

Bumps Ahead!

A Data Analysis of Traffic
Accidents and Road Safety

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Data Preparation Approach

01

Understanding

- 7,728,394 rows, 45 columns
- Info, summary, nulls, head

02

Cleaning

- Dropped End_Lat & End_Lng*
- Start_Time & End_Time formatting (Time, Date, Hour, Weekday, Month)

03

Feature Addition

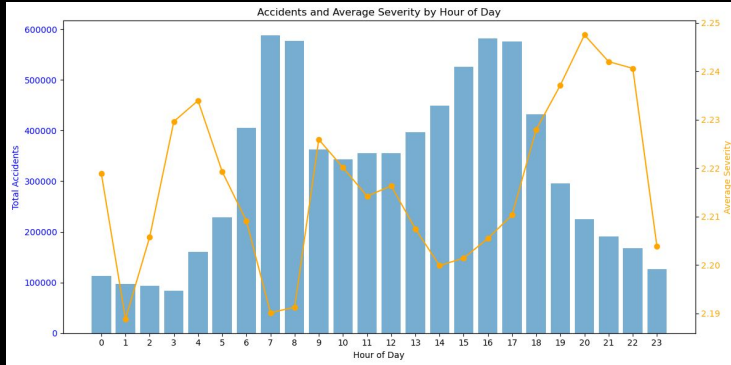
- Is_Weekend, Is_Rush_Hour, Below_Freezing, Severe_Weather_Condition
- Decision tree for weather tipping points

04

Statistical Analysis

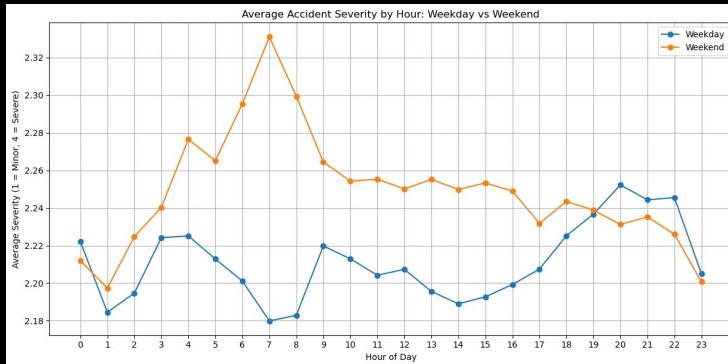
- Data exploration via feature + target plotting
- T-test, Chi-squared, ANOVA, and Tukey HSD Post Hoc to find statistical significance

When Accidents are Most Likely



The number of accidents increases with congestion.

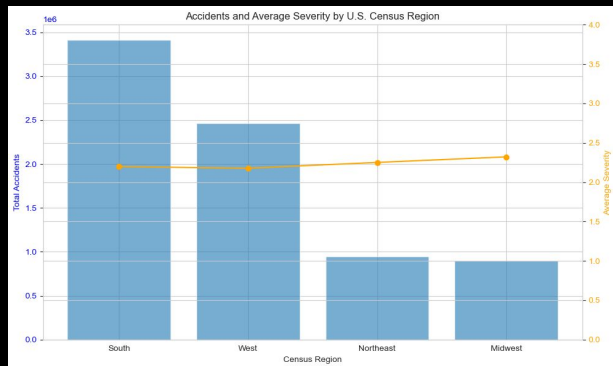
- Rush hour significantly increases likelihood of an accident.
- Accidents are more likely during the week than over the weekend.



Inverse correlation between number of accidents and total accidents.

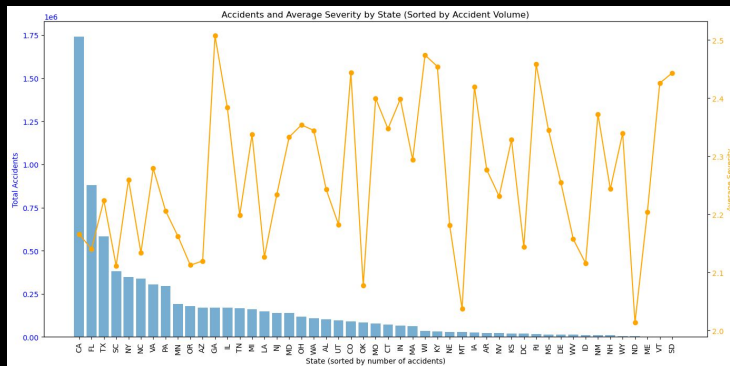
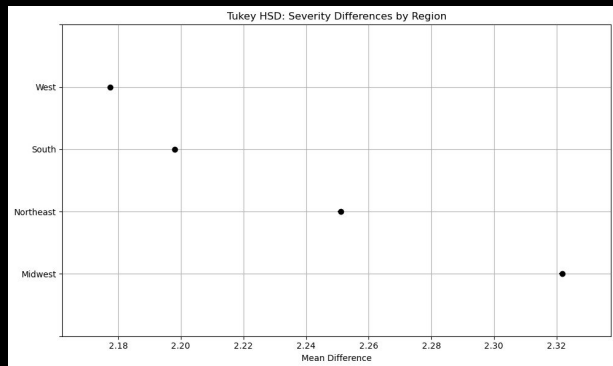
- Accident severity increases on weekends and nights

Where Accidents are Most Likely

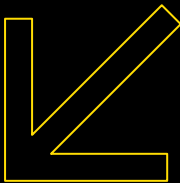


The South and West regions statistically have the most number of accidents and highest severity.

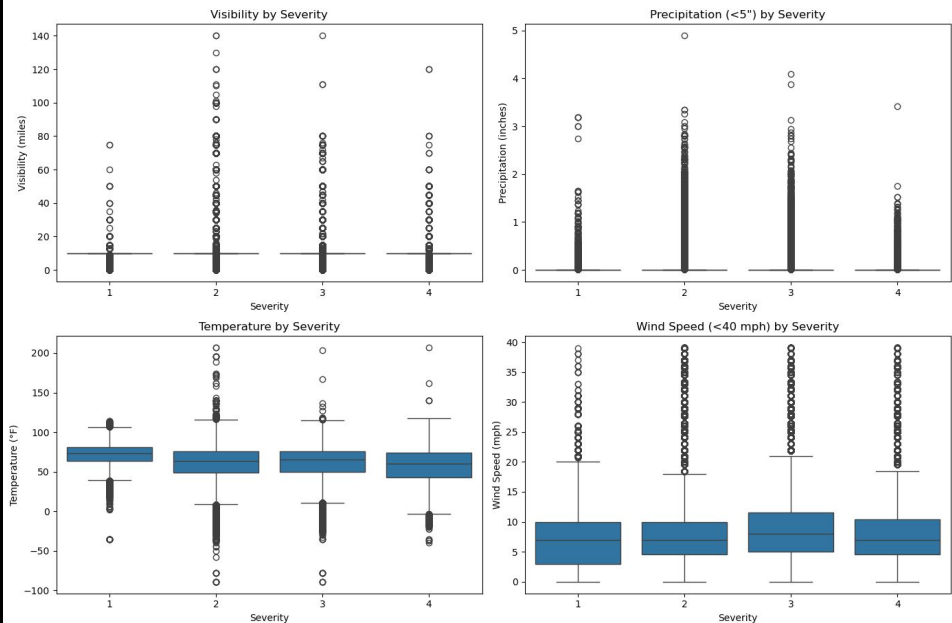
- Although a simple plot shows the Midwest with the highest avg severity, an ANOVA test followed by Tukey post hoc verified that the West has the statistically highest mean accident severity followed by South, Northeast, and Midwest.
- The same test performed on states revealed Georgia, Wisconsin, and Kentucky to have the statistically highest mean accident severity.



What Weather Makes Accidents Worse?



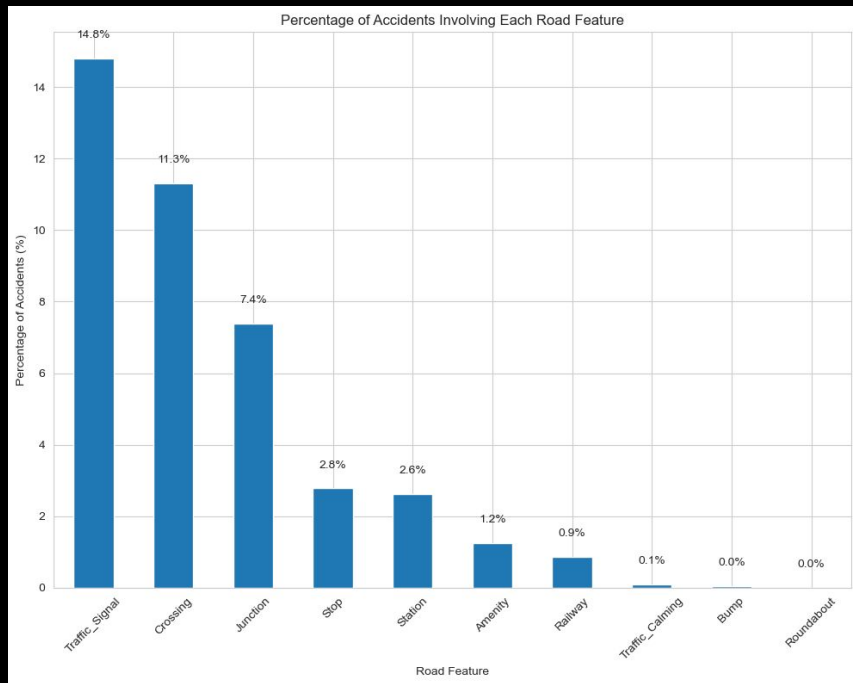
Environmental Factors by Accident Severity



Visibility, wind speed, and precipitation are all significantly correlated with higher severity (ANOVA $p < 0.001$)

- Precip > 0.04 in
- Wind > 3.25 mph
- Visibility < 1.05 mi
- Probability of a severe accident rises to ~44% under these conditions, even without freezing temps or severe weather

Road Features That Influence Accident Outcomes



Accidents are not more likely to occur at infrastructural features (Chi2 p = 1.0 for all)

- But severity is lower at:
 - Intersections with traffic signals or stop signs
 - Crossings and roundabouts
- Suggests safety infrastructure may help mitigate harm when accidents do occur

Data-Driven Actions for Safer Roads

01

Deploy weather-responsive alert systems:

Use real-time data to warn drivers when visibility drops below 1 mi, precipitation exceeds 0.04 in, and wind is over 4 mph. Consider partnering with navigation maps to incorporate in-app notifications.

02

Prioritize infrastructure improvements:

Decrease congestion while slowing vehicle speeds by prioritizing roundabouts instead of traffic lights at new intersections.

03

Schedule patrols on nights & weekends:

Law enforcement presence can naturally reduce vehicle speeds during high-severity times. Consider also adding variable speed signage on highways to ease congestion during peak hours.

Interactive Dashboard

Explore most data visualization
and analysis in the interactive
Tableau dashboard.

