

# **Rural and Urban Area Crashes in Michigan: 2017-2021**



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## Special Note

The Michigan Office of Highway Safety Planning and the University of Michigan Transportation Research Institute acknowledge the differences in traffic and commuting patterns in 2020 and 2021 due to the COVID-19 pandemic. Travel restrictions from the “Stay Home, Stay Safe” Executive Order (EO 2020-21) were initially in place starting on March 24, 2020. That order was then extended through additional executive orders. The stay-at-home order was officially lifted June 1, 2020.

The total number of police-reported crashes on Michigan roadways decreased from 2019 to 2020 by 21.9%, declining from 314,376 in 2019 to 245,432 in 2020, and then in 2021 increased slightly to 282,640 crashes which is still 10.1% less than the 2019 crash total. Despite the lower amount of crashes in 2020 and 2021, the fatality count has increased each year from 985 in 2019, to 1,083 in 2020 (9.9% increase from 2019), and 1,131 in 2021 (14.8% increase from 2019). In 2020, there was a decrease in vehicle miles traveled, licensed drivers, and vehicle registrations: vehicle miles traveled decreased 15.5% to 86.31 billion, motor vehicle registrations were down 0.5% to 9.04 million, and the number of licensed drivers was down 1.9% to 7.12 million. The increased 2020 fatality count in combination with the reduction of the exposure factors contributed to a fatality rate of 1.25 per 100 million miles of travel, a 30.2% increase from 2019 (0.96 per 100 million miles). The 2020 fatality rate is also above the 10-year (2011-2020) average of 1.01 fatalities per 100 million miles. In 2021, vehicle miles traveled was still 5.3% less than 2019 at 96.74 billion miles, and the fatality rate was 1.17 per million miles of travel – a slight decrease from the 2020 fatality rate but still much higher than the 2011-2020 average rate.

## 1.0 Executive Summary

This report utilizes police-reported crash data in Michigan from 2017 through 2021 to study crash trends in rural and urban areas. Major findings include:

- Rural crashes made up 31.7% of all crashes while urban crashes comprised 68.1% of crashes in Michigan with 0.2% of crashes having an unknown rural/urban area designation.
- Rural crashes had a higher fatal crash severity than urban crashes (0.5% vs. 0.3%), yet also had a higher proportion of crashes with no injury (85.6% vs. 80.0%).
- Crash types of single vehicles were much more common in rural crashes (74.4%) than urban crashes (17.5%). The most common urban crash type was rear-end crashes (33.1%).
- Most urban crashes occurred at posted speed limits of 45 mph and lower, while 72.2% of rural crashes were at a posted speed limit range of 50-55 mph.
- A total of 41.0% of rural crashes occurred in dark unlighted lighting condition compared to only 8.4% of urban crashes. About 69.1% of all urban crashes occurred under daylight conditions, compared with 44.8% of rural crashes.
- Winter weather road conditions (snow, ice, or slush) regardless of month were more common in rural areas (17.3% of crashes) than urban areas (10.5%).
- Comparing crash percentages by month, rural crashes had a low of 5.6% in April and peaked in November at 13.2%, while urban crashes showed less monthly variation with percentages ranging from 6.5% in April to 9.7% in October.
- Most crashes took place on weekdays for both urban and rural areas, with urban crashes showing more of a drop during weekends than rural crashes.
- Urban crashes had a higher proportion than rural crashes between the hours of 8 a.m. and 6 p.m. with a peak at 5 p.m. Rural crashes had a peak at 7 a.m.
- Rural crashes were much more likely to involve deer than urban crashes (47.1% of crashes vs. 4.3%), and rural crashes had a slightly higher proportion of motorcycle, alcohol, and drug involvement than urban crashes.
- Urban crashes had a slightly lower rate of unrestrained occupants in passenger vehicles than rural crashes (1.0% vs. 1.3%).
- Crashes with passenger cars, SUVs, or vans were more common in urban areas than rural areas (83.5% vs. 74.0%), while pickup trucks, motorcycles, snowmobiles, and ORVs/ATVs crashes were more common in rural areas.
- Motor vehicle drivers in crashes tended to be slightly younger in urban areas and older in rural areas.

## **2.0 Introduction**

This report analyzes trends in police-reported traffic crashes in Michigan from 2017-2021. Michigan traffic crashes are defined as taking place on public roadways in Michigan, involving at least one motor vehicle in transport, and resulting in death, injury, or property damage of \$1,000 or more. In this report, the distinction between rural and urban area crashes are based on U.S. Census Bureau data linked to the specific location of the crash.

In this report, injury severity of people involved in crashes is frequently categorized according to the KABCO scale:

- K - Fatal Injury
- A - Suspected Serious Injury
- B - Suspected Minor Injury
- C - Possible Injury
- O - No Apparent Injury

Similarly, crashes are sometimes classified according to the most severe injury suffered by anyone involved in the crash. Again, the KABCO scale is used, but for O-level severity this refers to crashes with property damage only (PDO) instead of no injury or fatality.

The report begins with a discussion of the number and severity of rural and urban crashes, followed by comparisons of various characteristics of the crash, such as crash type, highway class, posted speed limit, lighting condition, and road condition. The next section focuses on the temporal variables of month, day of the week, and time of day. The following section compares the proportions of various crash involvement indicators such as deer-involved, motorcycle-involved, alcohol-involved, and drug-involved crashes. The final section examines the distributions of person party type, restraint use, vehicle type, and driver age groups.

## **3.0 Crash Counts and Severity**

A Michigan map showing the areas defined as rural and urban is shown below in Figure 1. These rural and urban area designations are based on the urban area shapefiles available from the U.S. Census Bureau.

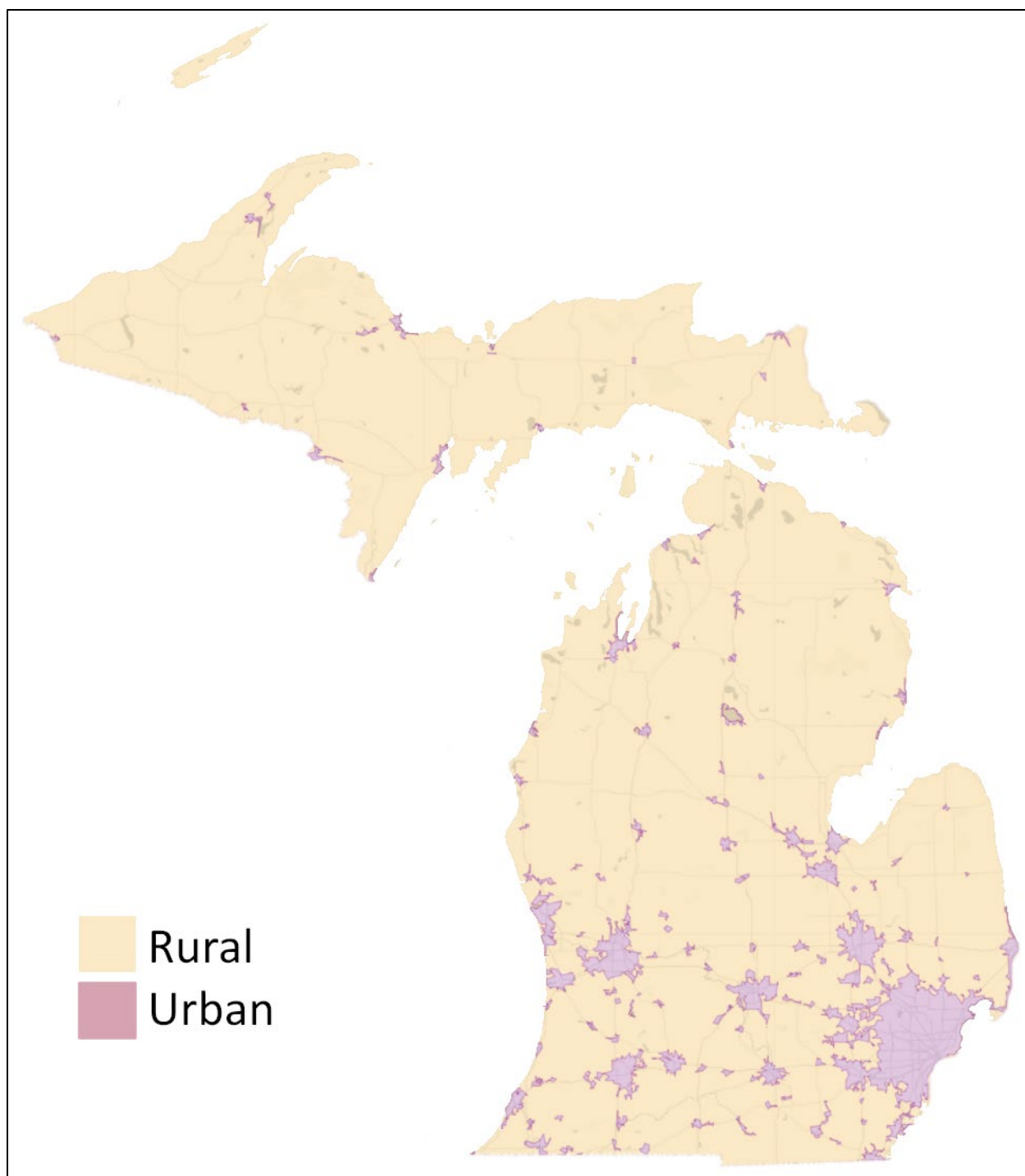


Figure 1 – Michigan State Map of Rural and Urban Areas

From 2017 to 2021, rural areas comprised 31.7% of all crashes, urban crashes made up 68.1% of all crashes, and 0.2% of crashes had an unknown rural or urban location. The annual distribution of rural and urban crashes which indicate a general trend of slightly increasing rural crash percentages are shown in Figure 2.

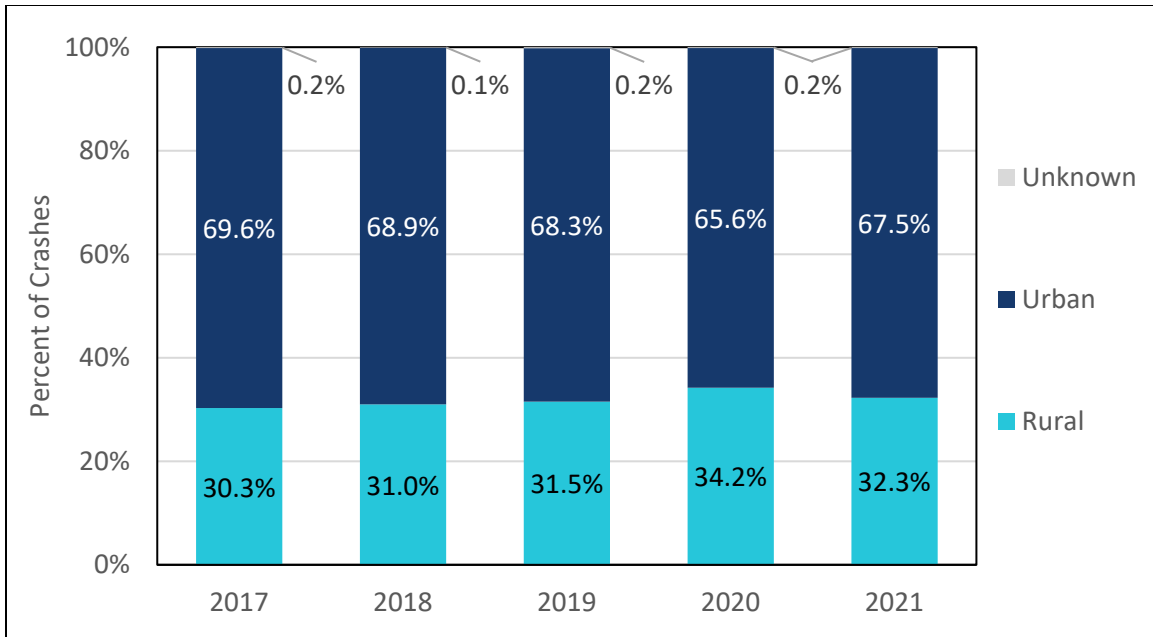


Figure 2 – Rural and Urban Crash Percentages by Year

The annual crash count trends prior to 2020 were gradually decreasing for urban crashes and increasing for rural crashes as seen in Figure 3. The number of rural crashes had gradually increased from 95,351 in 2017 to 99,058 in 2019, then dropped 15.2% to a low of 83,987 crashes in 2020, and then increased 8.6% to 91,223 in 2021. Urban crashes had been gradually decreasing from 219,074 in 2017 to 214,740 in 2019, then dropped 25.0% to a low of 161,056 in 2020, and then rebounded 18.5% to 190,912 in 2021.

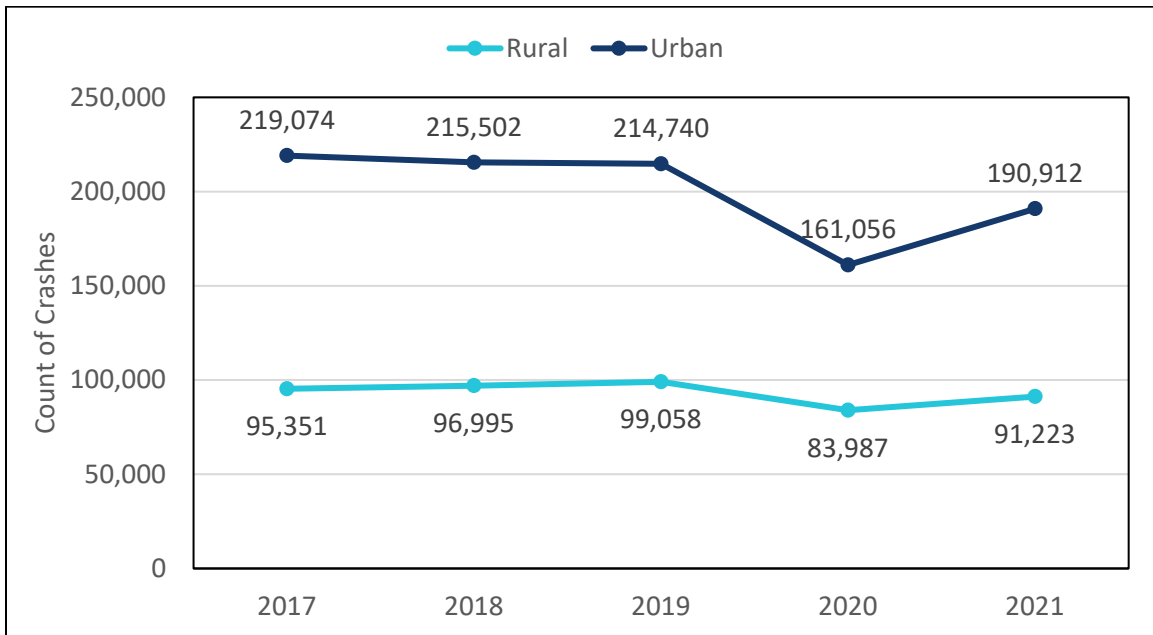


Figure 3 – Rural and Urban Crash Counts by Year

The Upper and Lower Peninsulas of Michigan have very distinct proportions of rural and urban area crashes as shown in Figure 4 where unknown crash areas are excluded. While the Lower Peninsula has 69.3% of crashes in urban areas, the Upper Peninsula has 32.6% of crashes in urban areas.

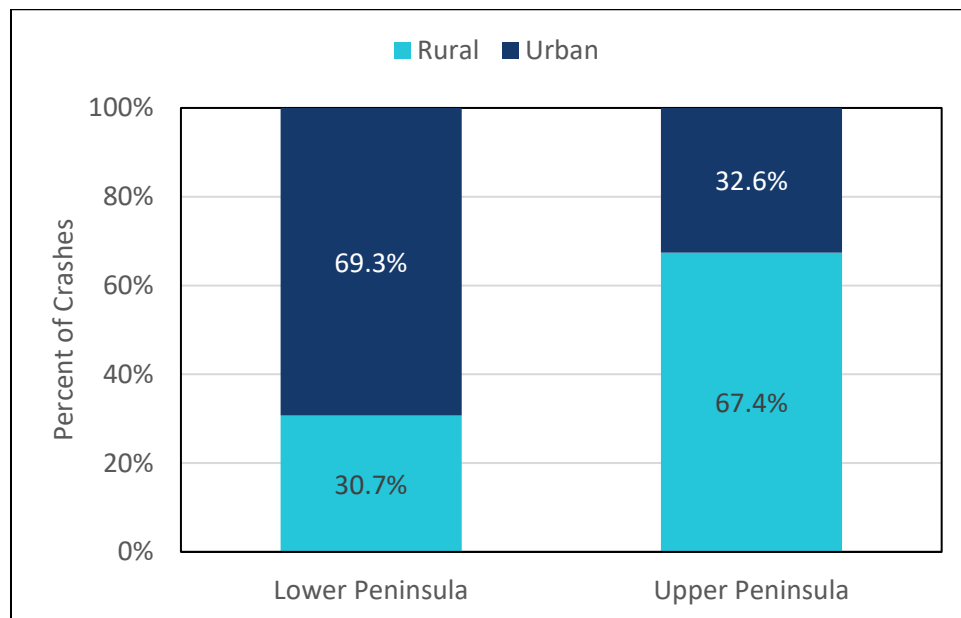


Figure 4 – Rural and Urban Crash Percentages by Peninsula

Crash severity proportions are visualized in Figure 5. Rural crashes have relatively more crashes with at least one fatality (0.5% of all crashes) compared with urban fatal crashes (0.3% of all crashes). On the other hand, the proportion of crashes with no injury (property damage only) for rural crashes (85.6%) is also higher than urban crashes (80.0%).

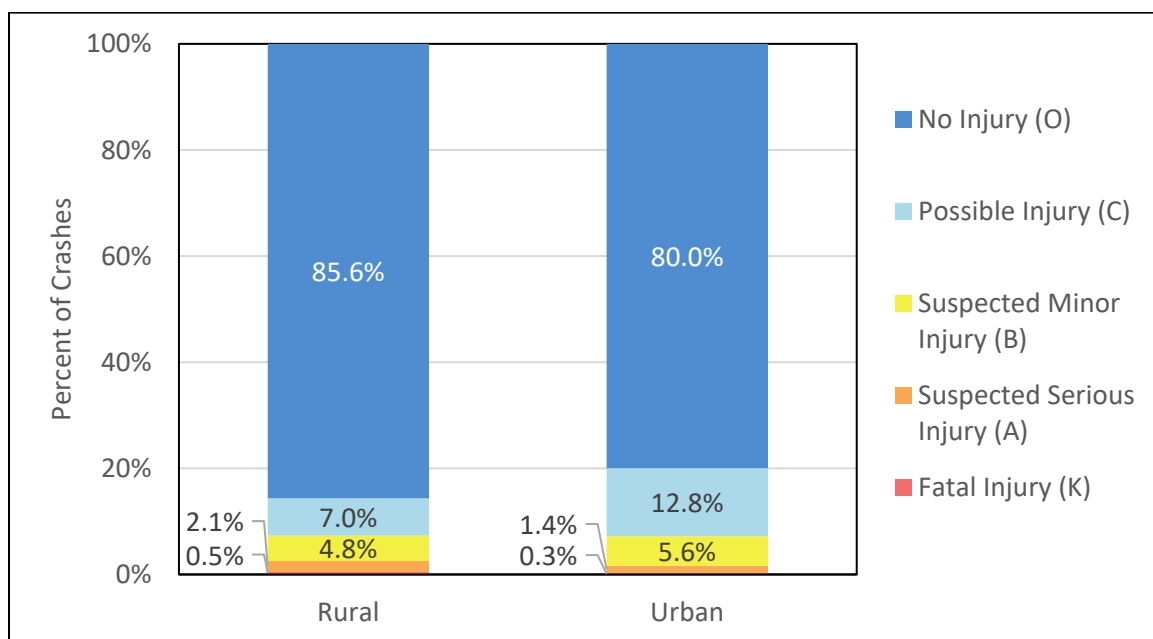


Figure 5 – Crash Severity in Rural and Urban Crashes, 2017-2021



## 4.0 Crash Characteristics

### 4.1 Crash Type

This section looks at several factors pertaining to crashes while comparing rural and urban crashes. Figure 6 shows crash distributions by the type of crash. The categories of crash type shown are single-vehicle, head-on (including head-on and head-on left turn), angle, rear-end (including rear-end, rear-end right turn, and rear-end left turn), sideswipe (including sideswipe same and opposite directions), backing, and other/unknown. Rural crashes have a rate of single vehicle crashes (74.4%) that is over 4 times the rate of single vehicle urban crashes (17.5%). This difference may be impacted by the higher proportion of deer-involved crashes (see Section 6.0). The most common urban crash type is rear-end crashes (33.1%).

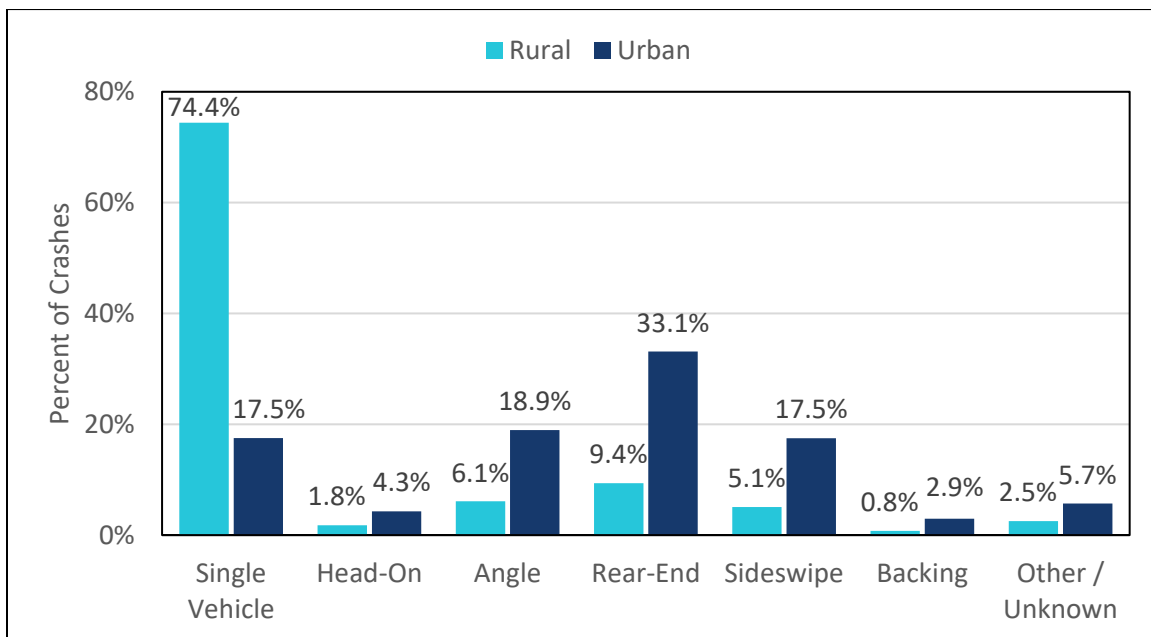


Figure 6 – Crash Type Distributions in Rural and Urban Crashes, 2017-2021

### 4.2 Highway Class

Figure 7 highlights the distinct highway class distributions between rural and urban crashes. Urban crashes have a higher proportion of interstate crashes (13.5%) than rural crashes (8.2%). Rural crashes have a higher proportion of US route crashes (11.6%) than urban crashes (7.9%), as well as slightly higher crash rates on state routes (21.2% vs. 20.1%) and local streets (59.0% vs. 58.5%). Other and unknown highway classes comprised about 0.005% of crashes in both rural and urban crashes.

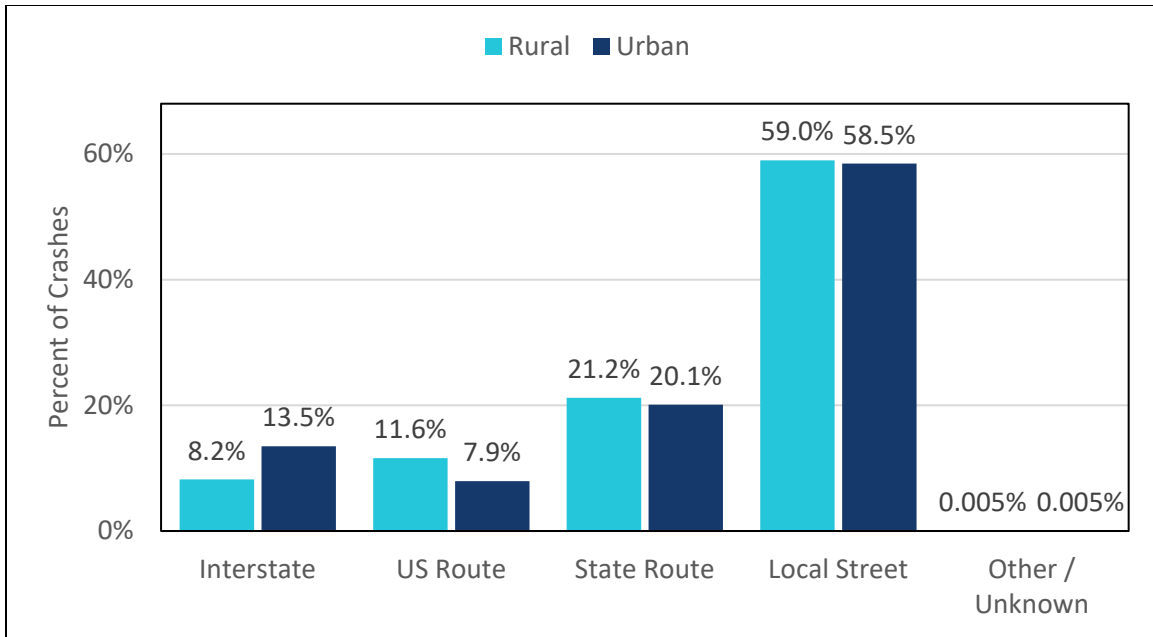


Figure 7 – Highway Class Crash Distributions in Rural and Urban Crashes, 2017-2021

#### 4.3 Posted Speed Limit

The comparison of rural and urban crashes by the posted speed limit range of the crash is shown in Figure 8. Most rural crashes occurred at posted speed limits between 50-55 mph (72.2%) while the most common posted speed limit range in urban crashes was 40-45 mph (32.1%). Rural crashes typically happen at speed limit ranges of 50 mph or more and a majority of urban crashes occur at posted speeds of less than 50mph.

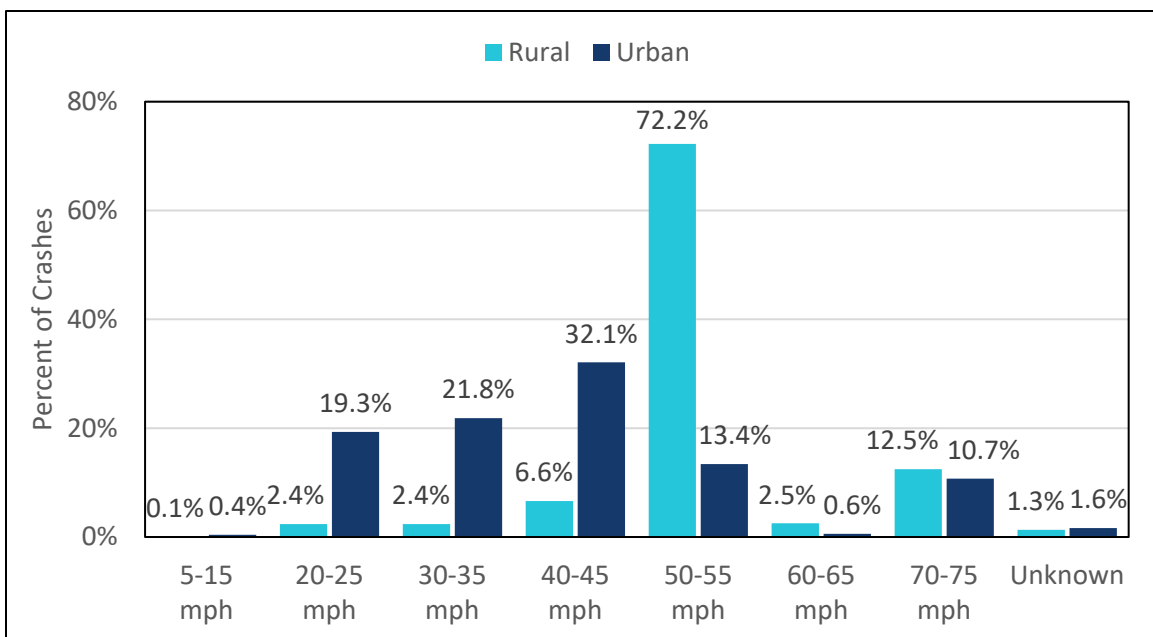


Figure 8 – Posted Speed Limit Range Crash Distributions in Rural and Urban Crashes, 2017-2021

#### 4.4 Lighting Condition

The distribution of rural and urban crashes by lighting condition is shown in Figure 9. Although the most common lighting condition is daylight for both urban (69.1%) and rural (44.8%) crashes, rural crashes have about 5 times the rate of crashes in dark unlighted conditions (41.0%) compared to urban crashes (8.4%). The rates for crashes in dawn and dusk lighting conditions were also higher for rural than urban crashes. This corresponds to the time of day crash data (see section 5.3) where between the hours of 6 p.m. and 7 a.m. there is a higher proportion of rural crashes than urban crashes.

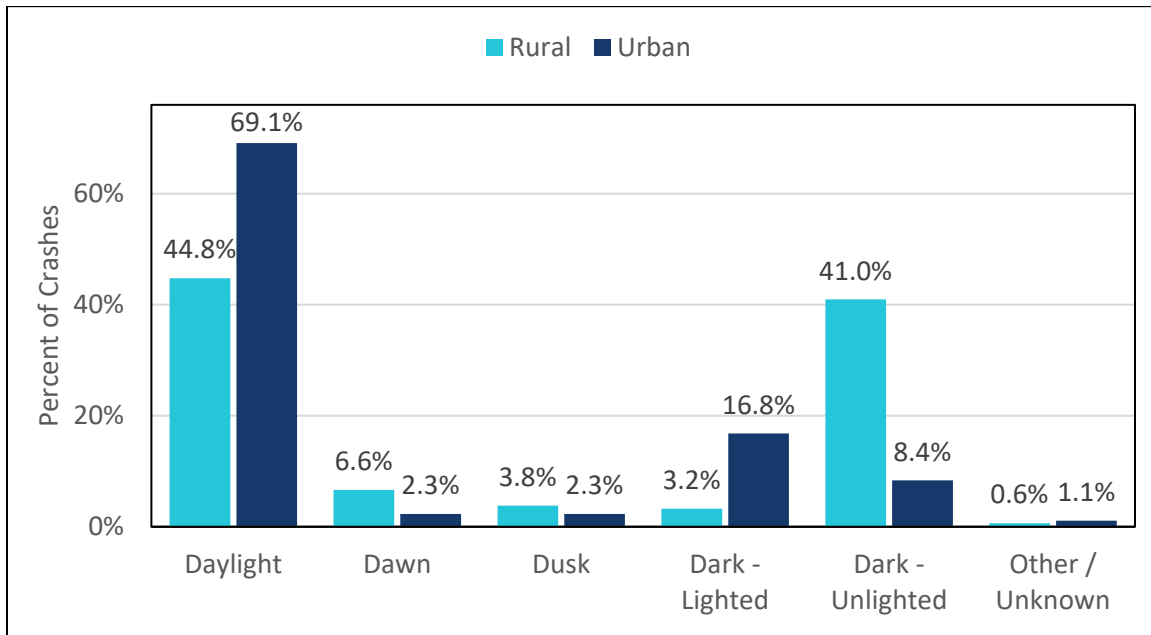


Figure 9 – Lighting Condition Crash Distributions in Rural and Urban Crashes, 2017-2021

#### 4.5 Road Conditions

Figure 10 displays the distribution of crashes by road condition with winter weather road conditions grouped into the category “snow, ice, or slush” (regardless of month) and road conditions other than dry and wet are all grouped into the “other” category. Snow, ice, or slush road conditions are higher in rural crashes (17.3%) than urban crashes (10.5%), while dry and wet road conditions have a higher proportion in urban crashes than rural crashes.

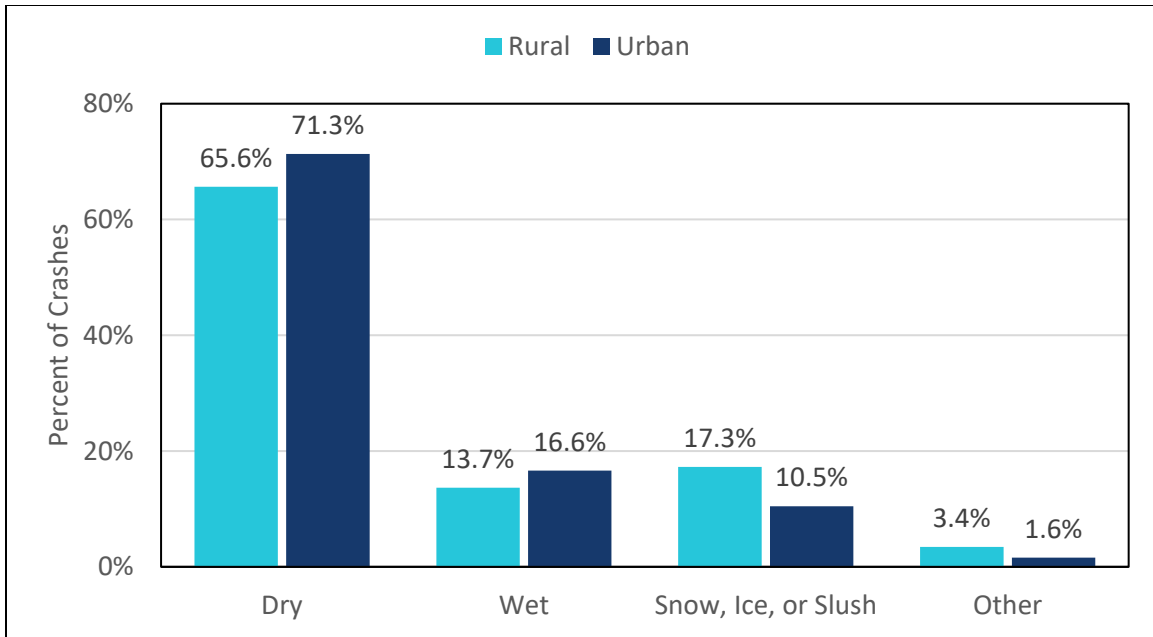


Figure 10 – Road Condition Crash Distributions in Rural and Urban Crashes, 2017-2021

In Figure 11, the percentage of all crashes that involved snow, ice, or slush road conditions are shown by month for rural and urban areas. While the overall percentage of rural area crashes with snow, ice, or slush road conditions is 17.3%, they peak in January comprising 49.3% of all rural area crashes. Urban area snow, ice, or slush road condition crashes also peak in January with a smaller proportion of 35.9% of crashes.

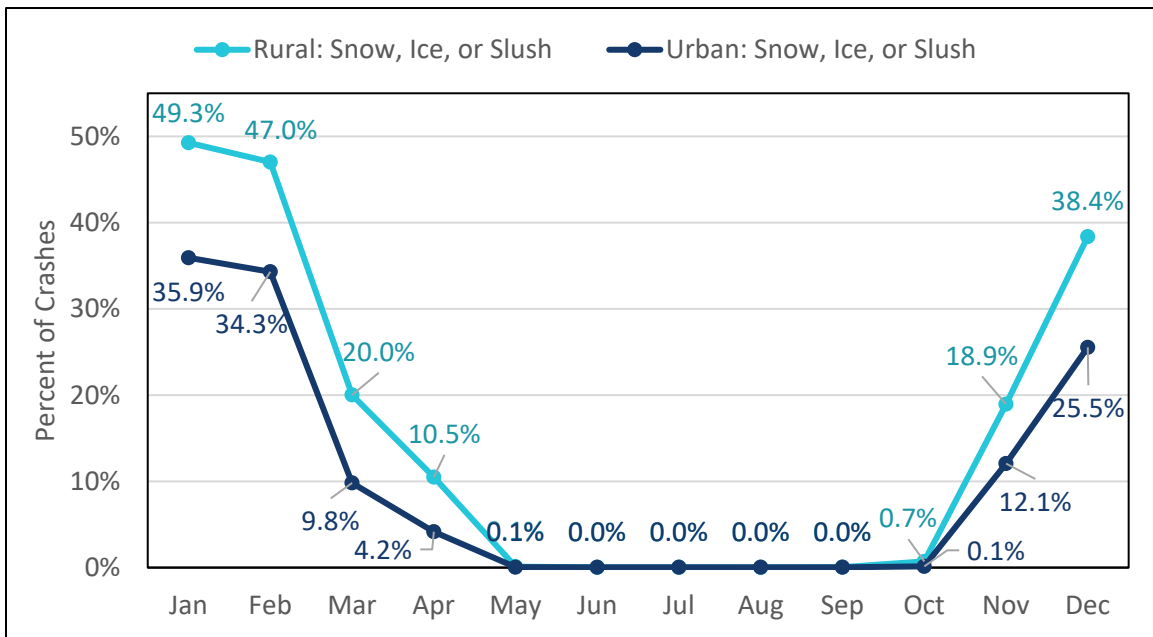


Figure 11 – Road Condition Crash Distributions in Rural and Urban Crashes, 2017-2021

## 5.0 Temporal Variables

### 5.1 Month of Year

The distribution of rural and urban crashes by month is shown in Figure 12. While both rural and urban crashes have the highest rates of the year from October through January (rural: 9.9% to 13.2%, urban: 9.0% to 9.7%), this seasonal difference is much higher for rural crashes which is impacted by the higher frequency of snow, ice, or slush road conditions (see section 4.5) and deer-involved crashes (see section 6.0) in rural areas. Figure 13 highlights this impact by excluding the two factors of deer involved crashes and snow, ice, or slush road conditions. When these factors are excluded, both rural and urban crashes have a relatively higher proportion of crashes from May through October with rural areas showing a more pronounced increase in the summer since most of their crashes in the winter months are due to deer or snow, ice, and slush road conditions.

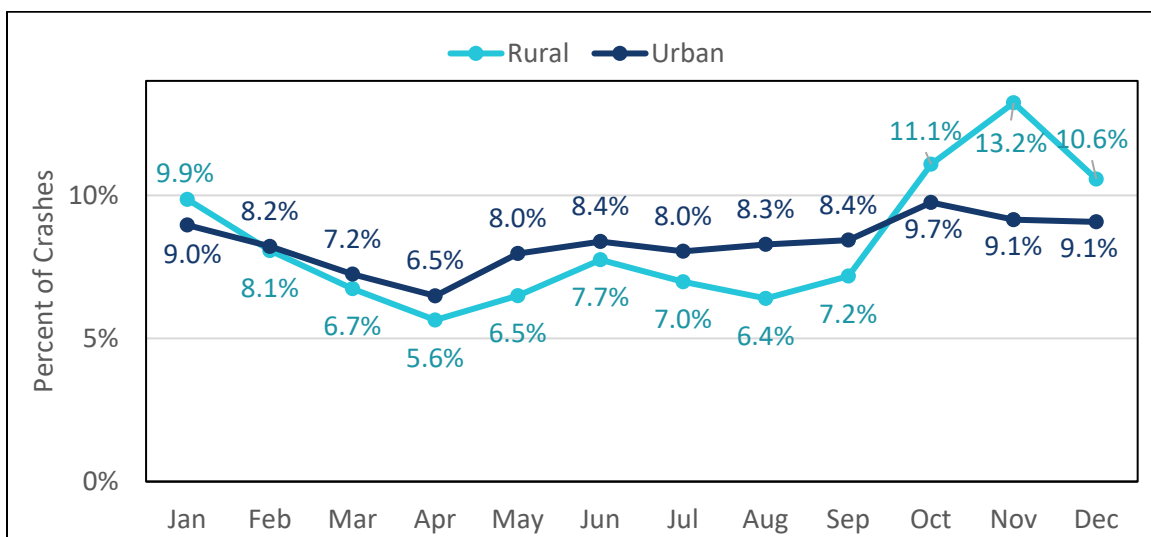


Figure 12 – Monthly Crash Distributions in Rural and Urban Crashes, 2017-2021

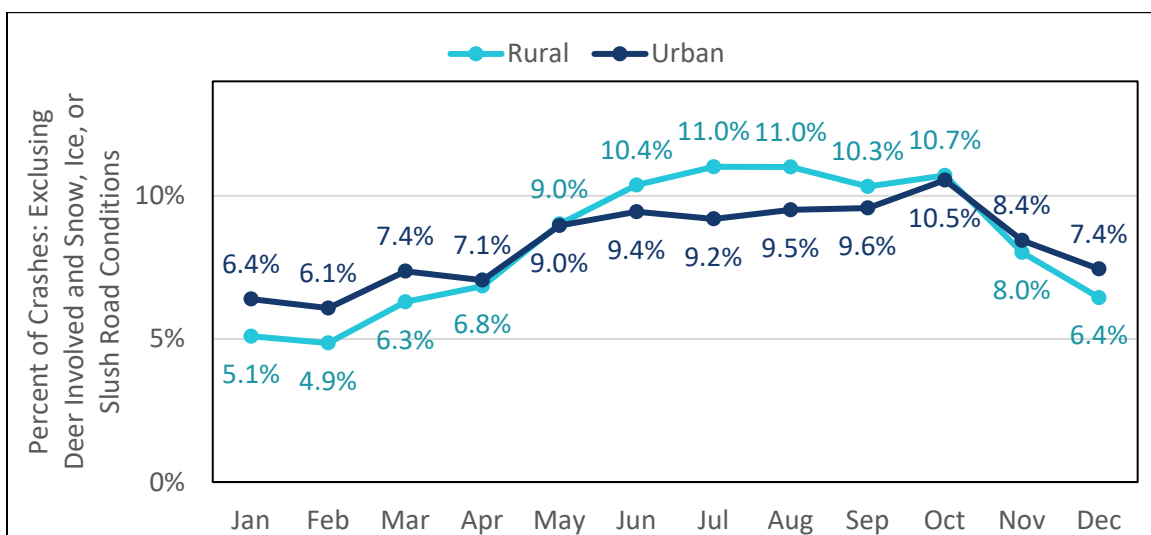


Figure 13 – Monthly Crash Distributions Excluding Deer Involved and Snow, Ice, or Slush Road Conditions in Rural and Urban Crashes, 2017-2021

## 5.2 Day of Week

Both rural and urban crashes were more likely to occur on weekdays than weekends as shown in Figure 14. This trend was more pronounced in urban areas as weekdays accounted for 77.9% of urban crashes and 74.2% of rural crashes. Friday was the most common day of the week for both rural (15.8%) and urban (16.6%) crashes, and Sunday was the least common day for both rural (12.1%) and urban (9.8%).

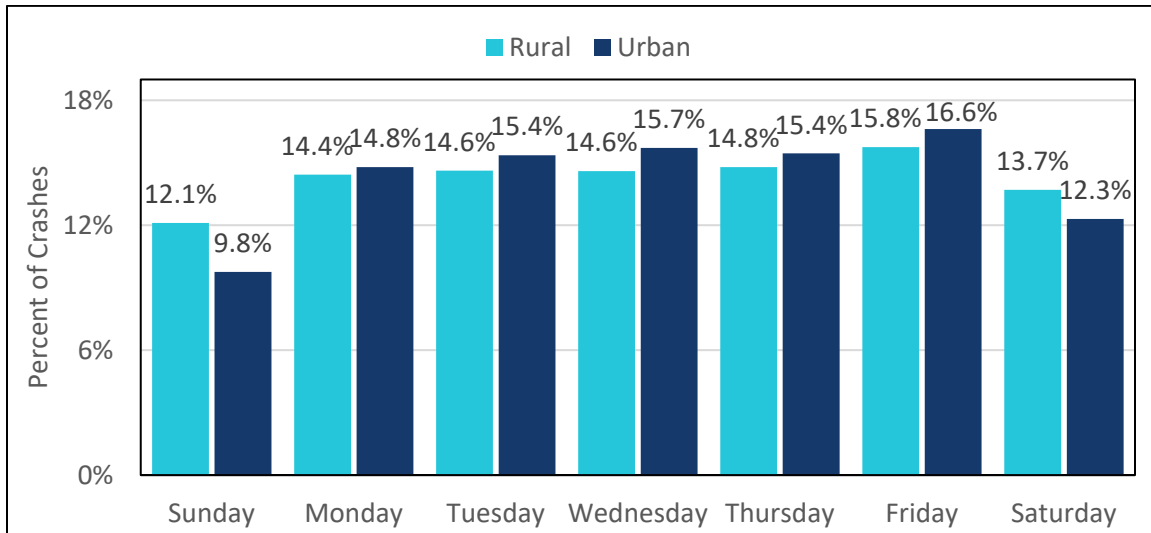


Figure 14 – Day of Week Crash Distributions in Rural and Urban Crashes, 2017-2021

## 5.3 Time of Day

Figure 15 shows the distribution of rural and urban crashes by time of day. About 0.1% of crashes where the time of crash was unknown are excluded from Figure 11. Urban crashes occurred more frequently than rural crashes between the hours of 8 a.m. and 6 p.m. (63.2% of urban crashes, with a high of 8.7% at 5 p.m.). In contrast, only 40.7% of rural crashes occurred between 8 a.m. and 6 p.m., and rural crashes occurred more often between 6 p.m. and 8 a.m. with a high of 8.2% at 7 a.m.

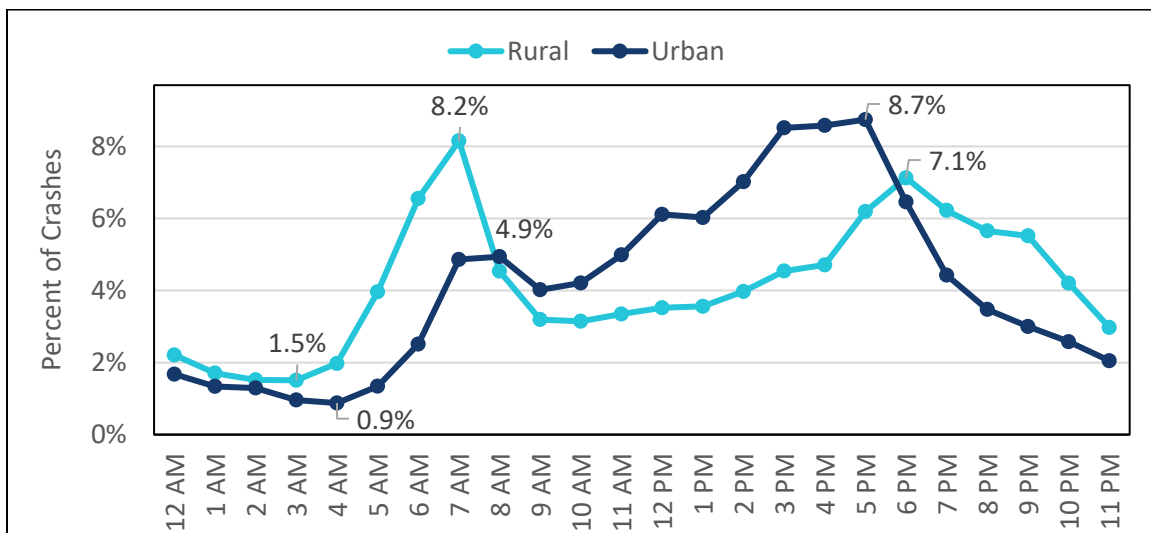


Figure 15 – Time of Day Crash Distributions in Rural and Urban Crashes, 2017-2021

## 6.0 Crash Involvement Indicators

The four crash-level involvement indicators of deer-involved, motorcycle-involved, alcohol-involved, and drug-involved crashes shown in Figure 16 all indicate a higher proportion of crashes for rural vs. urban crashes. The most extreme difference is in deer-involved crashes with 47.1% of rural crashes and 4.3% of urban crashes being deer-involved.

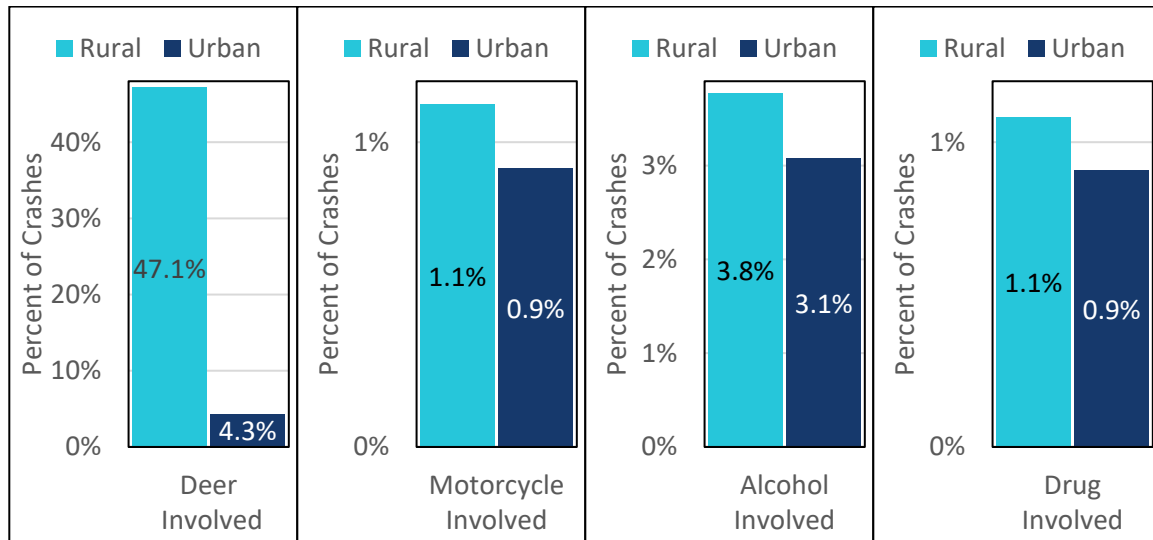


Figure 16 – Comparison of Four Involvement Indicators in Rural and Urban Crashes, 2017-2021

Looking at deer-involved crash distributions by month, Figure 17 highlights the differences between rural and urban crashes. Deer-involved crashes peak in October and November for both areas, comprising 62.1% and 61.2% of all rural crashes, and 7.5% and 9.4% of all urban crashes in October and November respectively.

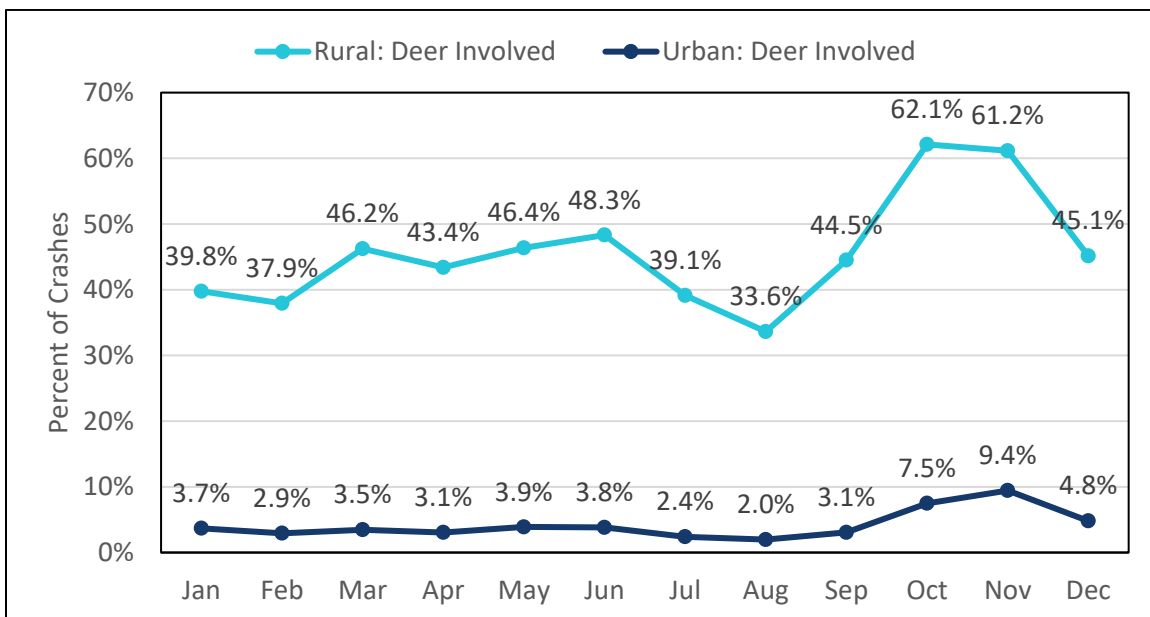


Figure 17 – Deer-Involved Rural and Urban Crashes by Month, 2017-2021

## 7.0 Restraint Use, Vehicle Type, and Driver Age Groups

The person restraint use for occupants in the front row of passenger vehicles is shown in Figure 18. Restraint use includes belts, child restraints, and restraint failures while unrestrained includes no belts available, no belts used, or child restraint not used. The front row passenger vehicle occupants in rural crashes were less likely to be using restraints than occupants in urban crashes (1.1% vs. 0.6% unrestrained).

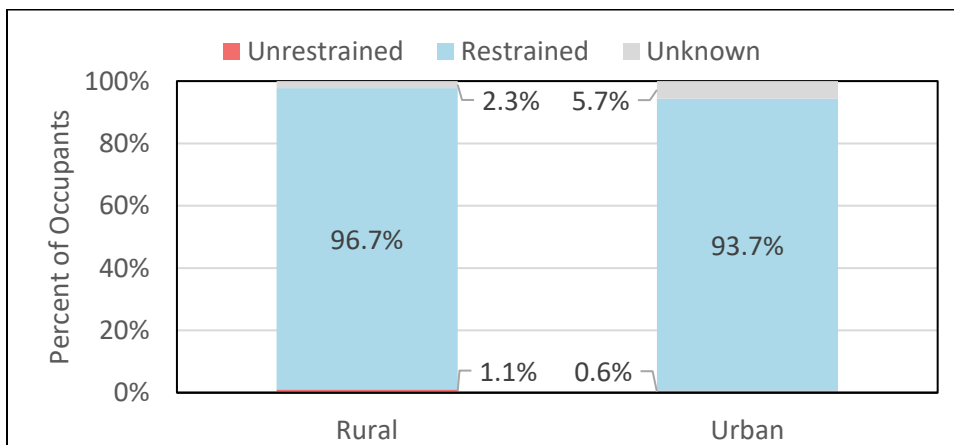


Figure 18 – Passenger Vehicle Occupant Restraint Use in Rural and Urban Crashes, 2017-2021

Figure 19 shows the distribution of vehicle types for motor vehicles only. Passenger cars, SUVs, and vans had a higher proportion of crashes in urban areas vs. rural areas (83.5% vs. 74.0%). Rural areas had a proportion of about twice the rate of urban areas for vehicle types of pickup trucks and motorcycles, and about 10 times the rate for vehicle types of snowmobiles and ORVs/ATVs.

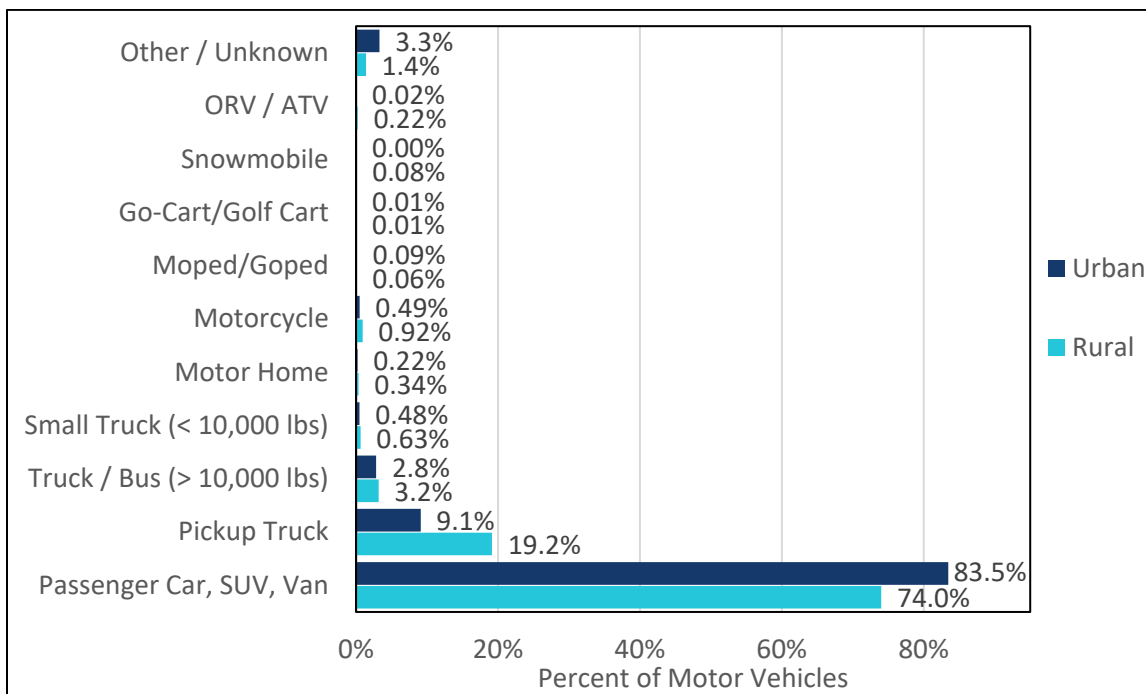


Figure 19 – Motor Vehicle Type Distribution in Rural and Urban Crashes, 2017-2021



The distribution of motor vehicle driver age groups between rural and urban areas as shown in Figure 20 (unknown driver ages excluded) indicates a slightly higher rate of younger drivers ages 18-34 in urban area crashes (40.6% of drivers) compared to rural area crashes (36.8% of drivers). Conversely, older drivers ages 35+ were slightly less common in urban area crashes (55.8% of drivers) compared to rural area crashes (59.2% of drivers). Among the youngest driver age groups ages 0-17 there was a slightly higher percentage of drivers in rural areas (4.0% of drivers) vs. urban areas (3.7% of drivers).

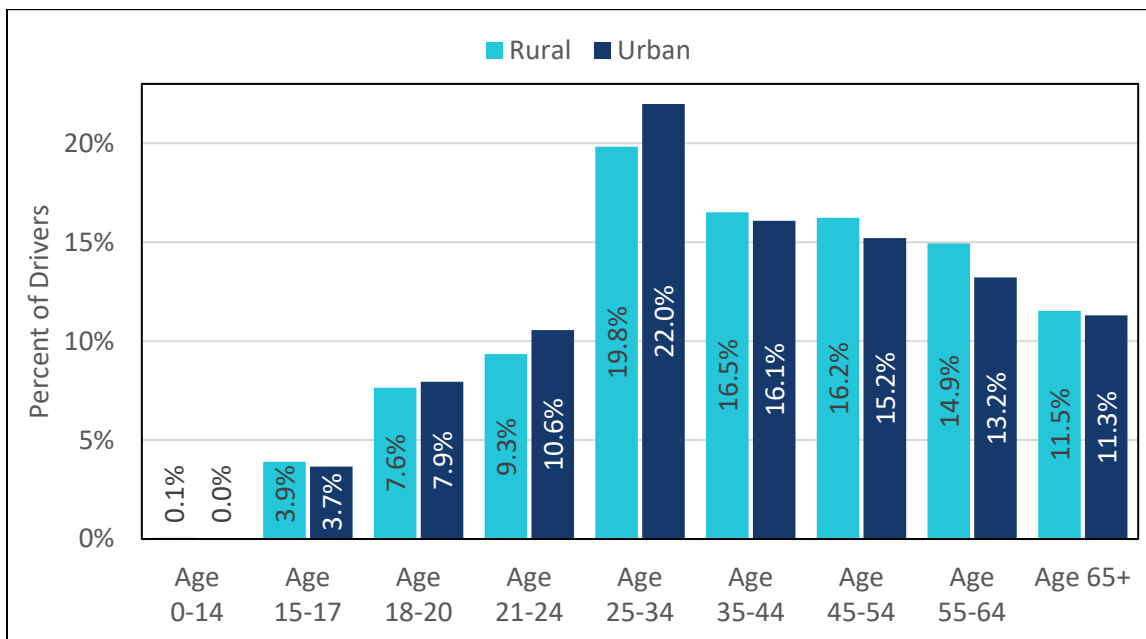


Figure 20 – Motor Vehicle Drivers by Age Group Distribution in Rural and Urban Crashes, 2017-2021

## 8.0 Summary

From 2017-2021 in Michigan, rural crashes made up 31.7% of all crashes while urban crashes comprised 68.1% of crashes in Michigan with 0.2% of crashes having an unknown rural/urban designation. Rural crashes had a higher fatal crash severity than urban crashes (0.5% vs. 0.3%), yet also had a higher proportion of crashes with no injury (85.6% vs. 80.0%).

Urban crashes tended to have a slightly higher frequency of crashes during weekdays, times between the hours of 8 a.m. and 6 p.m., and younger drivers age 34 and below.

Rural crashes tended to have a higher frequency of single vehicle crash types, crashes at posted speed limits of 50 mph and higher, dark unlighted lighting conditions, and winter weather road conditions. Rural areas also had higher crash proportions during October through January, deer-involved crashes, motorcycle-involved crashes, alcohol-involved crashes, drug-involved crashes, and unrestrained occupant rates. Rural crashes featured more pickup trucks, motorcycles, snowmobiles, and ORVs/ATVs than urban crashes.