



# Auto Loss Costs: Collision

January 2020



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## Introduction

Collision coverage helps pay to repair or replace vehicles if damaged in an accident with another vehicle or object. When leasing or financing your car, collision coverage is typically required. When a car is paid off, collision coverage is optional.

Collision frequency exhibited an annual fluctuation (Figure 1). At the beginning of each year, during the first quarter, there is a spike in collision frequency. The only exception was the first quarter in 2011.

Obvious trends emerged when looking at collision severity over time. With each passing year, severity increases (Figure 2). It is possible that in addition to general inflation, rising severity is due to the increased cost of repairing automobiles with added safety features and new technologies such as cameras or sensors. The average annual inflation rate between 2010 and 2018 is 1.7%, whereas the average yearly increase in severity was 3.8%. This is possible evidence that increased costs of automobiles, among other factors, are adding to this trend.

Figure 1  
Collision Frequency Over Time

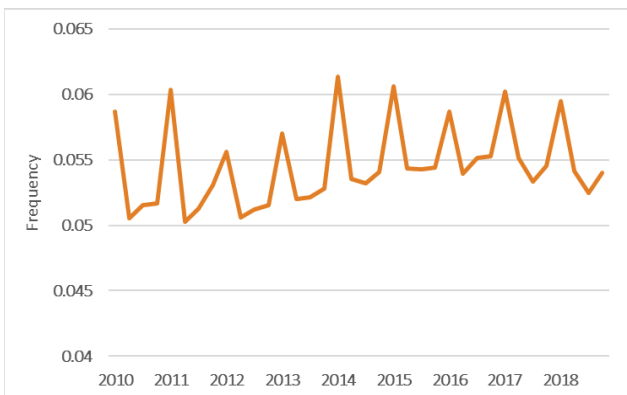
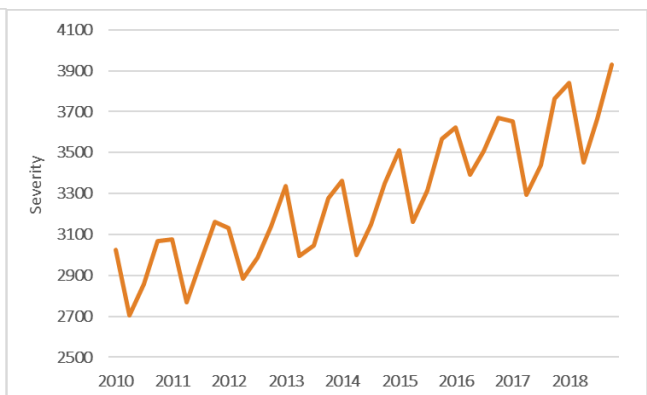


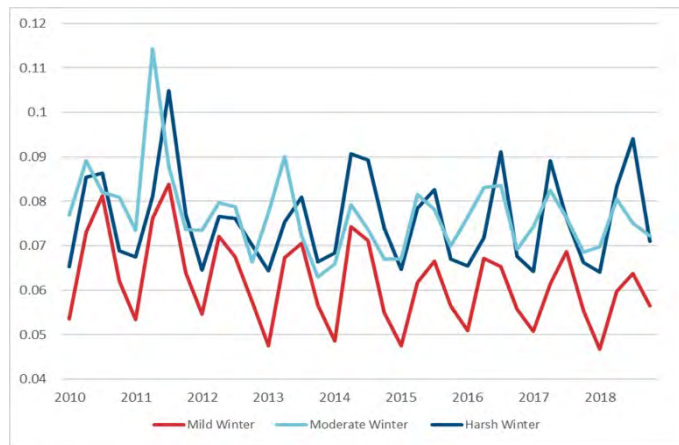
Figure 2  
Collision Severity Over Time



## Snowfall

We further broke down our analysis by grouping states by their yearly snowfall. States were split into three groups: the ten states with the most annual snowfall (denoted by the dark blue line in Figure 3), the ten states with the least snowfall (red line) and the remaining 30 middle as moderate winter states (light blue line).<sup>1</sup> The harsh winter states have the highest collision, especially in the winter as the snowfall impedes driving and greatly increases accident rates. Though the moderate and mild winter states also showed this trend, it was less dramatic than the harsh winter states. Additionally, our mild winter states tended to have higher population densities. More drivers on the road facilitates a higher frequency of collisions on average.

Figure 3  
Collision Frequency by States and Winter Severity



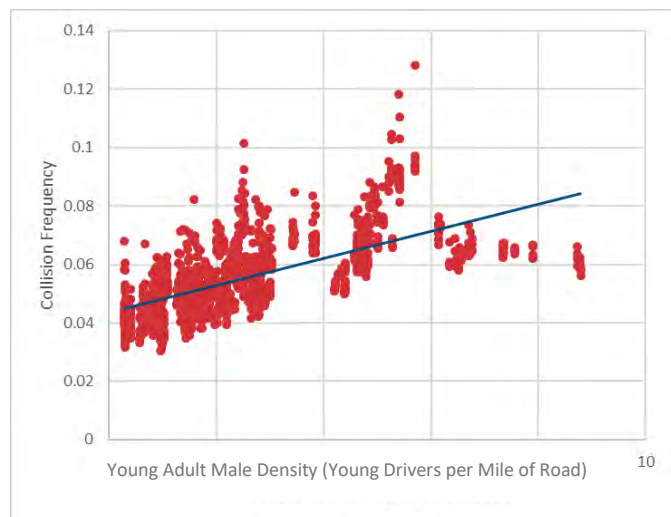
## Congestion

Beyond these patterns, there is a strong, positive correlation between collision frequency and vehicle miles traveled per road mile. Collision loss cost also had a strong, positive correlation with vehicle miles traveled per road mile. Measuring a similar effect, licensed drivers per road mile is also positively correlated with collision frequency and loss cost.

## Driver Age

Thinking that a higher proportion of young, inexperienced drivers would be positively correlated with loss, it is surprising to find that the ratio of drivers under 24 and the ratio of drivers over 79 were both negatively correlated with collision frequency and loss cost. Although these drivers may be more inexperienced, it is possible they do not contribute to traffic as much as drivers between 24 and 79. Perhaps it is not the population size of these cohorts that is significant, but their density on the road. For example, the density of young-adult drivers per road mile (measured by number of licensed male drivers between the ages of 20 to 24 by total miles of road) has a moderately strong and positive correlation with collision frequency (0.656) as seen in Figure 4. Furthermore, when looking at the group of males aged 70 to 74, we get similar results of high correlation (0.606) with collision frequency. Therefore, the count of young adult drivers may not be as significant in explaining collision frequency as the density of young adult drivers. One more interesting thing to note is that collision frequency has a moderately strong positive correlation with licensed male drivers age 20 to 24 per mile of rural public road

Figure 4  
Collision Frequency and Road Density



<sup>1</sup> Harsh winter: AK, CO, MA, ME, MI, NH, NY, VT, WI, WY. Mild Winter: AL, AR, CA, FL, GA, HI, LA, MI, SC, TX

(0.565), but there is almost no correlation with licensed male drivers age 20 to 24 per mile of urban public road (0.053).

### Marijuana

Another notable covariate in recent history is the decriminalization of marijuana. We did not find a significant relationship between collision frequency or severity and the legal status of marijuana. More granular data may provide further insights into the number and size of claims where marijuana was involved.

### Road Type

By considering each road type individually and finding its correlation with severity, loss cost, and frequency, it was found that type of road does not have any association with the severity of accidents. However, frequency had some low and moderate correlations with many of the road type lengths.

### Conclusion

In our analysis of the data, we came across several relationships between our covariates and collision frequency and severity. Some of these relationships are very logical and conventional; however, others are surprising. Generally, we observed that collision frequency has a strong pattern within each year with a peak in the first quarter and that collision severity has increased over time more quickly than inflation. The majority of our research consists of finding correlations between different covariates and collision claims. One relationship to note was that the density or concentration of young and old drivers in a state had a significant correlation with collision frequency whereas the overall population size of the same cohorts did not.