Appendix C

Kansas Active Transportation Plan

Crash Analysis

Summary

April 2021

Kansas Department of Transportation

Contents

Introduction

The Kansas Department of Transportation initiated the development of the Kansas Active Transportation Plan (ATP) in part to improve the safety of bicycling and walking in the state. This portion of the plan focuses on a crash analysis of all roadways in the state. This analysis will be utilized to inform recommendations for safety, implementation actions, and toolkits for state and local agencies to improve bicycling and walking in Kansas. Between 2010 and 2019 (ten years), there were a total of 8,002 bicycle and pedestrian crashes in the state, 298 of which resulted in a person killed, and 971 resulting in a serious injury. The most impacted group of Kansans is young people under 30 years old.

Impact of Bicycle and Pedestrian Crashes

The estimated cost to society resulting from crashes during this period adds up to $5.35 billion, which equates to approximately $535 million per year. This data is shown in Table 1. To compare the relative cost of bike and pedestrian crashes compared to all crashes to society, average annual cost for all crashes in 2019 was estimated based on the same crash values. The total crash costs for all crashes was approximately $7.7 billion dollars per year. Therefore, bike and pedestrian crashes account for approximately 7% of annual crash costs, even though the mode share for biking and walking is estimated to be less than 3%.

- Each year, approximately 30 Kansas are killed, and 100 Kansas are seriously injured while walking or bicycling
- Pedestrian and bicyclist crashes result in an estimated $500M in societal costs per year
- Pedestrian and bicycle crashes are increasing with fatal and serious injury crashes increasing at a higher rate than minor injury crashes

Table 1: Estimated Crash Costs to Society from Bicycle and Pedestrian Crashes in Kansas, Statewide (2010 – 2019)

Cost of Crashes to Society for Pedestrian and Bicycle Crashes in Kansas Statewide (2010-2019)				
Severity	**Crashes**	**Cost per Crash Severity**	**Cost to Society***	**Average Cost per Year**
Fatal	**298**	**$12,186,397**	**$3,631,546,000**	**$363,154,600**
Serious Injury	**971**	**$663,375**	**$644,137,000**	**$64,413,700**
Non-Disabling Injury	**3,556**	**$209,287**	**$744,225,000**	**$74,422,500**
Possible Injury	**2,718**	**$118,507**	**$322,102,000**	**$32,210,200**
Property Damage Only (PDO)	**459**	**$10,297**	**$4,726,000**	**$472,600**
Total	**8,002**		**$5,346,736,000**	**$534,673,600**
***Crash costs are an estimation of the monetary impact of a crash. This includes direct costs such as medical bills, lost wages, repairs, etc. as well as intangible consequences such as reduced quality of life.**				

Trends

Bicyclist and pedestrian crashes have been increasing in Kansas over the past 10 years. All crashes have been increasing but fatal and serious injury crashes have been increasing at a higher rate. The bicycle and pedestrian crash trends using five-year rolling averages are shown in Figure 1. The increase of crashes based on the five-year rolling averages are:

- Fatal and Serious Injury Bicycle Crashes = 6.9% increase
- Fatal and Serious Injury Pedestrian Crashes = 16.4% increase

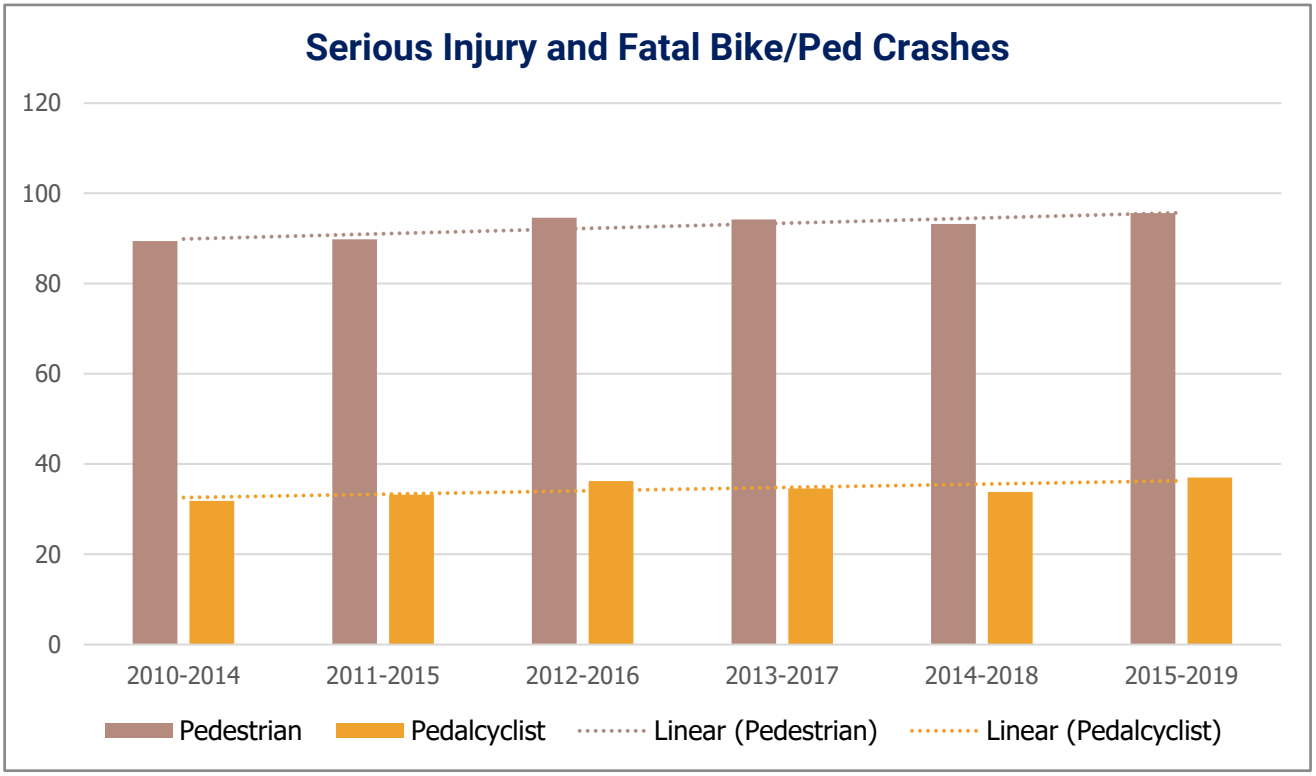


Figure 1: Fatal and serious injury bicycle and pedestrian crashes in Kansas five year rolling averages (2010 – 2019)

Crash Frequency and Characteristics

The location of bicycle and pedestrian crashes in Kansas is highly influenced by who the user is and whether the pedestrian or cyclist is in an urban area or rural area. Young people between the ages of 14 and 24 represent the highest risk group for being hit, injured, or killed while walking or biking. The second highest risk group is adults ages 45 – 60. Nearly 80% of the crashes, deaths, and serious injuries occurred in urban areas (as seen in Figure 2). A slightly greater proportion of pedestrian crashes in urban areas also result in more severe consequences: 19% of pedestrian crashes in urban areas result in a death or serious injury compared with 16% in rural areas. The proportion for cyclists is nearly the same in urban and rural areas—in both areas about 9% of the crashes result in a death or serious injury.

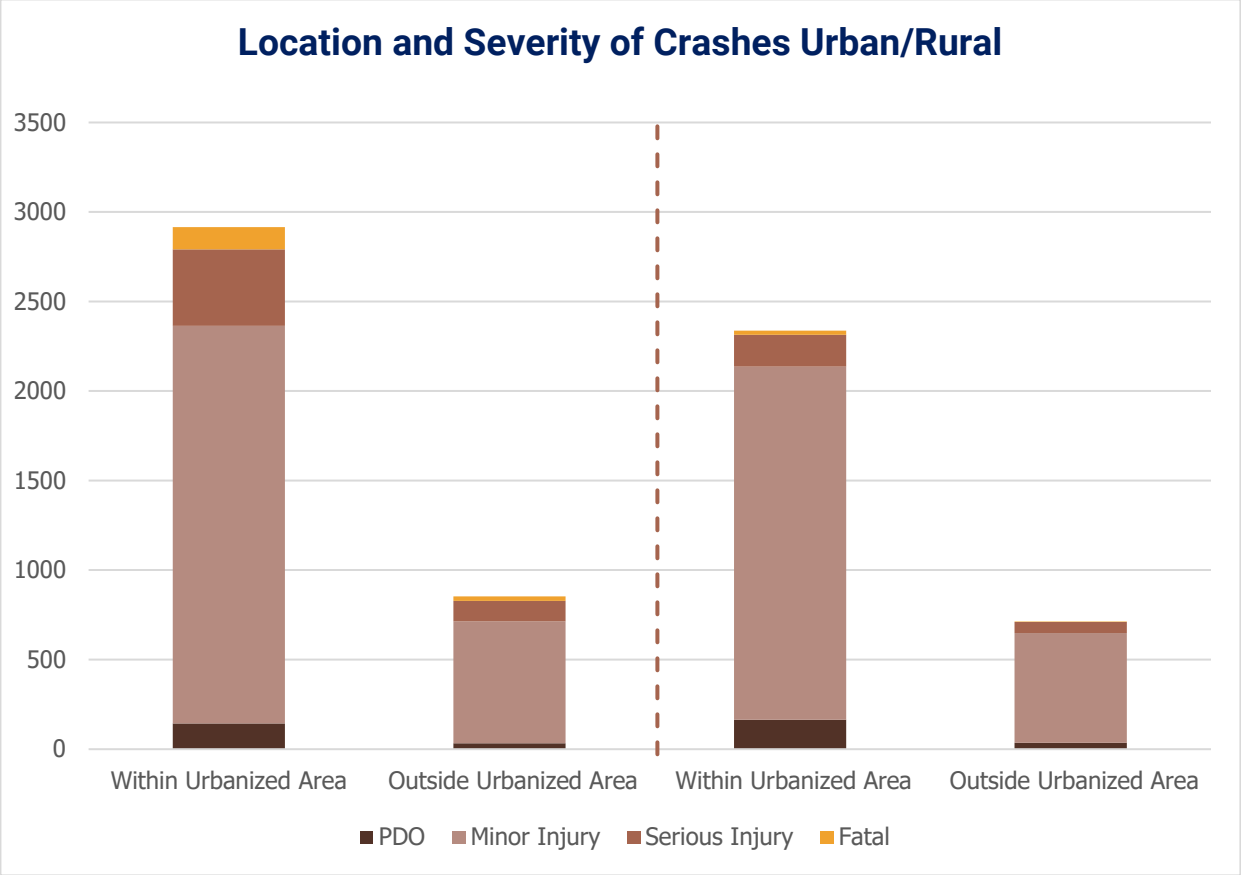


Figure 2: All pedestrian and bicycle crash severity separated by urban/rural designations (2010 - 2019)

Analysis also shows that location on a roadway and presence of bicycle and pedestrian infrastructure has a significant impact. As can be seen in Figure 3, approximately 90% of crashes happen when a cyclist or pedestrian is in the street (as opposed to on a sidewalk or shared use path). When in the street, more pedestrians are hit at non-intersection locations, whereas more cyclists hit at intersection locations. However, it should be noted that this does not account for the availability of facilities, only the location of the crashes.

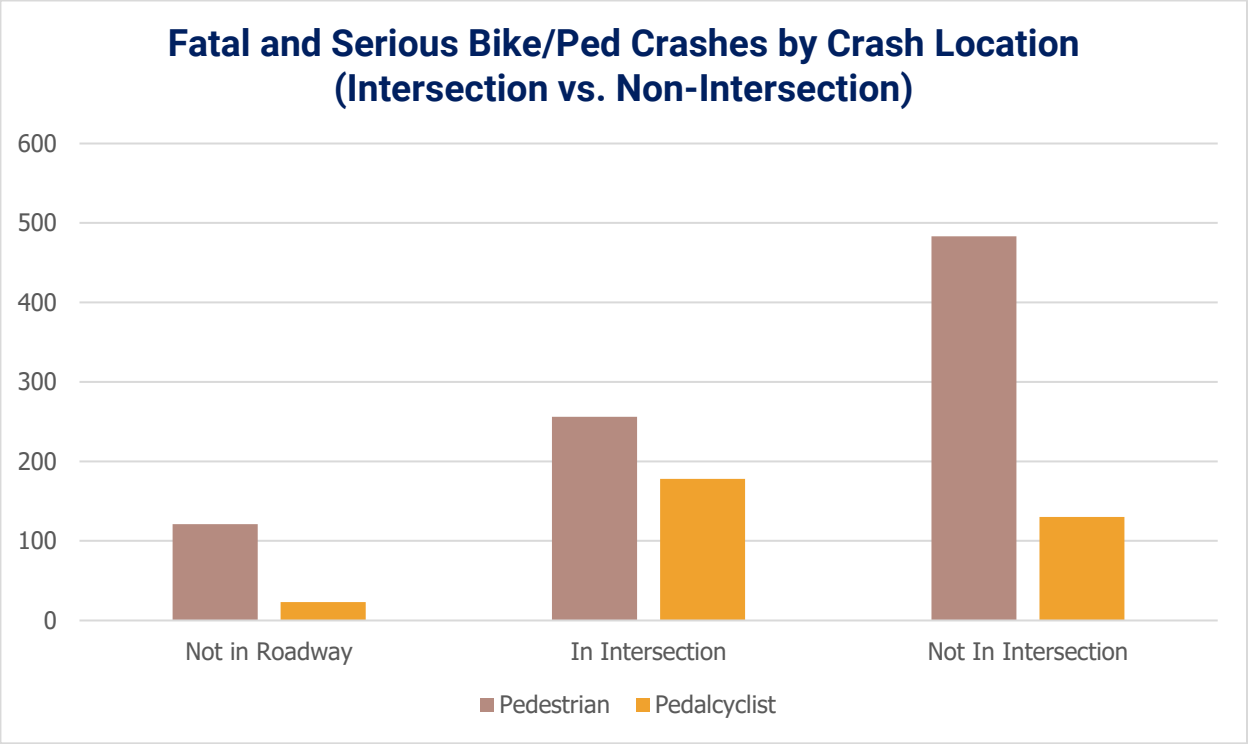


Figure 3: Fatal and serious injury bicycle and pedestrian crashes by location (in intersection vs. not in intersection) (2010 - 2019)

Bicycle and pedestrian infrastructure presence was also found to have a major impact. Whether or not a crosswalk or bikeway is present has a major influence on both number of crashes and severity of crashes. Nearly 70% of the fatal and serious injury crashes happened when in the street and not in a crosswalk or bikeway at intersections. 95% of the fatal and serious injury crashes happened when in the street and not in a crosswalk or bikeway at non-intersection locations. This can be seen in Figure 4 on the following page.

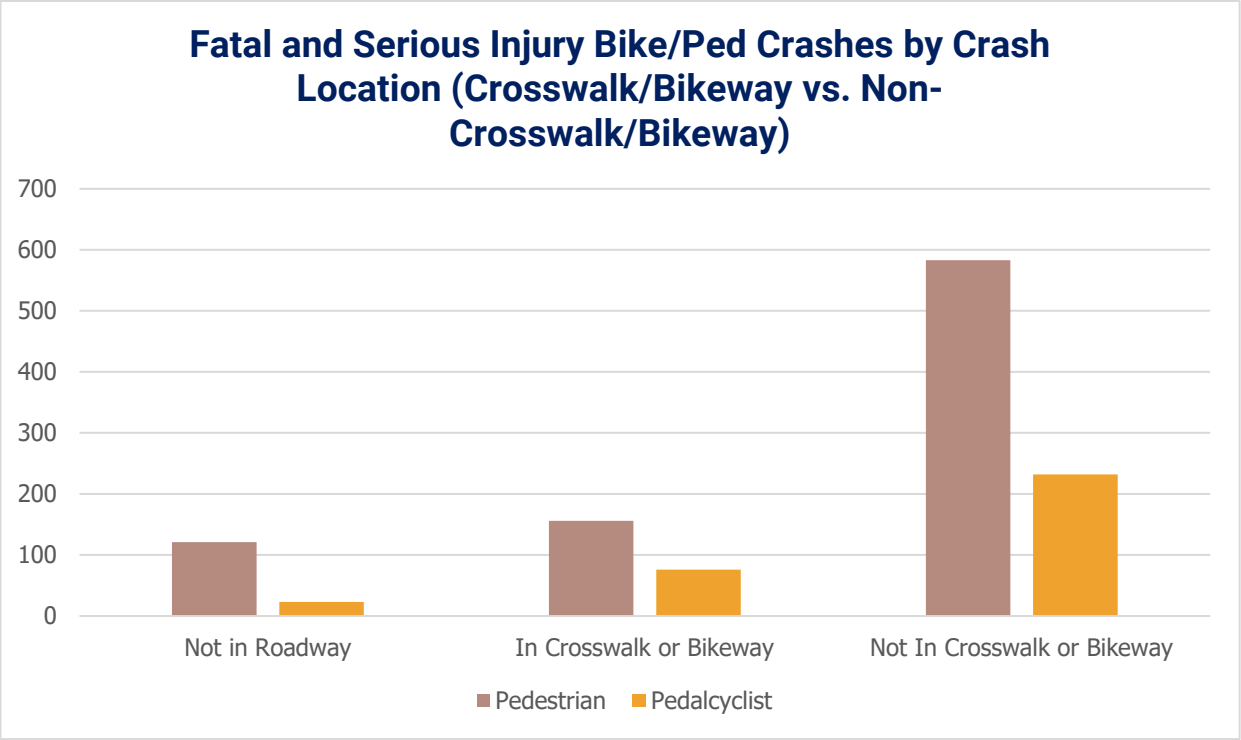
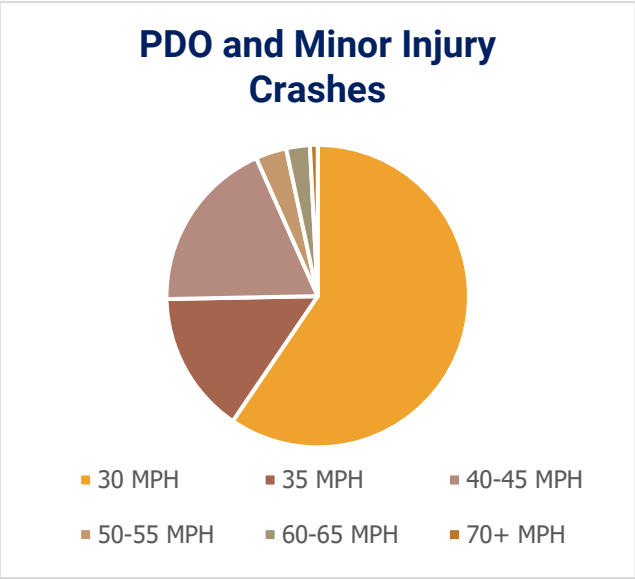


Figure 4: Fatal and serious injury bicycle and pedestrian crashes by location (in crosswalk/bikeway vs. not in crosswalk/bikeway) (2010 - 2019)

Posted speed limits also have an influence according to the data available (Figure 5). The vast majority of bicycle and pedestrian crashes in the state occur on low-speed roadways (30 mph roadways). However, severity of crashes increases dramatically at higher posted speed limits, which leads to higher proportions of fatal and serious injury crashes on higher speed roadways. On roadways with posted speeds of 30mph or less, only 12% of crashes result in a serious injury or fatality, however on roadways with posted speeds of 70mph, this rate jumps to 50%. More than 50% of all fatal and serious injury crashes occurred on roadways with speeds greater than 35mph. It is important to note that the speed is the posted speed limit, not the speed at which a vehicle is traveling at the time of impact with a pedestrian or cyclist.



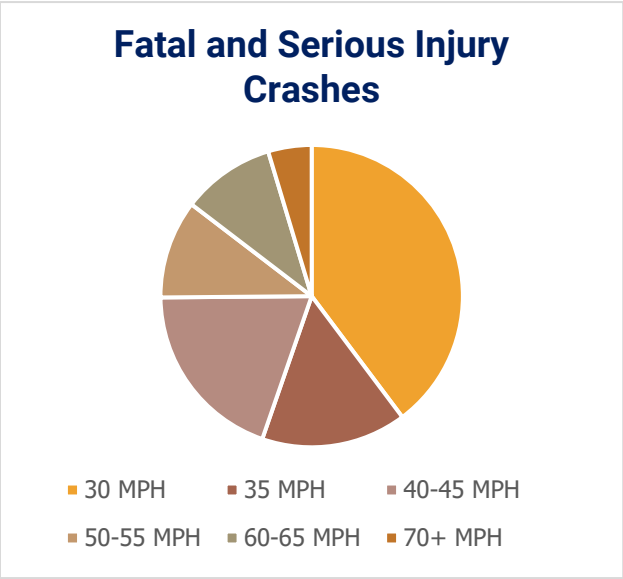


Figure 5: Speed categories for fatal and serious injuries compared to PDO and minor injuries

Environmental factors show major differences in crash risk based on weather, lighting, and time. However, the data likely only indicates that most pedestrians and cyclists are hit when more are likely on the roads. In general, bicycle and pedestrian crashes happen during daytime, on weekdays, during good weather conditions. Lighting conditions do have an impact primarily on pedestrians. 55% of the fatal and serious injury pedestrian crashes happen at night, dusk, or dawn. It can be assumed that the majority of pedestrians are not walking during these times so this is likely a significant over-representation.

Systemic Safety Analysis

A systemic analysis was undertaken to provide a tool for various agencies to identify high-priority roadway types for safety countermeasures. For the systemic analysis a crash tree methodology was utilized. At every level of the tree, the total proportion of bicycling or pedestrian crashes was compared to the total proportion of centerline miles of roadways at that level. From this, a crash representation ratio was calculated. This representation ratio compared the relative proportion of roadway to relative proportion of crashes. So if 50% of the crashes happened on 10% of the roadway miles on a given tree level, then the crash representation ratio would be 5.0.

In addition to the individual tree level crash representation ratios, a global crash representation ratio was calculated. This global crash representation ratio shows the approximate relative risk of that roadway compared to all other roadways in the state. This gives an equivalent measure of relative risk for all roadways and characteristics in the state. A color coding was utilized on the crash trees to easily depict this global crash representation ratio.

The analysis was codified by the size of the cities or rural areas. Towns were defined utilizing the U.S. Census Bureau “Urban Cluster” designation. This designation looks at populated areas (whether inside municipal boundaries or not) with populations between 2,500 and 50,000 residents. Cities were defined as U.S. Census Bureau “Urbanized Areas” which is populated areas with more than 50,000 residents. Rural areas are everything outside an Urban Cluster or Urbanized Area. The figures at the end of this summary depict the crash trees for the various users and contexts.

The systemic safety analysis shows roadway context and roadway features have a major impact on the prevalence of bicycle and pedestrian crashes in Kansas. In general, urban areas including cities and towns have much higher crashes proportional to miles of roadway than rural areas. Roads in urban areas are 50 times more likely to have a pedestrian crash and 70 times more likely to have a bicycle crash than rural roadways. Cities have roughly twice as many bicycle and pedestrian crashes proportionally than towns. In general, state system roads are more likely to have crashes than local roads.

The most significant roadway features are motor vehicle volumes, speed limit, and number of lanes. In general, higher volume roadways, lower speed roadways, and roadways with more lanes have more bicycle and pedestrian crashes. The traffic volume and number of lanes has the most significant impact, especially on local roads. High-volume local roads in cities and towns range approximately 35 to 60 times higher crash representation for both bicycle and pedestrian crashes than average Kansas roads. 4-lane undivided roads also have extremely high global crash representation ratios. High-volume local roads in cities and towns range approximately 30 to 50 times higher crash representation for both bicycle and pedestrian crashes than average Kansas roads.

Summary

This analysis looked at all of the safety aspects related to walking and biking in Kansas that was possible with the current data availability. Bicycle and pedestrian crashes have a huge impact on society in Kansas. Every year, about 30 Kansas are killed, 100 Kansas are seriously injured, and 630 more Kansans are injured less seriously. This relates to more than $500 million per year in crash costs to society in Kansas. Bicycle and pedestrian crashes are increasing in Kansas with fatal and serious injury crashes increasing at a faster rate than minor injury

crashes. Over the past 10 years, fatal and serious injury bicycle crashes have increased 6.9% since 2010 and fatal and serious injury pedestrian crashes have increased 16.4% since 2010. The most impacted group of Kansas is young people under 29 years old.

The analysis showed that the context of the street, the configuration of the street, traffic volume on the street, and the speed limit on the street were major determining factors for heightened frequency of bicycle and pedestrian crashes. Many more bicyclists and pedestrians are hit and killed in cities compared to rural areas. Roads in urban areas are 50 times more likely to have a pedestrian crash and 70 times more likely to have a bicycle crash than rural roadways.

Many more bicyclists and pedestrians are hit and killed in the roadway as opposed to on sidewalks or shared use paths. And when in the roadway, many more are hit and killed when not in a crosswalk or bikeway. Higher traffic roads, and roads with more lanes have much higher rates of bicycle and pedestrian crashes. High volume street and streets with four or more lanes in cities have bicycle and pedestrian crash rates 35 to 55 times higher than would be expected based on their share of the roadway network. Streets with lower speed limits corresponded to increased amounts of crashes, but higher speed streets corresponded to an increased proportion of fatal and serious injury crashes. 60% of the state's minor injury crashes happened on streets with 30mph or lower posted speed limit, but only 40% of the state's fatal and serious injury crashes happened on these roads. Lighting conditions also have an impact primarily on pedestrians. 55% of the fatal and serious injury pedestrian crashes happen at night, dusk, or dawn. It can be assumed that the majority of pedestrians are not walking during these times so this is likely a significant over-representation.

To address the safety issues noted in the analysis, the following items should be considered:

- Prioritize safety efforts on high-volume, low-speed urban roads, especially four-lane undivided roads
- Prioritize installation of bicycle/pedestrian infrastructure such as sidewalks, protected/off-street bike facilities, and crosswalks
- Proritize reducing vehicle speeds to reduce the likelihood that a collision results in a serious injury or death
- Prioritize installation and improvement of street lighting, especially at pedestrian street crossing locations, at intersections, and in high pedestrian traffic areas

Systemic Analysis Crash Trees

Figure 6: Bicycling crash tree for roadway contexts (2010 - 2019)

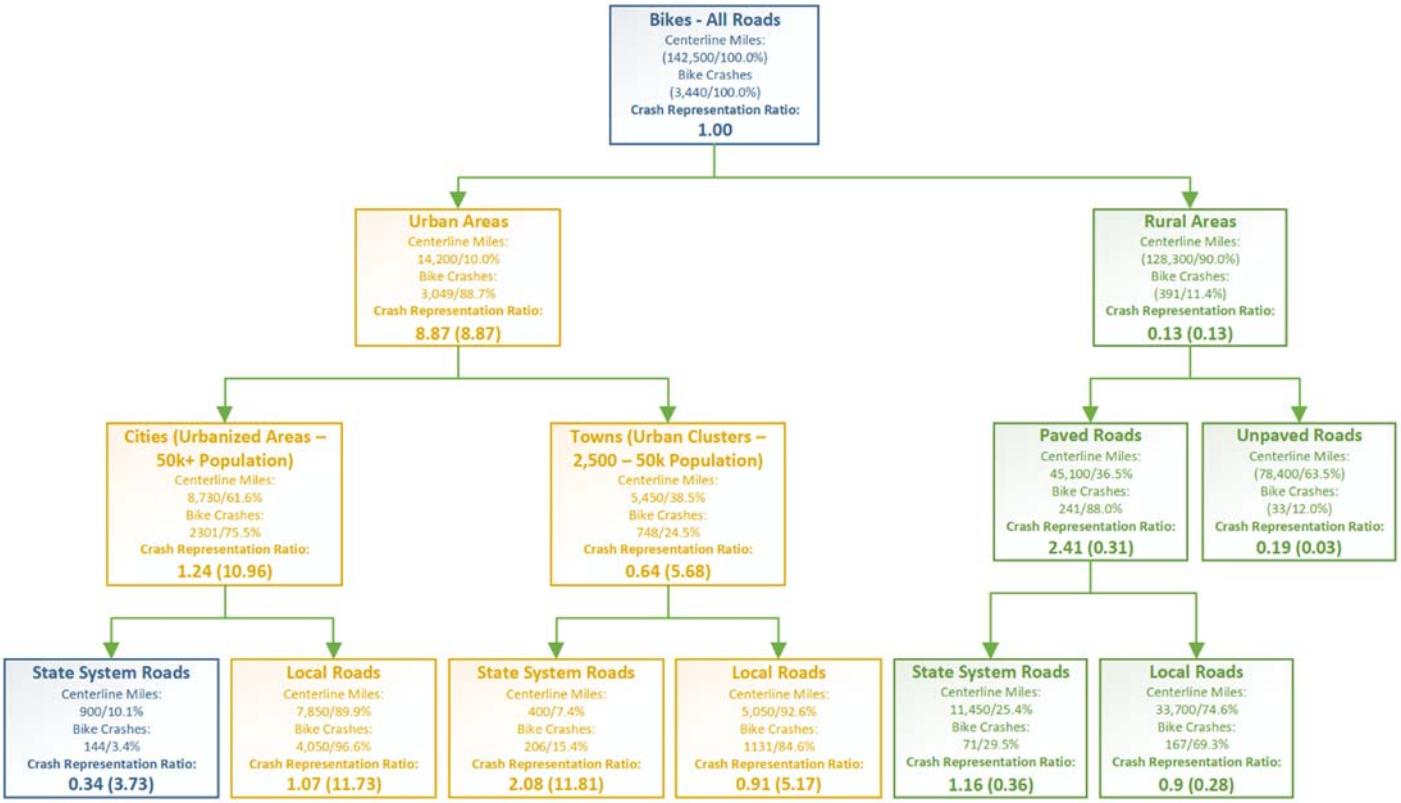


Figure 7: Bicycling crash tree for roadway characteristics for rural paved roads (2010 - 2019)

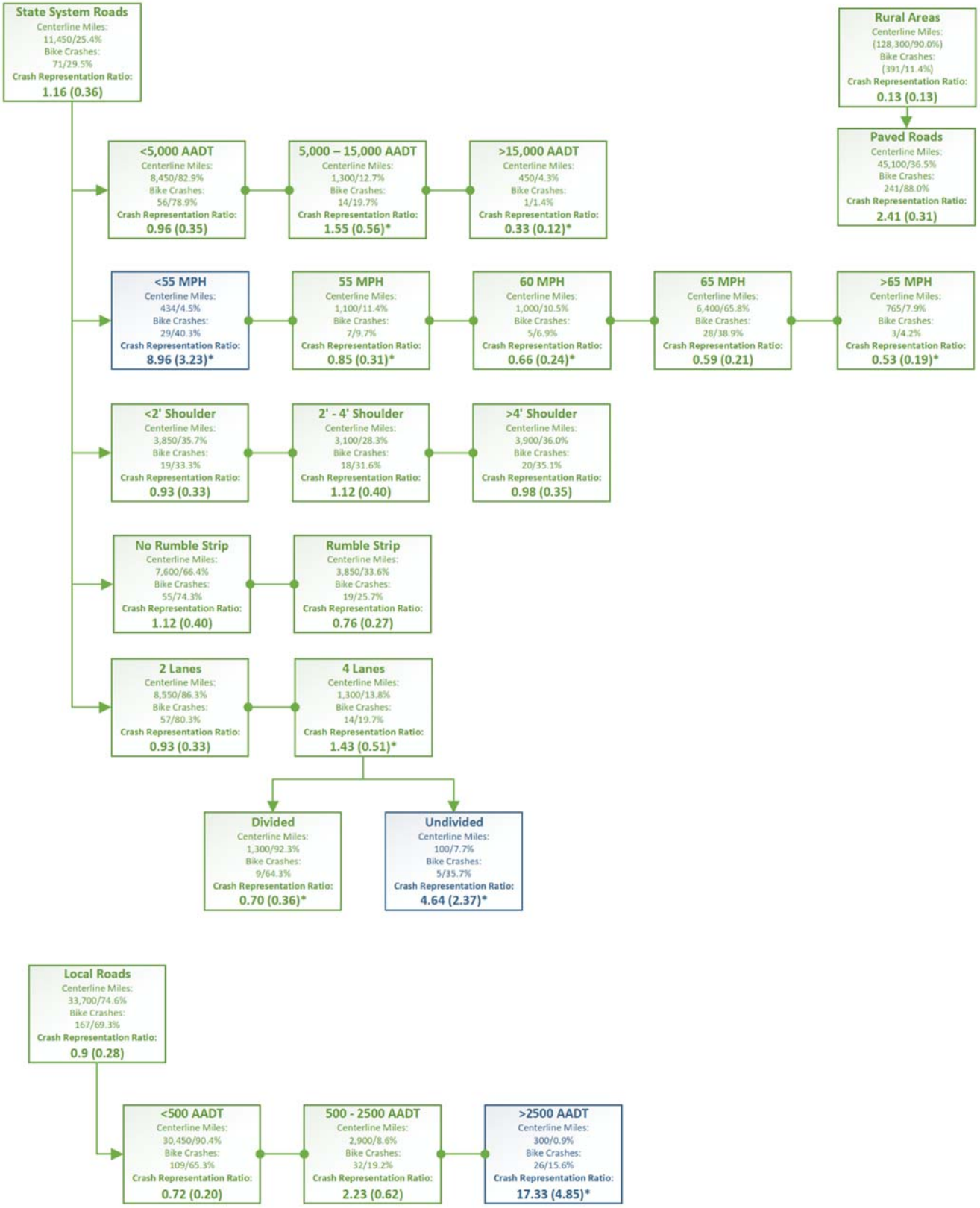


Figure 8: Bicycling crash tree for roadway characteristics for towns (urban clusters) (2010 - 2019)

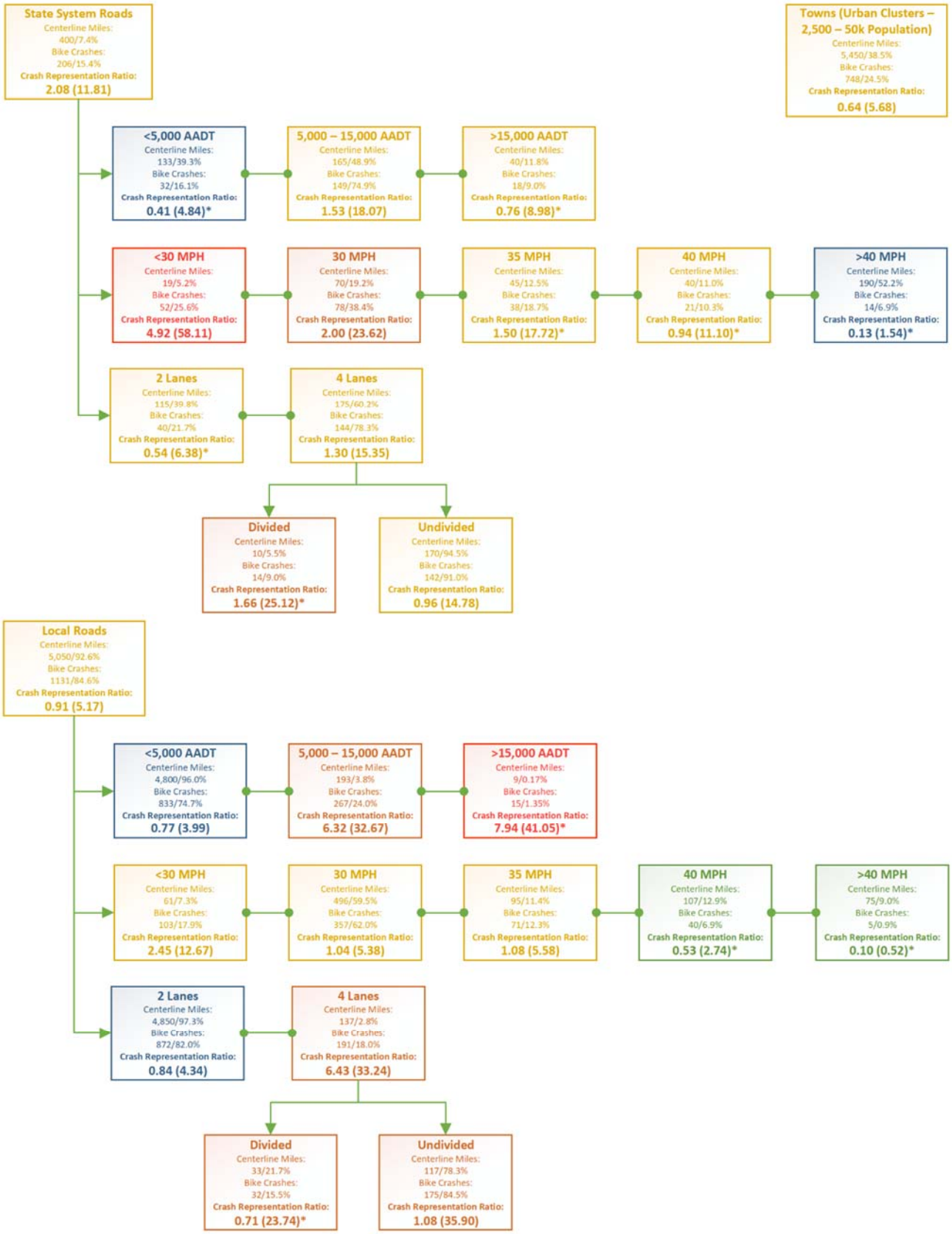


Figure 9: Bicycling crash tree for roadway characteristics for cities (urbanized areas) (2010 - 2019)

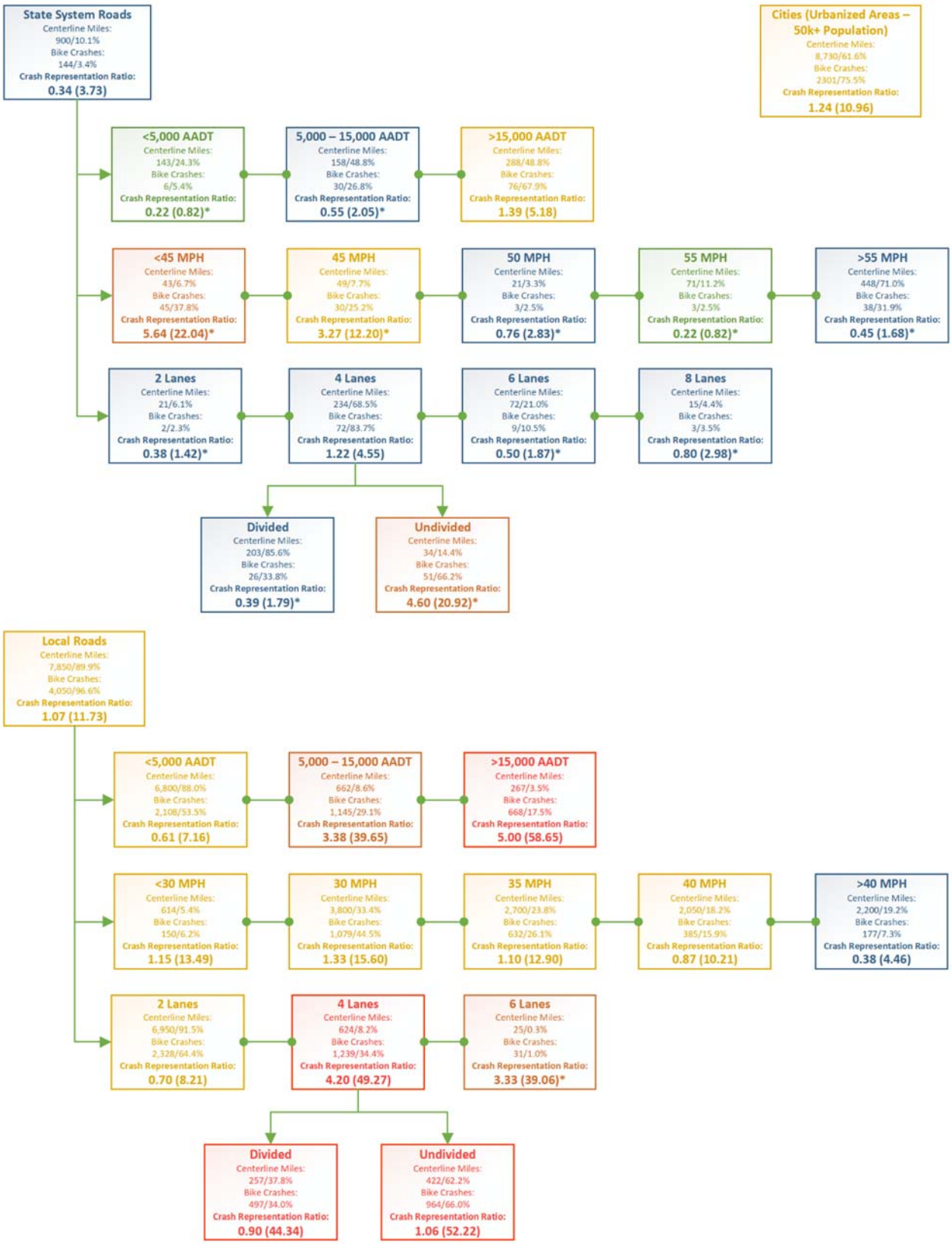


Figure 10: Pedestrian crash tree for roadway contexts (2010 - 2019)

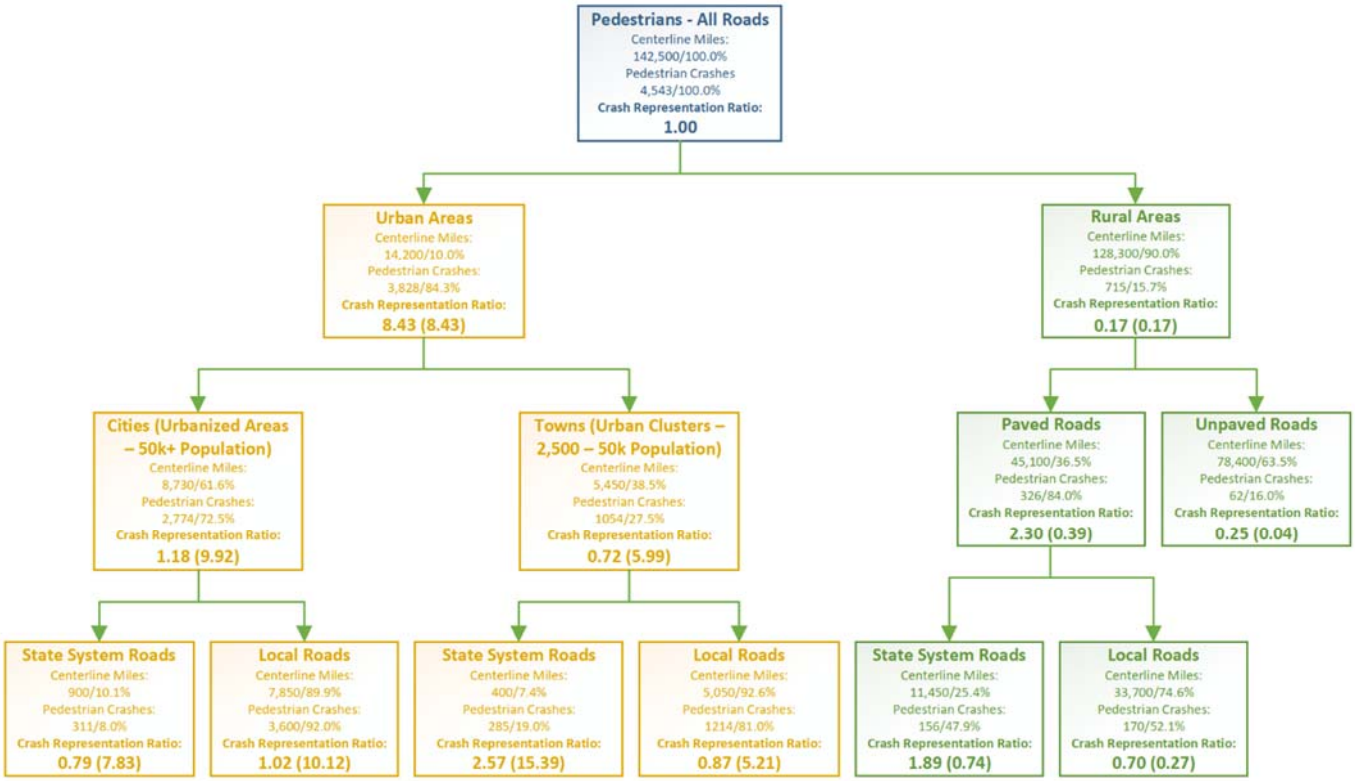


Figure 11: Pedestrian crash tree for roadway characteristics for rural paved roads (2010 - 2019)

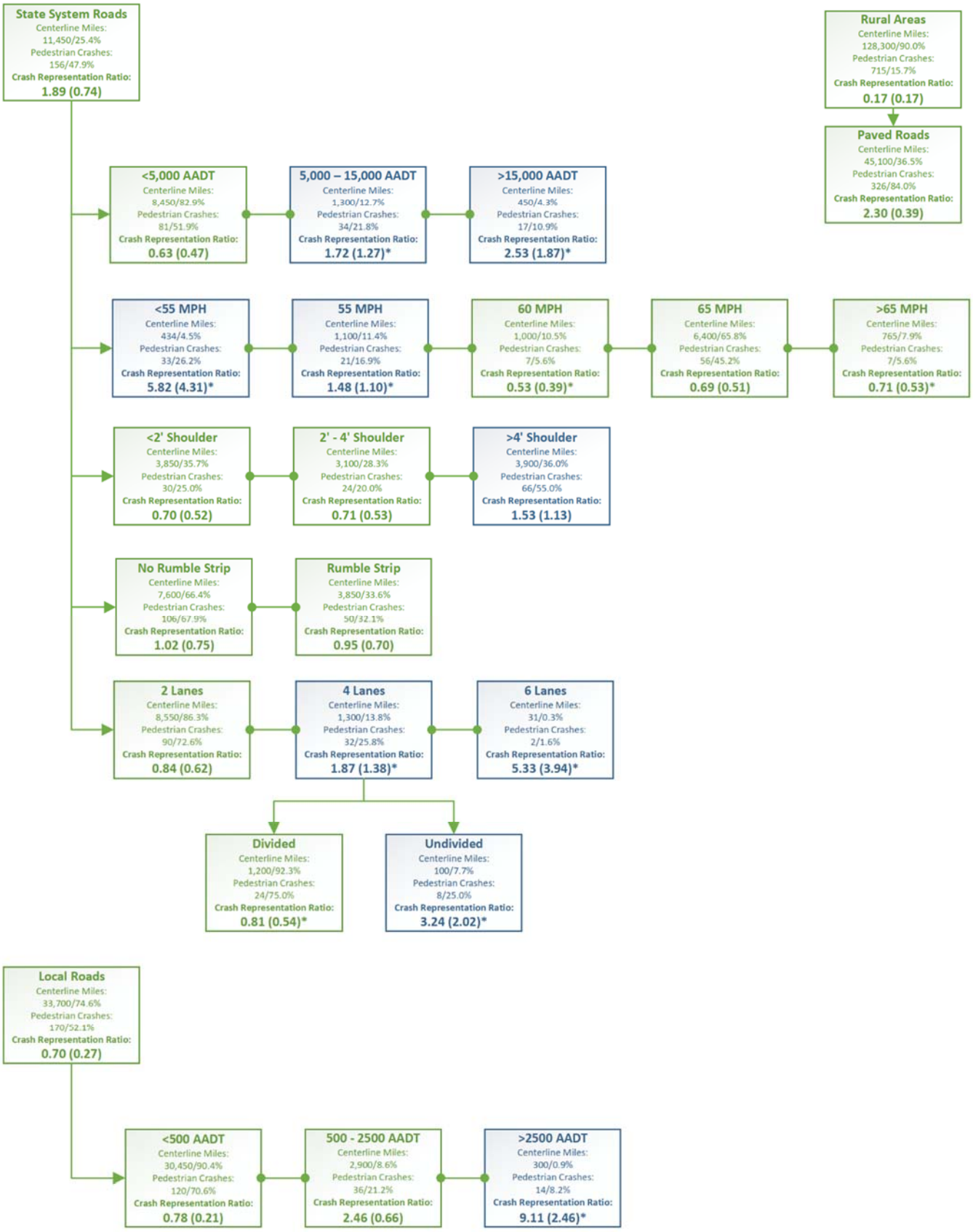


Figure 12: Pedestrian crash tree for roadway characteristics for towns (urban clusters) (2010 - 2019)

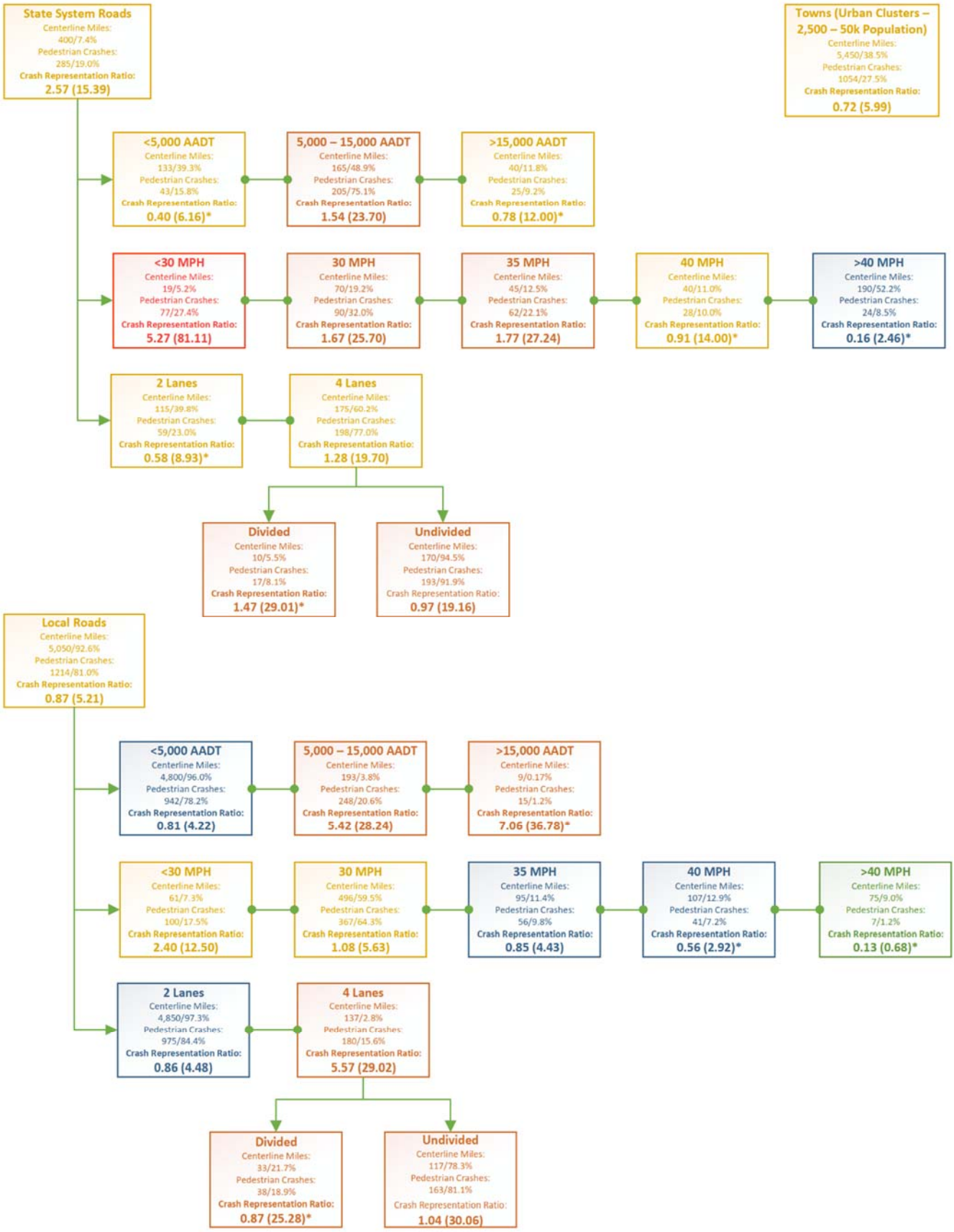


Figure 13: Pedestrian crash tree for roadway characteristics for cities (urbanized areas) (2010 - 2019)