Peak Hour Identification & Pattern Analysis

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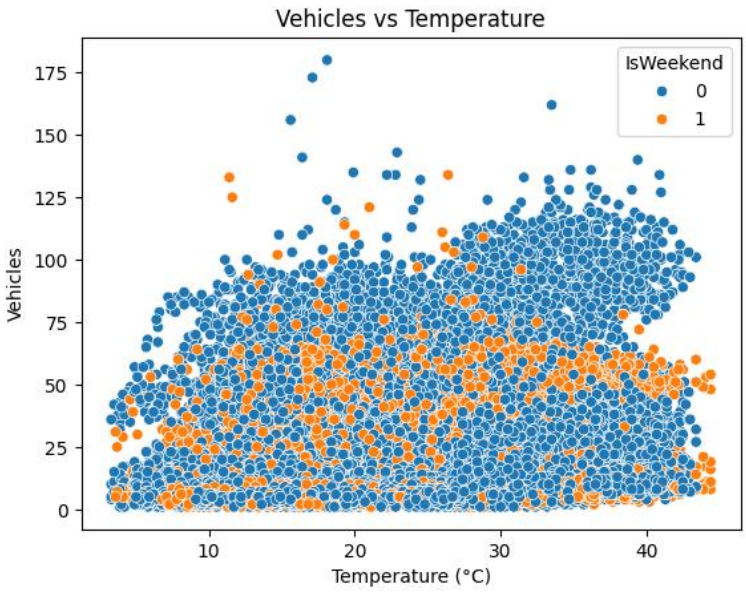
1. Objective

To identify peak traffic hours for each junction using congestion metrics and understand temporal patterns and influencing factors like weather and special events. This report supports planning, management, and congestion mitigation.

2. Congestion Metrics & Peak Hour Detection

Peak hours were identified using hourly average vehicle count, moving averages and standard deviation thresholding.



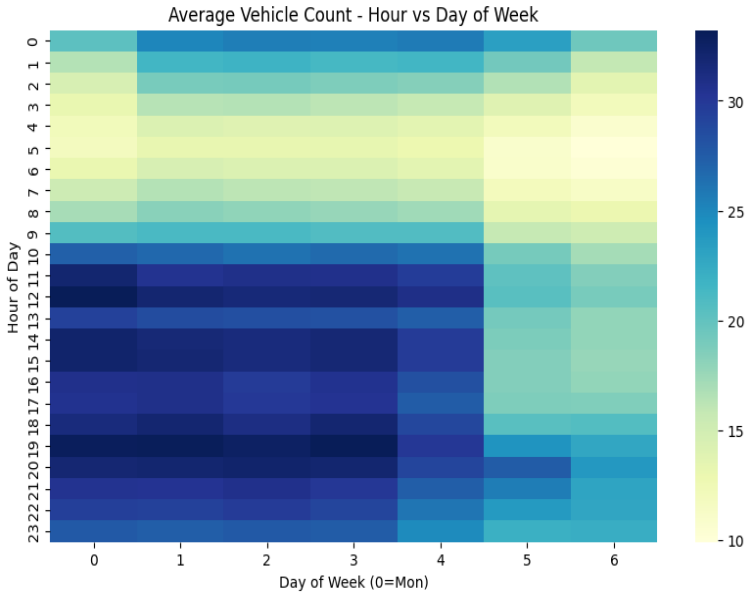
3. Influence of Weather & Events

A linear regression model was built to analyze external factor influence on congestion. Key insights:

- Temperature ↑ → slight increase in congestion.

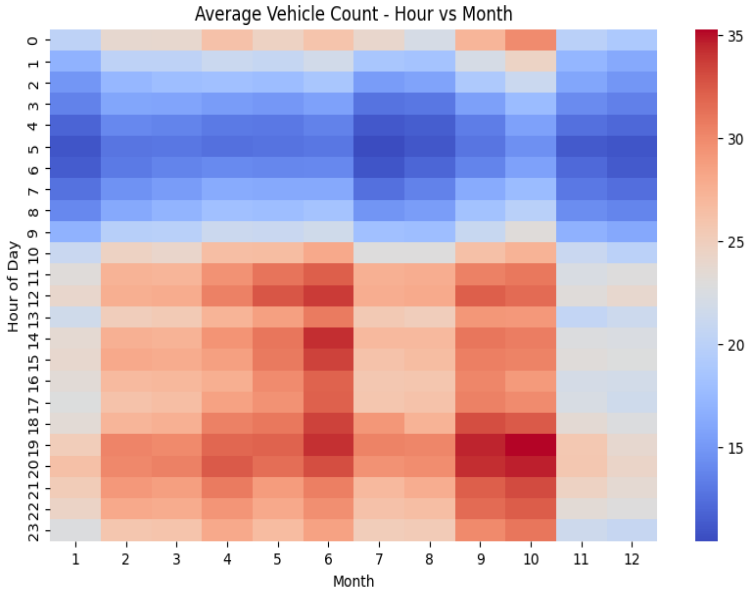
- Humidity ↑ → slight decrease.

- Weekends and holidays reduce congestion significantly.



4. Temporal Pattern Analysis

Heatmaps show clear weekday vs weekend and seasonal variations in peak hours.



5. Identified Peak Hours by Junction

Junction 2: Peak Hours = [12, 15]

Junction 3: Peak Hours = [20]

Junction 4: Peak Hours = [12, 22]

6. Patterns and Influencing Factors

Hourly Patterns:

• Vehicle counts generally increase during morning and evening hours, with clear peaks identified in the data.

• Residual analysis by hour (see plots) shows systematic under/over-prediction at certain hours, indicating consistent patterns.

Day of Week:

• Heatmaps show higher congestion on weekdays, especially during commute hours.

Weather Factors:

• Correlation analysis indicates temperature has a mild positive correlation with vehicle count, while humidity and precipitation have weak or negative correlations.

Event and Holiday Effects:

• 'Is Holiday' and 'IsWeekend' flags show lower vehicle counts, but some junctions may experience local surges due to events.

7. Actionable Insights & Recommendations

• Dynamic Traffic Signal Timing: Adjust signal timings at identified peak hours for each junction to improve flow.

• Congestion Alerts: Implement real-time alerts for drivers during peak hours, especially at Junctions with multiple peak periods.

• Promote Off-Peak Travel: Encourage travel during non-peak hours through incentives or public messaging.

• Weather-Responsive Planning: Prepare for minor increases in congestion during warmer periods; monitor for unexpected spikes during adverse weather.

• Event Coordination: Coordinate with event organizers to manage traffic surges on holidays or weekends.