Comprehensive Report on Peak Hour Traffic Analysis

1. Introduction:

This report presents a detailed analysis of traffic congestion patterns to identify peak traffic hours and understand the underlying factors influencing these trends. Data has been analyzed across various junctions, days, and months, with a focus on vehicle counts and environmental variables.

2. Congestion Metrics:

- Primary Metric: Vehicle counts per hour.
- Temporal Features Extracted: Hour, Day, Weekday, Month, and Year.
- External Factors Included:
  - Weather data: Temperature (°C), Wind Speed (km/h), Humidity (%), Precipitation (mm)
  - Events: Public holidays, Sports events, Concerts, Demonstrations

Data Overview:

- Total Entries: 48,024
- Columns include: DateTime, Vehicles, Hour, IsWeekend, Temperature, Event indicators, etc.

3. Peak Hour Identification:

Hourly average vehicle counts were analyzed:

- Statistical Smoothing: Moving average techniques used to smooth hourly traffic patterns.
- Findings:
  - Peak hours consistently observed around **8:00–10:00 AM** and **5:00–8:00 PM**.
  - These hours align with typical commute times.

4. Temporal Pattern Analysis:

Weekday vs Weekend:

- Weekdays show distinctive dual peaks (morning and evening rush hours).
- Weekends display flattened traffic curves, with midday activity being more dominant.

Monthly Patterns:

- Slight increases in traffic noted in festive and holiday months.
- Weather-related seasonal variation had a subtle impact, further discussed below.

5. Analysis of Influencing Factors:

Regression Analysis:

- Linear regression conducted to quantify relationships between vehicle count and external variables.
- R-squared value: 0.051 (indicates other hidden/complex patterns may exist).
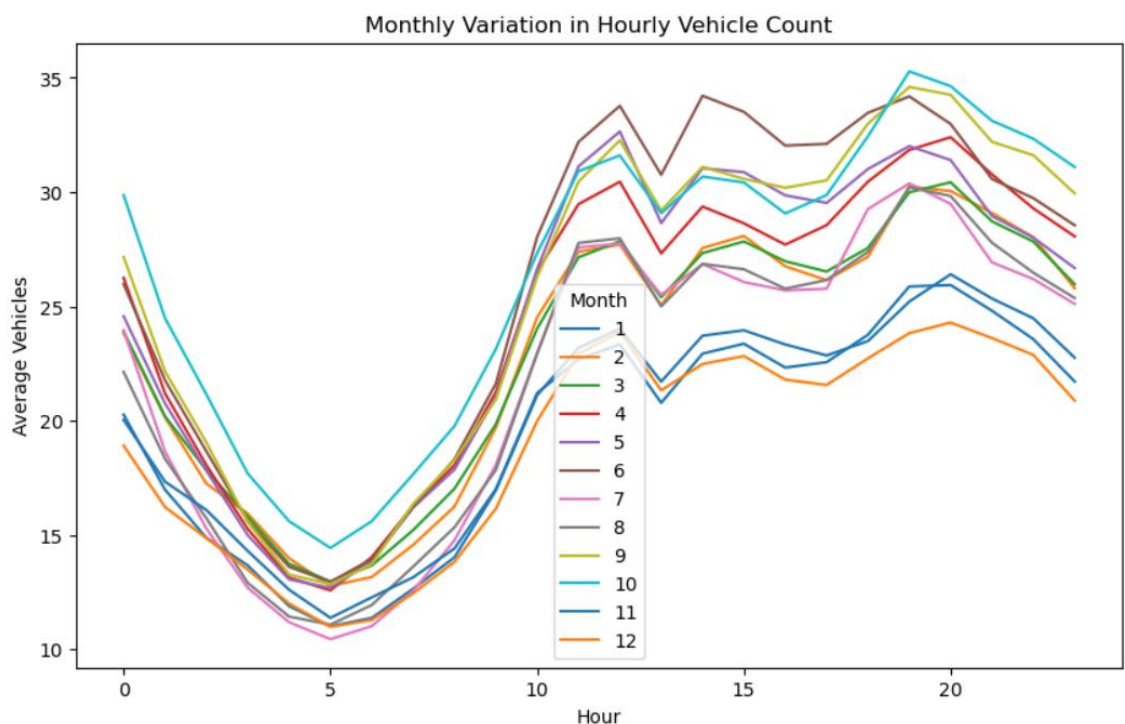
Observations:

- Temperature: Slight positive correlation with traffic volume.
- Precipitation: Rain and heavy weather reduce traffic volume marginally.
- Events (e.g., concerts, public holidays): Local spikes or drops in traffic during special events.
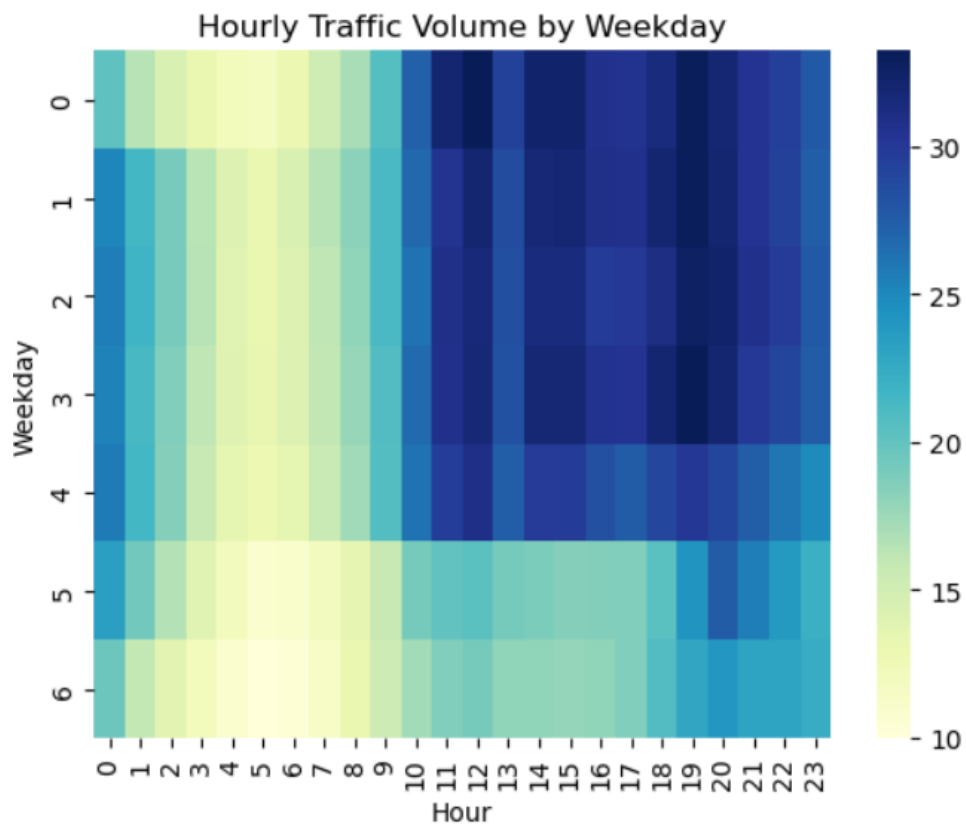
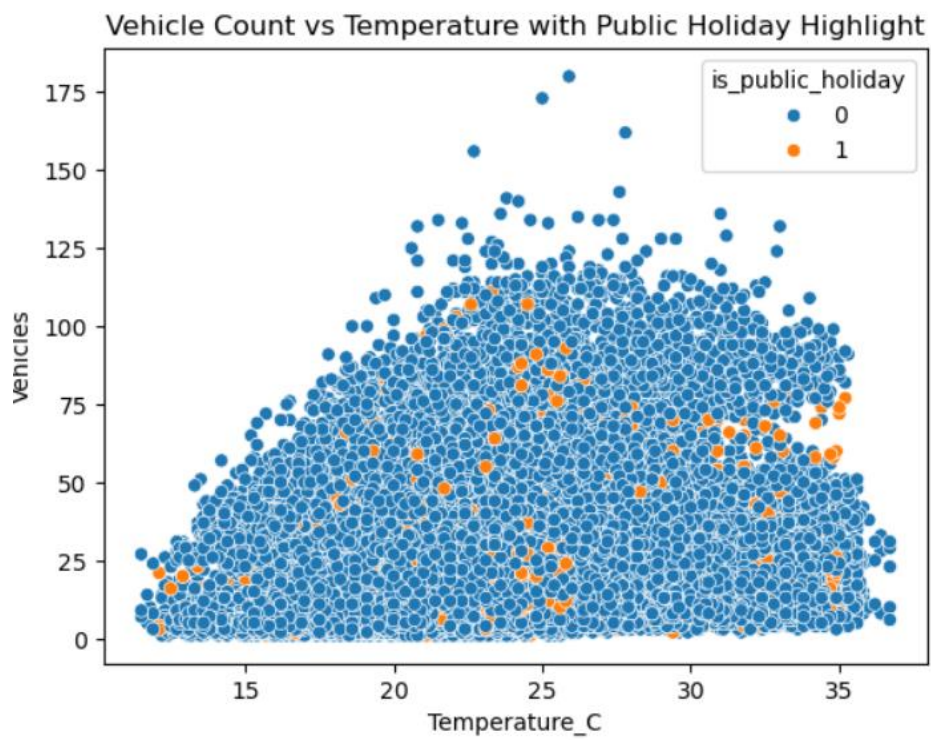## 6. Visualizations:

Include the following:

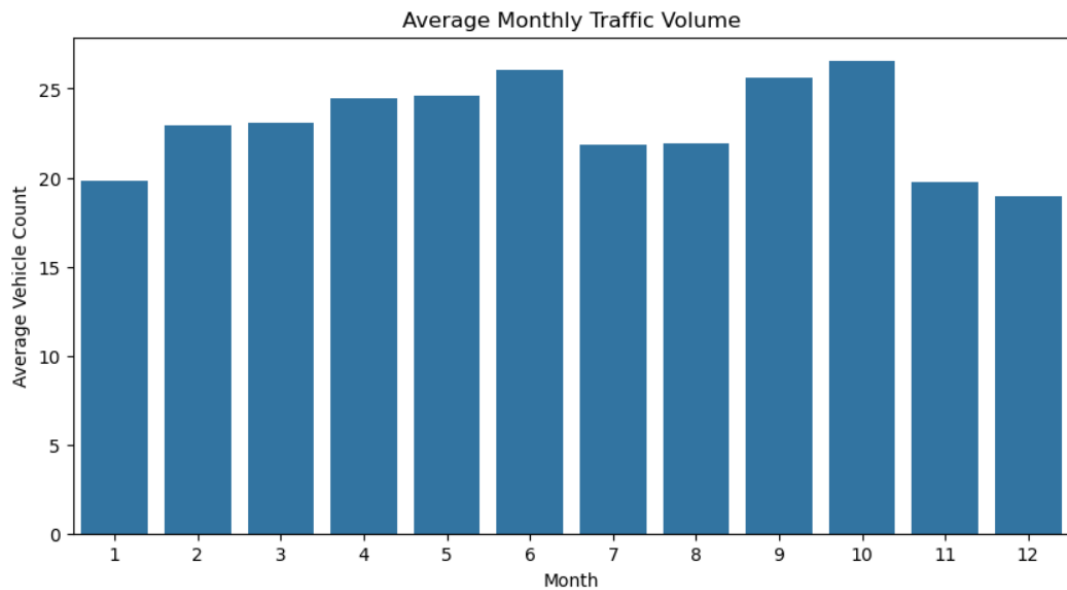- Line plots for hourly traffic volumes across different days.

- Heatmaps showing traffic intensity by hour vs weekday.

Hourly Traffic Volume by Weekday

- Scatter plots showing weather/event correlations.

Vehicle Count vs Temperature with Public Holiday Highlight

- Monthly distribution charts.

7. Key Insights & Recommendations:

- Morning (8–10 AM) and Evening (5–8 PM) are critical hours for congestion management.
- Weekend traffic requires different strategies due to flattened and delayed peak periods.
- Weather forecasts and event schedules should be integrated into dynamic traffic control systems.

- **Recommendation**: Implement dynamic signal timing and ramp metering during peak hours, especially at high-traffic junctions.

8. Conclusion:

This analysis identifies not only the peak hours of traffic congestion but also contextualizes them within daily, weekly, and external-event-based patterns. Integrating environmental and event-driven factors allows for a more holistic approach to traffic management.