Section 3

REVIEW OF MOST FREQUENT SEVERE CRASH TYPES

As noted earlier, crashes are categorized into a variety of types. Definitions and explanations of those types are included in the introduction. This section provides a more detailed review of the most prevalent crash types that result in severe crashes (those that are categorized as involving non-incapacitating injury, incapacitating injury, or fatal crashes).

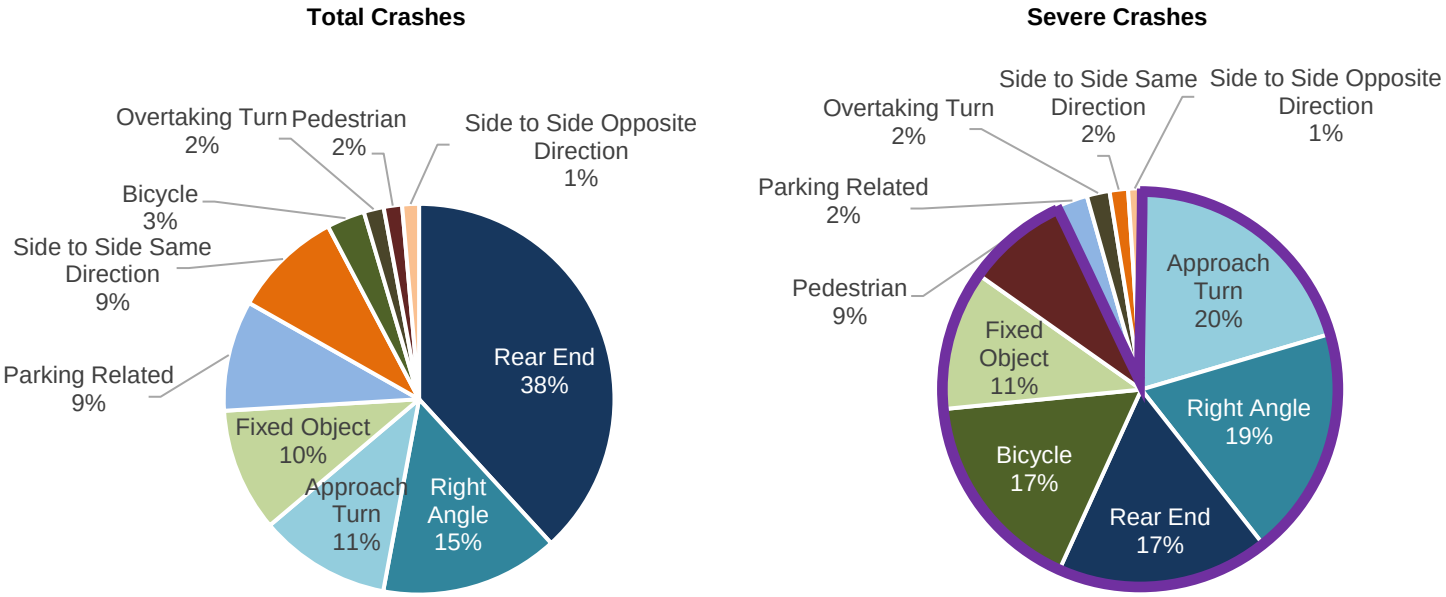


Figure 30. Crash Types by Total Crashes and Severe Crashes

Figure 30 indicates the type of crashes that occur, both when evaluated among all crashes, and then only among severe crashes. There are six types of crashes that are responsible for 88% of all severe crashes (outlined in purple color in Figure 30. While rear end crashes see large numbers in both overall crashes and severe crashes, bicycle crashes and pedestrian crashes become a larger component of the severe crash picture and join approach turns, right angle and fixed object crashes as the most prevalent.

While all traffic crashes are of concern, those that occur most often with the more serious consequences are of special interest. (Note that motorcycle crashes are not separated as a type of crash type in this analysis and are discussed in Section 2.)

Table 4 provides a numerical summary of the six crash types that result in the highest number of severe crashes each year. These are the types of crashes that may have greater prospects for safety improvements and should be a key focus in the roadway safety program. Each one of these crash types is reviewed in more detail in subsequent pages.

6 crash types are responsible for **88%** of severe crashes:

Approach Turn
Right Angle
Rear End
Bicycle
Fixed Object
Pedestrian

Type of Crash	Avg. Number of Crashes / Year	Percent of Crashes that are Severe	Avg. Number of Severe Crashes / Year
Approach Turn	326	17.8%	**58**
Right Angle	442	12.2%	**54**
Rear End	1144	4.3%	**49**
Bicycle	94	50.0%	**47**
Fixed Object	306	10.5%	**32**
Pedestrian	45	52.9%	**24**

Table 4. Summary of Crash Types Involved in the Highest Number of Severe Crashes (Using 5 Years of Data: 2018-2022)

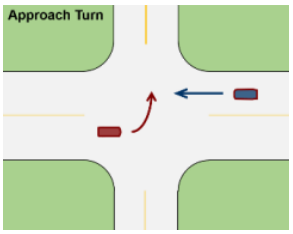
APPROACH TURN CRASHES

Approach turn crashes involve two vehicles traveling in opposite directions, and one turns left (or attempts a U-turn) in front of the oncoming vehicle and is struck. There are two main causes of approach turn crashes:

Approach Turn Crashes

326 crashes each year

17.8% are severe



Poor estimation of distance / speed of approaching through traffic: These crashes occur at both signalized and unsignalized intersections. Poor visibility – often the result of offset left turn lanes – also contributes to these crashes.

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 the green ball or flashing yellow arrow 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 and turn in front of oncoming traffic.

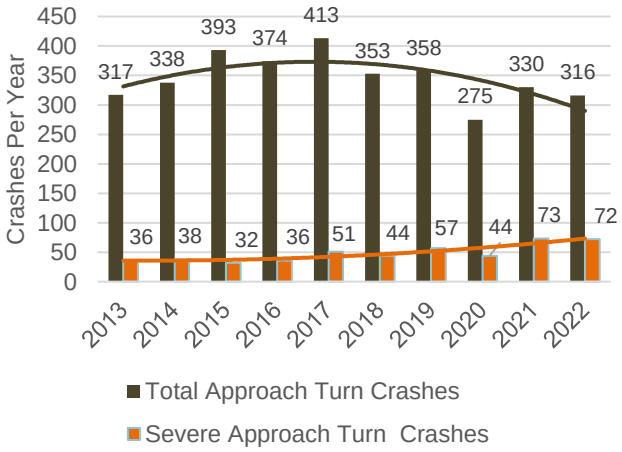


Figure 31. Historic Trend of Approach Turn Crashes

Figure 31 shows the 10-year historic trend of approach turn crashes in Fort Collins. The total number of crashes is generally decreasing (by 23% since a high in 2017), however the number of severe approach turn crashes is up 41% in the last five years.

Severe approach turn crashes up

41%

In the past five years

90%

at intersections

96%

on arterials

A review of the last three years of data shows that 90% of approach turn crashes occur at intersections, and 96% occur on arterial streets. With the highest number of severe crashes in the city in this category, a priority for safety focus should be targeted countermeasures for this type of crash as discussed later in this report.

Table 5 lists the locations with the greatest number of approach turn crashes in the last three years (2020-2022). Note that this list is sorted by the number of crashes and therefore locations with higher traffic volumes will also tend to have higher numbers of crashes. The pattern

recognition section in this report identifies locations of higher-than-expected approach turn crashes based on a statistical evaluation. A combination of the two lists should be used to determine locations for further review.

Facility ID	North - South Street	East - West Street	Number of Approach Turn Crashes in 3 years
119	Shields St	Prospect Rd	20
35	College Ave	Troutman	19
10	College Ave	Drake Rd	18
59	Lemay Ave	Drake Rd	18
111	Shields St	Horsetooth Rd	18
25	College Ave	Mulberry St	15
108	Shields St	Drake Rd	15
144	Timberline Rd	Drake Rd	15
69	Lemay Ave	Riverside Ave	14
68	Lemay Ave	Prospect Rd	13
110	Shields St	Harmony Rd	12
7290	College Ave	Mason/Palmer	12

Notes

Table is sorted by the number of approach turn (AT) crashes

Locations included with at least 12 approach turn crashes in three years

Additional locations may be identified through statistical anlaysis

Table 5. Locations with Most Approach Turn (AT) Crashes

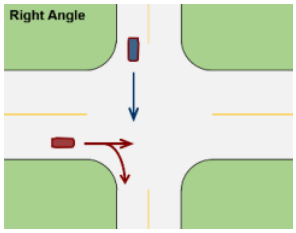
RIGHT ANGLE CRASHES

Right angle crashes occur at intersections when vehicles arrive on perpendicular roads and one fails to yield or passes a traffic control device and strikes the other. There are two main types of right angle crashes – one where approaching traffic has stopped and then proceeds inappropriately into the intersection, and one where entering traffic disregards a stop sign or signal.

Right Angle Crashes

442 crashes each year

12.2% are severe



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.

Passing a signal/STOP without stopping: Typical contributing factors to these crashes include inattention, visibility of signal heads or STOP signs, wide streets and/or "busy" areas where traffic control devices become less noticeable, and icy roads. This also tends to occur more often if the STOP sign or signal is not warranted and may be unexpected.

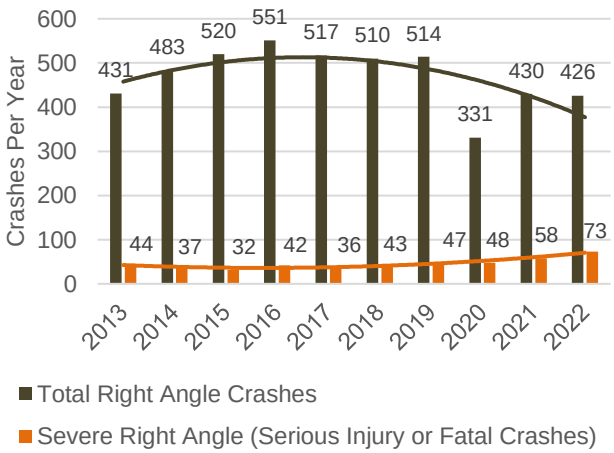


Figure 32. Historic Trend of Right Angle Crashes

Figure 32 shows the 10-year historic trend for right angle crashes in Fort Collins. There has been a significant reduction in right angle crashes since 2016 (down 23%). However, severe right angle crash numbers are steadily increasing - up 100% in five years. This trend should be a priority for safety focus.

Figure 33 shows that 58% of right angle crashes occur when someone stops but then proceeds into oncoming traffic. Most the remaining crashes (40%) are the result of a motorist running a red light or stop sign.

Table 6 lists the locations with the greatest number of right angle crashes in the three-year period. Note that this list is sorted purely by the number of crashes and therefore locations with higher volumes will also tend to have higher numbers of crashes. The pattern recognition section in this report identifies locations of higher-than-expected right angle crashes based on a statistical evaluation. A combination of the two lists should be used to determine locations for further review.

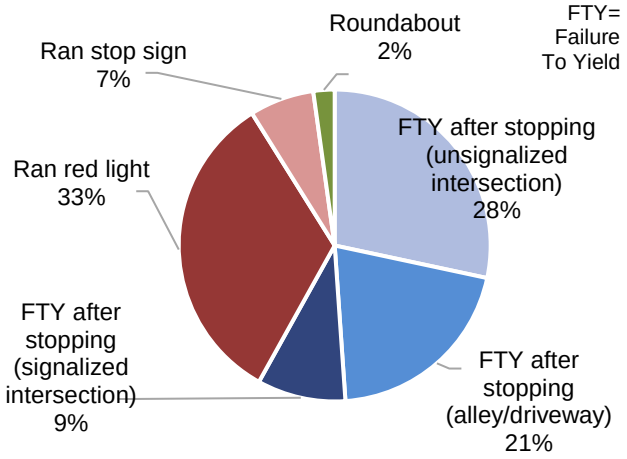


Figure 33. Right Angle Crashes by Type

Facility ID	North - South Street	East - West Street	Number of Right Angle Crashes in 3 years
18	College Ave	Kensington	14
25	College Ave	Mulberry St	13
80	Mason St	Harmony Rd	12
8	College Ave	Columbia	12

Table 6. Locations with Most Right Angle (RA) Crashes

Notes

Table is sorted by the number of right angle crashes

Locations included with at least 12 right angle crashes in three years

Additional locations may be identified through statistical anlaysis

REAR END CRASHES

Rear end crashes are the most prevalent crash type in Fort Collins, accounting for 38% of all crashes with an average of 1,144 crashes each year. Only 4.3% of rear end crashes are considered severe and involve a non-incapacitating injury, incapacitating injury, or fatality. However, because of the sheer number of these types of crashes, they are an important element to consider in safety reviews as their high quantity adds up in societal costs, community impact, congestion, etc. and whiplash injuries can be long term issues.

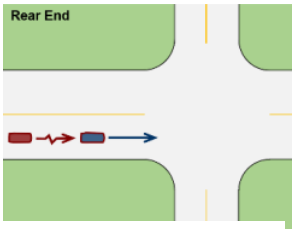
The majority (63%) of rear end crashes occur at signalized intersections. Eighteen percent (18%) of rear end crashes are mid-block crashes.

The 10-year historic trend for rear end crashes is shown in ***Figure 34***. The total number of rear end crashes is down 49% from a high in 2015. Severe rear end crash numbers have been steady, with an unusual jump in 2022.

Rear End Crashes

1,144 crashes each year

4.3% are severe



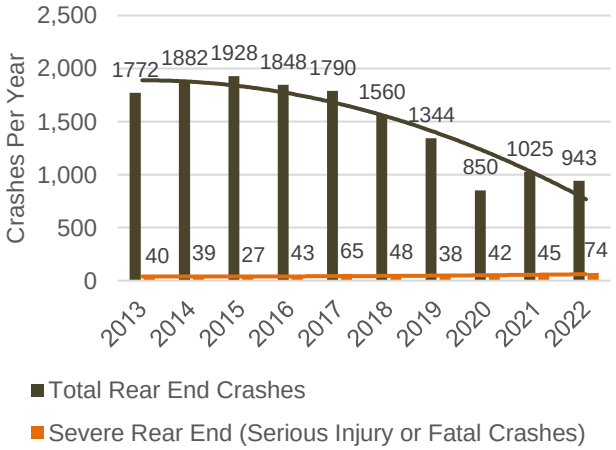


Figure 34. Historic Trend of Rear End Crashes

Table 7 lists the locations with the greatest number of rear end crashes in the three-year period. Note that this list is sorted purely by the number of crashes and therefore locations with higher volumes will also tend to have higher numbers of crashes. The pattern recognition section in this report identifies locations of higher-than-expected rear end crashes based on a statistical evaluation. A combination of the two lists should be used to determine locations for further review.

Facility ID	North - South Street	East - West Street	Number of Rear End Crashes in 3 years
145	Timberline Rd	Harmony Rd	68
14	College Ave	Harmony Rd	64
162	Lemay Ave	Harmony Rd	54
10	College Ave	Drake Rd	47
1	Boardwalk Dr	Harmony Rd	45
16	College Ave	Horsetooth Rd	41
149	Timberline Rd	Prospect Rd	39
119	Shields St	Prospect Rd	34
28	College Ave	Prospect Rd	32
68	Lemay Ave	Prospect Rd	32
66	Lemay Ave	Mulberry St	31
143	Timberline Rd	Carpenter Rd	31
25	College Ave	Mulberry St	30
157	Ziegler	Harmony Rd	30
34	College Ave	Trilby Rd	30
105	Riverside Ave	Mulberry St	30
55	JFK	Harmony Rd	30

Notes

Table is sorted by the number of rear end crashes

Locations included with at least 30 rear end crashes in three years

Additional locations may be identified through statistical anlaysis

Table 7. Locations with Most Rear End (RE) Crashes

Rear end crashes are typically the result of motorist inattention, and/or following too closely combined with unexpected stops in the traffic stream. 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, or the addition of protected only left turn signal phasing at existing traffic signals are countermeasures that may be used to reduce right angle of left turn crashes. However, they also tend to increase the potential for rear end crashes. Since right angle and approach turn crashes tend to be more severe, it may be reasonable to implement these countermeasures, but careful analysis and consideration regarding the impact on rear end crashes is critical to effective overall safety improvements.

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. This section analyzes reported bicycle crashes, which involve a bicycle and a motor vehicle.

Bicycle Crashes

94 crashes each year

50.0% are severe

Figure 35 shows the historic trend of bicycle crashes in Fort Collins during the past ten years. The general trend is decreasing numbers of bike crashes, with overall crashes down 33% since 2018. Severe crashes consistently account for between 50-60 crashes each year (discounting the pandemic year), with a 20% decrease in the last year.

Overall, bicycle crashes account for 3% of all crashes in Fort Collins. However, they account for 16% of severe crashes. This illustrates that bicycle crashes, when they do occur, tend to be more serious than other motor vehicle crashes. The comparison in severity is depicted in ***Figure 36***.

Bicycle crashes are down
33%
Since 2018

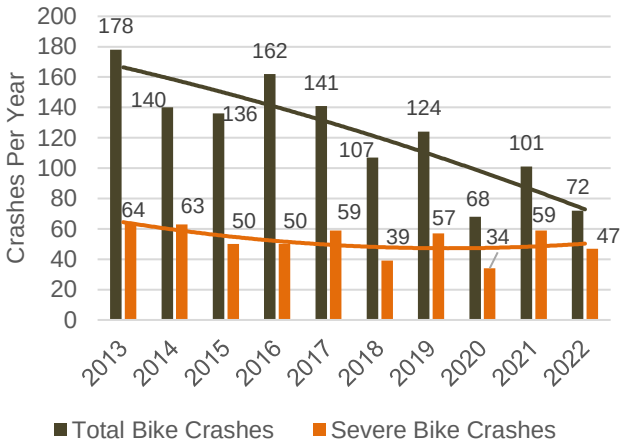


Figure 35. Historic Trend of Bicycle Crashes

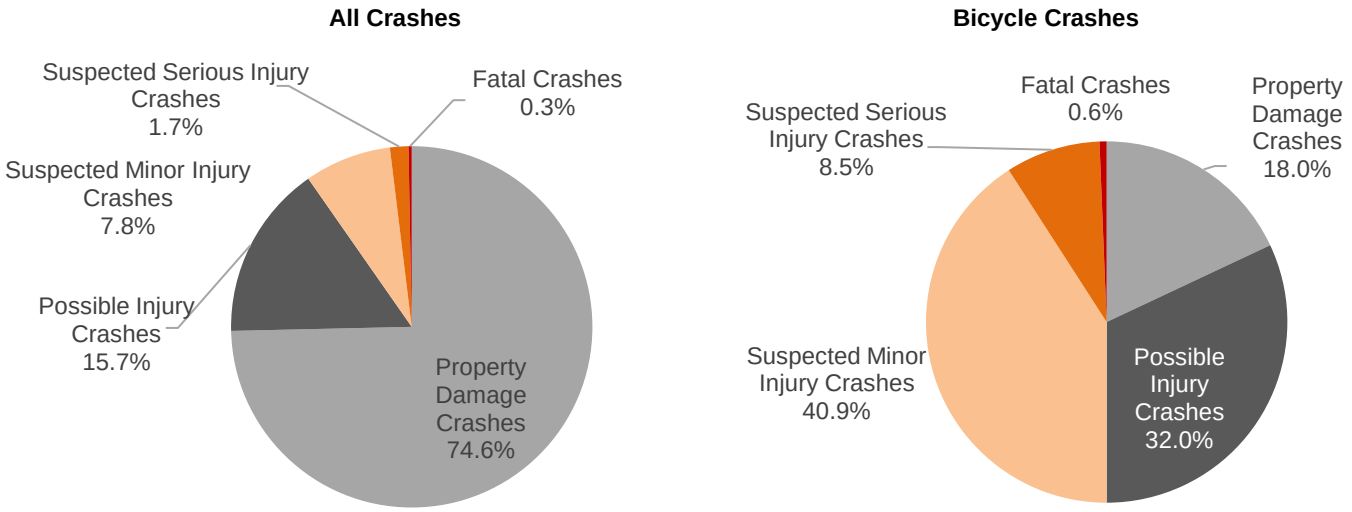


Figure 36. Severity Impact on Bicycle Crashes

The numbers related to severe bicycle crashes are shown in ***Figure 37***. Minor injury (or non-Incapacitating) crashes vary significantly from year to year, while serious injury (or incapacitating) crashes have generally been trending up, with a slight decrease in 2022.

Male cyclists are involved in 73% of all bicycle crashes.

Bicycle crashes can be further evaluated by location. See ***Figures 38 and 39***.

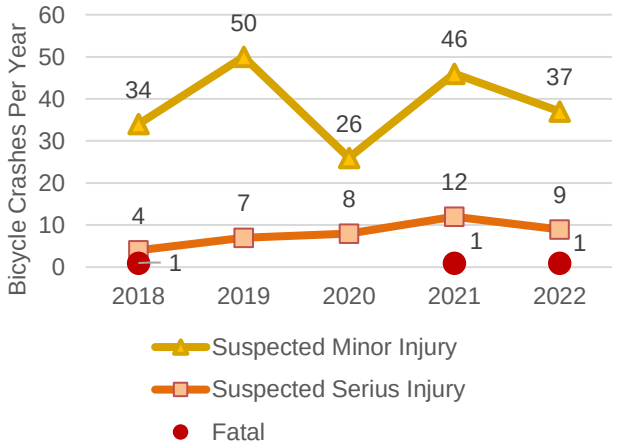


Figure 37. Numbers of Severe Bicycle Crashes

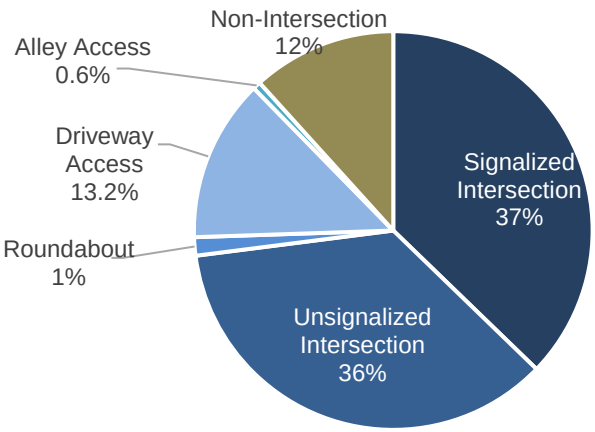


Figure 38. Bicycle Crashes by Location

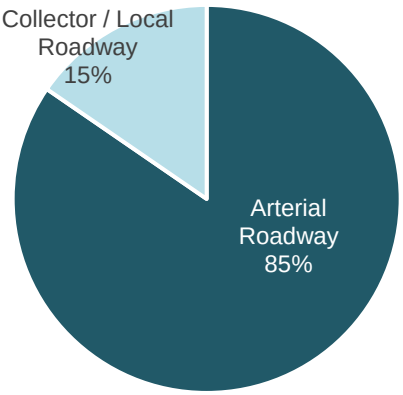


Figure 39. Bicycle Crashes by Road Classification (2020-2022)

The location of greatest risk for bicycle riders is not along various road segments (12% of bicycle crashes), but rather at locations where crossing traffic occurs such as driveways and intersections (88%). While corridor projects such as wider bicycle lanes and features to increase comfort such as buffers and protected bicycle lanes support bicycling mobility and increase perceived safety, an emphasis on intersection safety for bicyclists is critical to reducing the number and severity of bicycle crashes. For instance, implementation of access management to combine/eliminate driveways reduces the number of conflict points.

In addition, 85% of bicycle crashes occur on the arterial roadway system, so similar to the trend in overall crashes, the priority locations for bike safety improvements should be arterial intersections.

Figure 42 is the citywide heat map of bicycle crash locations in the last three years (2020-2022).

Bicycle Crashes

88%
at intersections, driveways, or alley access

85%
on arterials

Figure 40 shows the types of bicycle crashes that have occurred in Fort Collins in the past five years. Depictions of the three most frequent types of bicycle crashes are shown in ***Figure 41*** and represent 82% of all bicycle crashes. Right angle crashes are the most common type representing more than half of all bicycle crashes.

A significant contributing factor in bicycle crashes and especially right angle crashes involves the bicyclist riding against traffic (on sidewalk or in the street). In these instances, motorists often do not see the bicyclist as they may be looking to the left, and not to the right. Twenty-five percent (25%) of all bike crashes and 44% of right angle bike crashes involve bicyclists traveling against traffic. Education for both motorists to 'look right before turning right' and for bicyclists to not ride against traffic is critical to addressing this.

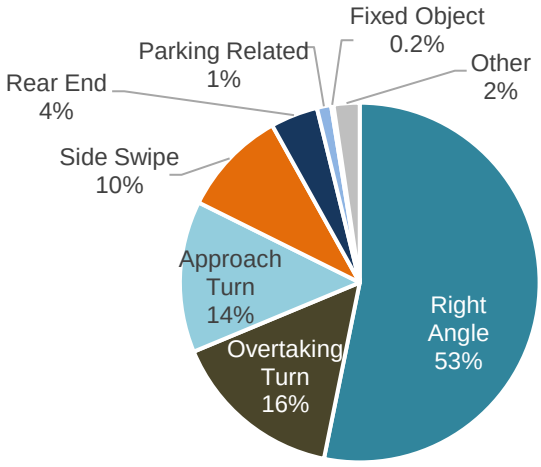


Figure 40. Types of Bicycle Crashes

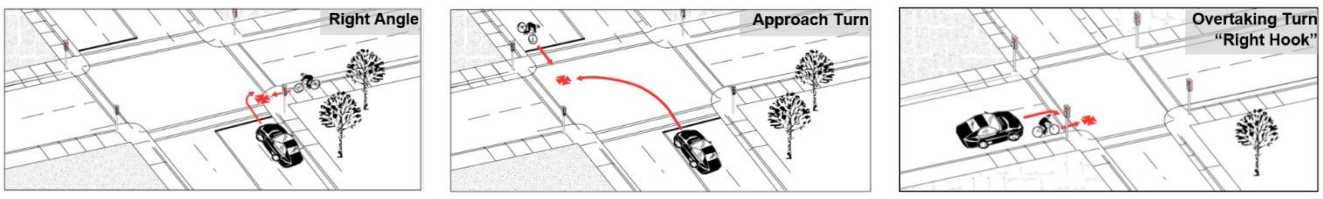


Figure 41. Visual Depiction of Types of Bicycle Crashes

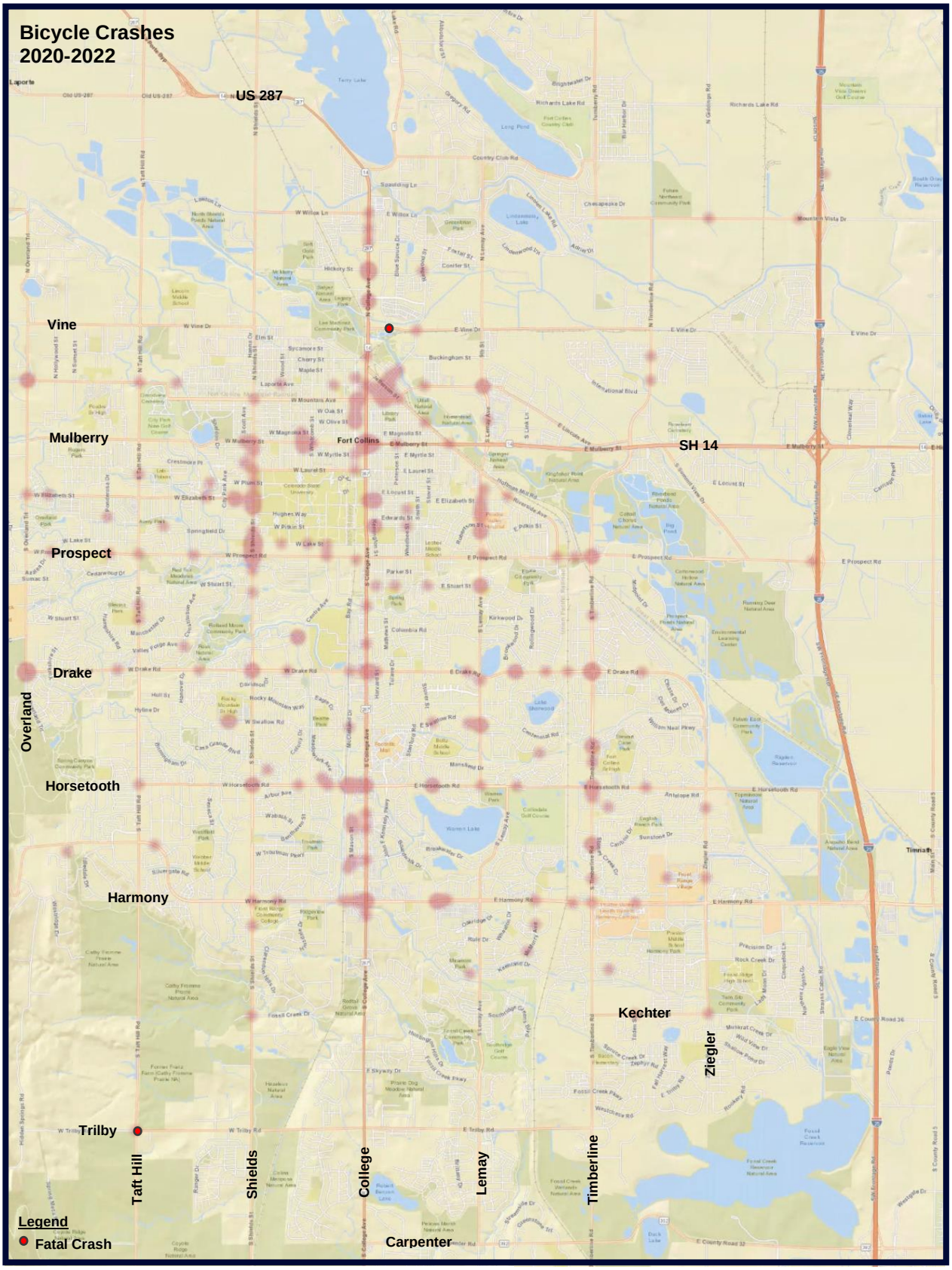


Figure 42. Bicycle Crash Heat Map (2020-2022)

Table 8 lists the location with the highest number of bicycle crashes in the past three years. Note that this list is sorted by the number of crashes and therefore locations with higher volumes (whether vehicle volumes or bicycle volumes) will also tend to have higher numbers of crashes. The pattern recognition section in this report identifies locations of higher-than-expected bicycle crashes based on a statistical evaluation. A combination of the two lists should be used to determine locations for further review.

25% of bicycle crashes involve bicyclists traveling against traffic

Facility ID	North - South Street	East - West Street	Number of Bicycle Crashes in 3 years
8562	Overland	Drake Rd	4
113	Shields St	Lake St	4
25	College Ave	Mulberry St	3
119	Shields St	Prospect Rd	3
144	Timberline Rd	Drake Rd	3
1	Boardwalk Dr	Harmony Rd	2
10	College Ave	Drake Rd	2
111	Shields St	Horsetooth Rd	2
108	Shields St	Drake Rd	2
14	College Ave	Harmony Rd	2
16	College Ave	Horsetooth Rd	2
149	Timberline Rd	Prospect Rd	2
146	Timberline Rd	Horsetooth Rd	2
64	Lemay Ave	Lincoln Ave	2
142	Timberline Rd	Caribou	2
71	Lemay Ave	Stuart	2
99	Remington Ave	Elizabeth St	2
102	Remington Ave	Pitkin	2
6664	McClelland	Horsetooth Rd	2
72	Lemay Ave	Swallow	2
9976	College Ave	Hickory	2
129	Stover	Horsetooth Rd	2
15995	Shields St	University	2

Table 8. Locations with Most Bicycle Crashes

Notes

Table is sorted by the number of bicycle crashes

Locations included with at least 2 bicycle crashes in three years

Additional locations may be identified through statistical anlaysis

FIXED OBJECT CRASHES

Fixed object crashes are predominantly single vehicle crashes (95%) 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, fence or utility pole. (Note crashes with parked cars are not included in fixed object crashes.) Eighty percent (80%) occur on the arterial road system.

Fixed Object Crashes

306 crashes each year

10.5% are severe

Figure 43 shows the historic trend for fixed object crashes. Like many other crash types, the general trend is a reduction in crashes since about 2015 (with the exception of 2019). Severe fixed object crash numbers saw a large increase in 2022.

Fixed object crashes are the crash type that occurs least frequently at intersections. One half (50%) of fixed object crashes are identified as non-intersection crashes.

Minor fixed object crashes often occur in inclement weather (31%). The other main contributor to these types of crashes, especially the higher speed crashes resulting in greater severity, is alcohol. 16% of all fixed object crashes involve alcohol. For severe crashes the percentage related to alcohol goes up to 35%.

Fixed object crashes

16% involve alcohol

35% of severe fixed object crashes involve alcohol

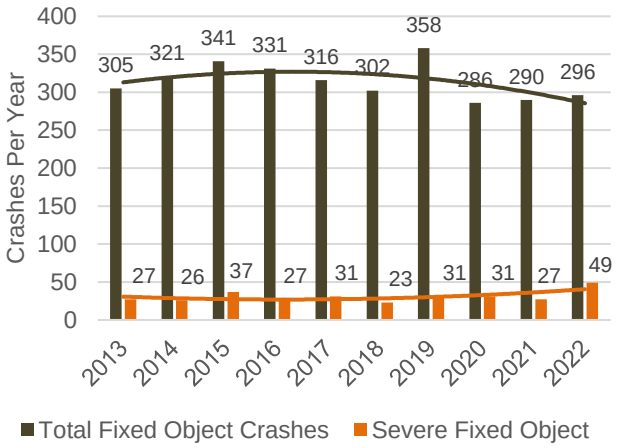


Figure 43. Historic Trends of Fixed Object Crashes

PEDESTRIAN CRASHES

Pedestrian crashes account for only 1.5% of all crashes; however, represent 8.4% of severe crashes. When pedestrian crashes occur, more than half (53%) will involve a documented injury or fatality. There have been eight (8) fatal pedestrian crashes in the last three years.

Pedestrian Crashes

45 crashes each year

52.9% are severe

Figure 44 shows the historic trends of pedestrian crashes in the last ten years in Fort Collins. The variability in pedestrian crash numbers from year to year is quite high partially due to the relatively small numbers, so care should be taken in looking for patterns or trends. Pedestrian crash numbers are quite steady, lower than the highest crash numbers experienced in 2015, but severe crashes have increased in the past five years.

Figure 45 shows the breakdown of severe pedestrian crashes by year for the past five years.

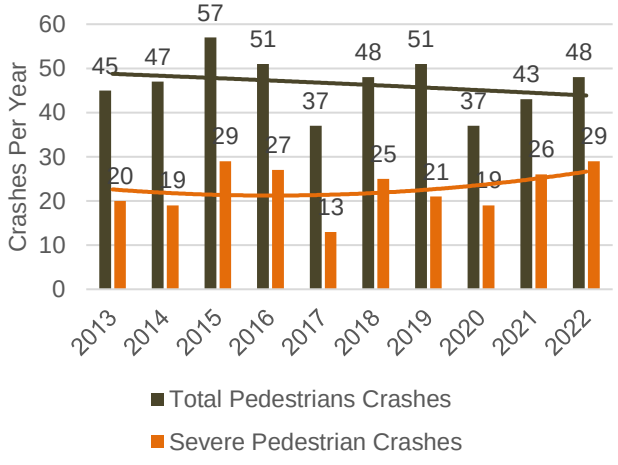


Figure 44. Historical Trends of Pedestrian Crashes

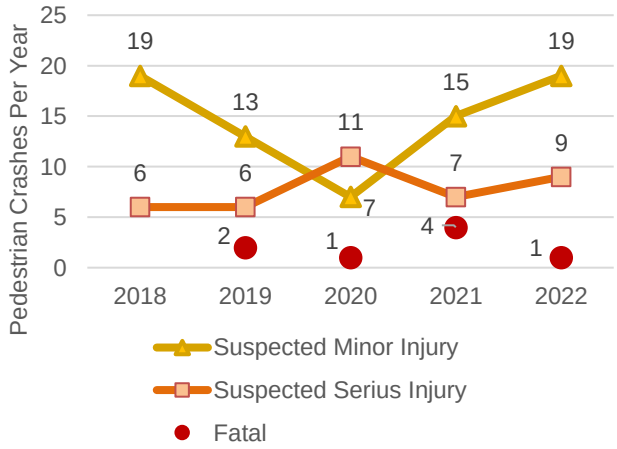


Figure 45. Numbers of Severe Pedestrian Crashes

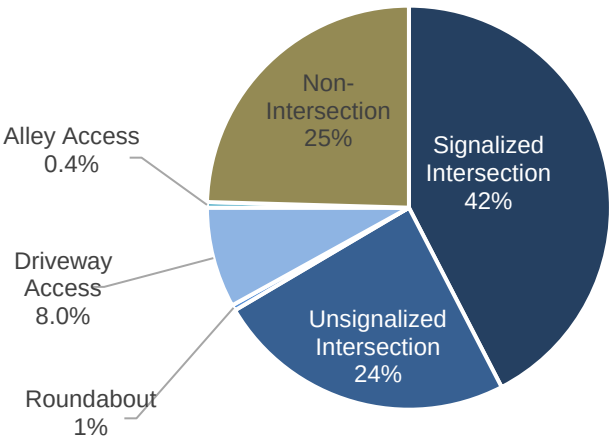


Figure 46. Pedestrian Crashes by Location

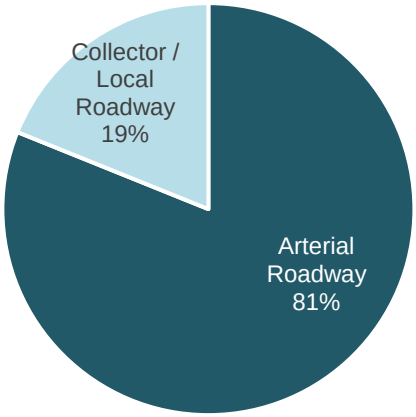
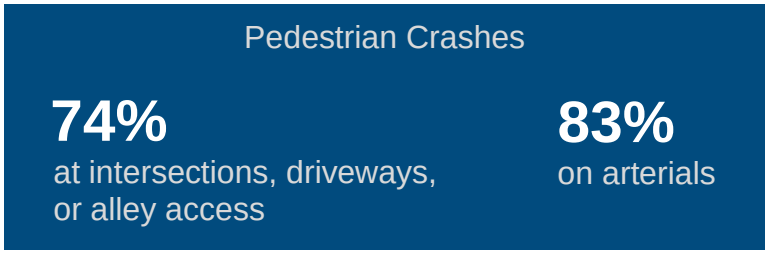


Figure 47. Pedestrian Crashes by Road Classification (2020-2022)

Categorizing locations of pedestrian crashes helps to understand locations of greatest interest in terms of pedestrian safety. ***Figures 46 and 47*** indicate where pedestrian crashes are occurring. Most pedestrian crashes occur at arterial intersections. As these major intersections are reviewed for operational and safety improvements, pedestrian safety is a critical component to consider.



When pedestrian crashes are categorized by gender of the pedestrian that was struck, males are disproportionately represented when compared to the overall population. Males are involved in 66% of pedestrian crashes.

Crashes are categorized into a variety of types, and their prevalence in pedestrian crashes are shown in ***Figure 48***. 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 motorist who is too close to avoid a collision.

Pedestrian Crosses Against Signal

Crashes at signalized intersections involving a pedestrian crossing against the signal indication.

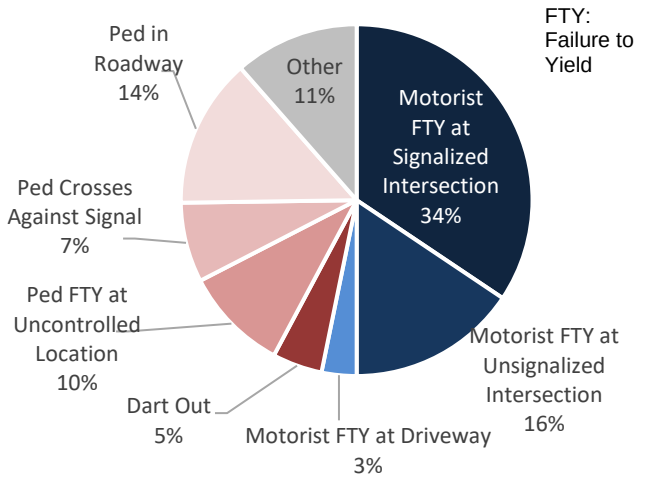


Figure 48. Pedestrian Crashes by Type

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. Many 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.

Table 9 lists the locations with the greatest number of pedestrian crashes in the three-year period. Note that this list is sorted by the number of crashes and therefore locations with higher volumes (both motor vehicle volumes and pedestrian volumes) will also tend to have higher numbers of crashes. The pattern recognition section in this report identifies locations of higher-than-expected pedestrian crashes based on a statistical evaluation called 'probability of exceedance'. A combination of the two lists should be used to determine locations for further review.

Facility ID	North - South Street	East - West Street	Number of Pedestrian Crashes in 3 years
25	College Ave	Mulberry St	3
20	College Ave	Laurel St	3
32	College Ave	Stuart	3
1	Boardwalk Dr	Harmony Rd	2
15033	College Ave	Rutgers	2
91	McMurry	Harmony Rd	2
7	College Ave	Cherry St	2
21	College Ave	Magnolia	2
84	Mason St	Mulberry St	2
5303	City Park	Plum	2

Notes

Table is sorted by the number of pedestrian crashes

Locations included with at least 2 pedestrian crashes in three years

Additional locations may be identified through statistical anlaysis

Table 9. Locations with Most Pedestrian Crashes

Figure 49 shows the location of pedestrian crashes in the last three years.

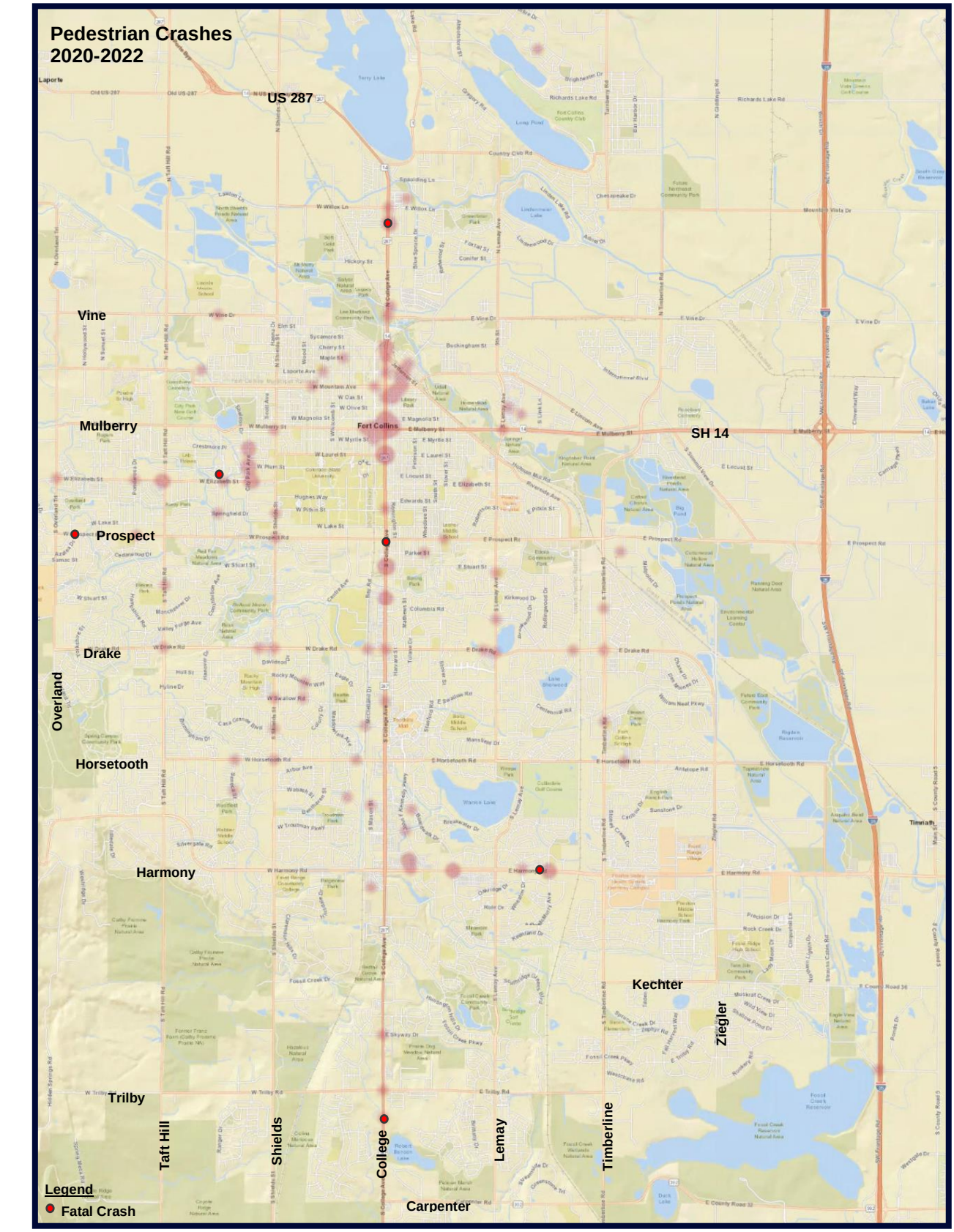


Figure 49. Pedestrian Crash Heat Map (2020-2022)