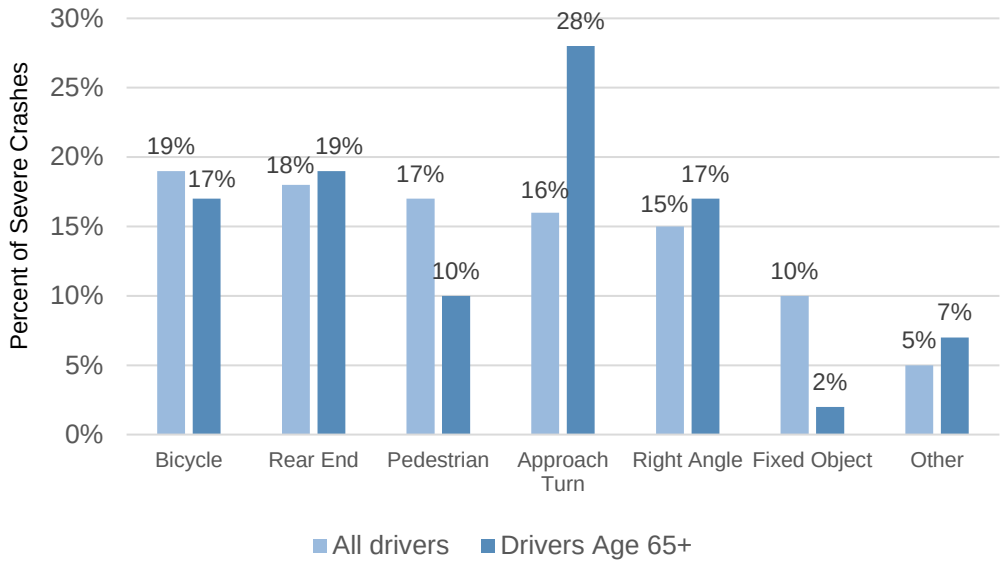


Figure 16

Severe crashes by type for drivers aged 65+ (2014 – 2018)

Drivers Under the Influence (DUI Crashes) 2014-2018

The graph below shows the number of DUI crashes over the past five years. The DUI crashes represent about 4% of all crashes. However, they account for 12% of severe crashes, and 25% of fatal crashes. This suggests that alcohol related crashes are more likely to result in serious injuries.

Total DUI crashes vary from year to year (including a 15% increase in the last year), but the 5-year trend is pretty consistent. Severe DUI crahes are down 30% since 2017 and are similar to the numbers in 2014 and 2015.

Crashes involving DUI represent
4% of all crashes
12% of severe crashes and
25% of fatal crashes

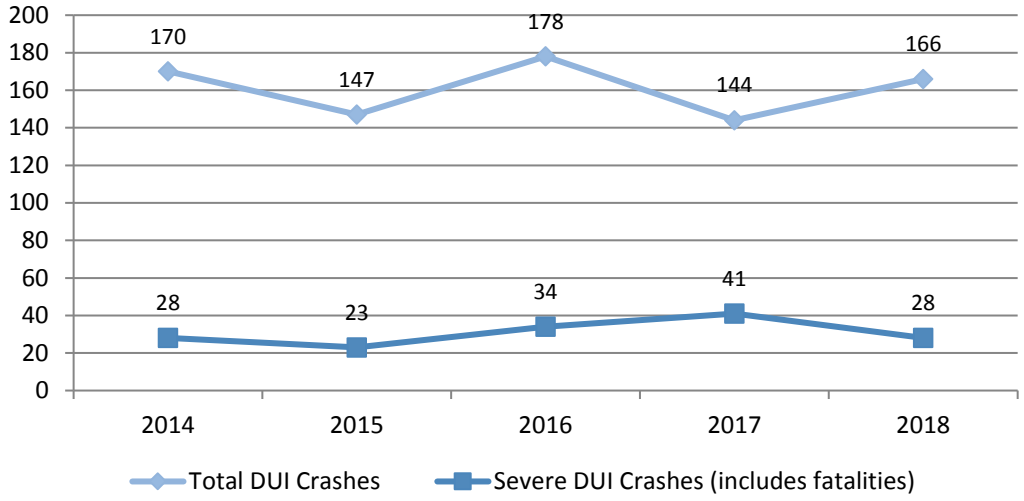


Figure 17

DUI crash trends (2014 – 2018)

DUI Crashes by Age 2014–2018

Crashes in the past five years that involve DUI are shown below by age of at fault drivers.

Drivers below the age of 35 are significantly over-represented in alcohol related crashes given the number of licensed drivers in those age groups. Also surprising is that drivers 15 – 19 years old are involved in 5% of DUI crashes despite the fact that they have not reached legal drinking age.

Drivers between ages 20 -34 represent
40%
of licensed drivers but cause
64%
of DUI crashes

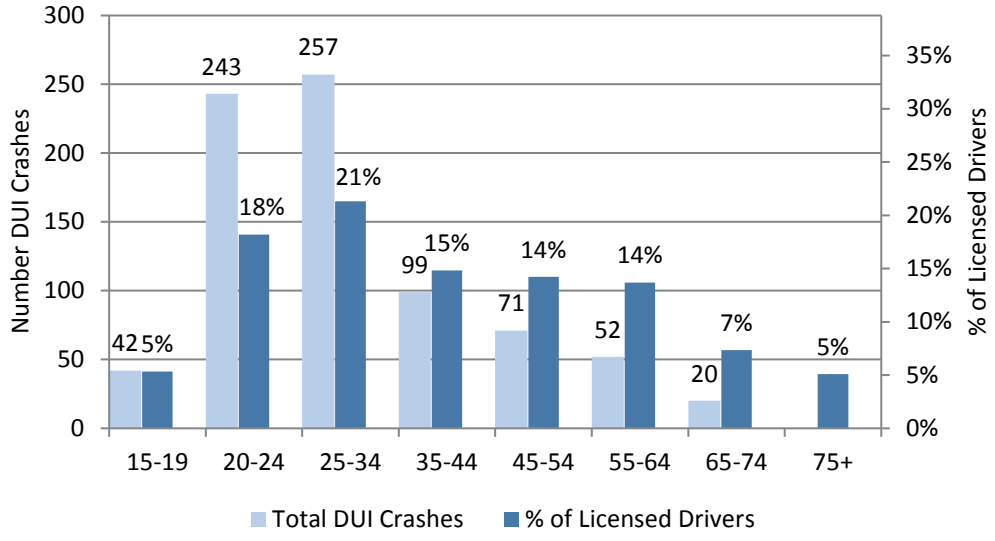


Figure 18

DUI crashes by age of at fault drivers (2014 – 2018)

Motorcycle Crashes 2014–2018

From 2014-2018 there were a total of 310 reported motorcycle crashes, including eleven fatalities (four in 2018). Total crashes are trending downward in the last three years, and are similar to five years ago.

Motorcycle crashes are down **36%** since 2015

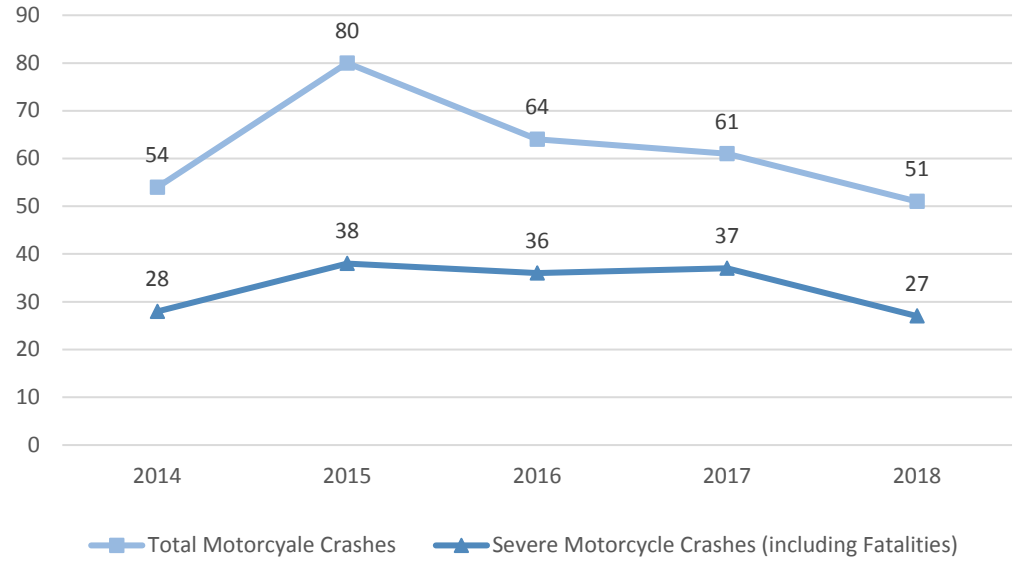


Figure 19

Motorcycle crashes (2014 – 2018)

While motorcycle crashes can follow the same patterns as other crashes they tend to be more severe as shown in the charts below. Overall, only 20% of all crashes result in some type of injury while more than 70% of motorcycle crashes result in injury.

In a crash, motorcyclists are almost **3** times as likely to be injured and **20** times as likely to be killed than people in vehicles

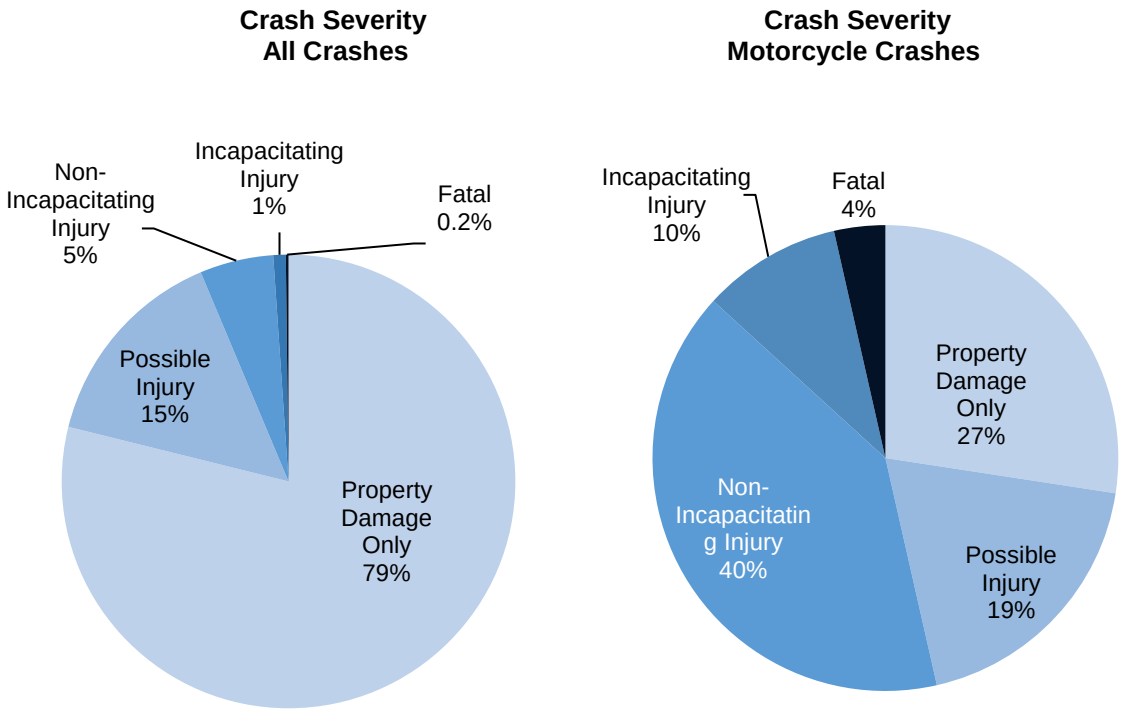


Figure 20

Comparison of crash severity between all crashes and motorcycle crashes

Section 3

Detailed Review of Most Frequent Severe Crash Types

Crashes are categorized into a variety of types. The definitions and explanations are detailed below:

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 cyclist.

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.

Crash Types by Severity

All Crashes by Type 2014–2018

Rear end crashes make up nearly half of all crashes. Right angle, side to side, approach turn, parking related, and fixed object crashes are the next most common types of crashes in the CIty. All together, they account for about 89% of all reported crashes in Fort Collins.

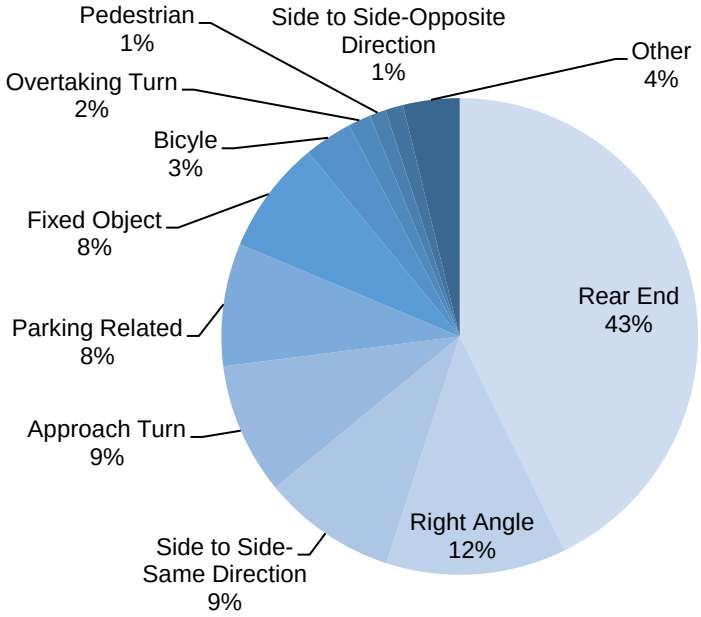


Figure 21

All Crashes by Type (2014–2018)

Severe Crashes by Type 2014–2018

While all traffic crashes are of concern, severe crashes (those involving non-incapacitating injuries, incapacitating injuries or fatalities) are of special concern. Bicycle, rear end, right angle, approach turn, fixed object, and pedestrian crashes account for almost 85% of the severe crashes in Fort Collins. These six crash types are discussed in more detail in subsequent pages.

Note that while bicycle and pedestrian crashes make up only about 5% of total crashes they make up 28% of severe crashes.

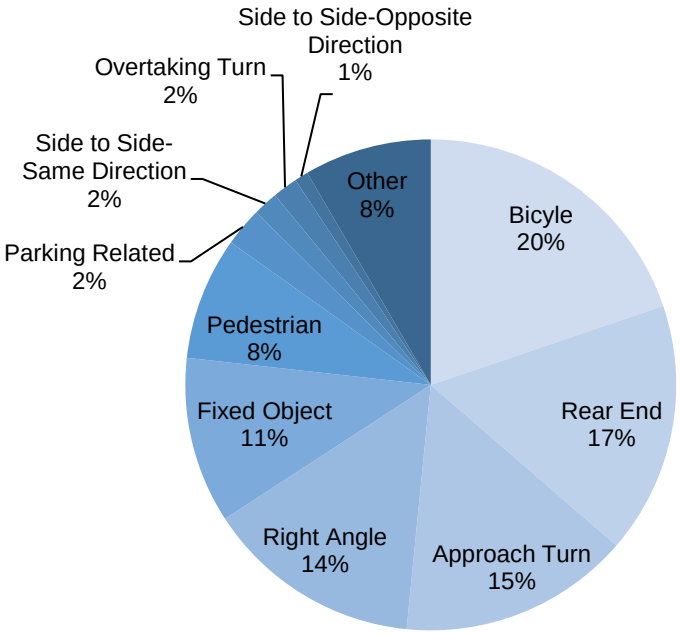


Figure 22

Severe Crashes by Type (2014–2018)

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 bike crashes in Fort Collins. The general trend for bike crashes has been downward for several years. Both total and severe bicycle crashes are down about 40% since 2012 (the year with the most crashes).

Total and severe bike crashes are down **40%** since highs in 2012

Number of Bike Crashes

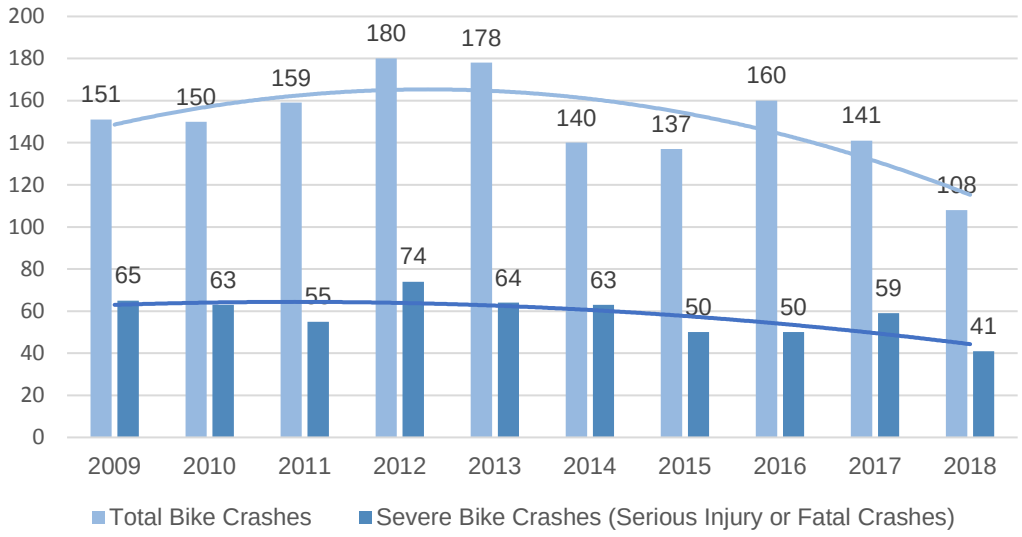


Figure 23

Historical bike crash data (10 years)

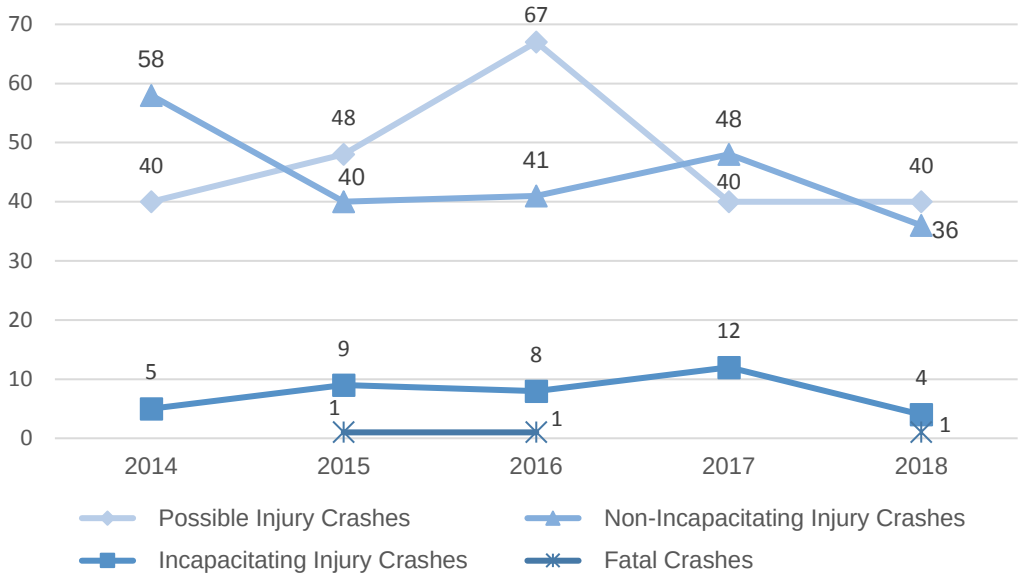


Figure 24

Bike crashes involving some level of injury (2014-2018)

Bike Crash Severity

Overall bike crashes account for 3.25% of all crashes in the City of Fort Collins. However, they account for 20% of serious injury (non-incapacitating injury and incapacitating injury) and 9% of fatal crashes. This illustrates that bike crashes, when they do occur tend to be more serious than motor vehicle crashes.

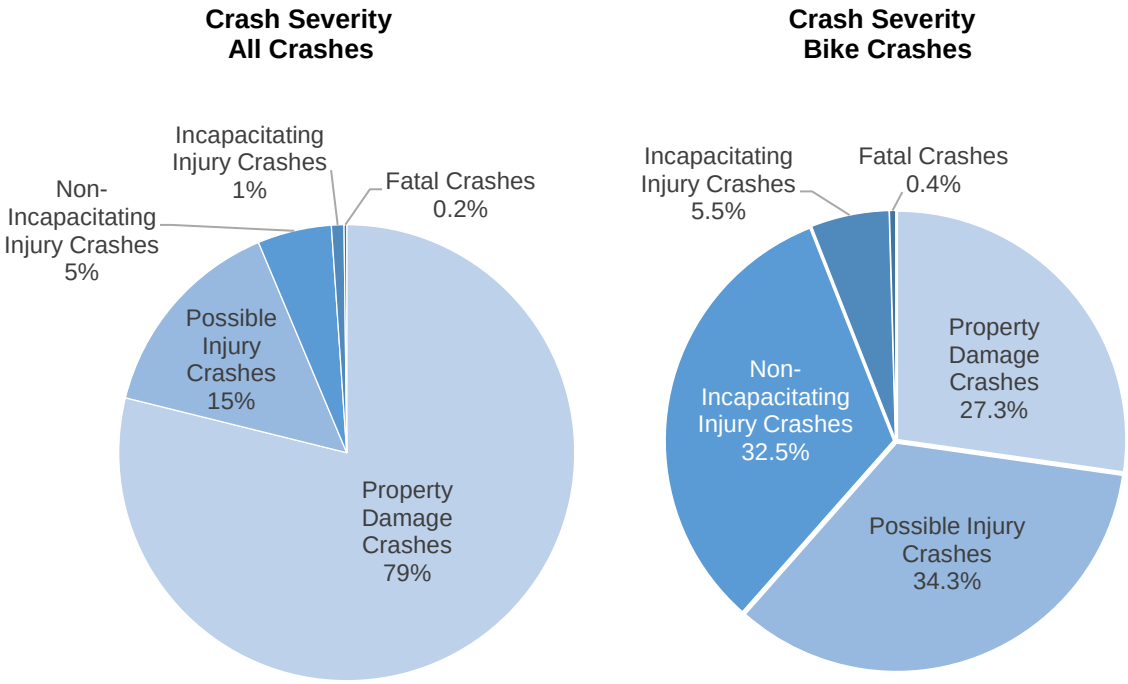


Figure 25

Comparison of crash severity between all crashes and bike crashes (2014-2018)

Bike Crashes by Age and Gender

The chart below shows the age of cyclists involved in crashes in Fort Collins as well as the percentage of population by age. Cyclists aged 15 - 34 years old are all significantly overrepresented in crashes. Male cyclists are involved in 70% of all bike crashes.

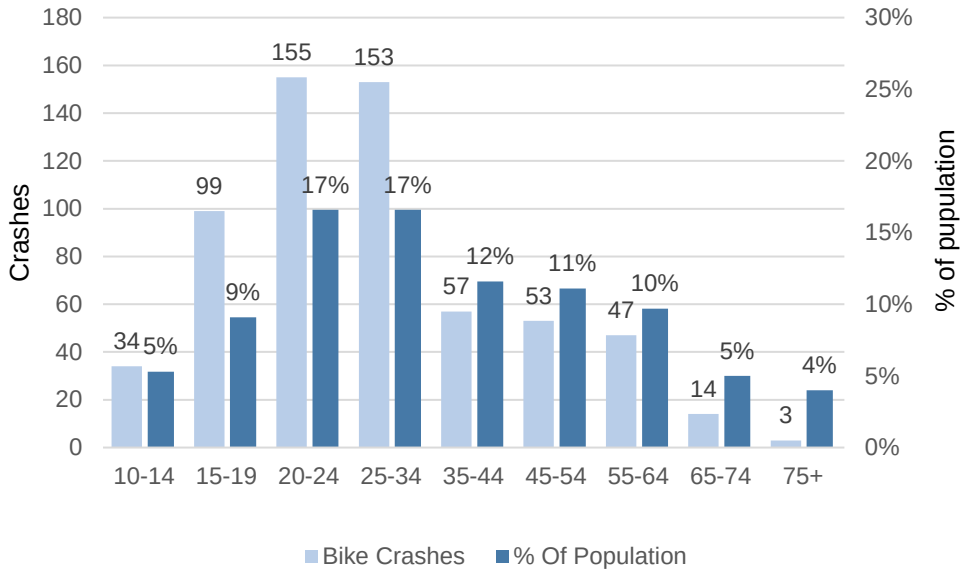


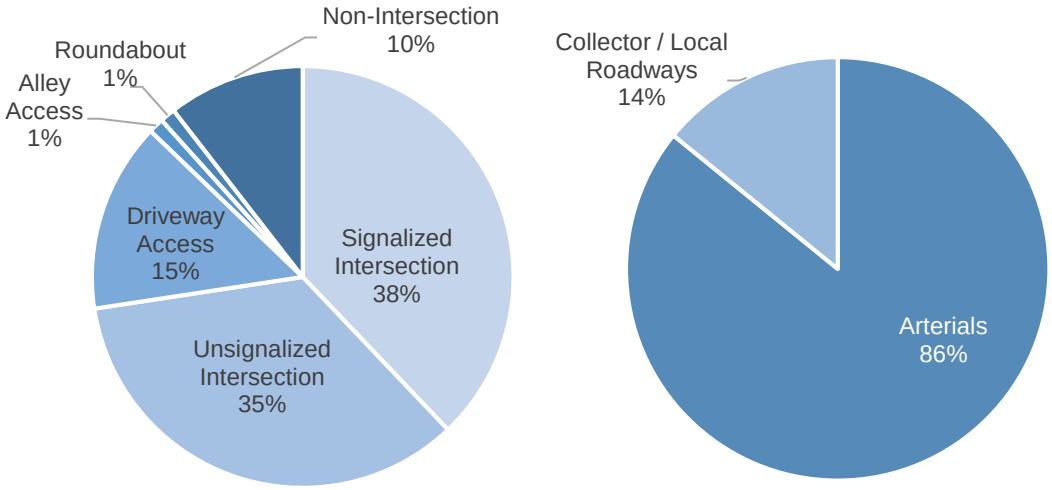
Figure 26

Bike crashes by age and percentage of popoulations (2014-2018)

70%
of all reported bike crashes involve a male cyclist

Bike Crash Location and Types (2014-2018)

Bike crashes can be further classified by location and type of collision.



89%
of all bike crashes occur at intersections or driveways

86%
of all bike crashes occur at a location that involves an arterial

Figure 27

Bike crashes by location (2014-2018)

Crashes at intersections, alleys or driveways account for almost 90% of all bike crashes. It is critical to note that intersections are the locations of greatest risk for bicycle riders. While corridor projects such as buffered or protected bike lanes support greater comfort and perceived safety, an emphasis on intersection safety is needed.

The figure below shows the type of bike crash in the past five years.

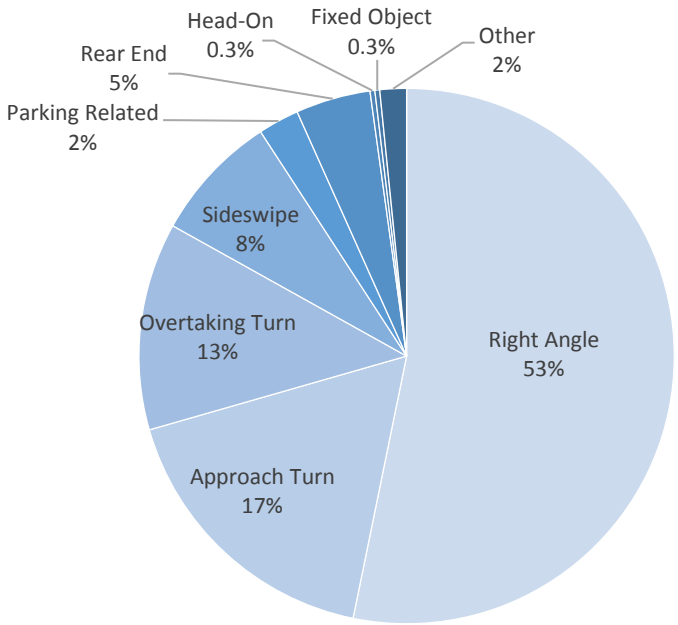


Figure 28

Bike crashes by type (2014-2018)

23%
of all bike crashes involve cyclists riding against traffic

Right angle crashes are the most common type of bike crash, and represent more than half of all bike crashes. Significant contributing circumstances in bike crashes include riding against traffic on the sidewalk or street (this includes almost 23% of all crashes, and 37% of right angle crashes).

Bike crashes along roadways are 2.5% parking related (i.e. “door zone” crashes) and 12% rear-end or sideswipe.

Graphical Depiction of Typical Bike Crashes

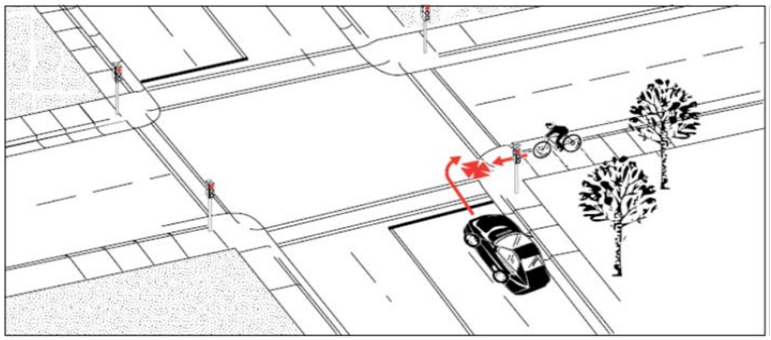


Figure 29

Right angle crash

Right angle crashes are by far the most common type of bike crash representing more than half of all bike crashes. Thirty eight percent (38%) of right angle crashes involve a bike riding against traffic on the sidewalk or street. (2014-2018)

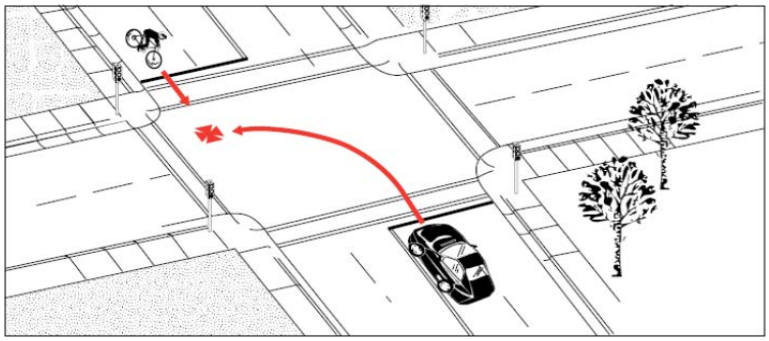


Figure 30

Approach turn crash

This type of crash represents 17% of all crashes. Forty-three percent (43%) of approach turn crashes result in a severe crash (serious injury of fatal). (2014-2018)

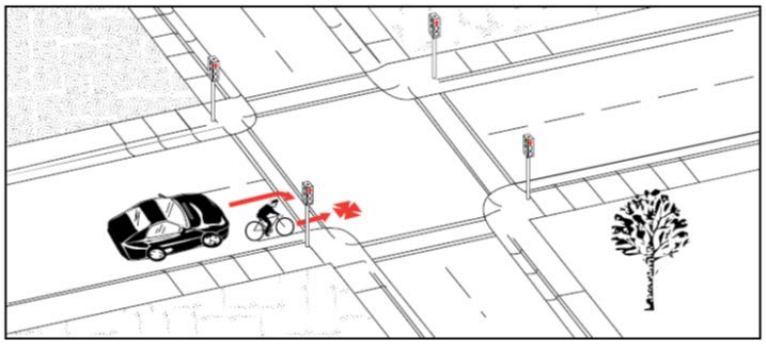


Figure 31

Overtaking turn crash

Also known as the “right hook” crash. This represents 13% of all bike crashes. (2014-2018)

Trends for Bike Crashes By Type (2014-2018)

The figure below shows the general trend of bike crash types for the past five years (as a percentage of total bike crashes). This depicts that right angle crashes remain the most prevalent crash type. The percent of overtaking turn crashes (i.e 'right hooks) increased in the last year.

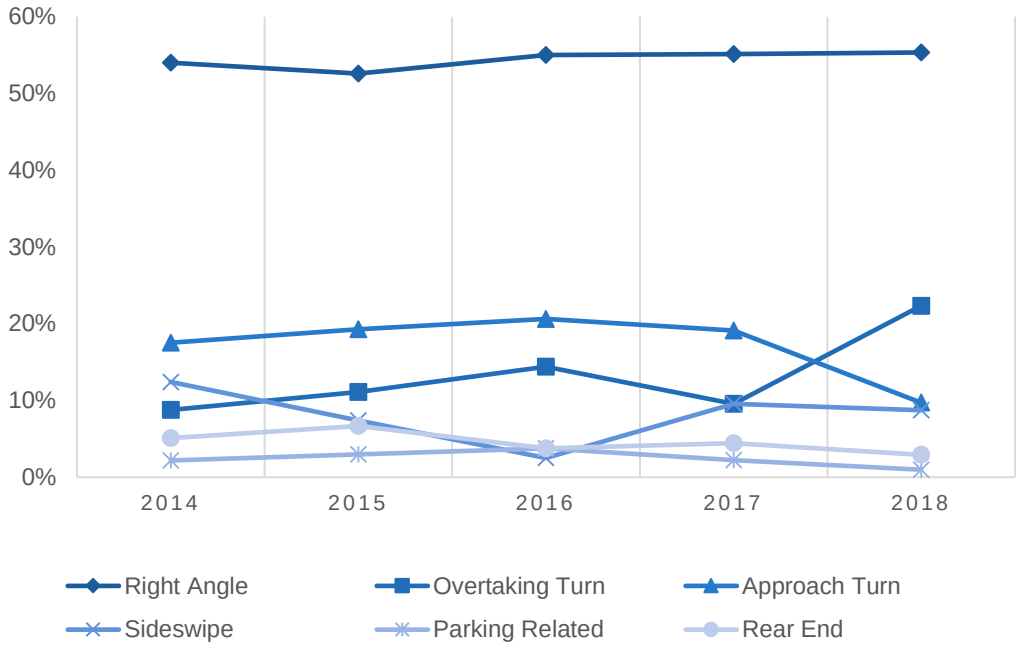


Figure 32

Trends for bike crashes by type

Bike Crashes By Month (2014-2018)

The figure below compares bike crashes by month with aggregated bike volumes from a series of continuous bike counters in Fort Collins. The strong similarity of the trends would indicate that as bike volume increase, bike crashes also increase. The pronounced peak in September is likely related to the start of the university school year.

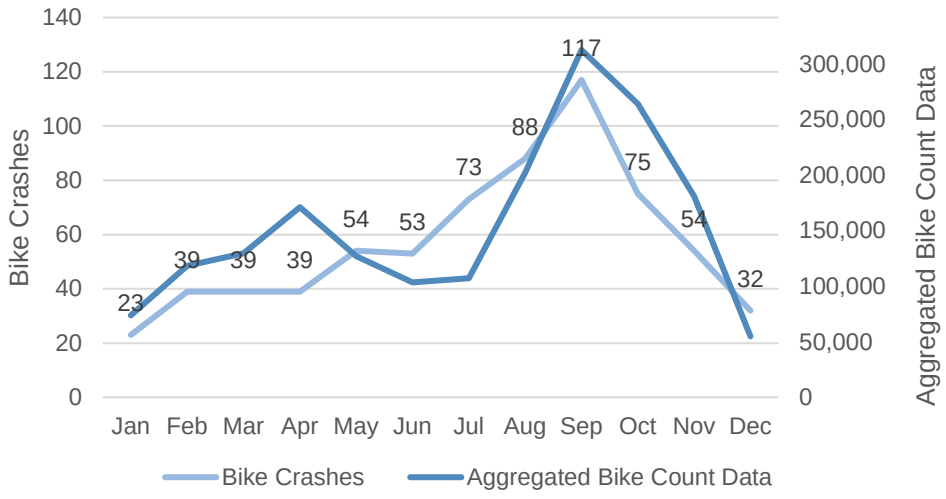


Figure 33

Bike crashes by month (2014-2018) compared with bike volumes

Detailed Bike Crash Tabulation (2014–2018)

Type of Crash	Total Crashes	Severe Crashes
Right Angle		
Bike riding with traffic on street	115	53
Bike riding against traffic on street	25	10
Bike riding with traffic on sidewalk/crosswalk	60	24
Bike riding against traffic on sidewalk/crosswalk	110	35
Bike crossing street mid-block	9	7
Unknown Location	46	10
Right Angle Total	**365**	**139**
Overtaking Turn		
Bike riding with traffic on street	54	18
Bike riding against traffic on street	4	1
Bike riding with traffic on sidewalk/crosswalk	12	3
Bike riding against traffic on sidewalk/crosswalk	7	1
Unknown Location	9	1
Overtaking Turn Total	**86**	**24**
Approach Turn		
Bike riding with traffic on street	83	38
Bike riding against traffic on street	1	1
Bike riding with traffic on sidewalk/crosswalk	21	8
Bike riding against traffic on sidewalk/crosswalk	6	2
Unknown Location	8	2
Approach Turn Total	**119**	**51**
Sideswipe		
Bike riding with traffic on street	44	19
Bike riding against traffic on street	4	3
Bike riding with traffic on sidewalk/crosswalk	1	1
Bike crossing street mid-block	1	0
Unknown Location	3	1
Sideswipe Total	**53**	**24**
Parking Related		
Bike riding with traffic on street	15	7
Bike riding against traffic on street	1	0
Unknown Location	1	0
Parking Related Total	**17**	**7**
Rear End		
Bike riding with traffic on street	30	12
Unknown Location	1	0
Rear End Total	**31**	**12**
Head-On		
Bike riding against traffic on street	2	1
Head-On Total	**2**	**1**
Fixed Object Total	**2**	**2**
Other Total	**11**	**4**
Total Bike Crashes	**686**	**264**

Table 4

Detailed bike crash tabulation (2014-2018)

Rear End Crashes

Rear end crashes are the most prevalent crash type in Fort Collins, accounting for 43% of total crashes. In 2018, there were 1,519 reported rear end crashes.

Number of Rear End Crashes

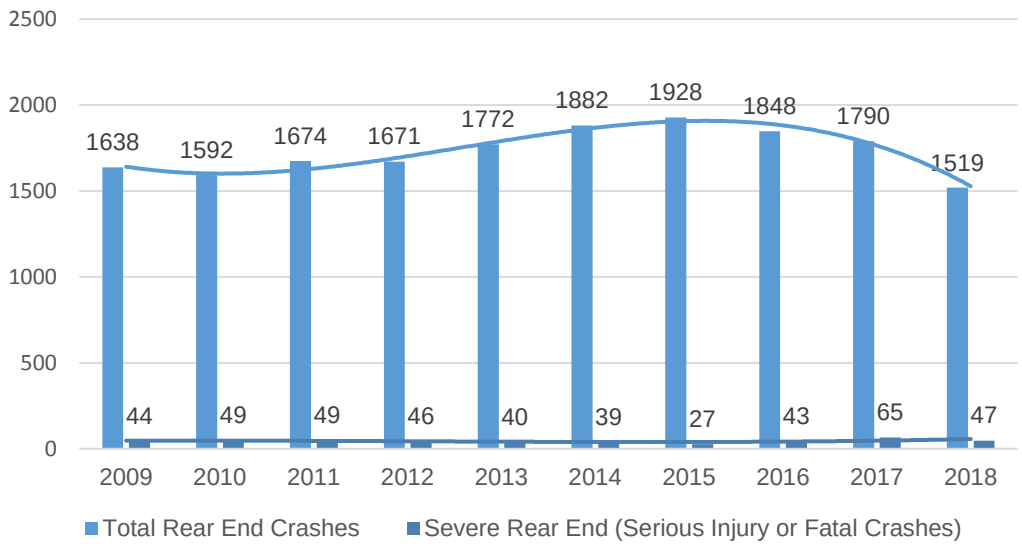


Figure 34

Historical Rear End crash data (10 years)

43%
of all reported crashes are rear-end crashes

Only 3% of all rear end crashes in 2018 were severe (resulting in non-incapacitating, incapacitating, or fatal injuries). 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 percentage of rear end crashes by location. The majority (68%) 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.

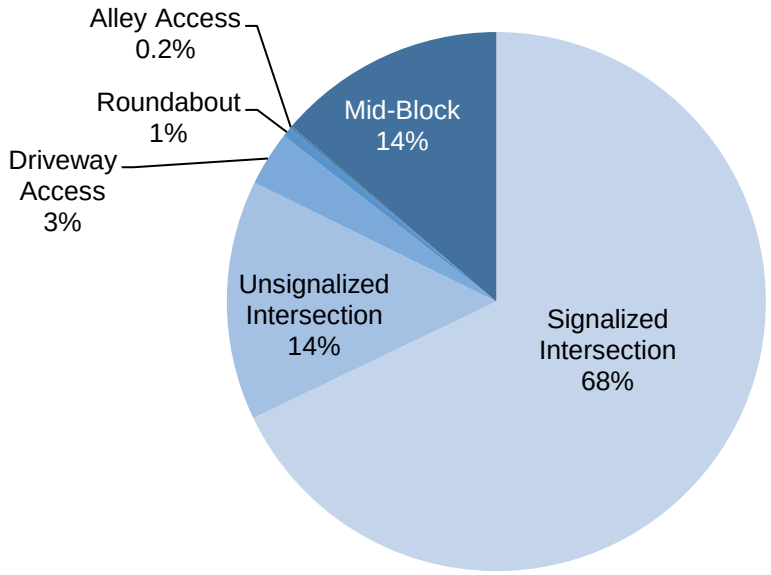


Figure 35

Rear end crashes by location (2014-2018)

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 may be reasonable 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 more serious crashes because of the increased risk of rear end crashes.

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:

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.

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 or flashing yellow arrow 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.

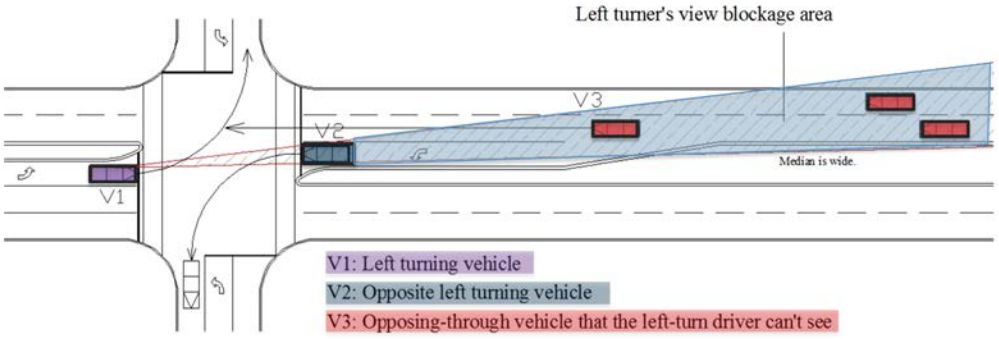
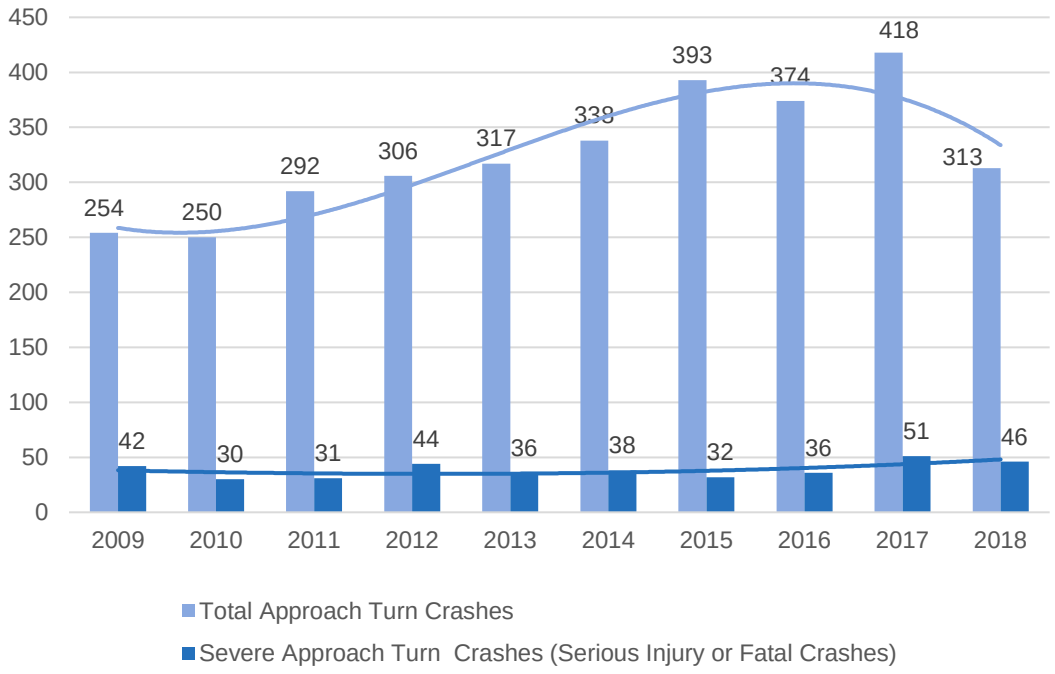


Figure 36

Depiction of typical approach turn crash

Number of Approach Turn Crashes

The chart below shows the historical trend of approach turn crashes in Fort Collins. After years of an increasing trend, the number of approach turn crashes was down 25% in 2018. Severe approach turn crashes were also down 10% from 2018, and similar in number as 2012.



Approach turn crashes decreased **25%** in last year

Figure 37

Historical Approach Turn crash data (10 years)

Approach Turn Crashes by Location (2014–2018)

The figure below 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 (70%) happen at signalized intersections. The combination of increased complexity and higher turning volumes along with the issue of turning on the yellow/red are likely causes to this trend.

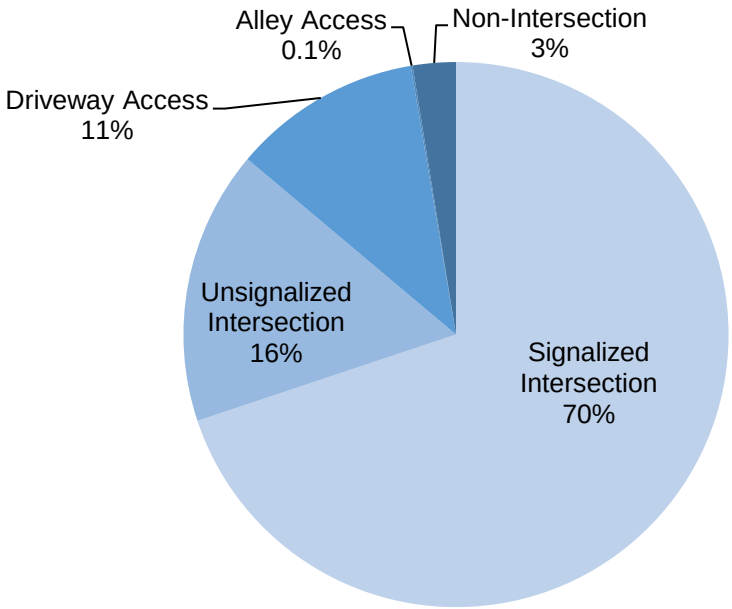


Figure 38

Location of approach turn crashes. (2014-2018)

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 – one where entering traffic has stopped, and one where entering traffic disregards a stop or signal.

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.

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.

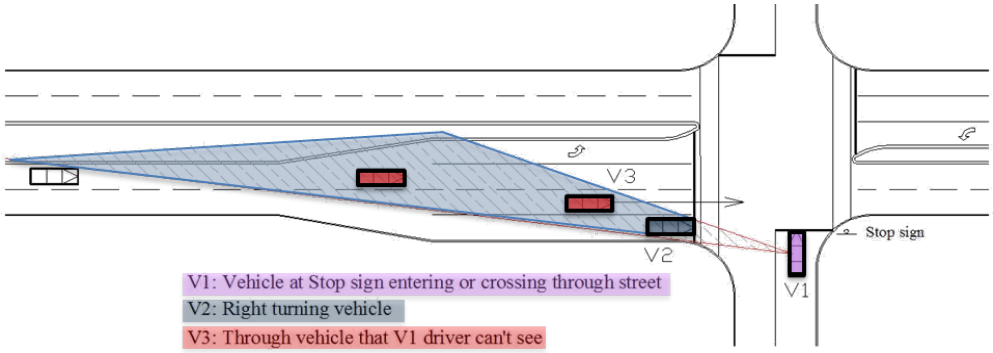


Figure 39

Depiction of typical right angle crash

Number of Right Angle Crashes

The chart below shows the historical trend of right angle crashes in Fort Collins. The general trend was increasing since 2012, but down slightly in 2018. The number of severe right angle crashes have been very consistent over 10 years.

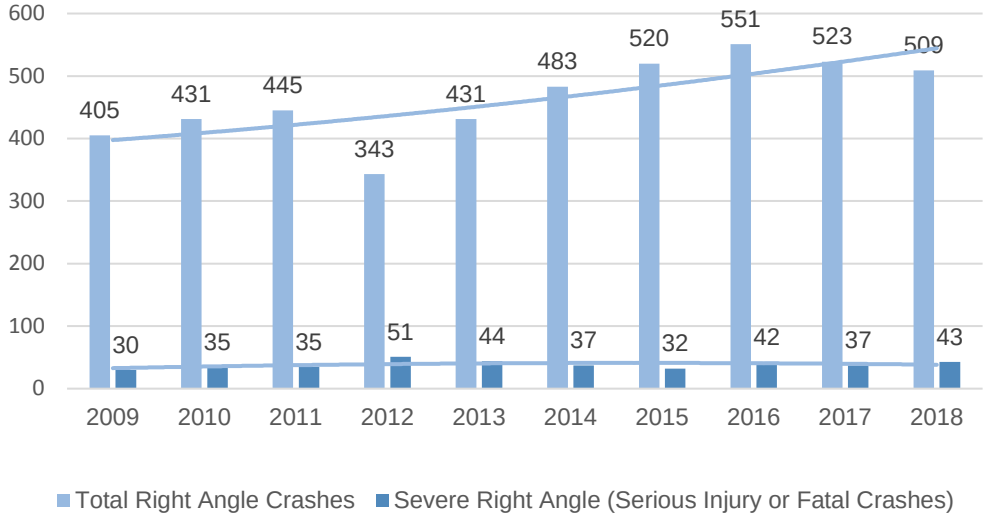


Figure 40

Historical Right Angle crash data (10 years)

Right Angle Crashes by Type and Location (2014–2018)

As shown, almost two-thirds (64%) of right angle crashes occur where someone stops but then proceeds into oncoming traffic (shades of blue in the chart). Most of the remaining crashes (35%) are the result of a motorist running a red light or stop sign.

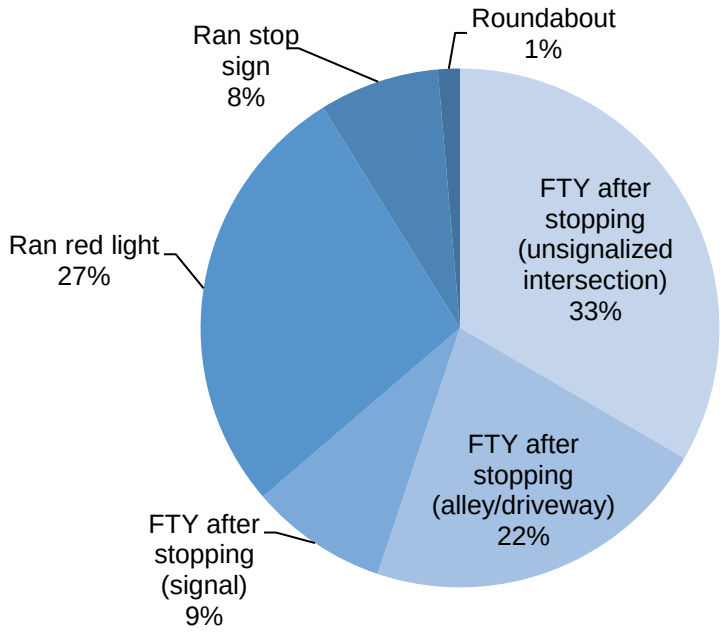


Figure 41

Right angle crashes by type (2014-2018)

FTY = Failure to Yield

Fixed Object Crashes

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.

Minor fixed object crashes often occur in inclement weather. The other main contributor to these types of crashes is alcohol. Seventeen percent (17%) of all fixed object crashes involve alcohol. For severe crashes the percentage related to alcohol goes up to almost 42%.

17%
of all fixed object crashes involve alcohol.

42%
of all severe fixed object crashes involve alcohol

Number of Fixed Object Crashes

The chart below shows the historical trend of fixed object crashes in Fort Collins. These crashes have been tracking relatively consistent in the past five years.

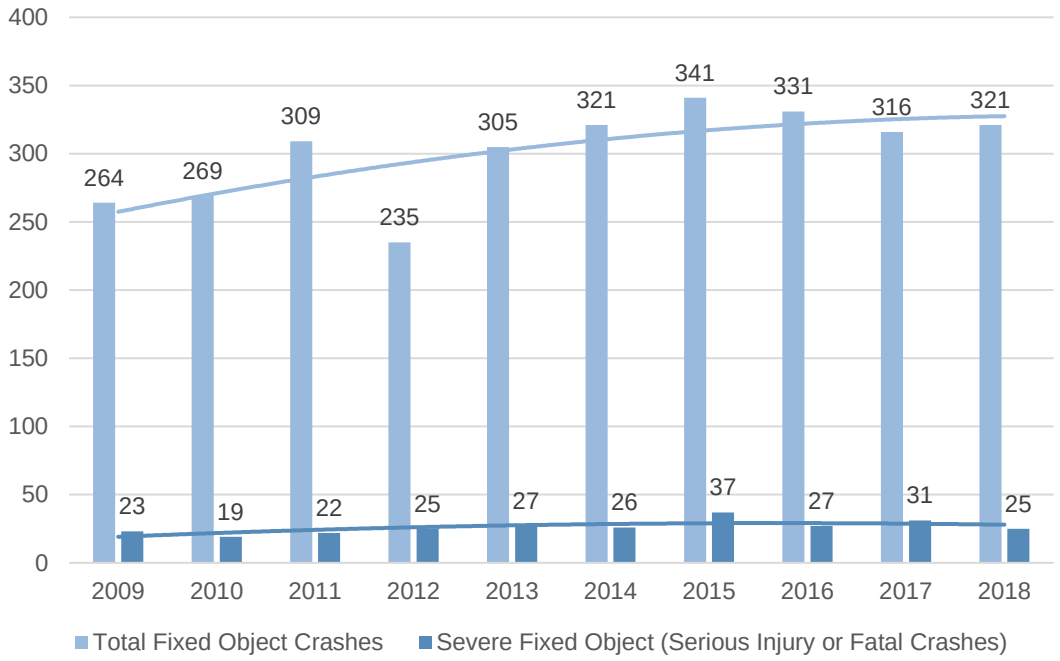


Figure 42

Historical Fixed Object crash data (10 years)

Fixed Object Crashes by Type (2014–2018)

The figure below shows fixed object crashes by the type of object struck.

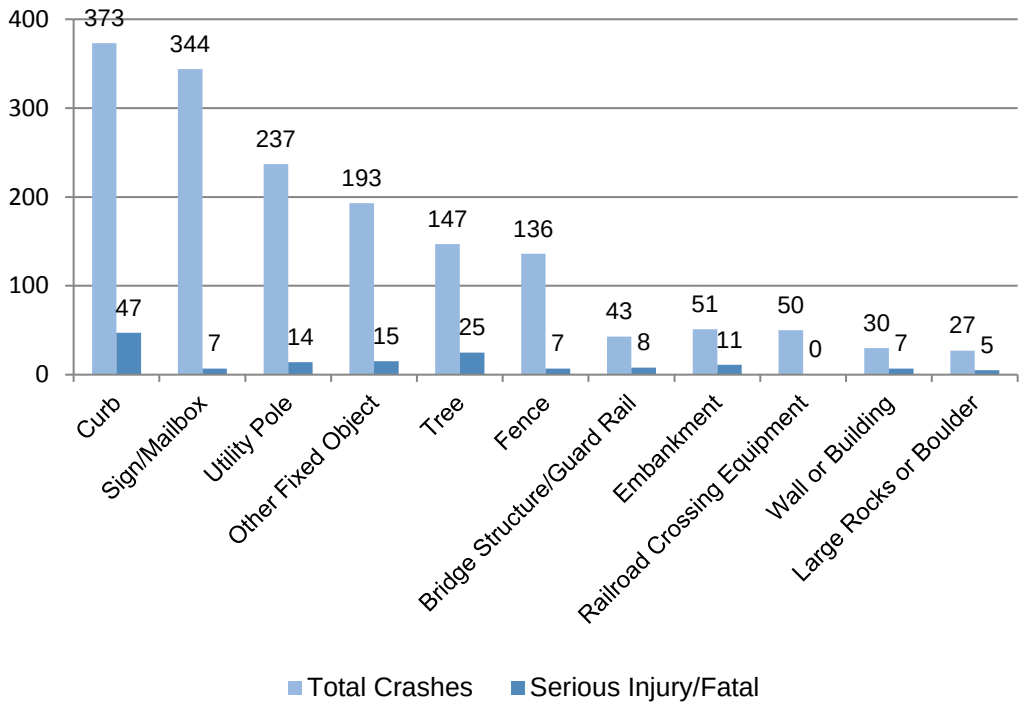


Figure 43

Type and severity of Fixed Object Crashes (2014-2018)

Pedestrian Crashes

Pedestrian crashes account for only about 1% of all crashes, but more than 8% of severe crashes. The charts below show the historical trends of pedestrian crashes in Fort Collins.

Pedestrian crashes tend to be serious crashes. Eighty-seven percent (85%) involve some level of injury and about half (46%) are severe crashes (non-incapacitating, incapacitating or fatal crashes).

85%
of all reported pedestrian crashes involve some level of injury or fatality

Number of Pedestrian Crashes

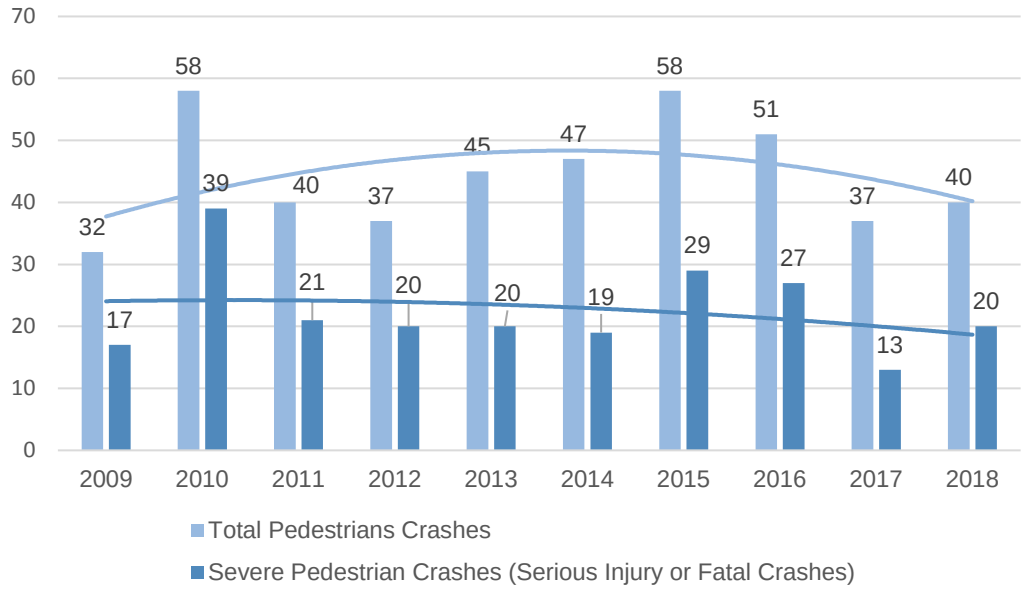


Figure 44

Historical pedestrian crash data (10 years)

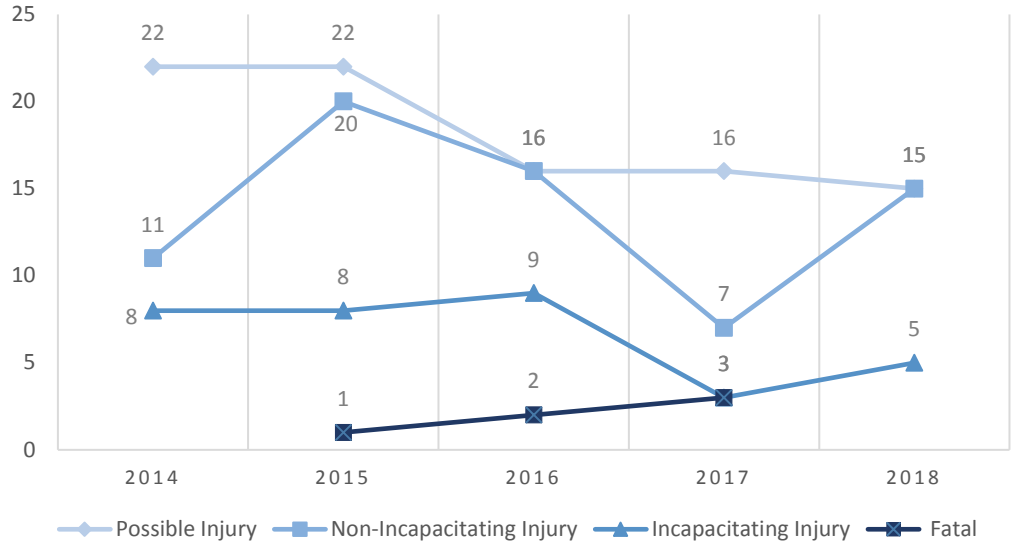


Figure 45

Pedestrian crashes involving some level of injury (2014-2018)

Pedestrian Crashes by Age and Gender (2014–2018)

The figure below shows the age of pedestrians involved in crashes. Pedestrian who are age 15-24 years old are significantly overrepresented in crashes; they account for 40% of pedestrian crashes but represent only 26% of the population. Crashes that involve a male pedestrian account for 63% of all pedestrian crashes.

63%
of all reported pedestrian crashes involve a male pedestrian

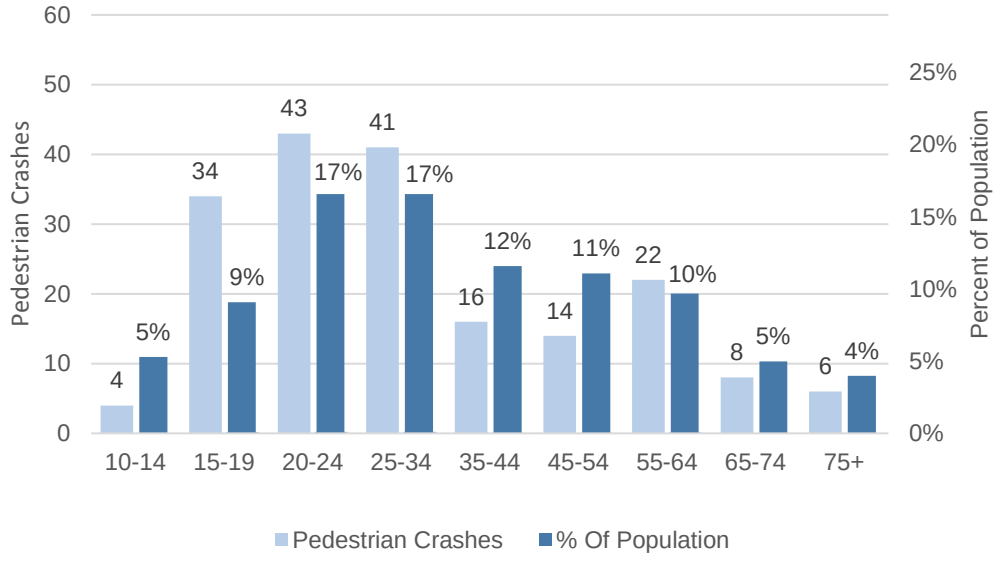


Figure 46

Pedestrian crashes by age and percentage of population (2014-2018)

Note: 45 crashes are not listed due to lack of age data in report

Pedestrian Crash Location and Types (2014-2018)

Categorizing pedestrian crashes by location and type helps to understand contributing factors. The figures below show the percentage of crashes in these categories in the past five years. Explanation of crash types is included on the following page. In general, about half of all pedestrian crashes are the result of a motorist failing to yield.

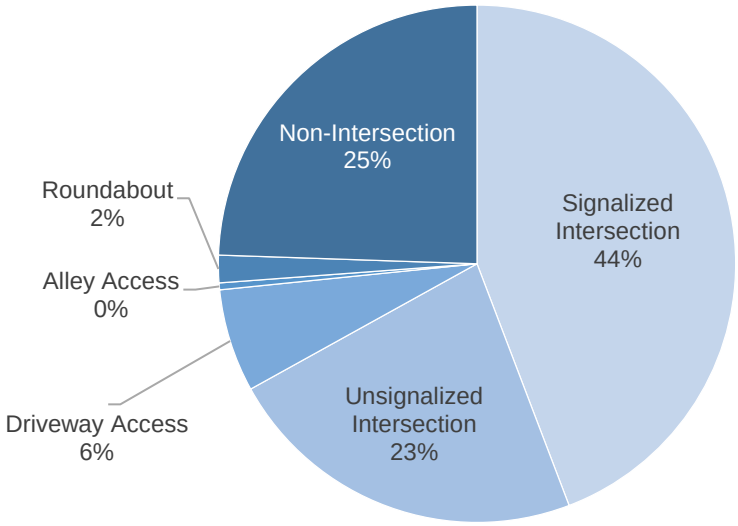


Figure 47

Pedestrian crashes by location (2014-2018)

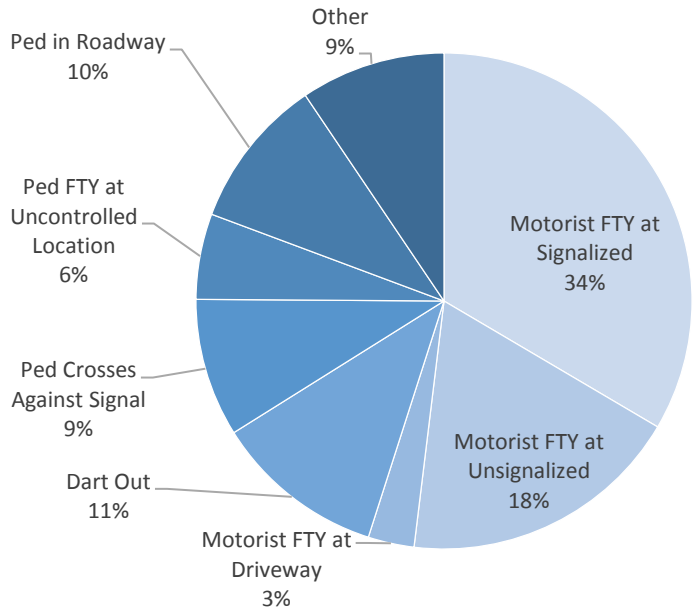


Figure 48

Pedestrian crashes by type (2014-2018)

FTY = Failure to Yield

Types of Pedestrian Crashes

Crashes are categorized into a variety of types. The definitions and explanation of 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 often 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 often 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 (2014–2018)

Type of Crash	Total Crashes	Severe Crashes
Motorist Fail to Yield at Signalized Intersection		
Motorist Turning Left on Green	36	16
Motorist Turning Right on Green	12	5
Motorist Turning Right on Red	20	9
Motorist Going Straight	10	7
Total Motorist Fail to Yield at Signalized Intersection	**78**	**37**
Motorist Fail to Yield at Unsignalized Intersection	43	13
Motorist Fail to Yield Exiting Driveway	7	0
Pedestrian Fail to Yield at Uncontrolled Location	13	6
Pedestrian Crosses Against Signal	21	12
Dart Out	26	16
Pedestrian Standing/Walking in Road	23	12
Other	22	12
Total Pedestrian Crashes (2014-2018)	**233**	**108**

Table 5

Detailed pedestrian crash tabulation (2014-2018)

Section 4
Intersection Evaluation

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.

Total crash numbers at any location (either in a chart or through crash density maps) identify the locations where the most crashes occur. While helpful information, because volumes and other elements at specific locations vary widely, it's difficult to draw relevant conclusions from this data. Therefore, 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 to identify locations that have a higher than expected 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.

City staff does an annual statistical evaluation of intersections in Fort Collins using three years of data (in this report: 2016 – 2018). Over 250 intersections were evaluated with 47% having an excess crash cost and 53% with a negative crash cost (indicating less crashes than predicted). This means that when aggregated and averaged, intersections in Fort Collins have slightly less crashes and/or severity than what would be predicted.

The table on the following page shows the 50 intersections (ranked by excess crash costs) with the greatest excess crash costs. (The top 10 are shaded darker, and the next 15 are shaded lighter.) Since injury crashes have higher crash costs associated with them, the ranking method gives more weight to locations with more injury crashes compared to locations with primarily "fender benders".

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.

Intersection Excess Crash Costs (2016 – 2018)

Table 6

Intersection excess cost (2016-2018)

Intersection		Input Data (Includes 3 Years of Crash Data)							Excess Crash Cost		
North/South Street	East/West Street	Major Street Volume	Minor Street Volume	Total AADT	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 Expected Crash Value ($)
College Av	Horsetooth Rd	42874	23531	66405	37.599	8.567	54.045	14.655	10.357	6.088	$1,050,393
College Av	Trilby Rd	34218	13553	47771	23.187	5.554	30.245	8.687	3.925	3.133	$525,663
Mason St	Harmony Rd	33717	7680	41397	17.289	4.253	33.068	6.656	13.377	2.402	$512,943
Lemay	Harmony Rd	48940	15750	64690	32.263	7.365	41.215	9.940	6.376	2.576	$465,537
Lemay	Drake Rd	28198	24983	53181	27.062	6.422	30.669	9.350	0.679	2.928	$459,568
Timberline R	Carpenter	18285	11215	29500	11.825	2.901	18.582	5.443	4.214	2.543	$437,511
Boardwalk Dr	Harmony Rd	47830	11350	59180	25.350	5.721	36.265	7.822	8.814	2.100	$417,952
Shields St	Mulberry St	19374	17980	37354	15.940	3.842	20.895	5.982	2.815	2.140	$360,534
Shields St	Prospect Rd	28850	21407	50257	25.544	6.095	32.036	8.098	4.488	2.003	$357,060
College Av	Drake Rd	45364	28220	73584	43.719	9.696	46.649	11.745	0.881	2.049	$325,976
Ziegler	Horsetooth	21185	6091	27276	4.934	0.938	16.180	1.180	11.004	0.242	$309,428
College Av	Laurel	35556	8242	43798	17.351	4.478	26.045	5.888	7.284	1.411	$295,132
College Av	Monroe	44097	4858	48955	14.597	3.742	25.199	4.841	9.503	1.099	$270,500
Lemay	Vine	14372	7524	21896	7.328	1.794	16.296	2.796	7.966	1.002	$239,241
Timberline R	Kechter	20332	4483	24815	8.398	2.155	14.008	3.244	4.522	1.089	$216,164
Remington	Mulberry St	24667	4156	28823	9.813	2.531	12.889	3.697	1.910	1.166	$200,344
College Av	Troutman	38392	6832	45224	16.322	4.202	21.631	5.188	4.323	0.986	$198,175
College Av	Vine	30748	6443	37191	9.788	2.297	10.907	3.556	-0.140	1.259	$193,035
Taft Hill Rd	Drake Rd	23530	17341	40871	19.118	4.635	29.045	5.207	9.354	0.572	$187,592
College	Smokey	37262	500	37762	2.027	0.449	3.902	1.566	0.758	1.117	$180,624
Mcmurry	Harmony Rd	52499	4452	56951	15.636	3.881	18.406	4.855	1.796	0.974	$169,549
Shields St	Drake Rd	32008	24438	56446	29.637	6.971	34.893	7.749	4.477	0.778	$167,737
Shields	Vine	8727	5281	14008	0.898	0.201	4.025	0.475	2.853	0.274	$157,398
Snow Mesa	Harmony Rd	51074	6262	57336	18.900	4.595	17.934	5.687	-2.058	1.092	$146,915
College Av	Harmony Rd	38799	36479	75278	41.157	9.261	49.497	9.590	8.011	0.329	$135,774
Linden	Vine	6418	2872	9290	1.546	0.536	4.877	1.206	2.661	0.670	$131,709
College Av	Swallow	43122	8854	51976	20.752	5.099	23.080	5.827	1.601	0.727	$129,330
Taft Hill Rd	Mulberry St	17141	10305	27446	10.543	2.585	13.341	3.275	2.108	0.690	$128,915
Lemay	Magnolia	19754	4215	23969	5.556	1.348	7.688	2.084	1.396	0.736	$128,516
9th (Lemay)	Buckingham	15165	1786	16951	2.620	0.694	3.415	1.420	0.068	0.727	$113,017
Raintree	Drake	22433	2006	24439	3.426	0.986	4.359	1.677	0.243	0.690	$109,250
Taft Hill Rd	Prospect Rd	23157	12949	36106	16.272	3.995	18.061	4.579	1.205	0.583	$102,885
College Av	Foothills	45886	2664	48550	10.390	2.768	15.451	3.055	4.773	0.287	$95,008
Lemay	Carpenter	14995	7521	22516	7.198	1.536	7.892	2.454	-0.224	0.918	$139,420
Mason	Mulberry	26295	3978	30273	10.185	2.628	14.056	2.986	3.514	0.358	$92,577
Mcclelland	Horsetooth	28645	2369	31014	5.390	1.320	8.237	1.726	2.441	0.406	$88,660
Overland	Elizabeth	11137	2275	13412	0.799	0.139	3.306	0.568	2.077	0.429	$88,369
Stover (East I	Prospect	25645	1720	27365	2.115	0.483	6.797	0.748	4.418	0.264	$87,682
College	Mason/Palmer	40314	4466	44780	7.372	1.840	7.916	2.403	-0.018	0.563	$86,788
Mcclelland	Drake	29357	3103	32460	6.357	1.538	9.291	1.920	2.553	0.381	$85,950
Mathews	Mulberry	27088	1000	28088	2.935	0.812	5.388	1.227	2.039	0.415	$85,662
Shields St	Harmony Rd	23093	18571	41664	19.423	4.694	21.412	5.132	1.551	0.438	$84,092
Automation W	Horsetooth	26018	2421	28439	2.362	0.530	2.895	1.038	0.025	0.508	$78,724
Overland	Drake	10983	5747	16730	2.542	0.758	9.065	0.786	6.495	0.028	$73,244
College	Oak	21138	350	21488	1.093	0.247	3.831	0.539	2.446	0.292	$71,027
Timberline R	Custer	30579	1225	31804	6.434	1.733	8.045	2.082	1.262	0.349	$67,342
College Av	Bockman	42930	1979	44909	8.267	2.288	9.328	2.674	0.676	0.386	$66,759
Shields	Bennett	29769	1140	30909	2.124	0.474	1.749	0.936	-0.837	0.462	$62,508
Giddings	Richards Lake	3608	853	4461	0.392	0.123	1.014	0.508	0.237	0.385	$62,050
Mason St	Horsetooth Rd	26632	5739	32371	12.367	3.139	14.560	3.394	1.937	0.256	$60,029

AADT = Annualized Average Daily Traffic
FI = Fatal / Injury Crashes
PDO = Property Damage Only Crashes

XXX *= top 10 intersections*
XXX = next 15 intersections

Intersection Location Map with Most Excess Crash Costs (2016 – 2018)

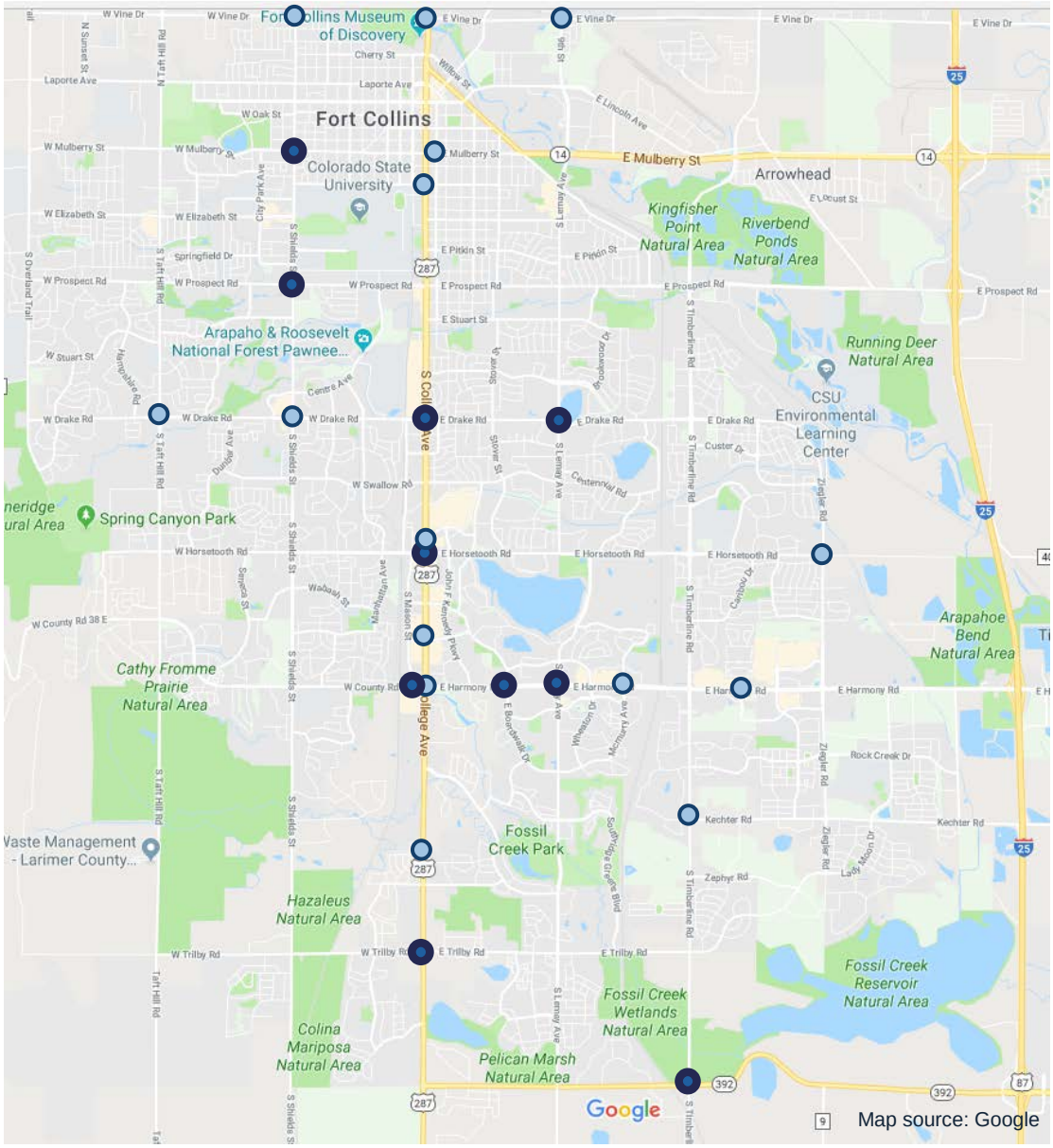


Figure 49

Map of intersections with most excess crash costs (2016-2018)

- *Top 10 Intersections with most excess crash costs*
- *Next 15 Intersections with most excess crash costs*

Maps, Trends and Patterns

In addition to identifying intersections with higher than expected crash numbers and severity, a review of maps, trends and patterns is helpful.

GIS Based Data

Crash information is geo-coded and can be evaluated through mapping efforts. This allows for a visual depiction of crash numbers at specific locations or along corridors. Maps can be created for specific crash types such as bicycle or pedestrian crashes.

Care should be taken to understand that 'hot spots' on the maps are simple number based, and neither correlated to volumes, nor necessarily indicative of statistically based higher than expected crash locations. The maps may be best used to target enforcement areas.

The heat maps of overall crashes as well as a few of the most prevalent severe crash types (bicycle, right angle, approach turn, and pedestrian) are posted to the City's Traffic Operations safety page at fcgov.com/traffic. Other maps can be created on request.

Example of Map. Visit fcgov.com/traffic for maps

Changes in Excess Crash Costs

Intersection screening in the City has been done since 2009. Reviewing the trends of excess crash costs can identify changing conditions and safety at specific locations. The tables below indicate the intersections with significant changes in excess crash costs, both positively and negatively. The comparison was made using the last six years of data (2013-2018). Excess crash cost for three years of data (2013-2015) and again (2016-2018) were compared.

Table 7

Intersections with largest decreasing crash costs (i.e. less crashes) 2013/2015 and 2016/2018

Intersections with improving safety trends

Intersection		2013 - 2015 Excess Crashes & Cost			2016 - 2018 Excess Crashes & Cost			Changes in Excess Crashes & Cost		
North/South Street	East/West Street	PDO / year	FI / year	Excess Expected Crash Value ($)	PDO / year	FI / year	Excess Expected Crash Value ($)	PDO	FI	Excess Crash Cost
Lemay	Prospect Rd	2.15	0.52	$79,030	-4.59	-3.10	-$527,305	-6.74	-3.61	**-$606,334**
Timberline Rd	Drake Rd	-6.42	1.79	$135,098	-2.72	-1.18	-$210,843	3.70	-2.96	**-$345,941**
College Av	Prospect Rd	3.03	-0.13	$15,454	-1.66	-1.73	-$285,179	-4.69	-1.60	**-$300,633**
Lemay	Riverside	2.50	1.28	$167,750	-0.38	-0.83	-$131,498	-2.88	-2.10	**-$299,248**
College Av	Maple/Jefferson	2.44	-0.45	-$26,330	-2.85	-1.89	-$321,798	-5.29	-1.43	**-$295,469**
Timberline Rd	Harmony Rd	-9.76	-0.66	-$171,331	-8.81	-2.39	-$462,505	0.95	-1.73	**-$291,174**
JFK	Harmony Rd	3.40	0.45	$84,014	-2.71	-1.11	-$199,724	-6.11	-1.55	**-$283,738**
Riverside Av	Prospect Rd	2.19	0.21	$45,700	0.45	-1.22	-$184,334	-1.74	-1.44	**-$230,034**
Lemay	Horsetooth (West)	0.66	2.09	$239,779	2.23	0.13	$44,493	1.58	-1.95	**-$195,286**
Timberline Rd	Horsetooth Rd	2.84	0.04	$32,483	-3.76	-0.79	-$161,157	-6.60	-0.82	**-$193,639**
Timberline	Lincoln	4.03	0.46	$91,534	-1.31	-0.51	-$93,377	-5.33	-0.97	**-$184,911**
Timberline Rd	Timberwood	-5.35	-0.34	-$91,316	-4.52	-1.47	-$275,638	0.82	-1.13	**-$184,322**
Corbett	Harmony Rd	4.00	-0.40	-$4,759	-1.45	-0.97	-$164,536	-5.46	-0.56	**-$159,777**
College	Triangle	0.26	0.93	$105,916	-1.19	-0.26	-$53,186	-1.45	-1.19	**-$159,102**
College Av	Fossil Creek	1.91	0.22	$44,133	-2.60	-0.54	-$111,493	-4.52	-0.77	**-$155,626**

FI = Fatal / Injury Crashes
PDO = Property Damage Only Crashes

Intersections with increasing crash trends

Intersection		2013 - 2015 Excess Crashes & Cost			2016 - 2018 Excess Crashes & Cost			Changes in Excess Crashes & Cost		
North/South Street	East/West Street	PDO / year	FI / year	Excess Expected Crash Value ($)	PDO / year	FI / year	Excess Expected Crash Value ($)	PDO	FI	Excess Crash Cost
College Av	Horsetooth Rd	3.770	3.490	$427,169	10.357	6.088	$1,050,393	6.587	2.598	**$623,224**
Lemay	Drake Rd	-0.090	-1.401	-$157,228	0.679	2.928	$459,568	0.769	4.329	**$616,795**
Shields St	Mulberry St	1.486	-0.224	-$10,181	2.815	2.140	$360,534	1.328	2.365	**$370,714**
Taft Hill Rd	Drake Rd	6.171	-1.638	-$121,068	9.354	0.572	$187,592	3.183	2.210	**$308,659**
Mason St	Harmony Rd	11.769	0.809	$207,982	13.377	2.402	$512,943	1.608	1.593	**$304,961**
Shields St	Prospect Rd	-0.397	0.724	$76,841	4.488	2.003	$357,060	4.885	1.279	**$280,220**
Lemay	Harmony Rd	6.332	1.235	$201,193	6.376	2.576	$465,537	0.044	1.340	**$264,343**
College Av	Drake Rd	7.392	-0.025	$71,136	0.881	2.049	$325,976	-6.511	2.074	**$254,840**
McMurry	Harmony Rd	-0.569	-0.588	-$71,335	1.796	0.974	$169,549	2.365	1.562	**$240,885**
Boardwalk Dr	Harmony Rd	4.160	1.269	$183,207	8.814	2.100	$417,952	4.653	0.832	**$234,745**
Ziegler	Horsetooth	2.863	0.119	$77,309	11.004	0.242	$309,428	8.141	0.123	**$232,119**
Remington	Mulberry St	-0.988	-0.009	-$10,906	1.910	1.166	$200,344	2.897	1.175	**$211,250**
College Av	Laurel	5.844	0.310	$92,993	7.284	1.411	$295,132	1.440	1.101	**$202,139**
Taft Hill Rd	Prospect Rd	-2.254	-0.552	-$84,166	1.205	0.583	$102,885	3.459	1.135	**$187,051**
College	Smokey	-0.175	-0.009	-$2,733	0.758	1.117	$180,624	0.933	1.126	**$183,357**
College Av	Vine	0.134	0.165	$19,720	-0.140	1.259	$193,035	-0.274	1.094	**$173,314**
Welch	Prospect	-2.227	-1.183	-$154,316	0.000	0.120	$18,504	2.227	1.303	**$172,820**
Shields	Laurel	-4.307	-1.271	-$184,932	0.505	-0.136	-$15,624	4.813	1.135	**$169,308**
College Av	Harmony Rd	7.346	-0.928	-$30,095	8.011	0.329	$135,774	0.665	1.257	**$165,869**
Taft Hill Rd	Mulberry St	-1.748	-0.145	-$33,623	2.108	0.690	$128,915	3.857	0.834	**$162,538**
College	Mason/Palmer	0.317	-0.682	-$72,904	-0.018	0.563	$86,788	-0.335	1.245	**$159,692**

FI = Fatal / Injury Crashes
PDO = Property Damage Only Crashes

Table 8

Intersections with largest increasing crash costs (i.e. more crashes) 2013/2015 and 2016/2018

Note that in locations with few crashes, a single severe crash (especially a fatality) can create a pronounced swing in excess crash costs. Therefore, each location should be reviewed in more detail to determine contributing factors to either improved safety or concern and whether a specific mitigation or trend is present that could explain the change.

Interesting finds include that intersections rebuilt with capital projects tend to see a safety improvement (College / Prospect, and Timberline/Horsetooth). The next large capital project is slated for College / Trilby.

Recognizing Patterns in Crash Types

The table below identifies intersections where a pattern of crash types are identifiable and the total number of this type of crash in three years (2016-2018). Only intersections with at least three crashes in three years (average 1/yr) are included. The analysis is a statistical analysis developed by the Colorado Department of Transportation. Some intersections may be listed in more than one category. For instance, Remington and Prospect is listed under both Bicycle crashes and Red Light Running crashes, the causes of which may be related. This more detailed information about patterns of crashes can aid in pin-pointing mitigation measures.

Table 9

Intersections with higher than expected particular crash types (and total number of that type of crash in three years) (2016-2018)

Approach Turn		
College	Troutman	28
College	Trilby	27
Shields	Horsetooth	23
Snow Mesa	Harmony	18
College	Mason / Palmer	15
Ziegler	Council Tree	10
Lemay	Carpenter	10
Lemay	Magnolia	10
College	Plum	6
Shields	Bennett	4
Riverside	Magnolia	4
Cook	Mulberry	4
Right Angle		
Meldrum	LaPorte	13
Mathews	Mulberry	13
College	Kensington	13
Mason	Magnolia	12
Linden	Vine	12
Stanford	Horsetooth	12
Shields	Vine	9
JFK	Horsetooth	9
Overland	Elizabeth	8
Peterson	Mulberry	8
Larkbunting	Harmony	7
Giddings	Richards Lake	7
JFK	Boardwalk	7
Taft Hill	Valley Forge	7
Remington	Prospect	7
Lochwood	Horsetooth	4
Remington	Elizabeth	6
Lady Moon	Kechter	4
Bicycle		
City Park	Elizabeth	6
Remington	Laurel	5
Remington	Prospect	5
Timberline	Custer	5
Shields	Pitkin	4
Raintree	Drake	4
Impala/Pond.	Mulberry	3
Shields	University	3
Rear End		
College	Harmony	115
Lemay	Harmony	100
Timberline	Harmony	90
Boardwalk	Harmony	84
Timberline	Prospect	84
College	Monroe	69
College	Laurel	67
Riverside	Mulberry	56
McMurry	Harmony	45
Timberline	Kechter	41
Shields	Trilby	33
Lady Moon	Harmony	31
College	Fossil Creek	17
Tulane	Drake	14
Taft Hill	Lake	13
College	Oak	12
Sherwood	Laurel	9
Pedestrian		
Remington	Mulberry	4
Howes	Laurel	3
Single Vehicle		
Timberline	Harmony	13
Timberline	Custer	7
Shields	Davidson	5
Remington	Laurel	4
Shields	Vine	4
Snow and Ice		
Taft Hill	Drake	14
Tradition	Horsetooth	3
Red Light Running		
College	Kensington	13
College	Cherry	12
Remington	Prospect	9
Stanford	Horsetooth	9
Taft Hill	Valley Forge	7
JFK	Boardwalk	7
Lemay	Oakridge	6
Whedbee	Mulberry	5
Lady Moon	Kechter	4

Note that just because an intersection is listed above doesn't automatically indicate a concern. Some of these locations may have low crash volumes, and a few crashes could create a 'trend'. Each location should be evaluated further for determination of safety concerns.

Section 5
Improving Roadway Safety

Successful improvement of roadway safety requires collaborative efforts from the City, the community, and individuals. It involves road users, vehicles, infrastructure, technology and emergency response. Roadway safety is complex, and both big and small initiatives are important.

The data in this report is used to inform the **Vision Zero Action Plan** – a companion document to this report that outlines the elements and actionable strategies to reduce the number and severity of crashes. The document (which is in the process of being finalized in 2019) acknowledges the complexity related to safety: some of the elements are policy related; some strategies are site specific and/or are identified to mitigate particular trends; and others (especially education-related efforts) are applicable across the City and address more behavioral issues.

Elements of the Vision Zero Action Plan

Incorporating safety into all City efforts

Roadway safety involves multiple City department and requires collaborative partnerships. A focus on safety is needed throughout transportation planning, adopted plans, project design, construction, operations, maintenance, enforcement incident management and more.

Robust annual review, evaluation, and understanding of safety data

This Roadway Safety Report is the compilation of safety data. The Vision Zero Action Plan is built using the safety data as a foundation. While there are numerous important transportation projects and efforts underway, only the ones that 'move the needle' on actual crash numbers and/or severity are reflected in the Vision Zero plan.

Apply all the elements of safety toolbox

Application of all elements in the 'safety toolbox' reflects a holistic systems approach to roadway safety that focuses on those projects that have an acutal impact on the number and/or severity of crashes. The toolbox incorporates the five "Es" of safety: Engineering, Education/Encouragement, Enforcement, and Evaluation.

Engineering

Engineering improvements can include low cost improvements such as the installation of flashing yellow arrows, or leading pedestrian intervals (LPIs) at intersections. Engineering improvements also include significant efforts such as capital projects.

A couple recent examples of impovements and their safety benefits are listed below:

College / Prospect – capital project:

College and Prospect was rebuilt as a joint City / CSU capital project with added lanes, right turn islands, and a new signal system. Both delay and crashes have decreased for improved operations and safety.

College / Prospect
Before: 47 crashes / year
After: 34 crashes / year

Result**:** **27% reduction in crashes**

Snow Mesa / Harmony – low cost signal change

Snow Mesa and Harmony had a crash pattern indicating a concern with approach turn (i.e. left turning) crashes. Signal changes were made to add protected left turns (red arrows).

This type of improvement can be very beneficial in addressing left turn crashes, but may contribute to added delay / congestion and can result in increased rear-end crashes. A site specific evaluation is important before implementing.

Snow Mesa / Harmony
Before: 21 crashes / year
5.7 left turn crashes / yr
After: 11 crashes / year
1 left turn crash / yr

Result**:** **47% reduction in crashes**
82% reduction in left turn crashes

<u>Education / Encouragement</u>

Education is an important component to a safer transportation system. This includes a broad range of efforts from staff in several departments, and the data in this report is used to inform specific education campaigns.

Recent efforts include the Bicycle and Pedestrian Safety Town, the bicycle friendly driver program, and tours and presentations to interested groups about safety.

<u>Enforcement</u>

Police Services is the lead entity for enforcement, and utilizes crash data to identify specific types or locations of crashes to target for enhanced presence and/or enforcement.

Other enforcement related efforts include:

- DUI campaigns and sobriety checkpoints are an important element.
- In the fall when school starts, a Bike Safety Week provides targeted education and enforcement by both Police Officers and Bicycle Ambassadors.
- Police Services partnered with others to create a Bicycle Traffic Citation Course for individuals who have received citations related to cycling. This alternative sentencing option teaches cycling laws and offers tips for safe cycling.
- In the past two years, Fort Collins Police Services has begun Community Impact Days to focus on traffic enforcement and reduce dangerous driving behaviors. Police Services works with Traffic Operations to identify locations for targeted enforcement based on crash data.

<u>Evaluation</u>

Finally, a key for the roadway safety program is to continue ongoing monitoring of the overall transportation system, trends, patterns as well as specific locations. Efforts to ensure data quality and completeness, robust analysis, and systematic use of the information in all aspects of roadway safety strategies will continue. The result of evaluation helps to determine the effect of the various safety projects, and identify the types of projects that are most beneficial.

Annual focus areas

There are numerous avenues that can be pursued for Visoin Zero, and the various strategies listed in the Action Plan reflect the breadth of options. Incorporating an annual 'focus area' provides an opportunity to delve deeper into the causes and potential mitigation for certain types of crashes.

Collaborate on best practices

Vision Zero as a concept has gained significant traction in the public consciousness, and across the nation hunderds of Vizion Zero Action Plans are being developed. The City can learn from others, as well as share what we experience in these efforts It is especially important to differentiate efforts that 'move the needle' on crashes from other important transportation improvements that may be focused on perceived safety/comfort, accessibility, or advocacy for a particular mode.

Tracking Improvements and Overall Roadway Safety

The Vision Zero Action Plan anticaptes an annual 'report card' on the efforts. This includes a compilation of the number and severity of crashes as well as detailed review of specific projects and/or initiatives and their impact on safety.

Section 6
Next Steps

Safety must be the city's top priority. Improving the safety of all roadway users requires everyone – the City, community and individuals – to share the effort and responsibility of improving and ultimately ensuring safety. The analysis in this report as well as the extensive data that supports the review is a critical step in the complex and multi-faceted challenge of roadway safety.

Implementing Strategies Identified in the Vision Zero Action Plan

The City's Vision Zero Action Plan idenfies 21 strategies to reduce the number and severity of crashes. Finalization of the plan and implementation of these strategies in a consistent and determined manner is a focus of the coming year.

Looking Towards the Future

In coming years, there are number of potential initiatives that can dramatically impact roadway safety.

Near-term changes include Collision Avoidance Systems that are becoming more standard on new vehicles. With almost half of all crashes being rear-end crashes, this has the potential of profound improvements.

In the longer term, connected and autonomous vehicles have the potential to increase capacity and improve safety on the roadway system.

Within the analysis realm, the use of big data including video analytics of near crash events could be one way to pro-actively detect systematic safety concerns before crash patterns in crash reports identify the issue.

All these initiatives and others that are not yet even identified can support the goal of Moving Towards Vision Zero.

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