Portfolio VII - Typical Day Model

Introduction

I collected 30 days of travel time data from the Google Traffic API for the Enniskillen to Belfast route, with data sampled at regular intervals. Each day serves as a sample, allowing me to construct a 'typical day' model by calculating the mean and 95% confidence intervals. This allows me to captures daily traffic patterns and fluctuations, making it useful for predictive analysis and traffic optimisation, and provides a reference for future queueing theory applications to reduce peak travel times, the objective of my final report.

Data Collection & Methodology

The traffic data was sampled discretely every 10 minutes over 30 days using Google's API, resulting in 144 data points per day for comprehensive coverage. For each 10-minute interval, I calculated the mean travel time and a 95% confidence interval to capture typical variability. This model provides a robust 'typical day' pattern, serving as a baseline for testing queueing strategies to smooth traffic flow.

The confidence interval (CI) for each time segment is calculated as:

$$CI = \bar{x} \pm 1.96 \cdot \frac{\sigma}{\sqrt{n}}$$

where $\bar{x}$ is the mean travel time, σ is the standard deviation, and $n = 30$ days.

Results

The generated 'typical day' profile (see Figure 1 and Table 1) shows average travel times for each interval, with confidence intervals capturing variability.

Figures 2 and 3 show further insights: on weekdays, travel times show significant peaks during school and work hours, with high congestion in the morning and late afternoon. In contrast, weekend travel times are generally lower and more stable, with minimal peaks, reflecting reduced commuting activity.

Thus, the visualisations support my hypothesis that peak travel times align with typical school and work hours — an intuitive assumption now backed by real-world data.

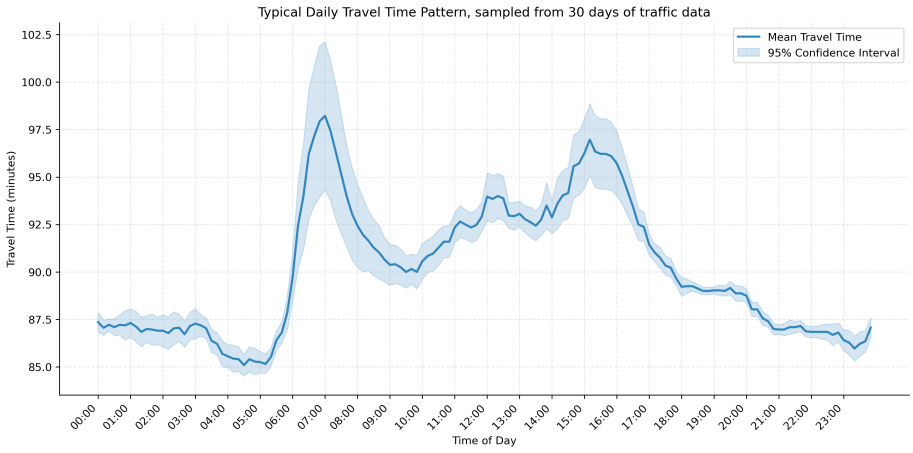

Figure 1: Typical Daily Travel Time Pattern, sampled from 30 days of traffic data with 95% confidence intervals.

Time	**Mean Travel Time (Minutes)**	**CI Lower**	**CI Upper**
00:00	87.36	86.86	87.85
00:10	87.06	86.66	87.47
00:20	87.22	86.90	87.53
...			
23:30	86.22	85.57	86.86
23:40	86.34	85.78	86.90
23:50	87.06	86.54	87.58

Table 1: Summary of travel time statistics for a typical day, including mean travel time and 95% confidence intervals at each time interval.

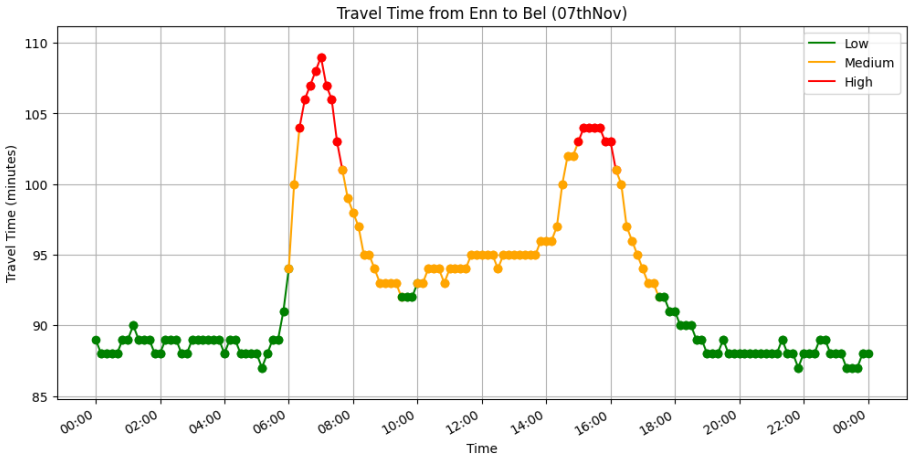

Figure 2: Weekday travel time pattern from Enniskillen to Belfast.

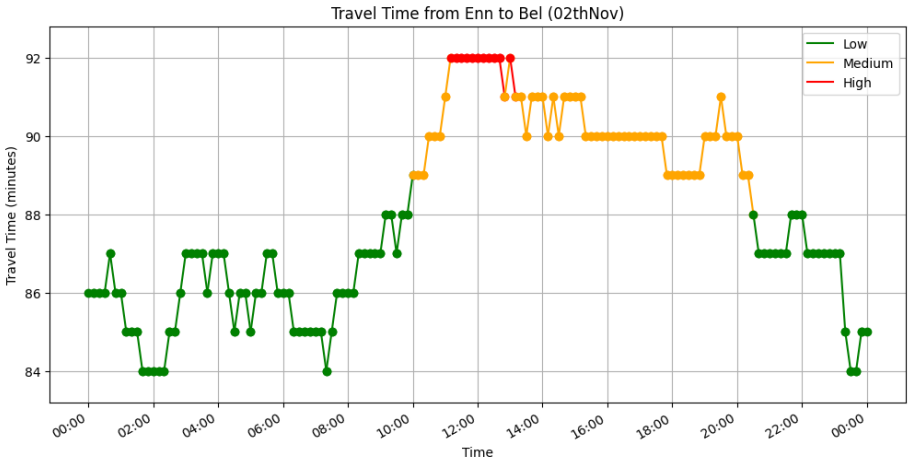

Figure 3: Travel time pattern from Enniskillen to Belfast on a Saturday (Weekend).

What I Learned

In producing this model, I learned:

- How to use external tools (Google Maps API) to collect real-world traffic data for meaningful analysis.
- Brought together ideas from previous blocks to build this 'typical day model' which I will use for future work (Using queuing theory to model this).
- Confirming hypotheses through visualising data, like peak congestion aligning with school and work hours, by backing them with empirical evidence.

Access to Code

Classmates interested in using this code for their own traffic data analysis can request access via the following Google Form: (https://forms.gle/vkMwnv8Ut2LwpxJ77).

References

- Google Maps Platform Documentation. Directions API. Retrieved from `https://developers.google.com/maps/documentation/directions/overview`