

# ACTIVE TRANSPORTATION PLAN

## BICYCLE AND PEDESTRIAN CRASH REPORT

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## ABOUT THE DATA IN THIS REPORT

The data source for this report is the Denver Regional Council of Governments-Colorado Department of Transportation traffic crash database. This database is a collaborative effort among multiple agencies. When crashes involving vehicles occur, officers fill out a crash form and send it the Department of Revenue, which processes the records and enters them into the state's DRIVES database. CDOT receives crash data from DRIVES, then processes the data. This process adds an additional crash type field, corrects common errors, updates location information and normalizes the data.<sup>1</sup> CDOT sends the Denver regional crash data to DRCOG, which geocodes the data. Once geocoded, CDOT verifies the final product. The database does not include records for crashes not reported to, or by, law enforcement agencies.

This report presents data on motor vehicle crashes involving pedestrians and bicyclists from calendar years 2010 through 2015. During those six years, 5,573 pedestrian crashes and 5,387 bicycle crashes were reported. Pedestrian crashes refer to crash types that were classified as "pedestrian" or if a pedestrian was involved in a harmful event that took place during the crash. Bicycle crashes refer to crash types that were classified as "bicycle" or if a bicycle was involved in a harmful event that took place during the crash.

Given data limitations, it is not possible to determine which individual or person type (for example, the driver, passenger, pedestrian or bicyclist) was injured in a specific crash. For data tabulations, it was assumed that the most vulnerable person was the most likely to suffer the most severe injury. Detailed injury data were not available for this crash report. There are also gaps in the data, as most of the crashes do not have all detailed fields available. For example, the age of the person associated with a crash may be available for one crash but not for another. All numbers in this report were derived from available data. Readers are encouraged to consider these data constraints while reading the results of this crash report.

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<sup>1</sup> CDOT. *The Colorado Department of Transportation Crash Data Process.*

<https://www.codot.gov/library/traffic/safety-crash-data/crash-data/crash-data-request-process>

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## INTRODUCTION

This report summarizes bicycle and pedestrian crash analysis prepared as part of the Denver Regional Council of Governments Active Transportation Plan. Over 2 million bicycle and walking trips are made each day in the Denver region. The percent of people who bicycle to work in the region is more than twice the national average and bicycling is the fastest-growing mode for work trips. Population and employment continue to grow and have brought more commuters to the region's roads. With an increase in pedestrians and bicyclists using the transportation system comes an increased risk of pedestrians and bicyclists being involved in crashes likely to result in injury or death. Identifying where crashes are taking place and other crash trends will allow the region to better organize its efforts and prioritize its projects to reduce the number of pedestrian and bicycle crashes.

Walking and bicycling are essential to the overall multimodal transportation system and have a significant effect on achieving regional goals. DRCOG helps local member jurisdictions plan for active transportation by providing crash information, policy guidance, tools, data and analysis. Metro Vision and the Metro Vision Regional Transportation Plan highlight opportunities to improve pedestrian and bicycle networks throughout the region, and to enhance connectivity and accessibility, safety and quality of life. In 2018, DRCOG kicked off the development of the first-ever regionwide Active Transportation Plan. When complete, the plan will highlight critical opportunities and strategies to improve active transportation across the region. DRCOG's commitment to expand active transportation is demonstrated through the breadth of its investment in shared-use paths, other bicycle and pedestrian facilities, and multimodal components of on-street transportation projects. In the 2016-2021 Transportation Improvement Program, 22 percent of TIP funds were dedicated to active transportation projects, in addition to those projects which had active transportation components.

DRCOG hosts the second-largest annual Bike to Work Day in the nation. Among DRCOG's efforts to change behavior and encourage smart commute options is its Way to Go partnership with seven local transportation management associations. The regional partnership facilitates local

coordination to reduce traffic congestion, improve air quality and make life better for the region's residents. It promotes commute options including bicycling, walking, riding public transit, carpooling and vanpooling.

DRCOG has also increased its efforts to improve pedestrian connectivity to, and from, transit. First- and final-mile connectivity is not a new concept, but increased emphasis on such connectivity is evident in DRCOG's efforts to fund Urban Center/Station Area Master Plans and through participation in local and regional first- and final-mile studies.

### Report Purpose

DRCOG is committed to providing a safe multimodal transportation network and prioritizing safety and safety initiatives to reverse recent traffic-related fatality trends. DRCOG's commitment is illustrated by the TIP focus areas:

1. Improve mobility infrastructure and services for vulnerable populations (including improved transportation access to health services).
2. Increase the reliability of existing multimodal transportation network.
3. Improve transportation safety and security.

Safety concerns are a leading inhibitor to more people walking and bicycling for transportation. A survey conducted by Toole Design Group revealed that 70 percent of respondents would bicycle more if they felt safer from traffic while riding a bicycle and 66 percent of respondents would walk more if there were more off-street walking and shared-use paths.

This report examines crashes in the Denver region that involve pedestrians and bicyclists to provide data to inform decision-makers and inspire the region to expand and improve its safety efforts. It identifies the context for crash characteristics and trends, providing insight into where and why pedestrian and bicycle crashes are happening in the region.

## DRCOG Safety Performance Measures and Targets

The DRCOG Board adopted the regional Metro Vision plan in January 2017. Metro Vision guides DRCOG’s work and establishes a shared aspirational vision among the counties and municipalities of the Denver region. Metro Vision promotes regional cooperation on issues, such as safety, that extend beyond jurisdictional boundaries.

Metro Vision includes regional objectives that identify areas in the region that require continuous improvement, and strategic initiatives that identify voluntary opportunities for regional and local organizations and governments to support local contributions. To track and determine the regional progress toward identified outcomes, Metro Vision establishes a series of performance measures based on:

- relevance to plan outcomes and objectives
- availability of regularly updated and reliable data sources
- use of measurable, quantitative information, rather than anecdotal insights

For each performance measure, a baseline indicates the region’s current status and a 2040 target establishes the desired future outcome.

*Regional Objective 5: Operate, manage and maintain a safe and reliable transportation system.* This objective directly relates to safety, as one of its three supporting objectives is “Improve transportation safety and security.” **Table 1** shows the performance measure, baseline and 2040 target associated with traffic fatalities.

**Table 1. Metro Vision Traffic Fatality Performance Measure**

Measure	Where are we today? (baseline)	Where do we want to be? (2040 target)
Number of traffic fatalities	185 (2014)	Fewer than 100 annually

The Federal Highway Administration’s Transportation Performance Management program uses transportation system performance outcomes to make investment and policy decisions to achieve national performance goals. Effective April 14, 2016, federal regulations established requirements for performance measures, targets and reporting. The federal regulations require CDOT and DRCOG to annually set targets for five safety measures and report on progress toward achieving the targets.

To develop 2018 safety targets, DRCOG staff worked with the Transportation Advisory Committee over several meetings to develop a methodology for setting the targets for the DRCOG transportation management area. Based on Metro Vision’s 2040 target of fewer than 100 traffic fatalities annually, the methodology considered how much fatalities would need to decrease each year to achieve the 2040 Metro Vision target. **Table 2** shows DRCOG’s 2018 safety targets based on a five-year moving average.

**Table 2. DRCOG’s 2018 Transportation Management Area Safety Targets - Five-Year Moving Averages**

Measures	Targets
Fatalities	242
Fatality rate per 100 million vehicle miles traveled	0.90
Serious injuries	1,948
Serious injury rate per 100 million vehicle miles traveled	7.20
Nonmotorized fatalities and serious injuries	59 + 287 = 346

Evaluation and reporting related to its progress toward target achievement will take place in 2019. The Federal Highway Administration will review all performance as part of the ongoing transportation planning process reviews.

## Traffic Fatalities and Other Leading Causes of Death

Traffic fatalities are one of the leading causes of death in the United States. This is especially true for younger Americans. According to the National Highway Traffic Safety Administration: “motor vehicle crashes were the 13th leading cause of death from 2012 to 2014. When ranked by age, motor vehicle traffic crashes were the number one cause of death among people 16 to 24 years old for each year 2012 to 2014. Motor vehicle crashes were also the number one leading cause of death for 11-year-old children in 2014, as well as for 4-year-old children in 2013. Similarly, motor vehicle traffic crashes were the number one leading cause of death for 13-year-olds and those 16 to 25 in 2012.”<sup>2</sup> The National Center for Health Statistics groups traffic fatalities with accidents (unintentional injuries). According to 2016 long-term health trends, such accidents are the fourth-leading cause of death behind heart disease, cancer and chronic lower respiratory diseases.

Where do pedestrian and bicyclist fatalities fall in these trends? The National Highway Traffic Safety Administration notes that, in 2016, “pedestrian fatalities increased by 492 (a 9.0 percent increase) and are at their highest number since 1990. Pedalcyclist fatalities increased by 11 (a 1.3 percent increase), and are at their highest number since 1991.”<sup>3</sup>

## Economic Cost

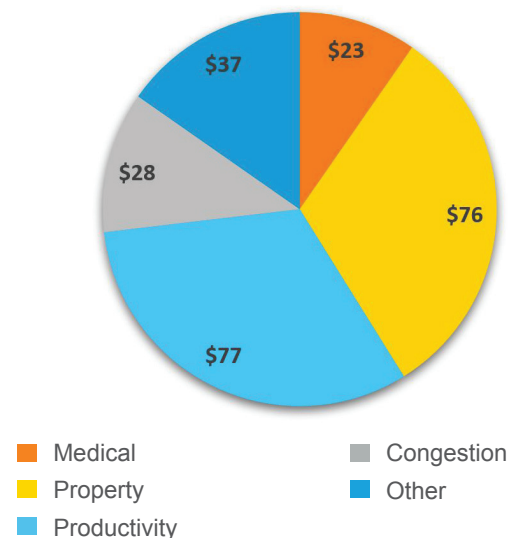
Not only do traffic crashes have devastating effects on victims and their loved ones, crashes are also associated with significant economic costs including property damage, workplace and household productivity loss of the victim, medical costs and traffic congestion. The National Highway Traffic Safety Administration’s study, *The Economic and Societal Impact of Motor Vehicle Crashes* accounts for the \$242 billion cost of traffic-related crashes in 2010 by category as illustrated in **Figure 1**. If the cost was

distributed to every person in the United States, the cost would be close to \$800 per person. Injuries involving pedestrians and bicyclists cause 7 percent of the economic cost and 10 percent of the societal harm.

## Safety Initiatives

With trends showing an overall increase in traffic-related fatalities throughout the United States, the implementation of safety initiatives has correspondingly risen. Local and national agencies have made such initiatives high priorities with the goal of making long-term change to traffic-related fatality trends. Vision Zero is a multinational traffic safety project to achieve a target of no fatalities or serious injuries involving road traffic, organized around the principle that “it can never be ethically acceptable that people are seriously injured when moving within the road transport system.”<sup>4</sup> In 2015, the City and County of Denver initiated a Vision Zero plan and in February 2016, Mayor Michael Hancock announced Denver’s commitment to the five-year action plan to achieve zero deaths and serious injuries by 2030. In October 2017, Denver released the Denver Vision Zero Action Plan.

**Figure 1. Economic Cost of Motor Vehicle Crashes in Billions of Dollars in the United States (2010)<sup>5</sup>**



Source: National Highway Traffic Safety Administration

<sup>2</sup> 2016. National Highway Traffic Safety Administration. “Motor Vehicle Traffic Crashes as a Leading Cause of Death in the United States, 2012-2014”

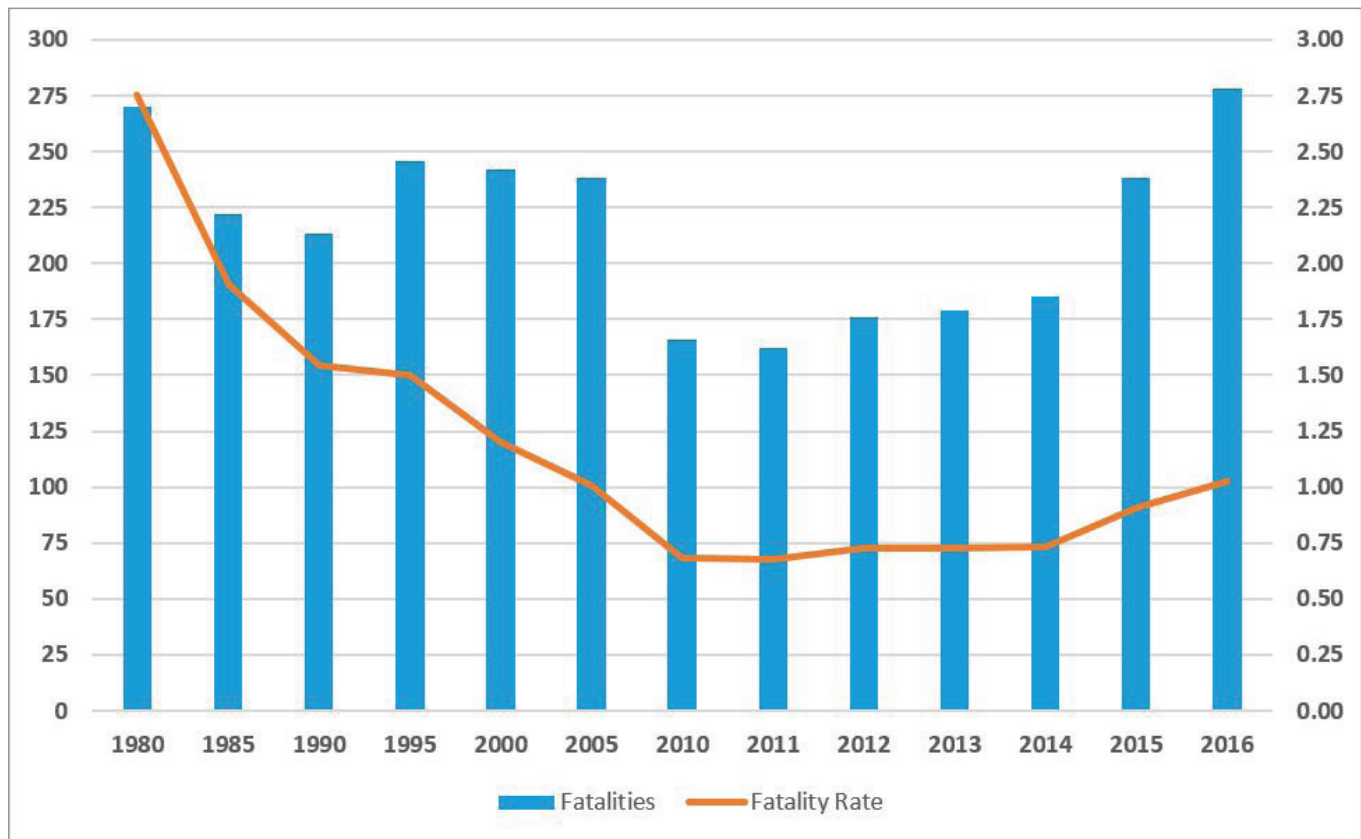
<sup>3</sup> 2017. National Highway Traffic Safety Administration. “2016 Fatal Motor Vehicle Crashes: Overview”

<sup>4</sup> 2016. Monash University Accident Research Center. “Vision Zero – An ethical approach to safety and mobility”

<sup>5</sup> 2015. National Highway Traffic Safety Administration. “The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised)”



**Figure 2. Number of Annual Fatalities and Fatality Rate for the Denver Region**



The Toward Zero Deaths National Strategy on Highway Safety, an initiative intended to provide a roadmap for the future that identifies key safety focus areas to ensure progress and unite the efforts of a wide array of stakeholders nationwide.<sup>6</sup> The Colorado Department of Transportation made Moving Towards Zero Deaths a core value of the state’s Strategic Highway Safety Plan, which provides innovative and data-driven approaches to improving highway safety. Strategies in the plan include demonstrating and measuring progress by setting realistic interim goals, such as reducing fatalities in the state of Colorado from 548 in 2008 to 416 by 2019.<sup>7</sup>

## TRENDS IN REGIONAL TRAFFIC FATALITIES

Data for the Denver region as presented in this report include Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin and Jefferson counties, and the southwest portion of Weld County. The fatality trend in the

Denver region has fluctuated over the last 30 years. From 1990 to 2000 the number of annual traffic fatalities in the region increased 12 percent, then decreased 46 percent from 2000 to 2010. There was a 46 percent increase in annual fatalities from 2010 to 2016. In 2011, annual fatalities fell to 162 and in 2016 they increased to 278. Growth in population and annual vehicle miles traveled contributed to the recent increase in annual fatalities.

Per 2010 census data, the Denver region’s population was 2.8 million, with an estimated population of 3.2 million for 2016. By 2040 the population is expected to increase to 4.3 million. The substantial population growth has resulted in a simultaneous increase in vehicle miles traveled.

Another way to present crash information is to calculate the rate of crashes or fatalities by dividing the number of fatalities by the number of vehicle miles traveled. From 1990 to 2000 the fatality rate decreased from 1.54 to 1.20

<sup>6</sup> 2014. Federal Highway Administration. *Toward Zero Deaths: A National Strategy on Highway Safety*

<sup>7</sup> 2014. CDOT. *Colorado Strategic Highway Safety Plan*

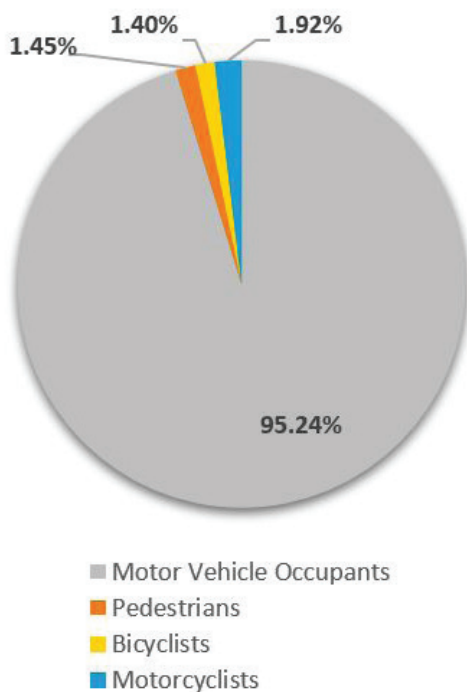
and continued to decrease significantly to 0.69 in 2010. In 2012, 2013 and 2014, the fatality rate remained at 0.73 and rose to 0.91 in 2015. **Figure 2** shows the number of fatalities and how they compare to the annual fatal crash rate per 100 million vehicle miles traveled from 1980 to 2016.

### Fatalities by Mode

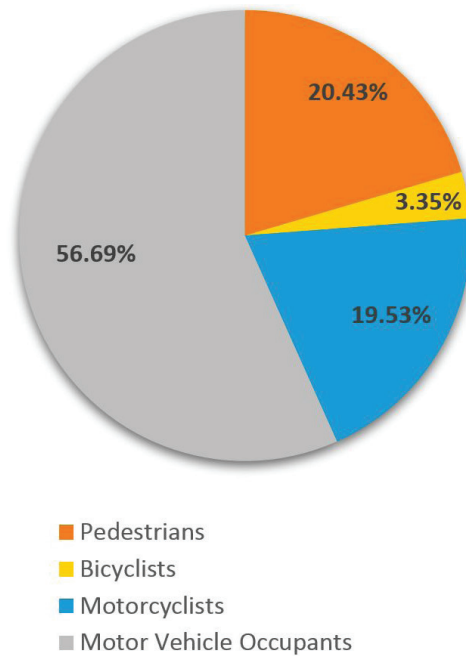
There were 1,106 traffic fatalities in the Denver region from 2010 through 2015. Around 77 percent of those deaths were from individuals inside a motor vehicle or people riding motorcycles. The remaining 23 percent were pedestrians or bicyclists. In 2015, pedestrian and bicycle trips made up only 14 percent of all trips in the DRCOG region<sup>8</sup>, while 22 percent of traffic-related fatalities in 2015 were associated with pedestrians and bicycles.

When fatalities by mode are compared to the overall crashes by mode, **Figure 3** and **Figure 4** illustrate that while pedestrians and bicyclists account for only 2.85 percent of overall crashes, 23 percent of fatalities involve pedestrians and bicyclists.

**Figure 3. Distribution Crashes by Mode, 2010-2015**



**Figure 4. Distribution Fatalities by Mode, 2010-2015**



### Nonmotorized Fatalities

The number of bicycle fatalities in the Denver region have been relatively consistent, while pedestrian fatalities vary from year to year. **Figure 5** shows the number of fatalities by mode and **Figure 6** shows the fatality rate per 100,000 residents by mode from 2000 to 2015.

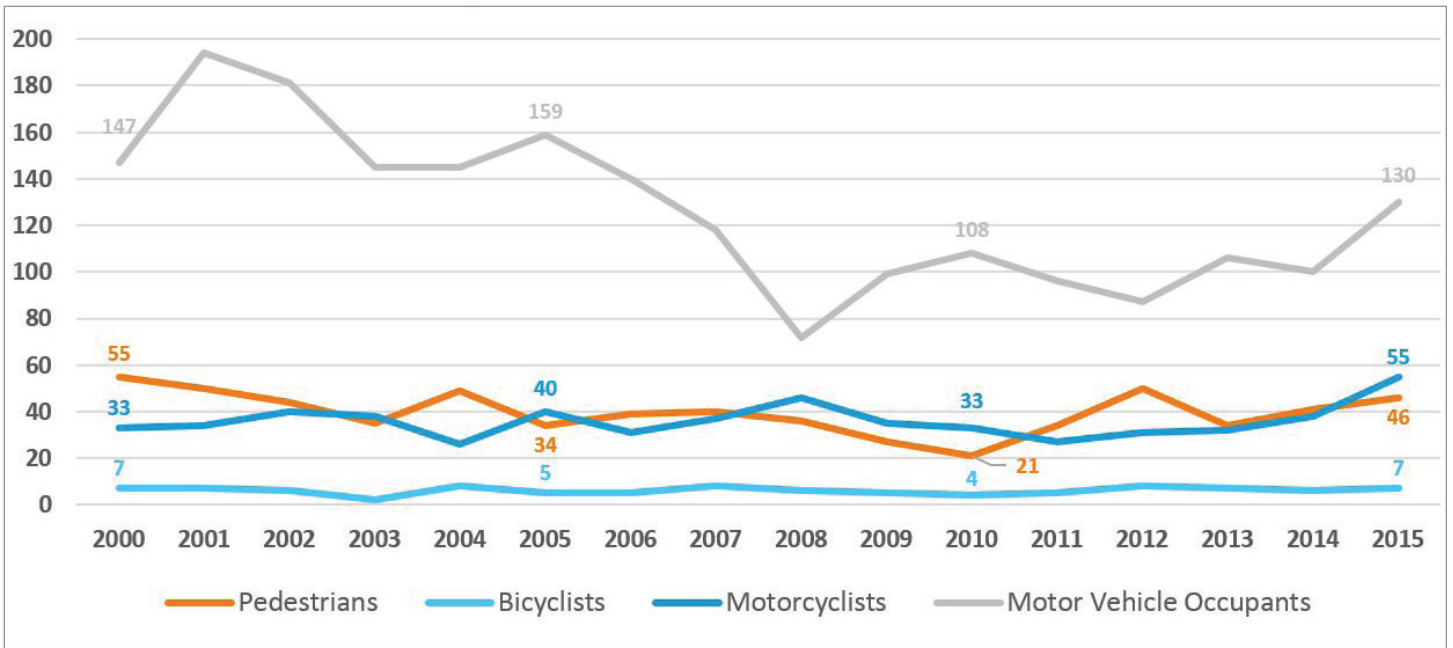
For pedestrians, the number of fatalities has ranged from a high of 55 (in 2000) to a low of 21 (in 2010). Since 2010, as few as 34 pedestrians died annually (in 2011 and 2013) to as many as 41 (in 2014) and 46 (in 2015).

Bicycle fatalities in the Denver region hit a low of four fatalities in 2010 and remained low with five in 2011. Since then, bicycle fatalities have ranged from six to eight per year.

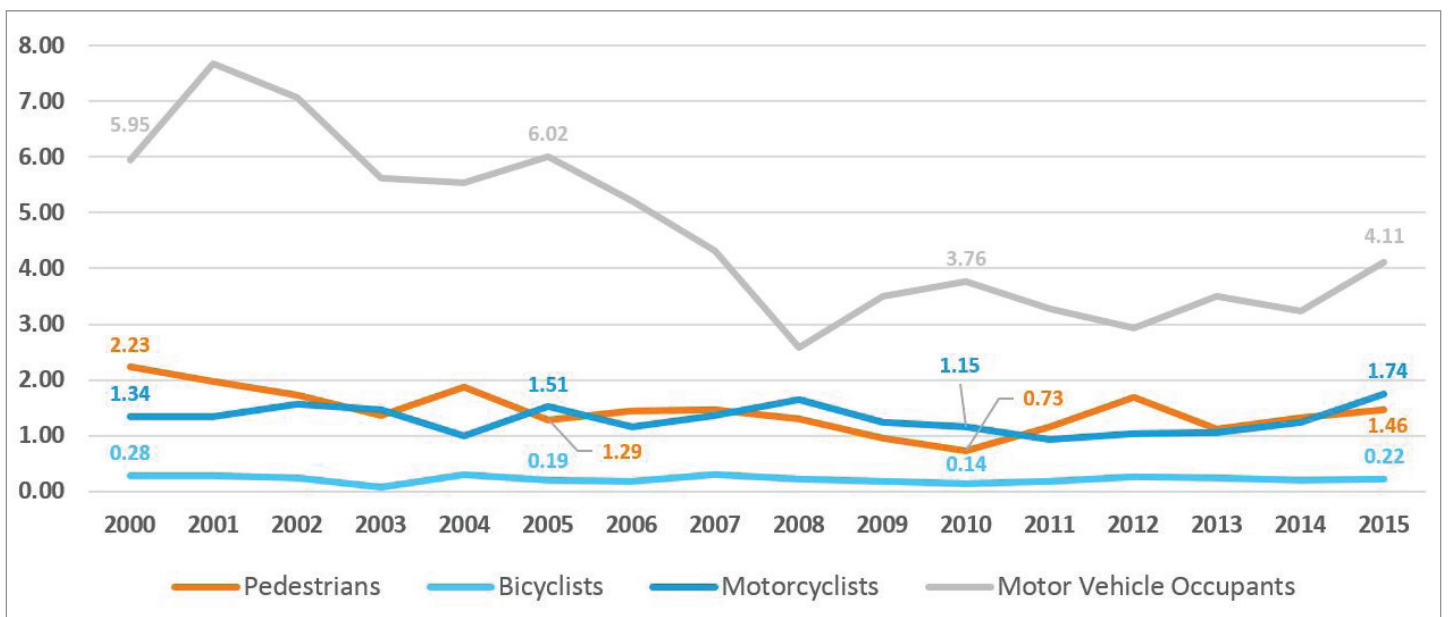
Data limitations make it difficult to identify the cause of the increase of nonmotorized fatalities, but factors such as sociodemographic changes, increased exposure (increase in walking and bicycling), unsafe environments and unsafe actions have consistently contributed to fatalities.

<sup>8</sup> DRCOG Travel Model, 2015

**Figure 5. Number of Fatalities by Mode, 2000-2015**



**Figure 6. Fatality Rate per 100,000 Residents by Mode, 2000-2015**



## OVERVIEW

Pedestrians and bicyclists are among the most vulnerable users of the transportation system. Pedestrian and bicyclist crashes and the resulting deaths and injuries are an essential issue in the Denver region.

The number of pedestrian crashes has been sporadic since 2010, ranging between 27 and 55 deaths per year. In 2016, the state of Colorado had 76 pedestrian fatalities, of which 52 happened in the Denver region.<sup>9</sup>

The number of annual bicycle fatalities are somewhat consistent, ranging from four to eight deaths a year since 2010. In 2016, the state of Colorado had 16 bicycle fatalities, 14 of which happened in the Denver region.<sup>10</sup>

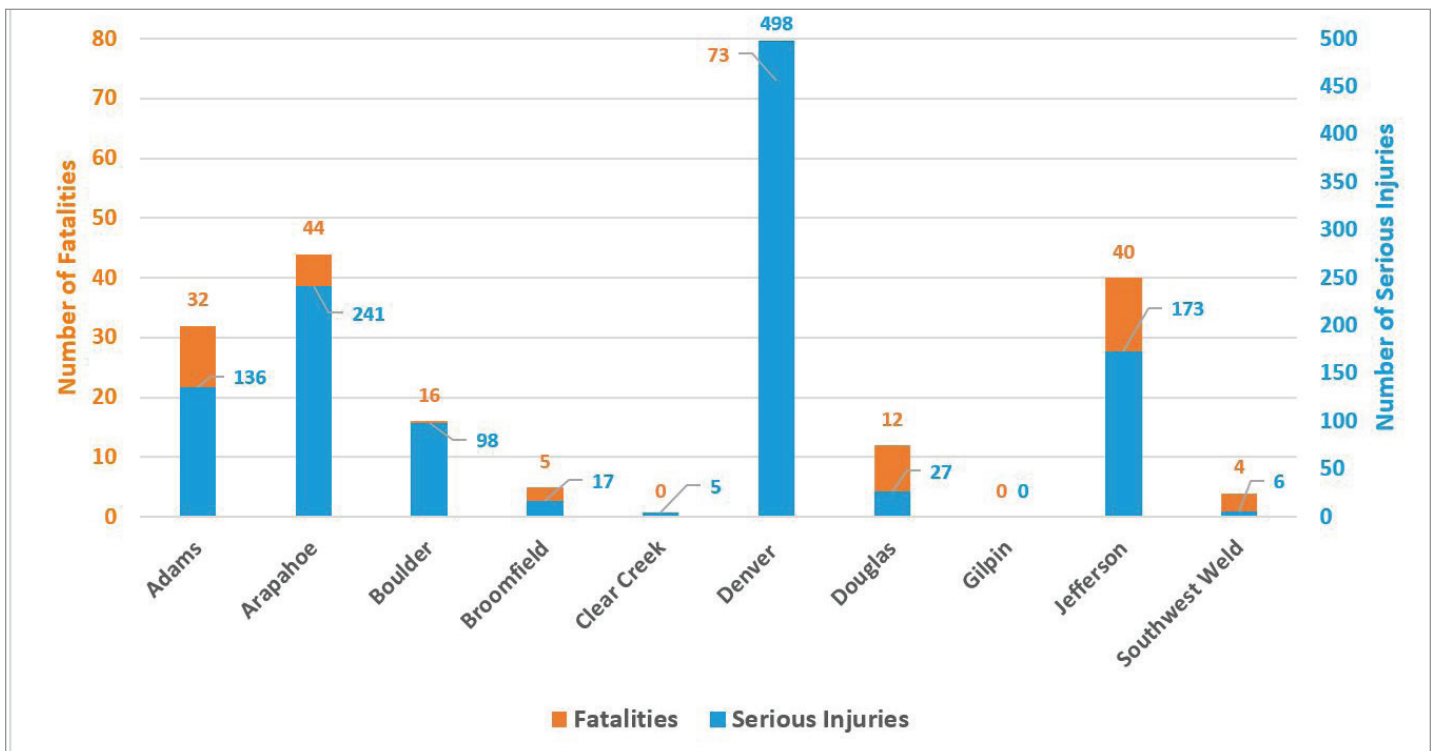
For the purposes of this report, a pedestrian crash is any crash that has been identified as a “pedestrian accident type” or a crash that has a harmful event involving a

pedestrian. A bicycle crash is any crash identified as being a “bicycle accident type” or a crash that has a harmful event involving a bicycle.

## Travel Trends

On a typical day in the Denver region, more than 1.9 million pedestrian trips account for around 13 percent of all trips.<sup>11</sup> These trips are, on average, just under a half-mile and include trips that range from daily commutes, to short trips to the store, to walking trips to or from transit. There are approximately 150,000 bicycle trips, accounting for around 1 percent of all trips.<sup>12</sup> These trips are, on average, just under 2 miles and include daily trips that range from daily commutes, to short trips to the store, to bicycle trips to or from transit.

**Figure 7. Pedestrian Serious Injuries and Fatalities by County, 2010-2015**



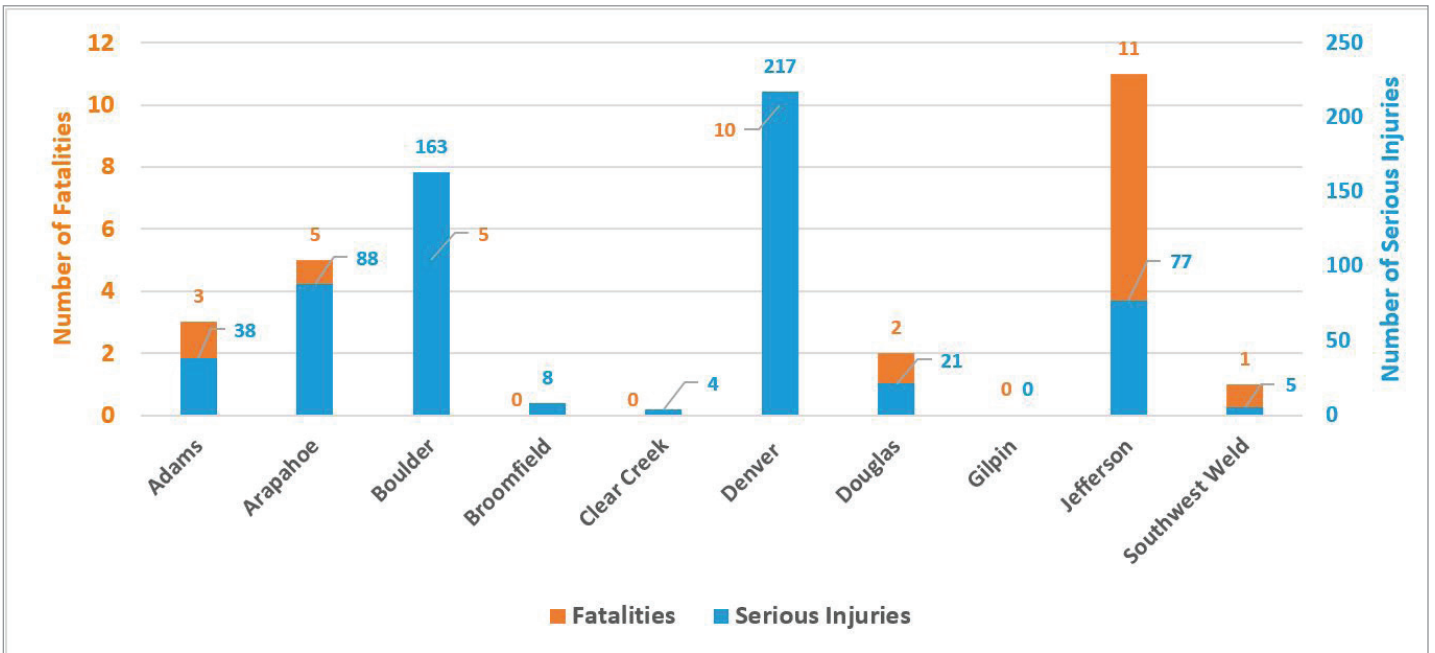
<sup>9</sup> 2016. National Highway Traffic Safety Administration, Fatality Analysis Reporting System.

<sup>10</sup> 2016. National Highway Traffic Safety Administration, Fatality Analysis Reporting System.

<sup>11</sup> DRCOG Travel Model, 2015

<sup>12</sup> DRCOG Travel Model, 2015

**Figure 8. Bicyclist Serious Injuries and Fatalities by County, 2010-2015**



Walk-to-work trips in the Denver region peaked at 4.7 percent of all work trips in 1980 and declined through 2010 to 2.2 percent. Since then, the percentage of commuters walking to work remained relatively steady. On a typical day, around 2.5 percent of the working population commutes by walking.<sup>13</sup>

The number of bicycle-to-work trips in the Denver region is continuing to grow. In 1980, 0.7 percent of workers commuted by bicycle. Currently, on an average day, 1.2 percent of workers commute by bicycle.<sup>14</sup> The number of workers who commute by bicycle is about double the national average and the share of Denver region commuters who bicycle to work is increasing faster than any other mode.

## County Crash Numbers

**Figure 7** shows serious injuries and fatalities among pedestrians by county from 2010 to 2015. For these years, the data reveal that Denver, Arapahoe and Jefferson counties have the most pedestrian crashes, serious injuries and fatalities.

**Figure 8** shows serious injuries and fatalities among bicyclists by county from 2010 to 2015. The City and County of Denver had significantly more bicycle crashes resulting in serious injuries than all the other counties. Jefferson County had the most bicyclist fatalities; Denver had one fewer bicyclist fatality over the six-year period.

<sup>13</sup> U.S. Census Bureau. American Community Survey Five-Year Estimates (2012-2016).

<sup>14</sup> U.S. Census Bureau. American Community Survey Five-Year Estimates (2012-2016).

## Injury Severity

Due to their lack of external protection pedestrians and bicyclists are among the most exposed and vulnerable users of the transportation system. **Table 3** and **Table 4** illustrate the severity of injury to bicyclists and pedestrians. In the DRCOG-CDOT crash database, five levels of injury may be identified in each crash. Frequently, multiple people are involved in a single crash resulting in multiple injuries. For this report, the most severe injury was considered. For example, if a single crash had a fatality and a serious injury (incapacitating injury), the crash’s severity would be considered fatal.

The crash data from 2013 through 2015 illustrated in **Figure 9** show that 63 percent of pedestrian crashes result in some level of injury and 25 percent in an incapacitating injury or death.

**Figure 10** shows that 66 percent of bicycle crashes result in some level of injury and 13 percent in a death or an incapacitating injury.

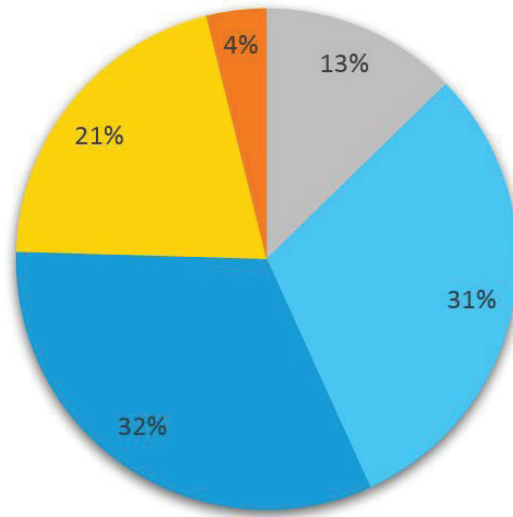
**Table 3. Pedestrian Crash Severity, 2013-2015**

Year	No injury crashes	Possible injury crashes	Non-incapacitating injury crashes	Incapacitating injury crashes	Fatal crashes
2013	128	324	329	217	33
2014	144	309	356	218	41
2015	121	324	314	205	46

**Table 4. Number of Bicycle Crash Severity, 2013-2015**

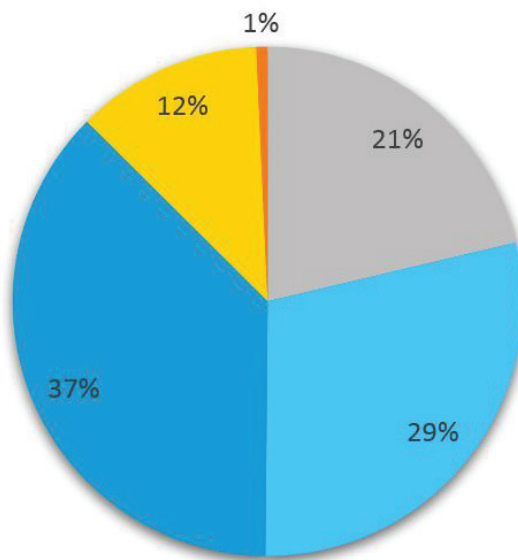
Year	No injury crashes	Possible injury crashes	Non-incapacitating injury crashes	Incapacitating injury crashes	Fatal crashes
2015	189	280	370	116	7
2014	196	261	350	122	6
2013	213	269	328	94	7

**Figure 9.** Distribution of Pedestrian Crash Severity, 2013-2015



- No injury crashes
- Possible injury crashes
- Non-incapacitating injury crashes
- Incapacitating injury crashes
- Fatal crashes

**Figure 10.** Distribution of Bicycle Crash Severity, 2013-2015



- No injury crashes
- Possible injury crashes
- Non-incapacitating injury
- Incapacitating injury crashes
- Fatal crashes

## Comparison with Other Regions

To better understand how the Denver region compares with other metropolitan areas, DRCOG assessed corresponding bicycle and pedestrian fatality rates across the nation.

In 2015, the number of pedestrian fatalities for each metropolitan area ranged from 14 to 98, representing rates of 0.46 to 2.20. The Denver region had a pedestrian fatality rate of 1.46 fatalities per 100,000 residents. Compared to peer metropolitan planning organization planning areas, DRCOG placed in the middle. The pedestrian fatality rates, by metropolitan area, are illustrated in [Table 5](#).

**Table 5.** Pedestrian Fatality Rate Across Peer Metropolitan Areas, 2015

Metropolitan planning organization	Metropolitan area	Pedestrian fatality rate (per 100,000 people)
Atlanta Regional Commission	Atlanta, Georgia	2.20
Wasatch Front Regional Council	Salt Lake City, Utah	1.84
Metro	Portland, Oregon	1.47
Denver Regional Council of Governments	Denver, Colorado	1.46
Puget Sound Regional Council	Seattle, Washington	1.40
Delaware Valley Regional Planning Commission	Philadelphia, Pennsylvania	0.86
Metropolitan Council	Minneapolis-Saint Paul, Minnesota	0.46

Source: National Highway Traffic Safety Administration – Fatality Analysis Reporting System, 2015 and American Community Survey – Population Estimates, 2015



In 2015, the number of bicycle fatalities for each metropolitan area ranged from three to nine, representing rates of 0.13 to 0.19. The Denver region had a bicyclist fatality rate of 0.19 fatalities per 100,000 residents.

**Table 6** compares DRCOG to peer metropolitan planning organizations and their associated metropolitan areas. DRCOG had the highest bicyclist fatality rate among the other metropolitan planning organizations.

**Table 6. Bicyclist Fatality Rate Across Peer Metropolitan Areas, 2015**

Metropolitan planning organization	Metropolitan area	Bicyclist fatality rate (per 100,000 people)
Denver Regional Council of Governments	Denver, Colorado	0.19
Wasatch Front Regional Council	Salt Lake City, Utah	0.18
Metro	Portland, Oregon	0.17
Delaware Valley Regional Planning Commission	Philadelphia, Pennsylvania	0.17
Puget Sound Regional Council	Seattle, Washington	0.15
Atlanta Regional Commission	Atlanta, Georgia	0.13
Metropolitan Council	Minneapolis-St. Paul, Minnesota	0.13

Source: National Highway Traffic Safety Administration – Fatality Analysis Reporting System, 2015 and American Community Survey – Population Estimates, 2015

## LOCATION OF CRASHES

### Roadway Facility Type

Analyzing functional classification helps identify the roadway capacity, speed and surrounding land use areas on which pedestrian and bicycle crashes take place.

Although many variables affect traffic-related crashes, speed primarily determines how severe a crash will be.

For bicycle or pedestrian crashes, speed elevates the likely severity of the crash. A pedestrian hit by a vehicle traveling at 25 mph has an 89 percent chance of survival, while a pedestrian hit by a vehicle traveling at 45 mph has a 35 percent chance of survival.<sup>15</sup>

**Tables 7 and 8** show the number and severity of pedestrian and bicyclist injuries by functional classification. Freeways, also known as express highways with controlled access, with the highest roadway capacity and traveling speeds, experienced the least amount of crashes with 53 pedestrian crashes and 26 bicycle crashes.

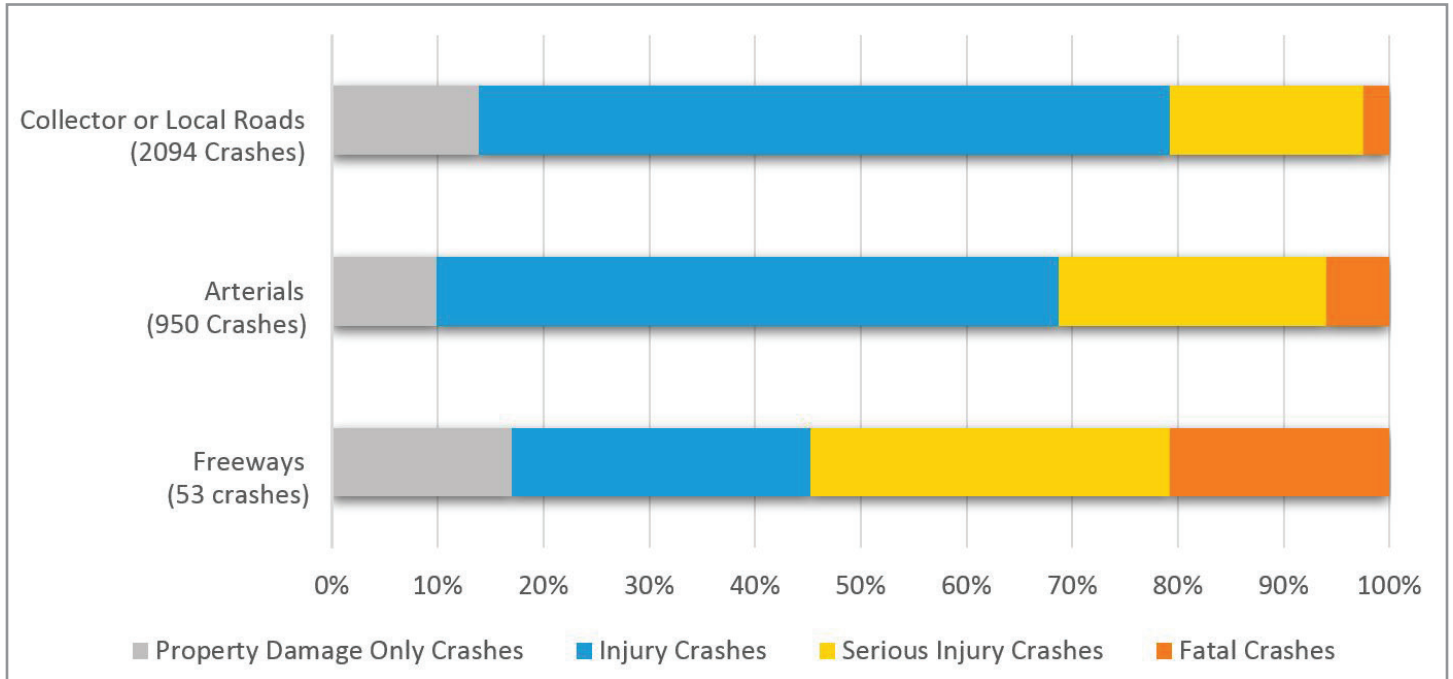
**Figure 11** shows that more than half of the 53 pedestrian crashes resulted in serious injuries or fatalities. Individuals who respond to traffic incidents and who are associated with construction zones are particularly vulnerable to harm

on freeways. The majority of pedestrian and bicycle crashes occurred on collector or local roadways, with more than 2,000 crashes for each mode. Collector or local roads have low to moderate capacity and lower speeds which likely contributed to the 79 percent of the pedestrian crashes and 88 percent of bicycle crashes resulting in injury or property damage only, as opposed to serious injury or fatal crashes.

Arterial roadways are high-capacity, often busy, urban roadways. Motorists, bicyclists and pedestrians using arterial roads encounter a high number of intersections, turning vehicles, driveways, buses, pedestrian activity and visual distractions. In the Denver region, the largest number of pedestrian fatalities occurred on arterial roads, despite arterial roads having less than half of the total pedestrian crashes as collector or local roads. Arterials accounted for 23 percent of bicycle crashes, 15 percent of which resulted in serious injuries or fatalities.

<sup>15</sup> 2013. Tefft, Brian. *Impact Speed and a Pedestrian's Risk of Severe Injury or Death*. <https://nacto.org/wp-content/uploads/2012/06/Tefft-B.C.-2011.pdf>

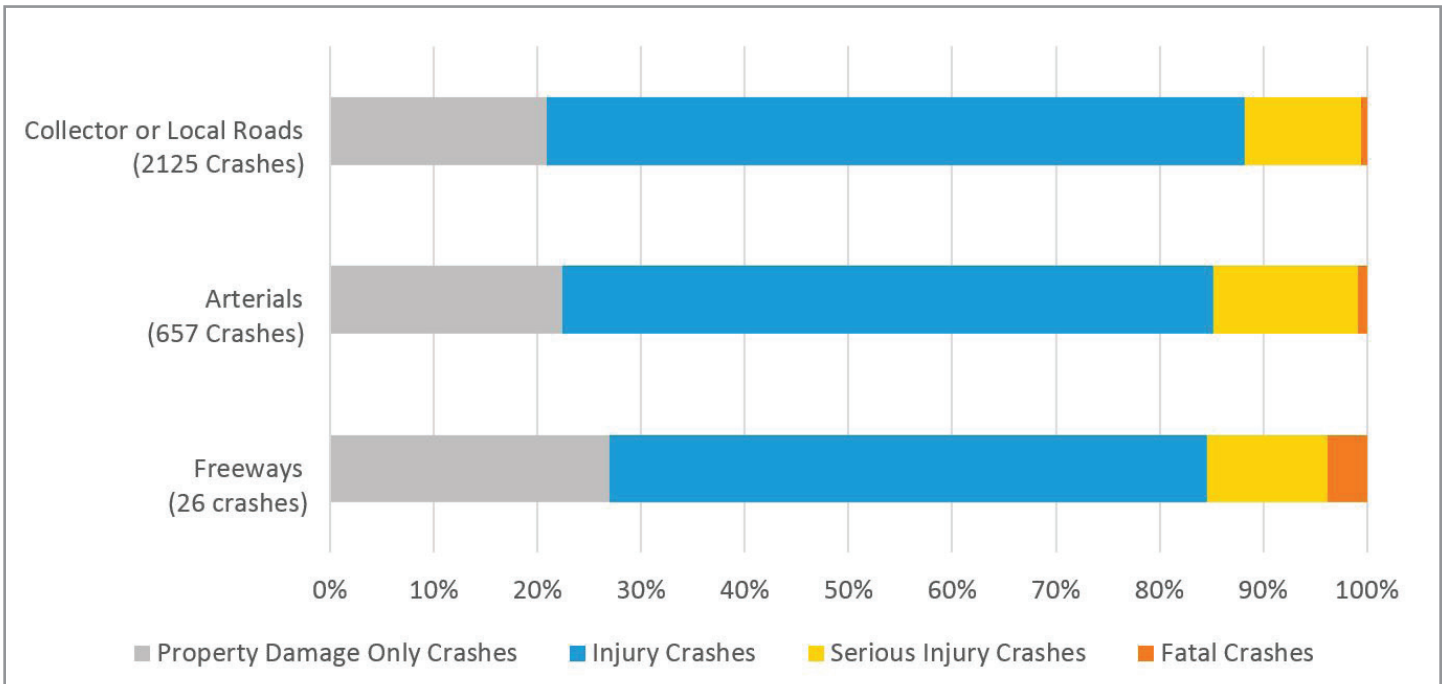
**Figure 11. Pedestrian Injury Severity by Functional Classification, 2013-2015**



**Table 7. Number of Pedestrian Injuries by Severity and Functional Classification, 2013-2015**

Facility type	Property damage only crashes	Injury crashes	Serious injury crashes	Fatal crashes
Freeways	9	15	18	11
Arterials	94	559	240	57
Collector or local roads	290	1,370	382	52
Totals	393	1,944	640	120

**Figure 12.** Bicyclist Injury Severity by Functional Class, 2013-2015



**Table 8.** Number of Bicyclist Injuries by Severity and Functional Class, 2013-2015

Facility type	Property damage only crashes	Injury crashes	Serious injury crashes	Fatal crashes
Freeways	7	15	3	1
Arterials	147	413	91	6
Collector or local roads	444	1429	238	13
Total	598	1857	332	20

### Midblock versus Intersection

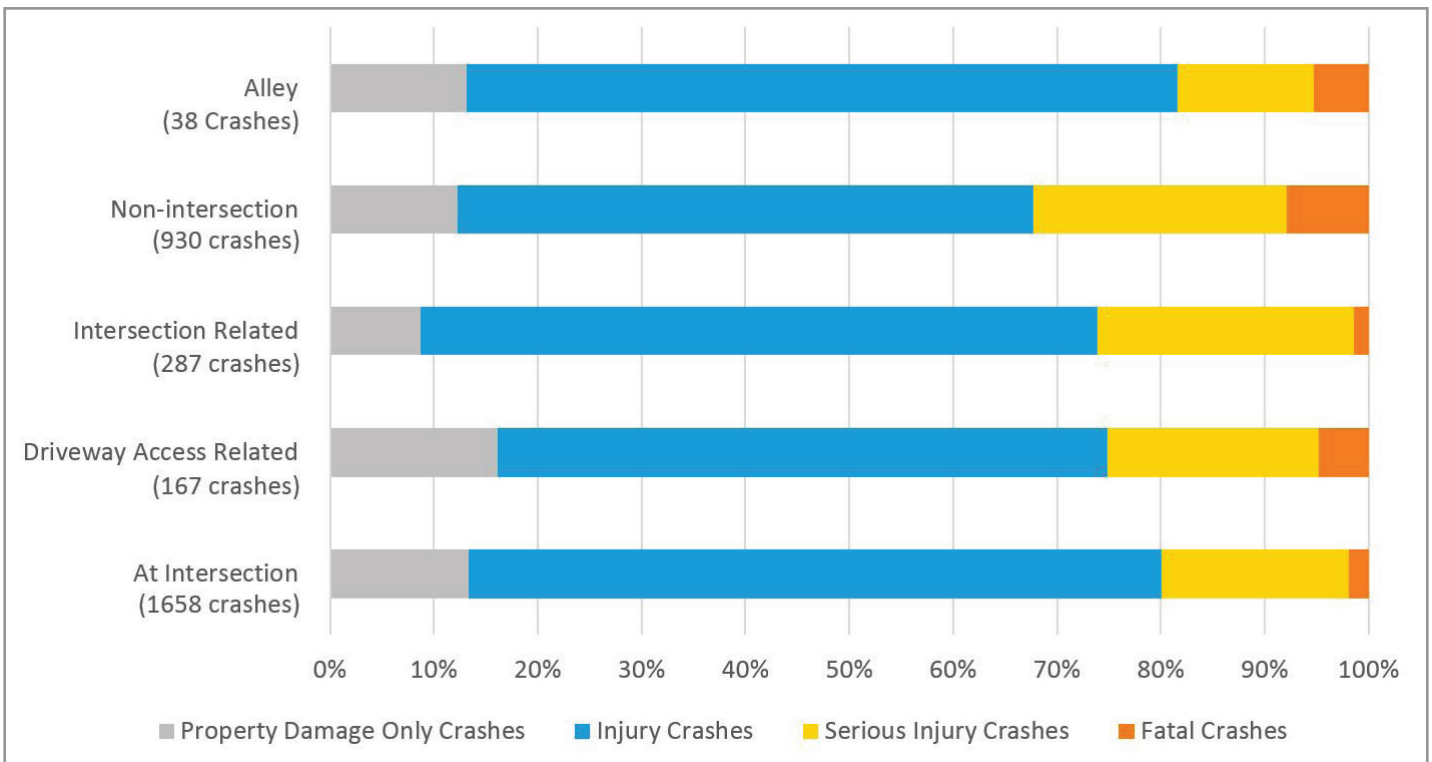
Tables 9 and 10 and Figures 13 and 14 include additional detail on the location of pedestrian and bicyclist crashes by identifying specific locations on roadways where crashes occurred from 2013 through 2015. Among the categories listed, “driveway-access related” “non-intersection” “alley” and “other” refer to midblock locations.

The data reveal that 63 percent of all pedestrian crashes occurred at, or are related to, intersections. Yet only 30 percent of the total pedestrian fatalities result from such crashes. In contrast, only 30 percent of pedestrian crashes took place at midblock locations but accounted for 61 percent of fatal pedestrian crashes.

**Table 9.** Number of Pedestrian Injuries by Severity and Location, 2013-2015

Facility Type	Property Damage Only Crashes	Injury Crashes	Serious Injury Crashes	Fatal Crashes
At intersection	221	1,106	299	32
Driveway-access related	27	98	34	8
Intersection related	25	187	71	4
Non-intersection	114	516	227	73
Alley	5	26	5	2
Other	1	11	4	1
Totals	393	1,944	640	120

**Figure 13.** Pedestrian Injury Severity by Locations, 2013-2015



**Table 10** shows that the majority of bicycle crashes occurred at, or related to, intersections.

Of the 1,821 bicycle crashes that occurred at intersections, less than 1 percent were fatal crashes, 78 percent resulted in injuries or serious injuries and

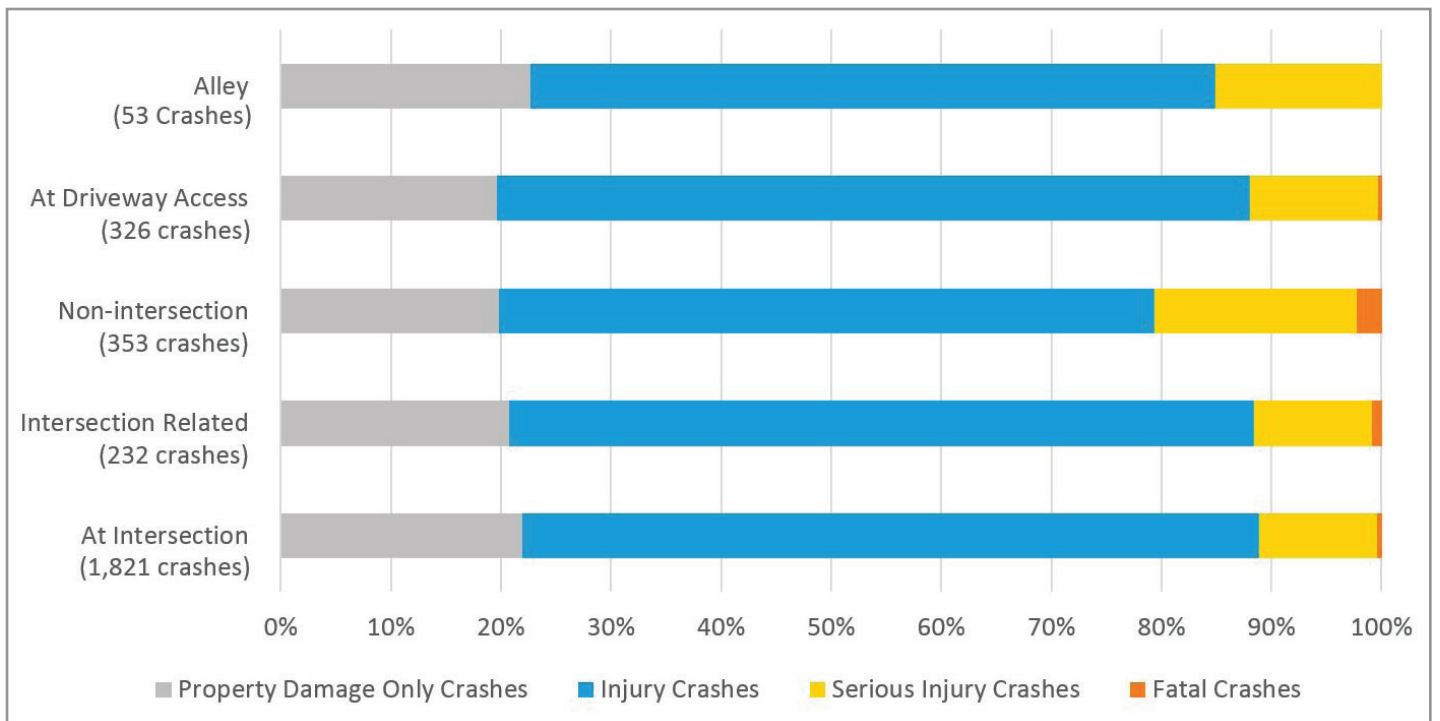
22 percent involved property damage only. Bicycle crash location distributions are illustrated in **Figure 14**.

Compared with pedestrian crashes, significantly more bicycle crashes are related to driveway access (326 bicycle crashes versus 167 pedestrian crashes at driveway access).

**Table 10. Number of Bicyclist Injuries by Severity and Locations, 2013-2015**

Facility type	Property damage only crashes	Injury crashes	Serious injury crashes	Fatal crashes
At intersection	399	1,216	195	8
Intersection related	48	157	25	2
Non-intersection	70	210	65	8
At driveway access	64	223	38	1
Alley	12	33	8	0
Other	5	16	1	1
<b>Total</b>	<b>598</b>	<b>1,855</b>	<b>332</b>	<b>20</b>

**Figure 14.** Bicyclist Injury Severity by Locations, 2013-2015



## Proximity to Schools

School locations considered for this report include 1,365 K-12 schools and 244 higher education institutions located within the Denver region. Of the region’s population, 95 percent live 1 mile or less from K-12 schools, 84 percent live 0.5 miles away and 54 percent live 0.25 miles from K-12 schools.

**Table 11** shows that, among pedestrians, 46 percent of serious injury crashes and 29 percent of fatal crashes happened within 0.25 miles of K-12 schools. Regarding pedestrian proximity to higher education institutions, 24 percent of serious injury crashes and 14 percent of fatal crashes happened within 0.25 miles.

**Table 11. Proximity of Pedestrian Serious Injury and Fatal Crashes to Schools, 2013-2015**

Proximity to schools	Serious injury crashes (Total: 640)		Fatal crashes (Total: 120)	
	Number	Percent	Number	Percent
1 mile from K-12 schools	620	97%	107	89%
0.5 miles from K-12 schools	535	84%	82	68%
0.25 miles from K-12 schools	289	45%	31	26%
<b>Higher Education Schools</b>				
1 mile from higher education schools	483	75%	72	60%
0.5 miles from higher education schools	288	45%	35	29%
0.25 miles from higher education schools	148	23%	14	12%



Table 12 shows that, similar to pedestrian crashes, a high percentage of bicycle crashes occurred within 1 mile of schools, with the percent of crashes dropping drastically as the distance decreases. Only 15 percent of fatal bicycle crashes occurred within 0.25 miles of schools K-12 or higher education schools.

**Table 12. Proximity of Bicyclist Serious Injury and Fatal Crashes to Schools, 2013-2015**

Proximity to schools	Serious injury crashes (Total: 332)		Fatal crashes (Total: 20)	
	Number	Percent	Number	Percent
1 mile from K-12 schools	302	91%	15	75%
0.5 miles from K-12 schools	252	76%	10	50%
0.25 miles from K-12 schools	135	41%	3	15%
1 mile from higher education schools	222	67%	10	50%
0.5 miles from higher education schools	133	40%	7	35%
0.25 miles from higher education schools	54	16%	3	15%

## Proximity to Transit

Transit locations considered for this report include 9,434 bus stops and 68 light rail stations located within the Denver region. Considering the substantial number of bus stops identified in the region, a shorter distance was analyzed.

**Table 13** shows that 23 percent of pedestrian serious injury crashes happened within 100 feet of bus stops and 24 percent of fatal pedestrian crashes happened within that distance. For pedestrians within 50 feet of stops, 4

percent of serious injury crashes and 7 percent of fatal crashes occurred.

There were no serious injury or fatal crashes near light rail stations. Only one serious injury crash and zero fatal crashes occurred 100 feet or less from the light rail stations. Given the substantial amount of infrastructure surrounding stations, the likelihood of motor vehicles traveling at a speed sufficient to cause serious injury or death is lower than in areas with less infrastructure.

**Table 13. Proximity of Pedestrian Serious Injury and Fatal Crashes to Transit Stops, 2013-2015**

Proximity to transit stops	Serious injury crashes (Total: 640)		Fatal crashes (Total: 120)	
	Number	Percent	Number	Percent
0.25 miles from bus stops	593	93%	91	76%
100 feet from bus stops	146	23%	29	24%
50 feet from bus stops	28	4%	9	8%
<b>Light Rail Stations</b>				
0.25 miles from light rail stations	38	6%	9	8%
100 feet from light rail stations	1	0%	0	0%
50 feet from light rail stations	0	0%	0	0%

**Table 14** shows that, among bicyclists, 79 percent of serious injury crashes and 60 percent of fatal crashes happened 0.25 miles from bus stops. Only 3 percent of bicycle serious injury crashes happened within 0.25 miles of light rail stations.

**Table 14.** Proximity of Bicyclist Serious Injury and Fatal Crashes to Transit Stops, 2013-2015

Proximity to transit	Serious injury crashes (Total: 332)		Fatal crashes (Total: 20)	
	Number	Percent	Number	Percent
0.25 miles from bus stops	263	79%	12	60%
100 feet from bus stops	49	15%	6	30%
50 feet from bus stops	6	2%	1	5%
<b>Light Rail Stations</b>				
0.25 miles from light rail stations	11	3%	0	0%
100 feet from light rail stations	0	0%	0	0%
50 feet from light rail stations	0	0%	0	0%

### Interactive Crash Viewer

To explore pedestrian and bicycle crash data from 2010 through 2015 in an interactive viewer, refer to DRCOG’s “Pedestrian and Bicycle Crash” web map at [gis.drcog.org](http://gis.drcog.org).

[gis.drcog.org/crashes](http://gis.drcog.org/crashes). Additional data viewers and geographic information system data downloads are available on DRCOG’s Regional Data Catalog at [data.drcog.org](http://data.drcog.org).

## VEHICLE MOVEMENT

In the DRCOG-CDOT crash database, up to three vehicle movements can be listed per crash. The numbers in [Tables 15](#) and [16](#) consider only the first vehicle's movement listed in each crash.

Assessing pedestrian crossings, 42 percent of serious injury crashes and 29 percent of fatal crashes involved a vehicle going straight. A vehicle turning left or right accounted for 26 percent of serious injury crashes and only 6 percent of fatal crashes involving pedestrians.

The remaining serious injury or fatal crashes —65 percent — involved other vehicle movements such as making a U-turn, backing up, parking or changing lanes.

For bicycle crashes, 54 percent of serious injury crashes and 50 percent of fatal crashes involved a vehicle going straight. A vehicle turning left or right accounted for 35 percent of serious injury crashes and 20 percent of bicycle fatal crashes involving a bicyclist.

**Table 15. Vehicle Movement Involved in Pedestrian Crashes, 2013-2015**

Vehicle movement	Serious injury crashes		Fatal crashes		All pedestrian crashes	
	Number	Percent	Number	Percent	Number	Percent
Vehicles going straight	271	42%	35	29%	1115	36%
Vehicles turning right	46	7%	3	3%	412	13%
Vehicles turning left	124	19%	4	3%	685	22%
All other vehicle movements	198	31%	78	65%	885	29%

**Table 16.** Vehicle Movements Involved in Bicycle Crashes

Vehicle Movement	Serious injury crashes		Fatal crashes		All bicycle crashes	
	Number	Percent	Number	Percent	Number	Percent
Vehicles going straight	179	54%	10	50%	1277	45%
Vehicles turning right	50	15%	1	5%	703	25%
Vehicles turning left	66	20%	3	15%	518	18%
All other vehicle movements	37	11%	6	30%	310	11%

## Age and Sex of People Involved in Crashes

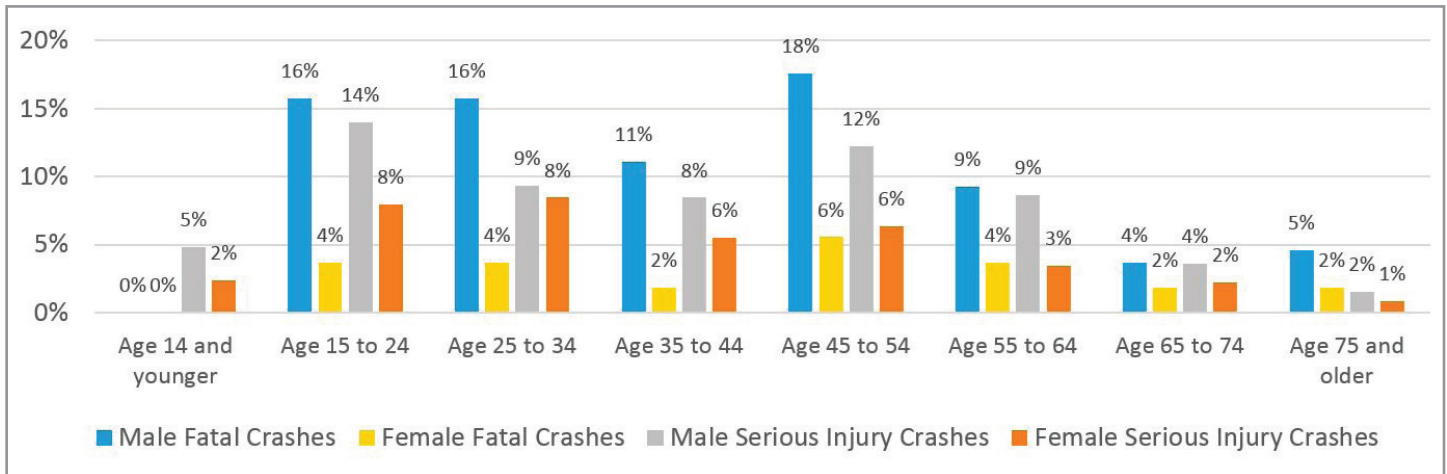
Not all crashes in the database list the age or sex of the individuals involved. This report considers only crashes for which sufficient information was provided.

**Table 17** and **Figure 15** show the numbers and percent of pedestrian crashes by age and sex. In the Denver region, 54 percent of pedestrian commuters are male, whereas 46 percent are female (U.S. Census Bureau, 2012-2016 American Community Survey). Among pedestrian crashes, males accounted for 63 percent of serious injury crashes

and 78 percent of fatal crashes. Females accounted for 37 percent of serious injury crashes and 22 percent of fatal crashes.

Overall, the most serious injury crashes (127) occurred among pedestrians age 15 to 24. The most fatal pedestrian crashes (25) occurred between pedestrians age 45 to 54.

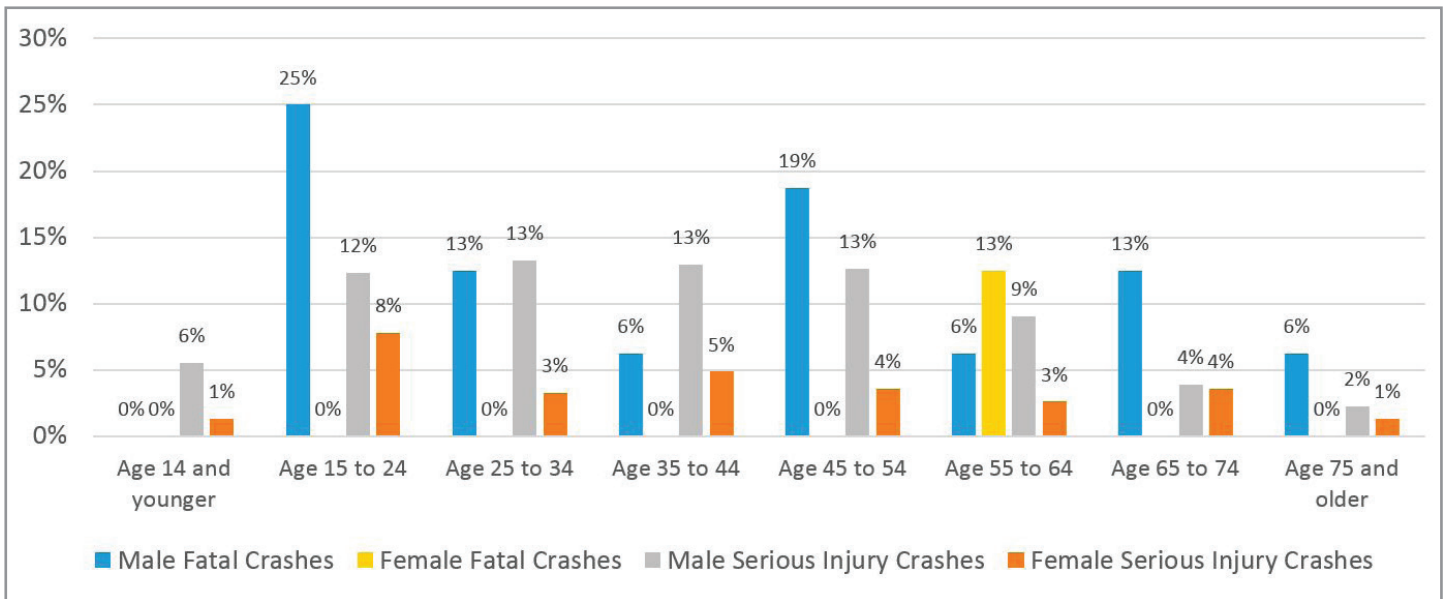
**Figure 15.** Pedestrian Age and Sex as a Percentage of Serious Injury and Fatal Crashes, 2013-2015



**Table 17.** Pedestrian Age and Sex for Serious Injury and Fatal Crashes, 2013-2015

Male ages:	Serious injury crashes (Total: 363)	Fatal crashes (Total: 84)
Age 14 and younger	28	0
Age 15 to 24	81	17
Age 25 to 34	54	17
Age 35 to 44	49	12
Age 45 to 54	71	19
Age 55 to 64	50	10
Age 65 to 74	21	4
Age 75 and older	9	5
Female ages:	Serious injury crashes (Total: 216)	Fatal crashes (Total: 24)
Age 14 and younger	14	0
Age 15 to 24	46	4
Age 25 to 34	49	4
Age 35 to 44	32	2
Age 45 to 54	37	6
Age 55 to 64	20	4
Age 65 to 74	13	2
Age 75 and older	5	2

**Figure 16.** Bicyclist Age and Sex as a Percentage of Serious Injury and Fatal Crashes, 2013-2015





**Table 18** and **Figure 16** show the number and percent of bicycle crashes by age and sex. In the Denver region, 71 percent of bicycle commuters are male, whereas 29 percent are female (U.S. Census Bureau, 2012-2016 American Community Survey). Among bicyclists, males

accounted for 72 percent of serious injury crashes and 88 percent of fatal crashes. Females accounted for 28 percent of serious injury crashes and 13 percent of fatal crashes.

The most serious injury crashes (62) and fatal crashes (four) occurred among bicyclists age 15 to 24.

**Table 18. Bicyclist Age and Sex of Serious Injury and Fatal Crashes, 2013-2015**

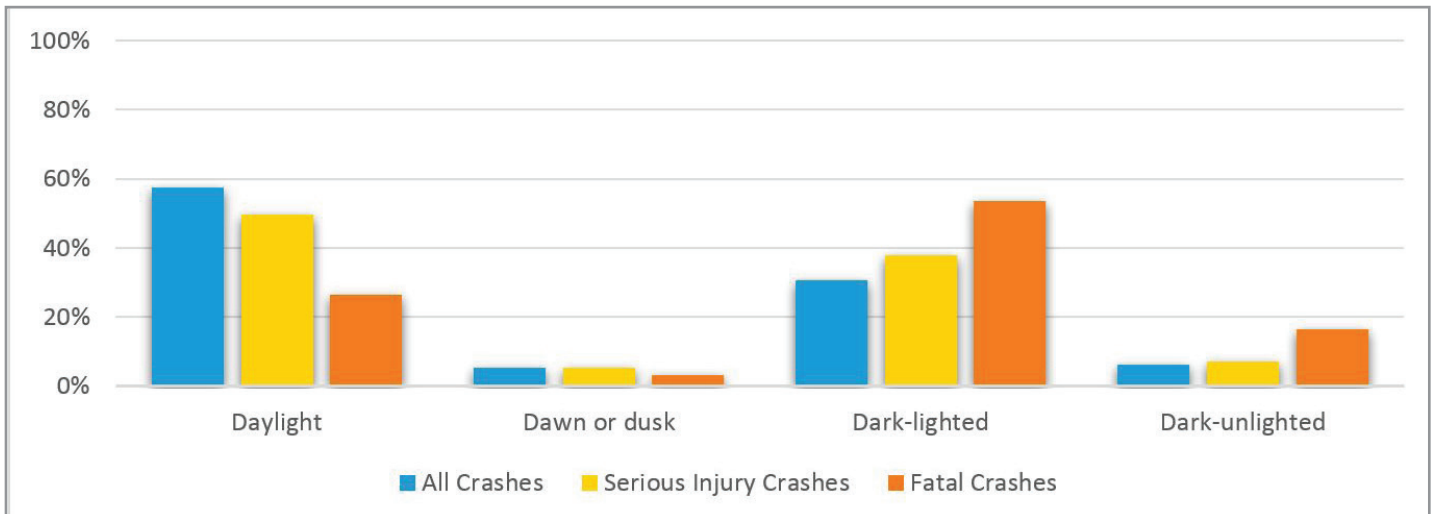
Male ages:	Serious injury crashes (Total: 222)	Fatal crashes (Total: 14)
Age 14 and younger	17	0
Age 15 to 24	38	4
Age 25 to 34	41	2
Age 35 to 44	40	1
Age 45 to 54	39	3
Age 55 to 64	28	1
Age 65 to 74	12	2
Age 75 and older	7	1
Female ages:	Serious injury crashes (Total: 87)	Fatal crashes (Total: 2)
Age 14 and younger	4	0
Age 15 to 24	24	0
Age 25 to 34	10	0
Age 35 to 44	15	0
Age 45 to 54	11	0
Age 55 to 64	8	2
Age 65 to 74	11	0
Age 75 and older	4	0

## CONDITIONS

Conditions on the roadway affect drivers, pedestrians and bicyclists. Better light quality allows drivers to be better aware of their surroundings, and rain or snow can affect a vehicle’s ability to make sudden stops. The number of pedestrian and bicycle crashes that occurred in various lighting, weather and roadway conditions were analyzed. **Figures 17 through 20** illustrate the distribution of all crashes (disregarding severity), all serious injury crashes and all fatal crashes for pedestrians and bicyclists.

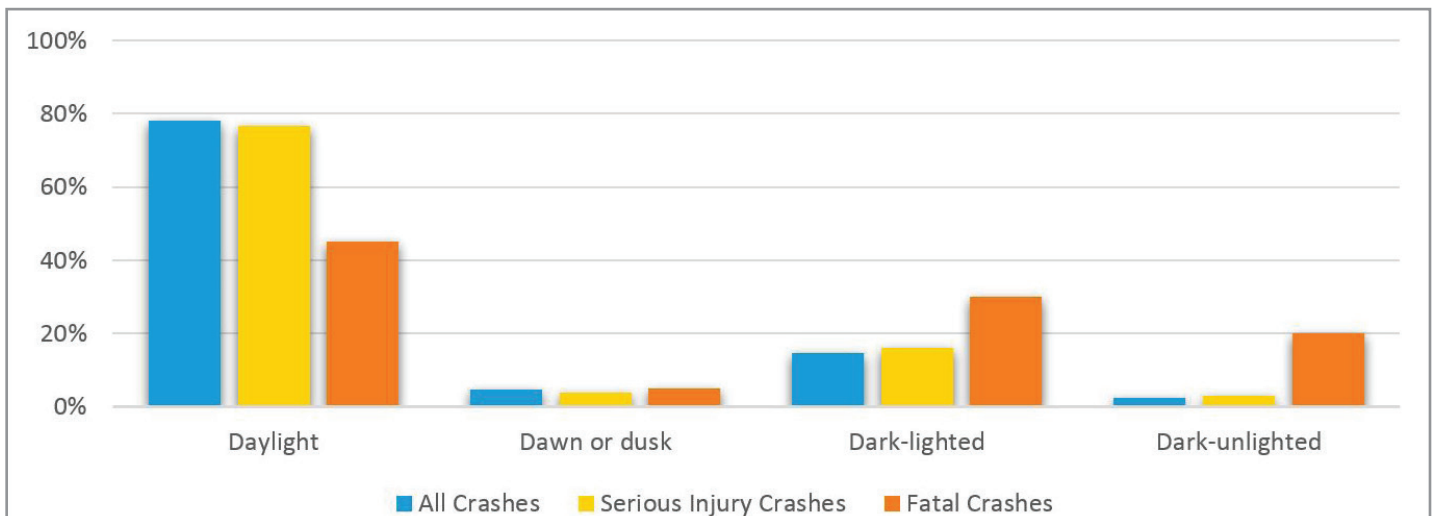
**Figure 17** shows that 58 percent of all pedestrian crashes occurred in daylight and 31 percent occurred in dark-lighted areas (dark areas with adequate lighting). Among fatal pedestrian crashes, 26 percent of happened in daylight, 54 percent in dark-lighted areas and 17 percent in dark-unlighted areas (dark areas with no lighting).

**Figure 17.** Distribution of Pedestrian Crashes in Various Light Conditions, 2013-2015



**Figure 18** shows that 78 percent of all bicycle crashes occurred in daylight and 15 percent occurred in dark-lighted areas. Among fatal bicycle crashes, 45 percent happened in daylight, 30 percent in dark-lighted areas and 20 percent of in dark-unlighted areas.

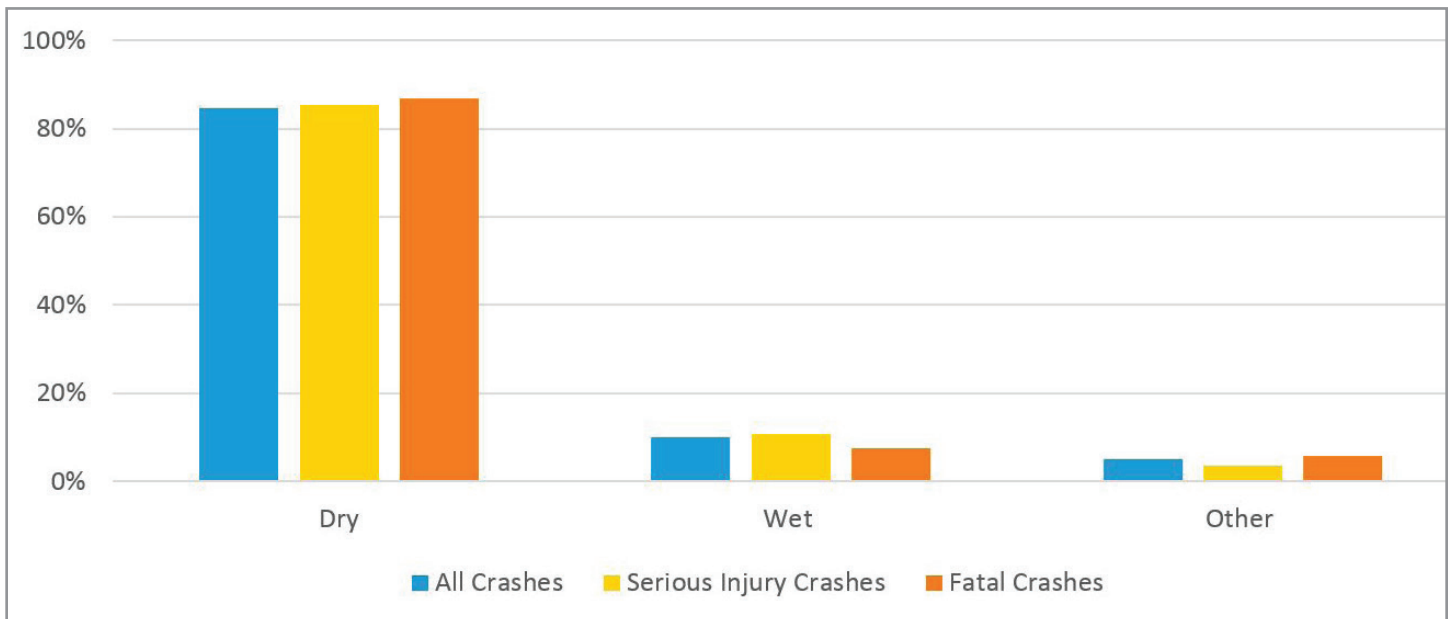
**Figure 18.** Distribution of Bicycle Crashes in Various Light Conditions, 2013-2015



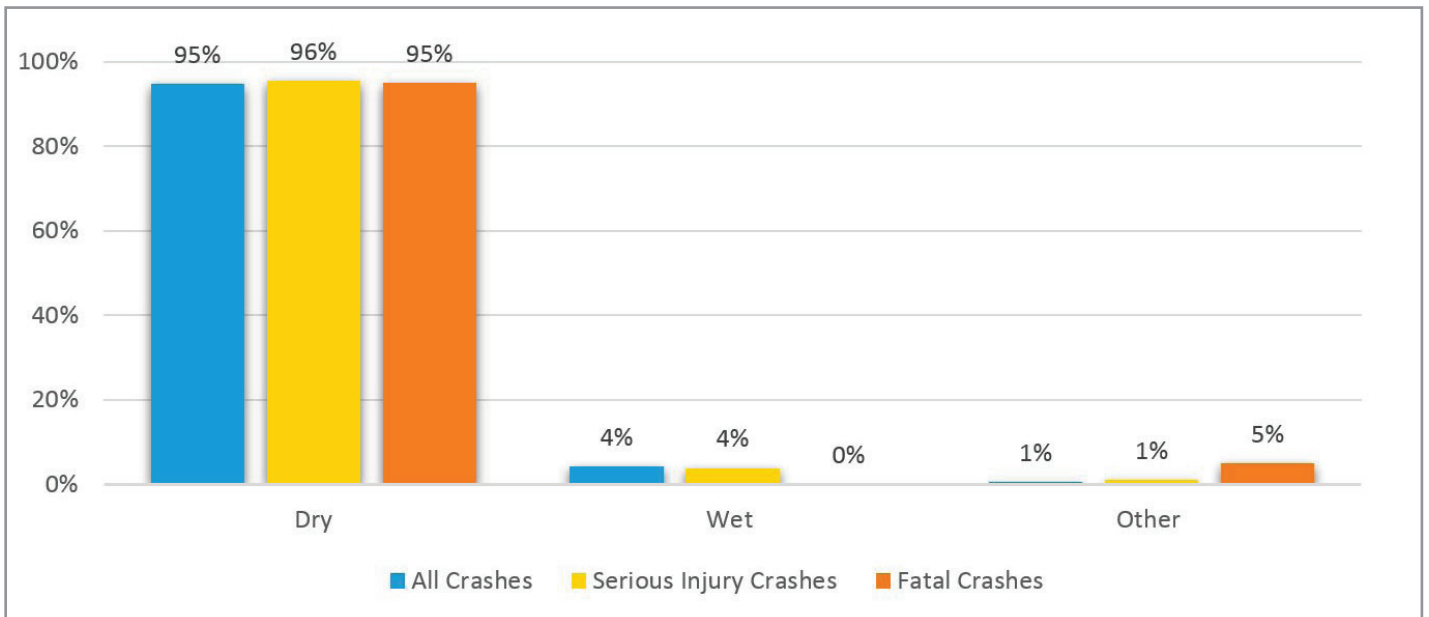
The Denver region's climate is mild and sunny. Weather data collected from 1981 to 2010 for the National Oceanic and Atmospheric Administration National Climate Data Center show Denver averages only 87 days a year with precipitation. **Figures 19** and **20** show that, among

pedestrians, no less than 85 percent of all crashes, serious injury crashes and fatal crashes happened on dry roadways. Among bicycle crashes, no less than 95 percent of all crashes, serious injury crashes and fatal crashes occurred in the absence of rain or snow.

**Figure 19.** Distribution of Pedestrian Crashes in Various Roadway Conditions, 2013-2015



**Figure 20.** Distribution of Bicycle Crashes in Various Road Conditions, 2013-2015



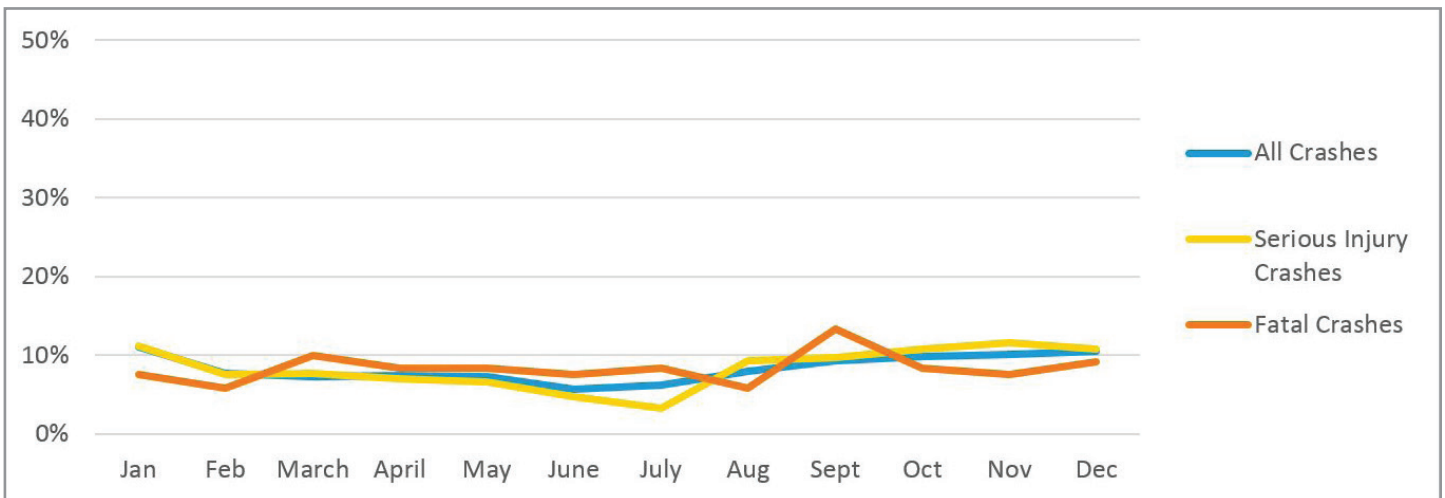
## When Crashes Occur

Figures 21 through 26 illustrate the distribution of all crashes (disregarding severity), all serious injury crashes and all fatal crashes for pedestrians and bicyclists.

For pedestrians, Figure 21 shows that the number of crashes are, for the most part, consistent, month-to-month.

When considering all pedestrian crashes, percentages range from 6 percent (June and July) to 11 percent (January). For pedestrians, November had the highest percent of serious injury crashes (12 percent), and September had the most fatal crashes (13 percent).

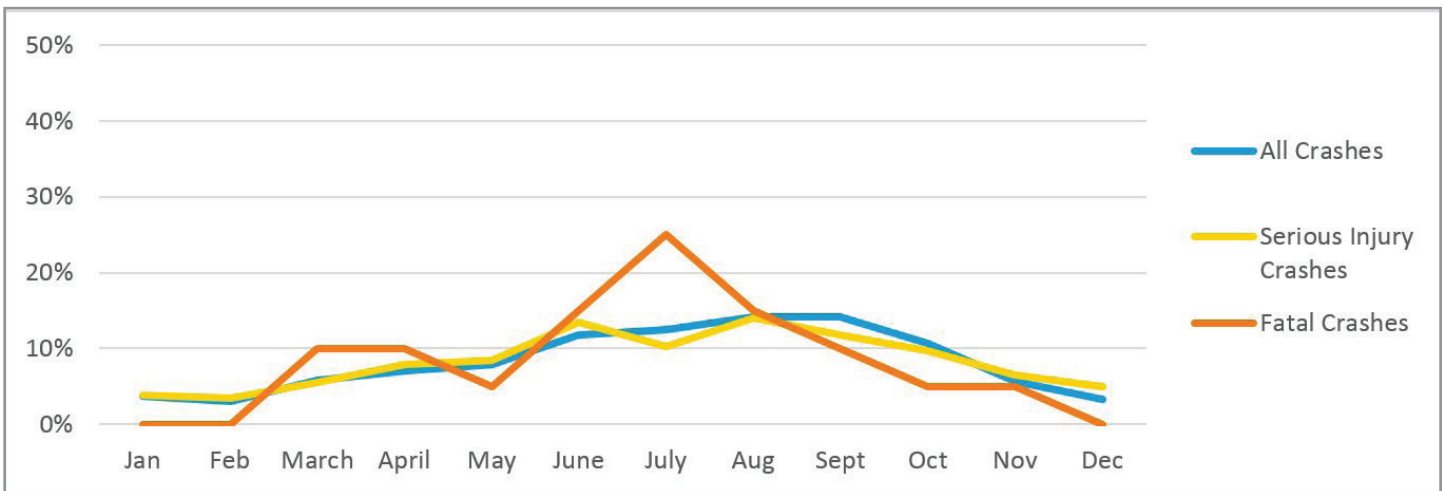
**Figure 21.** Distribution of All Pedestrian Crashes by Month, 2013-2015



For bicyclists, **Figure 22** shows that the month in which crashes occurred fluctuated slightly more than for their pedestrian counterparts. When considering all bicyclist crashes, the percentages range from 3 percent (February

and December) to 14 percent (August and September). For bicyclists, the highest percent of serious injury crashes occurred in August (14 percent), and the most fatal bicyclist crashes occurred in July (25 percent).

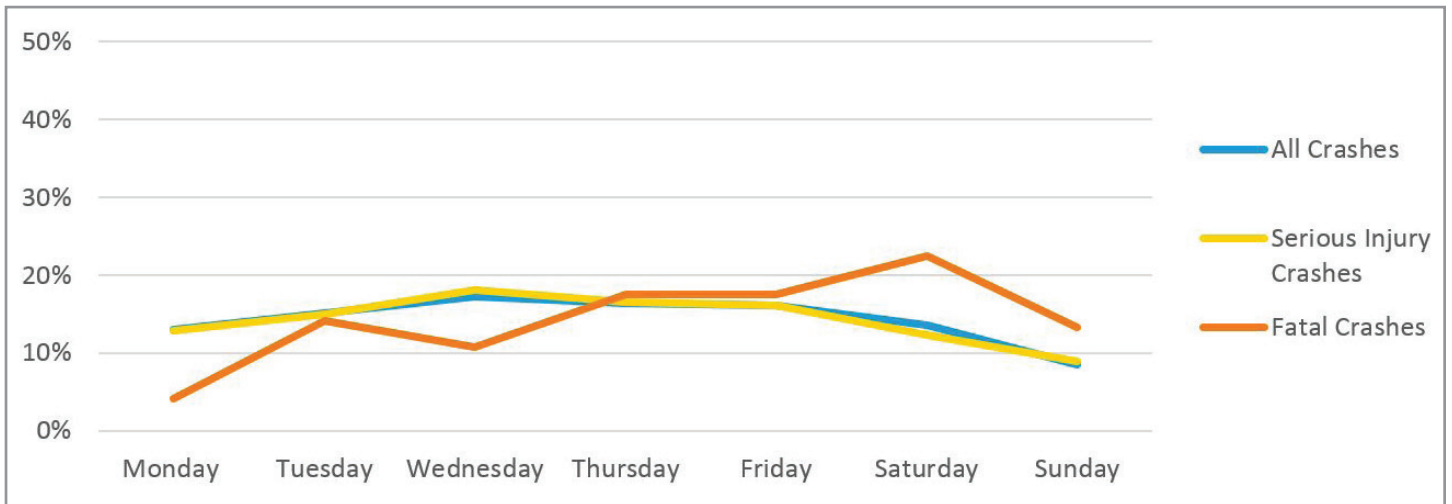
**Figure 22.** Distribution of All Bicyclist Crashes by Month, 2013-2015



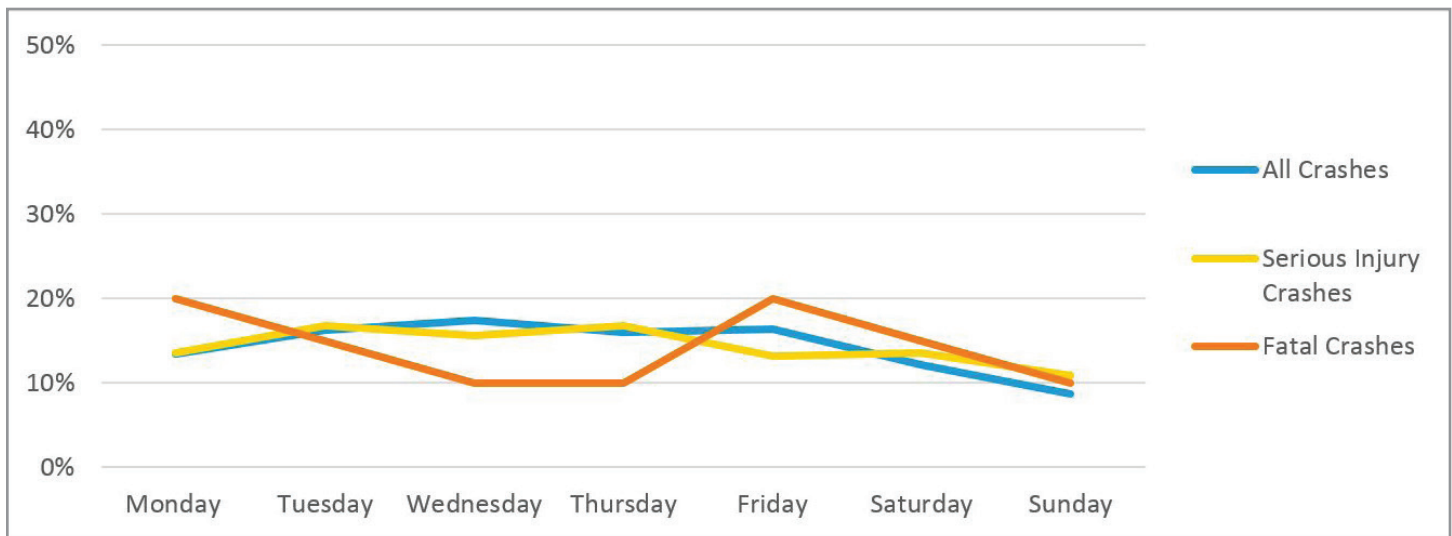
Figures 23 and 24 illustrate consistency among the days pedestrian and bicycle crashes took place. For both modes, crashes ranged from 12 to 17 percent for every day except Sunday which had a low of 8 percent for pedestrian

crashes and 9 percent for bicyclist crashes. The most fatal pedestrian crashes occurred on Saturday and the most fatal bicyclist crashes occurred on Monday and Friday.

**Figure 23.** Distribution of Pedestrian Crashes by Day of Week, 2013-2015



**Figure 24.** Distribution of Bicyclist Crashes by Day of Week, 2013-2015

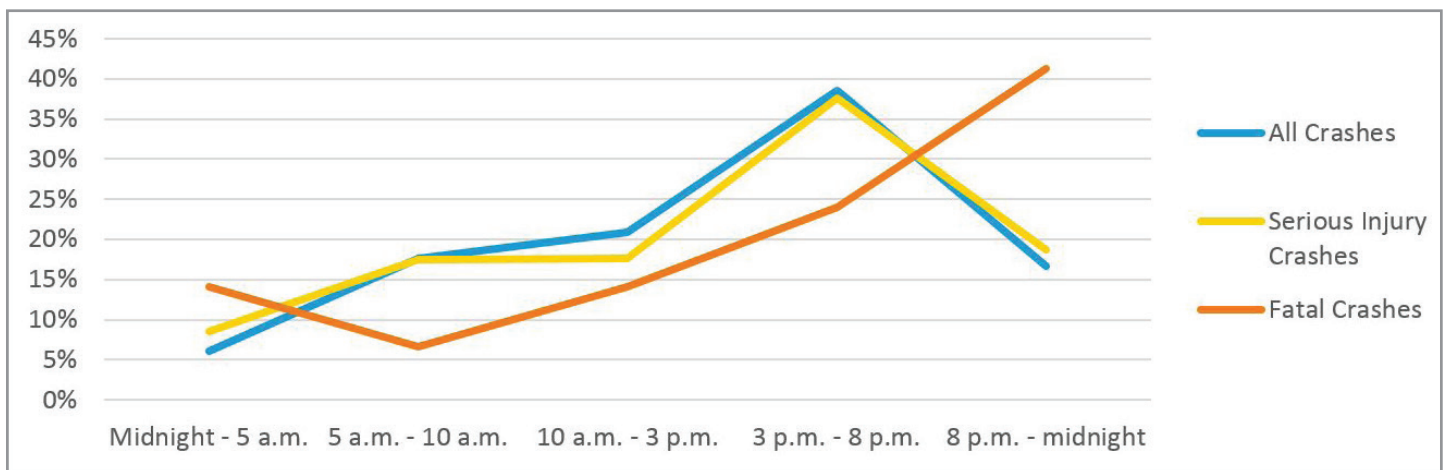




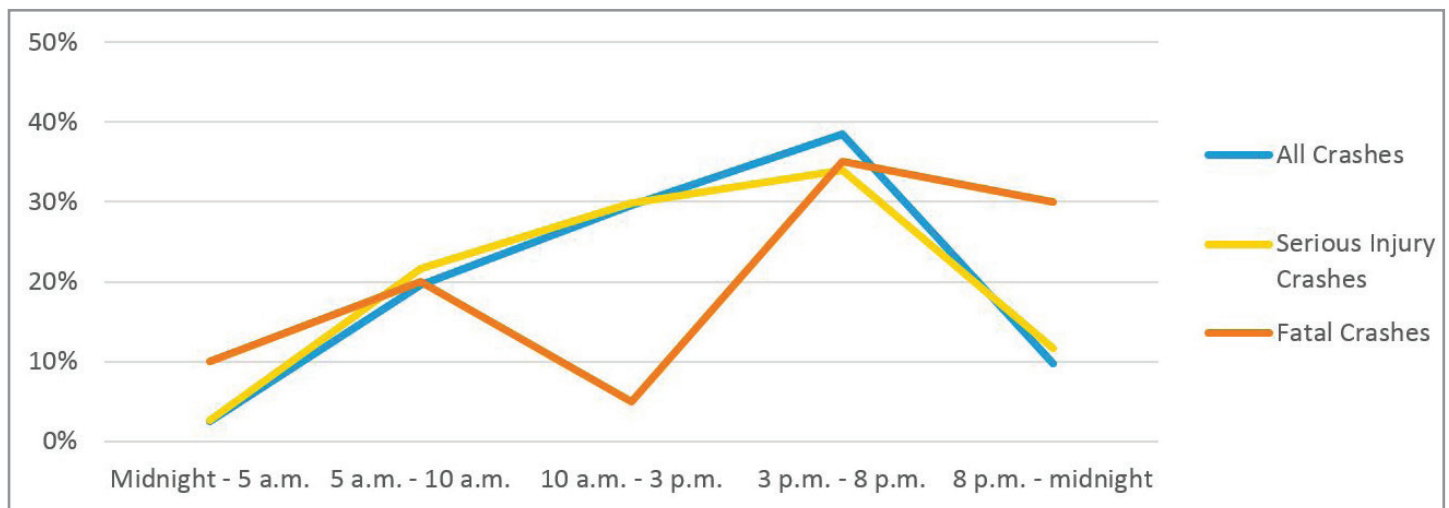
Figures 25 and 26 show that among all crashes and serious injury crashes, most occurred between 3 p.m. and 8 p.m. for both bicyclists and pedestrians. For pedestrians, about 40 percent of all crashes and serious injury crashes occurred between 3 p.m. and 8 p.m., and 41 percent of

fatal crashes happened between 8 p.m. and midnight. Among bicyclists, the highest percentage of all crashes, serious injury crashes and fatal crashes occurred between 3 p.m. and 8 p.m. For fatal bicycle crashes, 65 percent occurred between 3 p.m. and midnight.

**Figure 25.** Distribution of Pedestrian Crashes by Time of Day, 2013-2015



**Figure 26.** Distribution of Bicyclist Crashes by Time of Day, 2013-2015

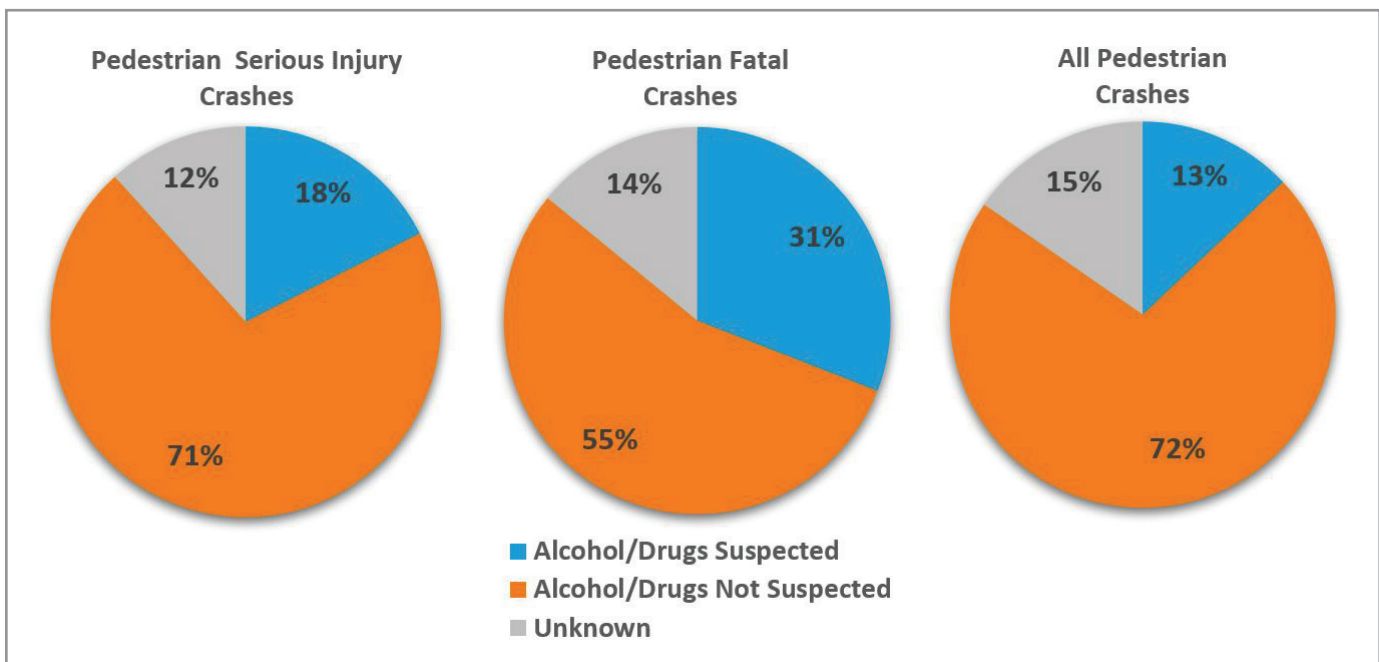


## Crashes Involving Impaired Driving

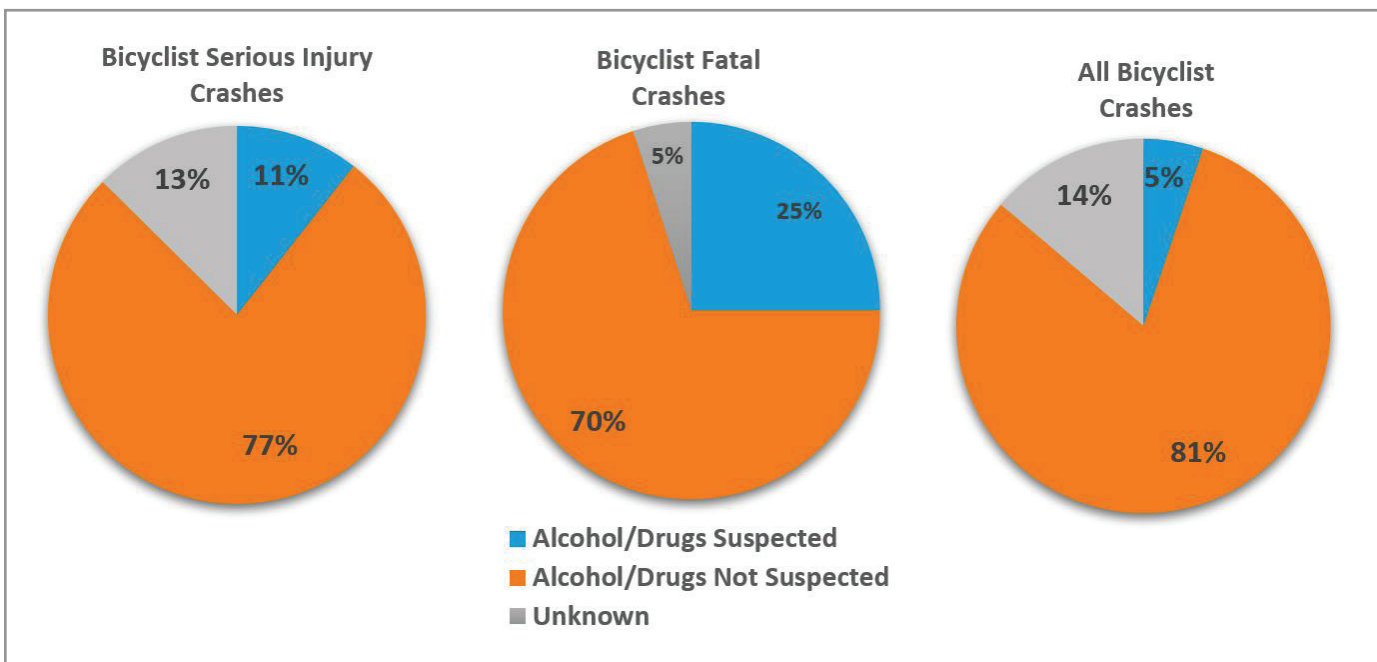
**Figure 27** shows the percentage of pedestrian crashes that involved drivers impaired by alcohol or drugs, which accounted for 31 percent of fatal pedestrian crashes.

**Figure 28** shows the percentage of bicycle crashes that involved drivers impaired by alcohol or drugs which accounted for one in four fatal bicycle crashes.

**Figure 27.** Pedestrian Crashes Involving Alcohol and Drugs, 2013-2015



**Figure 28.** Bicycle Crashes Involving Alcohol or Drugs, 2013-2015



## Crashes Involving Human Contributing Factors

In some crashes, the behavior of the motor vehicle driver causes crashes that involve pedestrians or bicyclists. Such contributing factors include, but are not limited to, falling asleep at the wheel, driver inexperience, aggressive driving, texting while driving and physical impairment.

**Table 19** shows the number of pedestrian crashes affected by such factors from 2013 through 2015. Among pedestrians, human behavior or contributing factors accounted for 42 percent of all crashes, 44 percent of serious injury crashes and 42 percent of fatal crashes.

**Table 19.** Pedestrian Crashes Involving Human Contributing Factors, 2013-2015

Pedestrian crashes involving human contributing factors	Serious injury crashes	Fatal crashes	All pedestrian crashes
Asleep at wheel	3	0	4
Driver fatigue	1	0	8
Illness/medical	5	1	12
Driver inexperience	24	3	109
Aggressive driving	23	2	122
Driver unfamiliar with area	5	0	34
Driver emotionally upset	4	0	15
Evading law enforcement	2	0	12
Physical disability	3	1	12
Driving under influence of alcohol, while impaired or under the influence of drugs	36	16	104
Distracted driver (for example, due to passenger, phone radio)	4	0	19
Other factors	141	21	601

**Table 20** shows the number of bicycle crashes affected by human contributing factors from 2013 through 2015. Among bicyclists, human contributing factors accounted for 50 percent of all crashes, 59 percent of serious injury crashes and 40 percent of fatal crashes.

**Table 20. Bicycle Crashes Involving Human Contributing Factors, 2013-2015**

Bicycle crashes involving human contributing factors	Serious injury crashes	Fatal crashes	All bicycle crashes
Asleep at wheel	2	0	10
Driver fatigue	0	0	6
Illness/medical	2	0	5
Driver inexperience	25	1	267
Aggressive driving	27	1	144
Driver unfamiliar with area	10	0	64
Driver emotionally upset	0	0	6
Evading law enforcement	0	0	3
Physical disability	0	0	3
Driving under the influence of alcohol, while impaired or under the influence of drugs	23	4	64
Distracted driver (for example, due to passenger, phone or radio)	18	0	196
Other factors	86	2	602

## NEXT STEPS

This report provides fundamental information on pedestrian and bicycle crashes in the Denver region, representing DRCOG's intent is to increase awareness among planners, engineers and elected officials as they contemplate safety issues in their communities and decide what action to take to resolve identified issues. This report uses the CDOT-DRCOG regional data sets and may not include detailed crash information available in some communities. DRCOG encourages local jurisdiction staff or elected officials who are interested in more detailed inquiries related to bicycle and pedestrian safety in their community to consult their local data, which often provide additional crash-level details.

DRCOG helps local member jurisdictions plan for active transportation by providing crash information, policy guidance, tools, data and analysis to local communities and stakeholders. Pedestrian and bicycle safety is multidisciplinary in nature; therefore, government agencies, law enforcement, drivers and educators will need to continue to work together to provide a transportation system which is safe and comfortable for all road users.





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