Appendix D: Crash Analysis

The crashes analyzed in this section include crashes involving a bicycle or pedestrian on the roadway network between 2015-2019. This dataset only includes crashes reported to the State of Colorado by law enforcement. Many bicycle and pedestrian crashes are not reported to law enforcement but may be in hospital or urgent care records if injuries resulted in treatment. Future efforts to analyze crash data should include efforts to collect any available information from health care providers.

Regionwide information presented in this section includes analysis of overall bicycle and pedestrian crash trends related to the characteristics of crashes as reported by law enforcement on the incident forms. Information reported by those involved in the crash is often lopsided. In crashes between a bicycle or pedestrian and a motor vehicle, the bicyclist or pedestrian is more likely than the driver to be in shock, flustered, injured, incapacitated, or killed. These factors affect what details are recounted and recorded.[43]

NFRMPO staff are available to assist local agencies with further analysis of crash data.

Corridor Analysis

2015-2019 crashes were analyzed on portions of every Regionally Significant Corridor (RSC) as well as corridors with discernable concentrations of bike- or pedestrian-involved crashes upon a visual scan of the geocoded crashes. A total of 69 corridors were analyzed (Listed in **Table AD-2**), representing just 7.6 percent (approximately 230 miles) of the road centerline miles in the NFRMPO region. **Table AD-1** shows a crash summary on these corridors.

Table AD-1: Crash summary across 69 roadway corridors, 2015-2019						
	Pedestrian-Involved		Bike-Involved		All Other	
	Crashes	Fatalities and Serious Injuries	Crashes	Fatalities and Serious Injuries	Crashes	Fatalities and Serious Injuries
Total	952	91	818	59	27,371	486
Percent of Crashes in NFRMPO Region	77.8 percent	68.9 percent	83.0 percent	76.6 percent	55.9 percent	36.1 percent

Table AD-1 demonstrates that a disproportionate number of pedestrian- or bike-involved fatality or serious injury (FSI) crashes and crashes overall are occurring on this small portion of the overall roadway network. Many of these 69 roadways have shared characteristics to one that may be contributing to safety issues. When looking at the 230 miles of analyzed corridors:

- 63 percent of the analyzed corridors had a 2017 Average Daily Traffic (ADT) above 10,000 vehicles

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[43] Schmitt, Angie. (2020). *Right of Way: Race, Class, and the Silent Epidemic of Pedestrian Deaths in America* (p. 54). Island Press.

- 58 percent of the analyzed corridors had 4 or more vehicle travel lanes
- 74 percent of the analyzed corridors had speed limits of 35 mph of higher

These corridors are comprised mainly of high volume, high speed, and wide roadways. Although robust bicycle and pedestrian count data is not available, it can reasonably be assumed that the majority of bicycle or pedestrian miles are not on this network, further emphasizing the safety disparities between major roadways compared with neighborhood streets. **Figure AD-1** shows the 69 corridors analyzed, overlaid with pedestrian- and bike-involved crashes.

Figure AD-1: 69 Roadway Corridors Analyzed for Crash Patterns
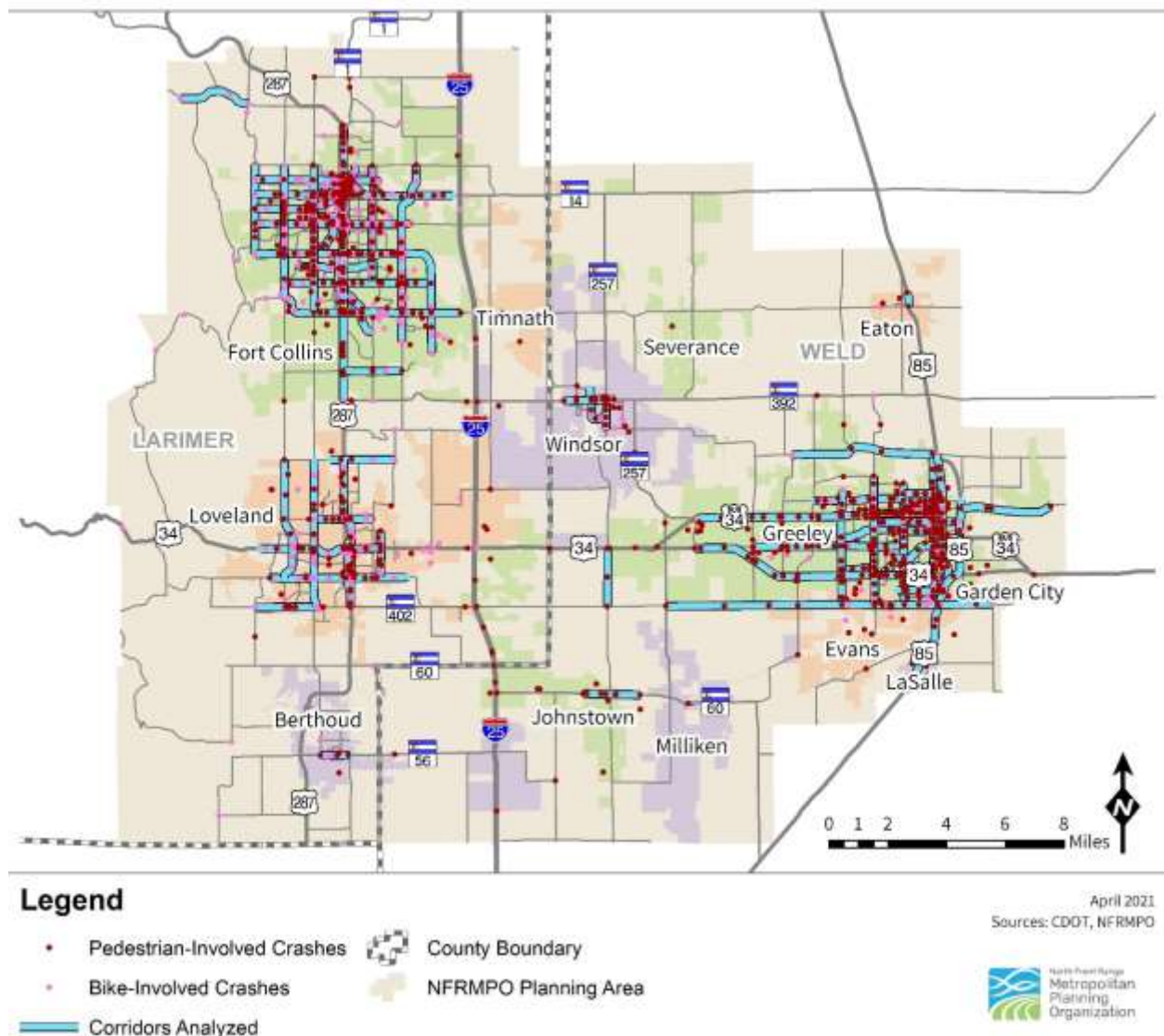

High Crash Corridors

These corridors represent the roads where the highest total number of bike- or pedestrian-involved crashes or FSI crashes are occurring, or where they are the highest as a percentage of all crashes or FSI crashes on that

specific corridor. These corridors are not normalized by length and were identified based on a visual scan of crash concentrations. These corridors do not reflect crash rates, such as "hot spots" where crash rates are higher than expected based on bicycle and pedestrian volumes, motor vehicle volumes, or other characteristics of the roadway or are travel patterns. Corridors are identified in **Table AD-2** and **Figure AD-2** as high crash corridors if they are in the Top 5 for the following metrics, measured using all crashes between 2015-2019:

- Total bike- or pedestrian involved crashes
- Total bike- or pedestrian involved crashes resulting in a fatality or serious injury (FSI)
- Bike- or pedestrian-involved crashes as a percentage of all crashes (minimum 10 bike or ped crashes)
- Bike- or pedestrian-involved FSI crashes as a percentage of all FSI (persons - minimum 2 FSI)

Table AD-2: NFRMPO High Crash Pedestrian- and Bike-Involved Corridors, 2015-2019			
Corridor Name	Crash Type	Mileage	Extents (N-S, W-E)
11th Ave (Greeley and Evans)	Ped	5.1	O St to 37th St
16th St (Greeley)	Ped	3.5	47th Ave to 8th Ave / Bus. US85
23rd Ave (Greeley and Evans)	Ped	4.1	C St to 47th Ave
29th St (Loveland)	Bike & Ped	2.0	Taft Ave to Madison Ave
7th St (Windsor)	Ped	1.0	SH2392 to Eastman Park Dr
Boise Ave (Loveland)	Bike	1.6	Silver Leaf Dr to 1st St
Center Place Dr (Greeley)	Ped	1.1	47th Ave to 35th Ave
College Ave / US287 (Fort Collins)	Bike & Ped	9.4	SH1 to Carpenter Rd / SH392
Drake Rd (Fort Collins)	Bike & Ped	5.0	Overland Trail to Timberline Rd
E 20th St (Greeley)	Ped	0.9	14th Ave to 4th Ave
Harmony Rd (Fort Collins)	Ped	6.3	Taft Hill Rd to Strauss Cabin Rd
Horsetooth Rd (Fort Collins)	Bike	5.0	Taft Hill Rd to Ziegler Rd
Lake St (Fort Collins)	Bike	1.2	Shields St to Mathews St
LaPorte Ave (Fort Collins)	Ped	3.0	Taft Hill Rd to College Ave / US287
Loomis/Meridian (Fort Collins)	Bike	0.7	Mountain Ave to North Dr
Mason St/Tr (Fort Collins)	Bike	1.7	Cherry St to Prospect Rd
Mulberry St (For Collins)	Ped	3.7	Overland Trail to Riverside Dr
Overland Tr (Fort Collins)	Bike	3.0	Vine Dr to Drake Rd
Pitkin St (Fort Collins)	Bike	1.1	Shields St to Remington St
Plum/North (Fort Collins)	Bike	0.7	City Park Ave to Meridian Ave
Remington St (Fort Collins)	Bike & Ped	1.7	Mountain Ave to Spring Park Dr
Shields St (Fort Collins)	Bike	5.0	Vine Dr to Harmony Rd
Timberline (Fort Collins)	Bike	6.2	Vine Dr to Kechter Rd
US287 (Loveland)	Ped	6.8	57th St to SH402
W 20th St (Greeley)	Bike	5.1	83rd Ave to 23rd Ave
W Business US34 (Greeley)	Ped	9.8	Promontory Pkwy to 8th St / Bus. US85
W Elizabeth (Fort Collins)	Bike	2.0	Overland Trail to Shields St
Prospect Rd (Fort Collins)	Bike	5.3	Overland Trail to Prospect Park Way
Ziegler Rd (Fort Collins)	Ped	4.2	Timberline Rd to Trilby Road

Figure AD-2: High Bicycle and Pedestrian Crash Network
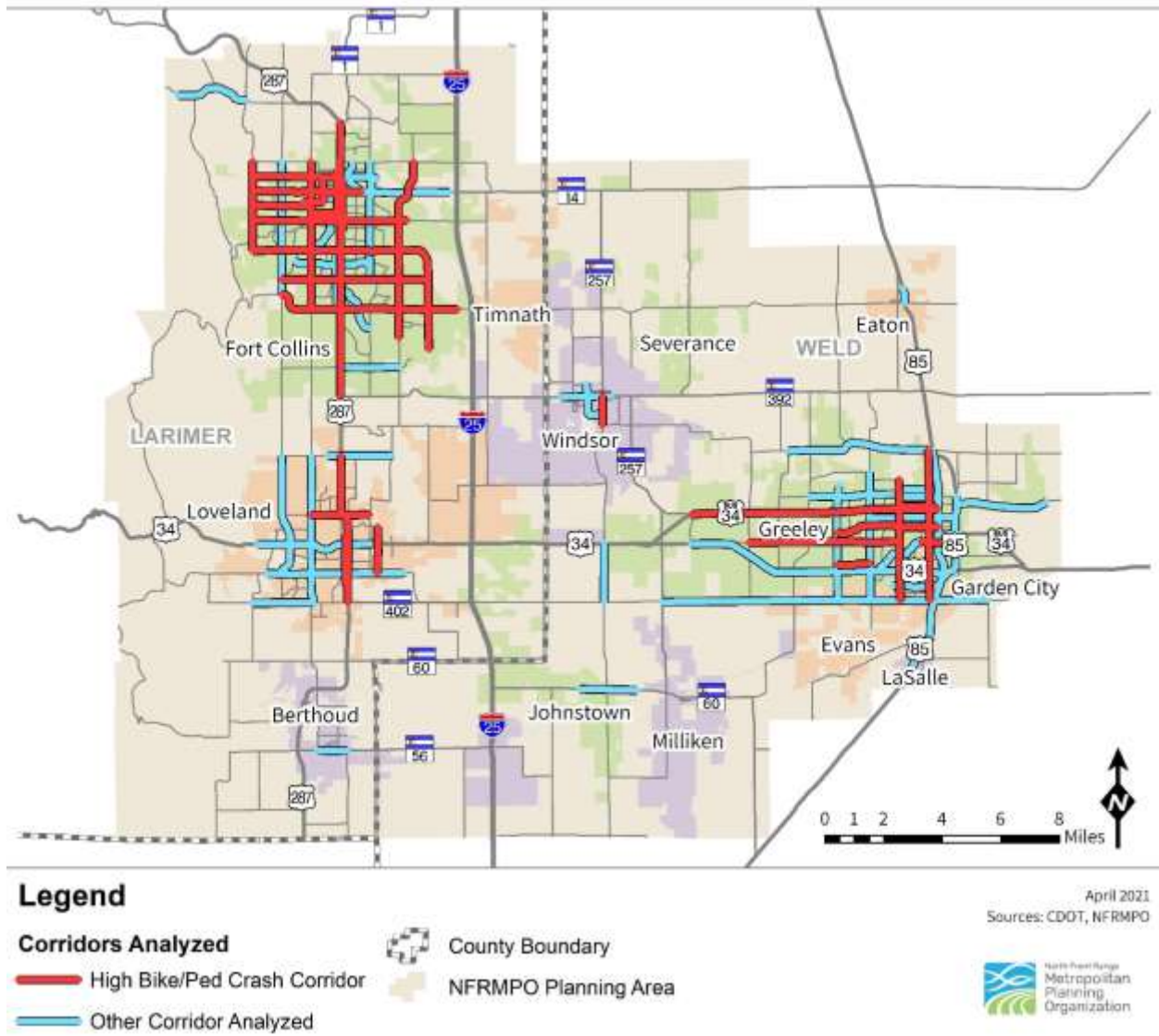
Pedestrian-Involved (PI) Crashes

Table AD-3: Top Corridors for Pedestrian-Involved Crashes (Totals), 2015-2019			
Total Pedestrian-Involved Crashes		**Total FSI in Pedestrian-Involved Crashes**	
Rank	**Crashes**	**Rank**	**FSI (Persons)**
1. College Ave / US287 (Fort Collins)	103	1. College Ave / US287 (Fort Collins)	12
2. W Bus. US34 (Greeley)	92	2. US287 (Loveland)	10
3. 11th Ave (Greeley and Evans)	61	3. Harmony Rd (Fort Collins)	7
4. 23rd Ave (Greeley and Evans)	52	4. 29th St (Loveland)	6
5. US34 (Greeley)	50	5. Drake Rd (Fort Collins)	6

Table AD-4-: Top Corridors for Pedestrian-Involved Crashes (Percentages), 2015-2019					
Pedestrian-Involved Crashes as a Percentage of All Crashes			**FSI in Pedestrian-Involved Crashes as a Percentage of All FSI**		
Rank	**Percent-age**	**Crashes**	**Rank**	**Percent-age**	**FSI (Persons)**
1. 16th St (Greeley)	7.0	34	1. LaPorte Ave (Fort Collins)	66.7	4
2. Remington St (Fort Collins)	6.8	15	2. 7th St (Windsor)	50.0	8
3. E 20th St (Greeley)	6.5	10	3. Mulberry St (For Collins)	44.4	26
4. 11th Ave (Greeley and Evans)	6.2	61	4. 23rd Ave (Greeley and Evans)	37.5	52
5. Center Place Dr (Greeley)	5.9	14	5. Ziegler Rd (Fort Collins)	37.5	7

Bike-Involved Crashes

Table AD-5: Top Corridors for Bike-Involved Crashes (Totals), 2015-2019			
Total Bike-Involved Crashes		**Total FSI in Bike-Involved Crashes**	
Rank	**Crashes**	**Rank**	**FSI (Persons)**
1. US287 (Fort Collins)	82	US287 (Fort Collins)	9
2. Shields (Fort Collins)	80	Shields (Fort Collins)	5
3. Drake Rd (Fort Collins)	59	Horsetooth Rd (Fort Collins)	5
4. Timberline (Fort Collins)	49	29th St (Loveland)	3
5. W Prospect Rd (Fort Collins)	45	Timberline (Fort Collins)	3

Table AD-6: Top Corridors for Bike-Involved Crashes (Percentages), 2015-2019					
Bike-Involved Crashes as a Percentage of All Crashes			FSI in Bike-Involved Crashes as a Percentage of All FSI		
Rank	Percent-age	Crashes	Rank	Percent-age	FSI (Persons)
1. Loomis/Meridian (Fort Collins)	18.5	10	1. Plum/North (Fort Collins)	66.7	2
2. Pitkin St (Fort Collins)	18.0	18	2. Mason St/Tr (Fort Collins)	50.0	2
3. Remington St (Fort Collins)	10.8	24	3. Overland Tr (Fort Collins)	50.0	2
4. Lake St (Fort Collins)	10.6	13	4. Boise Ave (Loveland)	50.0	2
5. W Elizabeth (Fort Collins)	8.4	31	5. W 20th St (Greeley)	33.3	2

Other Spatial Analysis

This section includes additional spatial analysis of crashes unrelated to roadway corridors. The geographic areas included are representative of point locations, Census Blocks, and/or Census Block Groups that are significant for various planning purposes.

Activity Centers

For the 2045 Regional Transportation Plan, 21 activity centers were identified, including higher education main campuses, all major medical centers, regional airports, major business and industrial parks, central business districts, and other and major commercial centers. Within ¼ mile of the activity centers:

- 47 percent (571) of all pedestrian-involved crashes occurred;
    - 39 percent (51) of pedestrian-involved fatalities or serious injuries occurred;
- 50 percent (496) of all bike-involved crashes occurred; and,
    - 32 percent (25) of bike-involved fatalities or serious injuries occurred.

University Campuses

Two specific activity centers with some of the highest rates of walking and bicycling are the Colorado State University (CSU) and University of Northern Colorado (UNC) main campuses in Fort Collins and Greeley, respectively. Within ¼ mile of the CSU and UNC main campuses:

- 13 percent (159) of all pedestrian-involved crashes occurred;
    - 10 percent (13) of pedestrian-involved fatalities or serious injuries occurred;
- 16 percent (158) of all bike-involved crashes occurred; and,
    - 10 percent (8) of bike-involved fatalities or serious injuries occurred.

K-12 Schools

Many K-12 students across the NFRMPO region bike or walk to school. Although some schools are not located in particularly pedestrian- or bicycle-friendly areas, many students have no other choice. The benefits of biking or walking to school include lower transportation costs for school districts and families, reduced student absences and tardiness, healthier students, improved academic performance, fewer asthma attacks, and

more.[44] These benefits, however, cannot be realized if safe walking and biking conditions do not exist around the school. Within ¼ mile of K-12 schools in the NFRMPO region:

- 32 percent (391) of all pedestrian-involved crashes occurred;
    - o 23 percent (31) of pedestrian-involved fatalities or serious injuries occurred;
- 24 percent (238) of all bike-involved crashes occurred; and,
    - o 19 percent (15) of bike-involved fatalities or serious injuries occurred.

Transit Stops

Transit stops are most commonly accessed as a pedestrian, and often as a cyclist. For individuals who do not have access to a vehicle and rely on transit, their safety is dependent on the quality of the bicycle and pedestrian infrastructure leading to and from transit stops. Within ¼ mile of transit stops within the NFRMPO region:

- 57 percent (701) of all pedestrian-involved crashes occurred;
    - o 54 percent (71) of pedestrian-involved fatalities or serious injuries occurred;
- 66 percent (650) of all bike-involved crashes occurred; and,
    - o 52 percent (40) of bike-involved fatalities or serious injuries occurred.

Environmental Justice (EJ) Areas

Approximately 46 percent of the NFRMPO population lives in EJ areas, according to 2014-2018 five-year estimates from the American Community Survey (ACS) and 2016-2017 estimates from the Colorado State Demography Office (SDO). EJ Areas were analyzed with a 100-foot buffer to capture the road right-of-way along their borders. Within 100 feet of EJ Areas:

- 82 percent (1,003) of all pedestrian-involved crashes occurred;
    - o 75 percent (99) of pedestrian-involved fatalities or serious injuries occurred;
- 80 percent (786) of all bike-involved crashes occurred; and,
    - o 74 percent (57) of bike-involved fatalities or serious injuries occurred.

Crash Characteristics, Conditions, and Contributing Factors

Certain crash attributes reported within the original dataset were selected for further analysis. A few of these attributes are reported below. Certain attributes such as age cannot be reliably summarized due to how missing values are coded in the crash database. Other attributes may warrant further analysis.

Alcohol or Drugs Suspected

Crashes in which alcohol or drugs are suspected tend to be deadlier in pedestrian- and bike-involved crashes than in all other crashes. **Table AD-7** illustrates the percentage of crashes resulting in a death or serious injury in which alcohol or drugs was suspected by someone involved in the crash.

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[44] "Benefits of Safe Routes to Schools, Sage Routes Partnership (2020). https://www.saferoutespartnership.org/safe-routes-school/101/benefits

Table AD-7: Fatality and Serious Injury Rates based on Suspected Alcohol or Drug Use						
Criterion	**No Alcohol or drugs suspected**			**Alcohol or drugs suspected**		
	Pedestrian-Involved	**Bike-Involved**	**All Other**	**Pedestrian-Involved**	**Bike-Involved**	**All Other**
Percent of crashes resulting in a fatality or serious injury	8 percent	7 percent	1 percent	29 percent	27 percent	7 percent

Month

Travel mode decisions are often dependent on time of year and weather patterns. Biking is more common in warmer weather months. Although this is true to some extent for pedestrian activity, nearly all trips involve some amount of time as a pedestrian, regardless of season. **Figure AD-3** illustrates that bike-involved fatalities and serious injuries are most common in the warmest months (May-August) and pedestrian-involved fatalities are more evenly distributed, with peaks across different seasons. All other crashes are more evenly distributed, with a small peak during summer months.

Figure AD-3: Percentage of All Fatalities and Serious Injuries by Month, 2015-2019
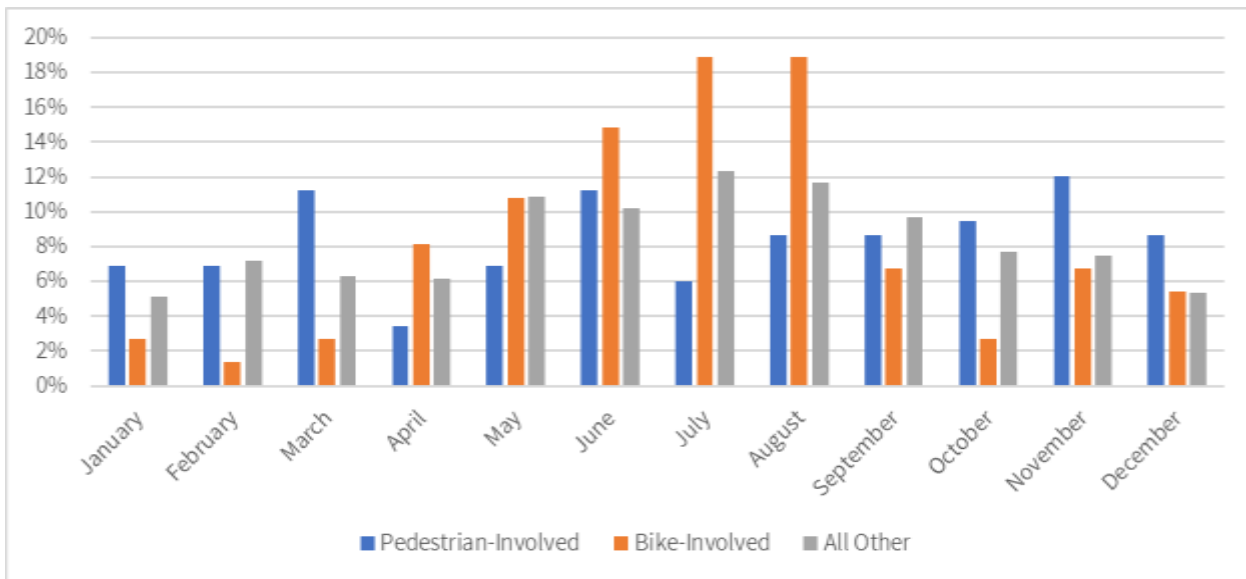
Roadway and Weather Conditions

Bike-involved crashes and fatalities or serious injuries are more common in fair or dry roadway or weather conditions than for pedestrian-involved and all other crashes.

Table AD-8: Crashes by Roadway and Weather Conditions, 2015-2019						
	Percentage of Crashes			Percentage of Fatalities or Serious Injuries		
Road Surface Condition	Pedestrian-Involved	Bike-Involved	All Other	Pedestrian-Involved	Bike-Involved	All Other
Dry	87 percent	94 percent	84 percent	91 percent	100 percent	89 percent
Other (Wet, Muddy, Snowy, Icy, Slushy, etc.)	13 percent	6 percent	16 percent	9 percent	0 percent	11 percent
Weather Conditions	Pedestrian-Involved	Bike-Involved	All Other	Pedestrian-Involved	Bike-Involved	All Other
Fair	91 percent	95 percent	89 percent	95 percent	100 percent	92 percent
Other (Rain, snow, sleet, hail, fog, dust, wind)	9 percent	5 percent	11 percent	5 percent	0 percent	8 percent

Human Contributing Factor

Human error is the most common reason for any type of crash. Specific conditions, actions, or impairments can often be identified as contributing factors to the crash. Although a contributing factor may not necessarily be the main reason for the crash, it can offer insight into the behaviors or actions that most often contribute a specific type of crash. **Table AD-9** highlights the top human contributing factors in pedestrian- or bike-involved crashes that resulted in a fatality or serious injury.

Contributing factors such as cell phone distraction are underreported because drivers are unlikely to admit to the action unless caught. In 2019, only 26 percent of Larimer County adults under age 44 reported never texting and driving, compared to 50 percent of those age 45-64 and 82 percent of those 65 or older. Although adults admit to cell phone use, 78 percent support policies that would restrict the use of handheld cell phones while driving.

	Pedestrian-Involved		Bike-Involved		All Other	
Table AD-9 Top Three Human Contributing Factors in Crashes Resulting in a Fatality or Serious Injury, 2015-2019						
Rank	**Human Contributing Factor**	**Percent of All FSI**	**Human Contributing Factor**	**Percent of All FSI**	**Human Contributing Factor**	**Percent of All FSI**
1	Distracted/Other i.e., Food, Objects, Pets	16 percent	DUI, DWAI, PUID	20 percent	DUI, DWAI, PUID	27 percent
2	DUI, DWAI, PUID	14 percent	Driver Inexperience	11 percent	Aggressive Driving	12 percent
3	Driver Inexperience	12 percent	(TIE) Aggressive Driving; Distracted/Other i.e., Food, Objects, Pets	7 percent (each)	Driver Inexperience	10 percent
	Other (without narrative)	*43 percent*	*Other (without narrative)*	*43 percent*	*Other (without narrative)*	*17 percent*

Driver Action

Certain actions by drivers may be more common with different types of crashes; however, in many cases a specific driver action may not be identified. This is especially true in pedestrian- or bike-involved crashes that result in a serious injury or fatality. In these crashes, the victim may either be in a state of shock or too incapacitated to offer their version of the events that led to the crash. Often, driver actions were not witnessed by anyone but those involved. For reasons such as these, driver actions are not always identified or may only portray one person's perception of the events. **Table AD-10** highlights the top driver actions that were reported in pedestrian- or bike-involved crashes that resulted in a fatality or serious injury.

Table AD-10: Top Three Driver Actions in Crashes Resulting in a Fatality or Serious Injury						
	Pedestrian-Involved		**Bike-Involved**		**All Other**	
Rank	**Driver Action**	**Percent of All FSI**	**Driver Action**	**Percent of All FSI**	**Driver Action**	**Percent of All FSI**
1	Careless Driving	8 percent	Failed to Yield ROW	7 percent	Careless Driving	10 percent
2	Reckless Driving	4 percent	Careless Driving	6 percent	Failed to Yield ROW	6 percent
3	Failed to Yield ROW	4 percent	Lane Violation	5 percent	Lane Violation	3 percent
	No Actions	*58 percent*	*No Actions*	*73 percent*	*No Actions*	*69 percent*

Pedestrian Action

Similar to driver actions, pedestrian actions may be dependent solely on the judgment of the reporting officer and the perceptions of those coherent enough to accurately report the events. **Tables AD-11** and **AD-12** below highlight the top pedestrian actions that were reported in pedestrian-involved crashes.

Table AD-11 Top Three Pedestrian Actions identified in Pedestrian-Involved Crashes		
	All Pedestrian-Involved Crashes	
Rank	**Pedestrian Action**	**Percent of All Crashes**
1	Cross/Enter at Intersection	15 percent
2	Cross Against Signal	7 percent
3	Cross/Enter NOT at Intersection	5 percent
	No Actions	*48 percent*
	Other (without narrative)	*17 percent*

Table AD-12: Top Three Pedestrian Actions identified in Pedestrian-Involved FSI Crashes		
	All Pedestrian-Involved Fatalities or Serious Injuries	
Rank	**Pedestrian Action**	**Percent of All FSI**
1	Cross/Enter at Intersection	10 percent
2	Cross/Enter NOT at Intersection	7 percent
3	Cross Against Signal	5 percent
	No Actions	*66 percent*
	Other (without narrative)	*6 percent*