

# Optimizing Traffic Flow in Austin Using Clustering and Analysis of Collision Trends

BAI 457: Visualizing Data for Business Intelligence

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## Objective of the Study

This project investigates patterns in traffic incidents across Austin, Texas with a focus on understanding how speed, volume, time, and incident severity contribute to collision trends. Using real world traffic data, the analysis applies various techniques in order to classify and analyze traffic patterns in a data driven and meaningful way. The goal is to provide evidence that supports more efficient traffic planning, risk detection, and policy decisions for urban safety.

## Data Insights for Each Figure

### Figure 1: Traffic Condition Clusters by Volume and Speed

The clustering results revealed three interpretable traffic conditions: High Speed/Low Volume, Rush Hour Flow, and High Congestion. Each cluster represents a unique traffic environment.

### Figure 2: Collision Frequency by Hour for each Traffic Cluster

The analysis shows that collision frequency varies significantly by time of day and traffic environment, highlighting rush hours and afternoon congestion as key periods.

### Figure 3: Collision Density by Hour and Day of the Week

Fridays and Saturdays between around 4 pm and 10 pm were identified as peak times for collisions, reinforcing the importance of considering both time and day in risk management.

### Figure 4: Speed Distribution of Collisions by Traffic Cluster

Speed profiles vary widely across clusters, with the highest speeds and highest risk of severity found in the High Speed/Low Volume cluster.

### Figure 5: Total Number of Collisions per Traffic Cluster

High Congestion environments contribute the most to the overall collision volume, whereas High Speed/Low Volume incidents are less frequent but potentially more severe.

### Figure 6: Monthly Distribution of Traffic Incidents by Severity

Seasonal analysis shows peaks in the spring and fall months, with most incidents categorized as minor or moderate. This could be due to factors such as school breaks or weather changes.

**Figure 7:** Hourly Traffic Speed and Incident Volume Trends

Speed drops as incident volume increases, particularly in the late afternoon, confirming typical rush hour congestion patterns. There seems to be a clear negative correlation between incident volume and speed.

**Figure 8:** Overall Distribution of Incident Severity Types

The pie chart clearly shows that minor and moderate incidents dominate and are most frequent, with major incidents representing a small, however non-negligible, proportion.

**Figure 9:** Hourly Breakdown of Incident Severity Levels

Moderate incidents peak in the late afternoon and early evening hours, while major incidents appear more frequently at night, indicating risker nighttime driving conditions.