# Investigating the Impact of Weather Conditions on Traffic Flow in Dublin

## 1 Introduction

Effective traffic management is crucial for urban planning, directly affecting commute times, economic productivity, and environmental sustainability. For city planners and traffic management authorities, understanding how daily weather conditions impact traffic flow can aid in making informed decisions to enhance urban mobility and reduce congestion. This study aims to investigate the correlation between weather parameters (such as temperature, rainfall, humidity, and wind speed) and traffic patterns in Dublin. The insights gained will support policy decisions, infrastructure investments, and public transportation planning, contributing to sustainable urban development and improved quality of life for residents.

## 2 Used Data

### 2.1 Traffic Flow Data

**Source:** South Dublin County Council (SDCC)
**Period:** January to June 2021
**Structure:** The data contains two columns after the ETL pipeline: date and flow.

- **date:** Represents the date in MM/DD/YYYY format.
- **flow:** Indicates the traffic flow volume on the respective date.

### 2.2 Weather Data

**Source:** Visual Crossing
**Period:** January to June 2021
**Structure:** The data includes the following columns: datetime, temp, humidity, precip, windspeed, and visibility.

- **datetime:** Represents the date in MM/DD/YYYY format.
- **temp:** Temperature in degrees Celsius.

- **humidity:** Humidity percentage.
- **precip:** Precipitation in millimeters.
- **windspeed:** Wind speed in kilometers per hour.
- **visibility:** Visibility in kilometers.

# 3 Analysis

## 3.1 Data Integration

I combined the traffic flow data and weather data based on the date. This involved standardizing date formats and merging the datasets to create a unified dataset that included daily traffic flow and corresponding weather parameters (temperature, humidity, precipitation, wind speed, and visibility).

## 3.2 Descriptive Statistics

I calculated basic descriptive statistics to understand the distributions and summary metrics of the traffic flow and weather data. This step helped in identifying any anomalies or patterns within the dataset.

## 3.3 Correlation Analysis

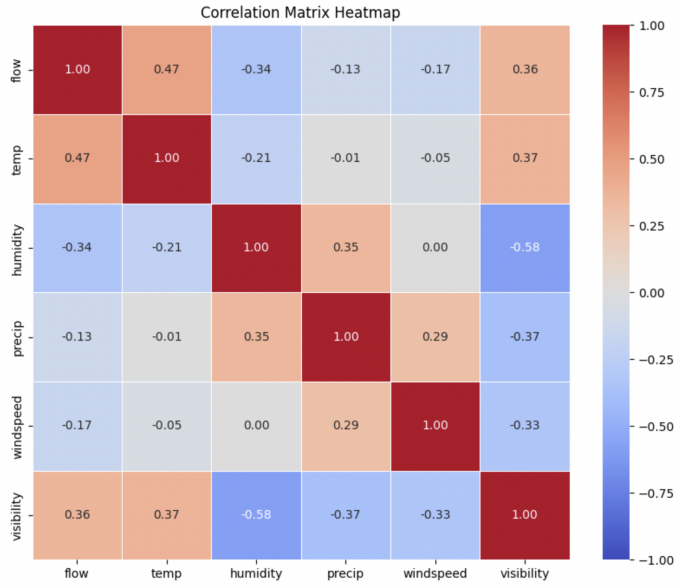


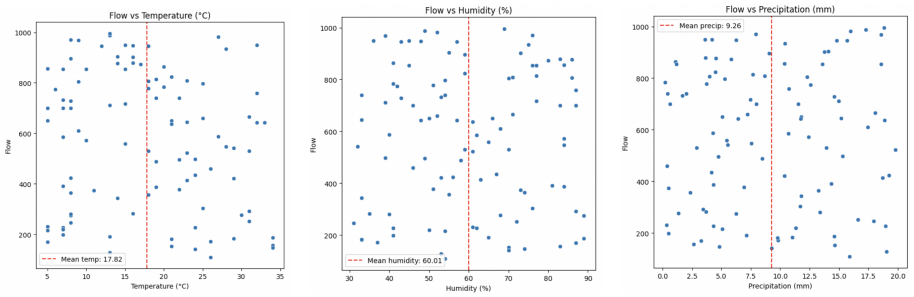

Figure 1: Correlation Heatmap between Weather Parameters and Traffic Flow

I computed the correlation matrix to quantify the strength and direction of relationships between weather parameters and traffic flow. The correlation coefficient ranges from -1 to 1, where values close to '1' indicate a strong positive correlation, values close to -1 indicate a strong negative correlation, and values around '0' indicate no correlation.

# 4 Results

The analysis revealed several key insights into the relationship between weather conditions and traffic flow in Dublin:

1. **Temperature:** The correlation analysis showed a positive correlation between temperature and traffic flow. This indicates that traffic volume tends to increase with higher temperatures. This finding was supported by the scatter plots, which showed a clear upward trend with change in temperature.




(a) Temperature vs Traffic (b) Humidity vs Traffic (c) Precipitation vs Traffic

Figure 2: Weather Parameters vs Traffic Flow

2. **Humidity:** I observed a negative correlation between humidity and traffic flow. Higher humidity levels were associated with lower traffic volumes. This suggests that people might prefer to stay indoors or use alternative modes of transportation on humid days.

3. **Precipitation and Windspeed:** There was a significant negative correlation between precipitation, wind speed and traffic flow. Rainy days saw a noticeable decrease in traffic volume. This trend was evident in both the correlation matrix and the scatter plots.

4. **Visibility:** Visibility showed moderate correlations with traffic flow compared to other weather parameters. Better visibility tends to correlate with increased traffic flow, indicating that people might like driving during pleasant days.

# 5 Interpretation

The results of my analysis provide valuable insights for city planners and traffic management authorities in Dublin. The positive correlation between temperature and traffic flow suggests that traffic volumes are higher on warmer days, likely due to increased outdoor activities and travel. Conversely, the negative correlations with humidity and precipitation indicate that adverse weather conditions, such as rain and high humidity, lead to reduced traffic volumes.

These findings highlight the importance of considering weather conditions in traffic management and urban planning. For instance, on days with forecasted heavy rain or high humidity, authorities can implement measures to manage traffic flow more efficiently, such as adjusting traffic signal timings or promoting the use of public transportation. Furthermore, the weaker correlations with wind speed and visibility suggest that while these factors do impact traffic flow, their effects are less pronounced compared to temperature, humidity, and precipitation.

By understanding the impact of weather on traffic patterns, city planners can make informed decisions to improve traffic flow, reduce congestion, and enhance overall urban mobility. This, in turn, supports the broader goals of sustainable urban development and improved quality of life for residents.

# 6 Limitations

## 6.1 Correlation vs. Causation

The analysis establishes correlations but does not confirm causation. While there is a relationship between weather conditions and traffic flow, it is not definitive that weather changes cause changes in traffic patterns.

## 6.2 Time of Day Effects

The analysis does not differentiate between traffic flow at different times of the day. Traffic patterns can vary significantly between peak and off-peak hours, and weather impacts may also differ accordingly.

## 6.3 Public Transportation Data

The study does not include data on public transportation usage, which could provide a more comprehensive understanding of how weather conditions affect overall urban mobility.

## 6.4 Behavioral Factors

The study does not account for human behavioral factors such as changes in driver behavior during adverse weather conditions or decisions to work from home, which can influence traffic flow.