

Preliminary Traffic Flow Study

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Introduction

- Electric Vehicles are an achievable method of reducing CO₂ emissions whilst maintaining a mobile populous
- However, EVs are a novel technology and it is not currently known what fundamental differences will exist between EVs and internal combustion engined vehicles
- It is necessary to consider the research questions which will enable us to discover the differences
- This work is being undertaken as part of the Smart Move 2 trial

Newcastle University: a World Class Research Centre in Transport Technology in ITS and Transport Research

transport



Transport Operations Research Group: The Team

- 6 Academic Staff
- 4 Visiting Professors
- 10 Research Associates (Contract Research Staff)
- 5 Research Associates funded in other schools
- 10+ Post Graduate Research Students (Doctoral and MPhil)
- 32 full and Part-Time MSc Students
- Multi-disciplinary links to many other Schools in the University.
- 2 new research staff posts currently advertised (May 2010).
- Over £5.5m (¥ 750m) of research work in hand



Vehicle Monitoring Capabilities within Newcastle University

- Hardware

- Large scale installations of pervasive sensors for monitoring purposes
- Individual vehicle loggers designed to collect second by second data from a “normal” vehicle
- Specially equipped vehicles with multiple sensor payloads

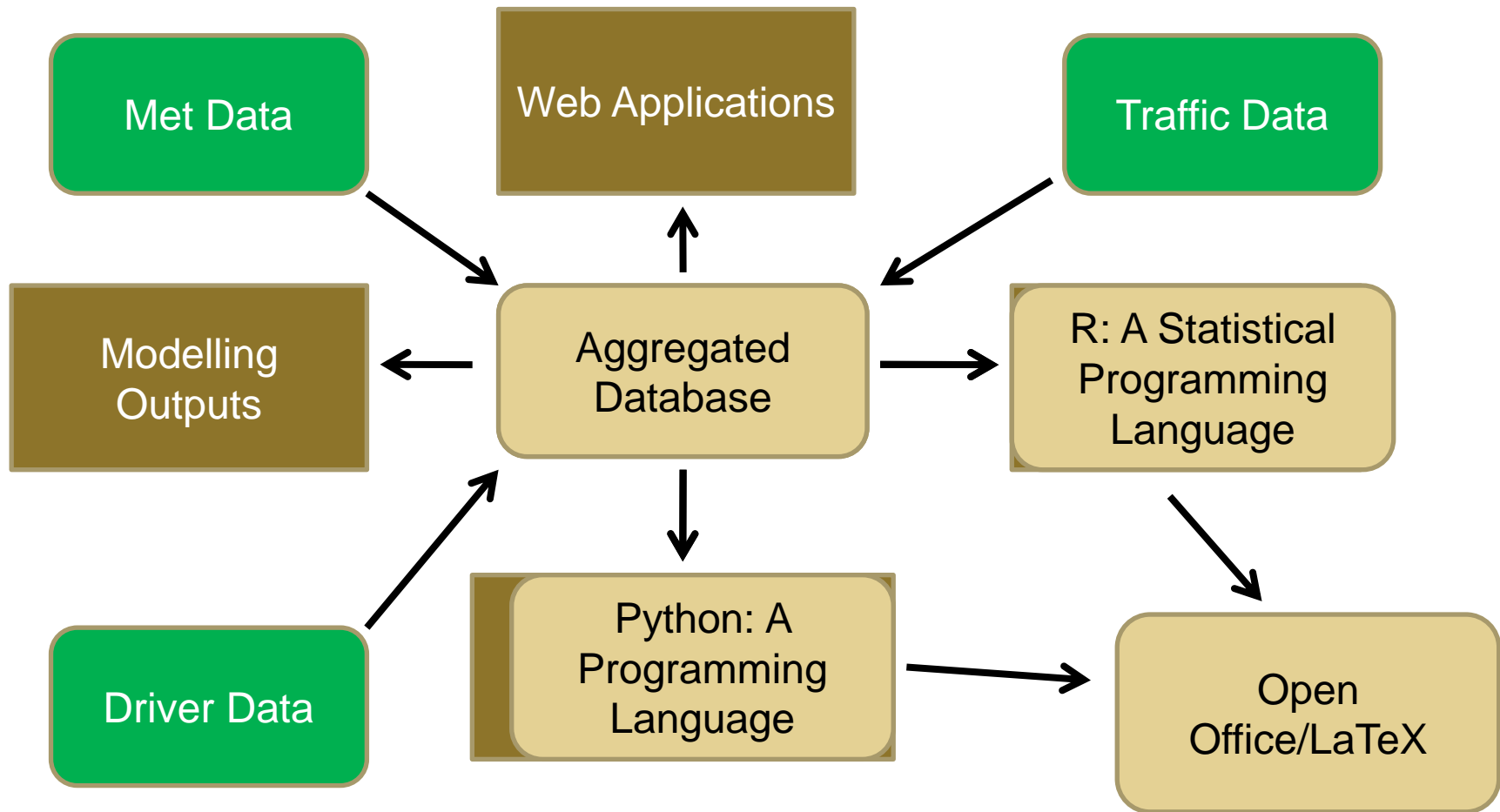
- Software

- Database systems with geographic querying capability
- Multiple Visualisation tools
- Statistical software and programming
- Automated connectivity between all three

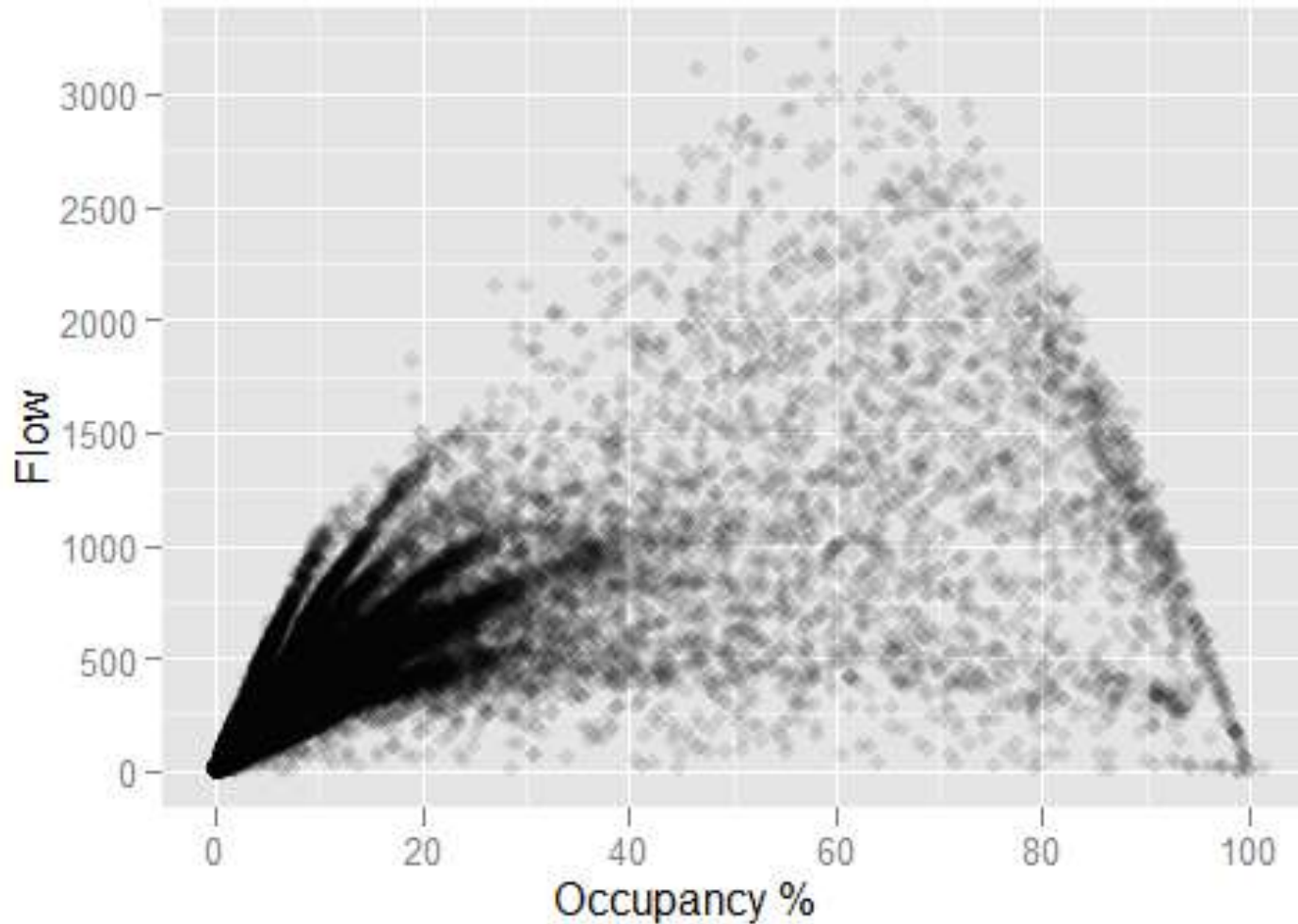
Vehicle Monitoring and Analysis Projects within Newcastle University

- Newcastle University is currently participating and has participated in multiple trials involving vehicular data collection and analysis including:-
- Switch-EV trial:- Demonstrating the large scale use of a series of electric vehicles within the north east
 - To achieve this a series of vehicles will be installed with data loggers which will track their movements and battery management systems
- Foot-LITE:- Demonstrating the use of feedback from second by second data to improve driving style for fleet users
 - Similar loggers are used as in Switch-EV except the data is post processed and made visually accessible
- MESSAGE:- A pervasive sensor installation project
 - Sensors were also used to monitor vehicles on an ad-hoc basis

Analysis of the Data



How does an Electric Vehicle behave in the presence of congestion?



What data do we need?

- To answer this research question it is necessary to collect two main data sets
- Second by second vehicle data:
 - This will allow power consumption, position and speed of the vehicle to be monitored
- Traffic congestion data
 - This will allow the local levels of congestion to be measured and compared against concurrent vehicle data

The Trial - Collecting the Data

- The vehicle data was collected through the use of an RDM logger which connected to the EV can bus. The data transmitted includes GPS, battery management, speed, engine speed and auxiliary “HOTEL” loads.
- The congestion data is collected through a SCOOT system (an induction loop based detection system with multiple measurements). The SCOOT data is taken from the ASTRID database and takes the form of multiple variables averaged at the 15 minute level and stored in 28 day blocks.

The Trial Area – Metro Centre

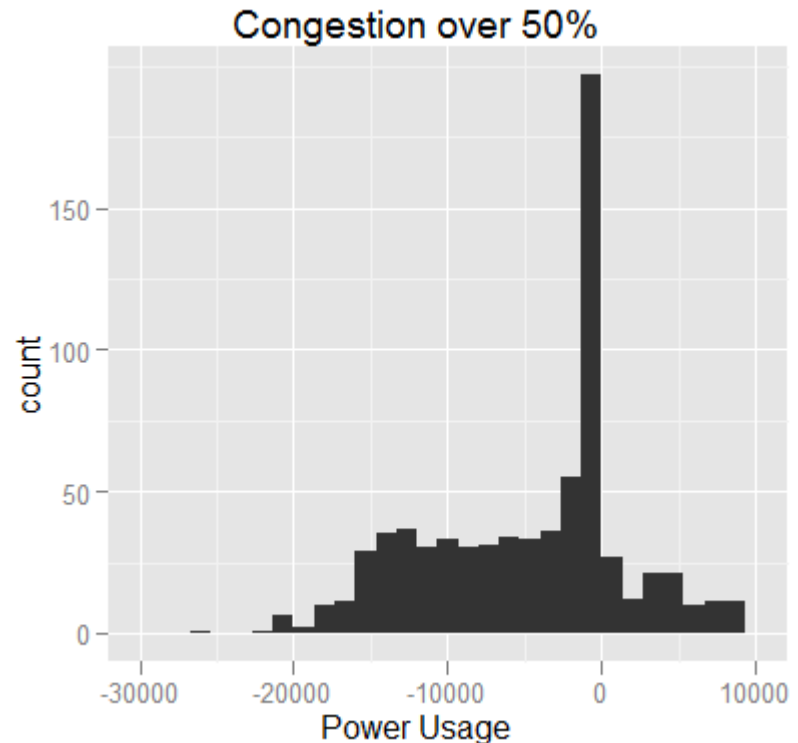
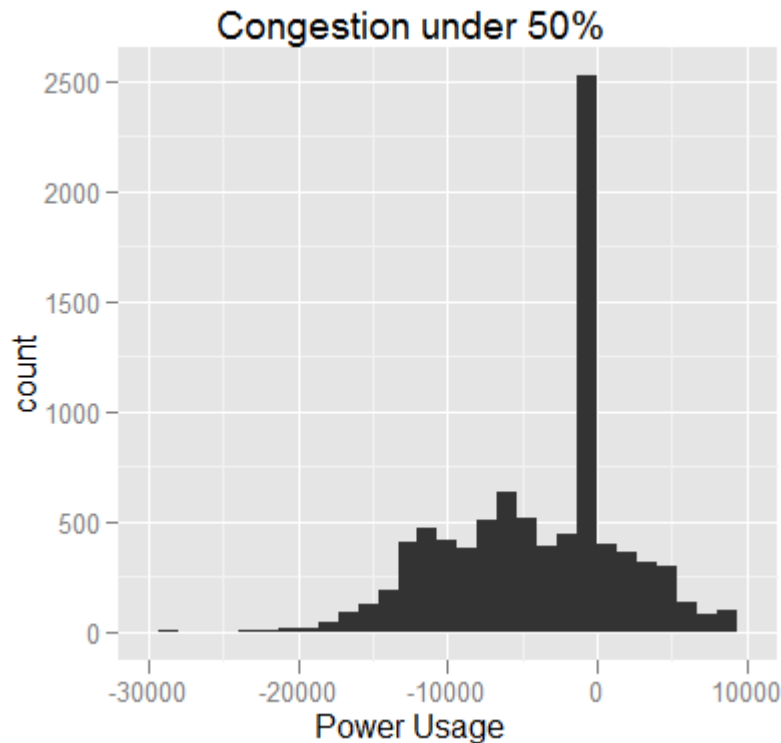


- The Metro Centre is a large shopping centre south of Newcastle in Gateshead. It experiences large fluctuations in traffic and as such is an ideal test bed for this project
- It is known that the Metro Centre can be almost guaranteed to exhibit congestion for certain parts of the day

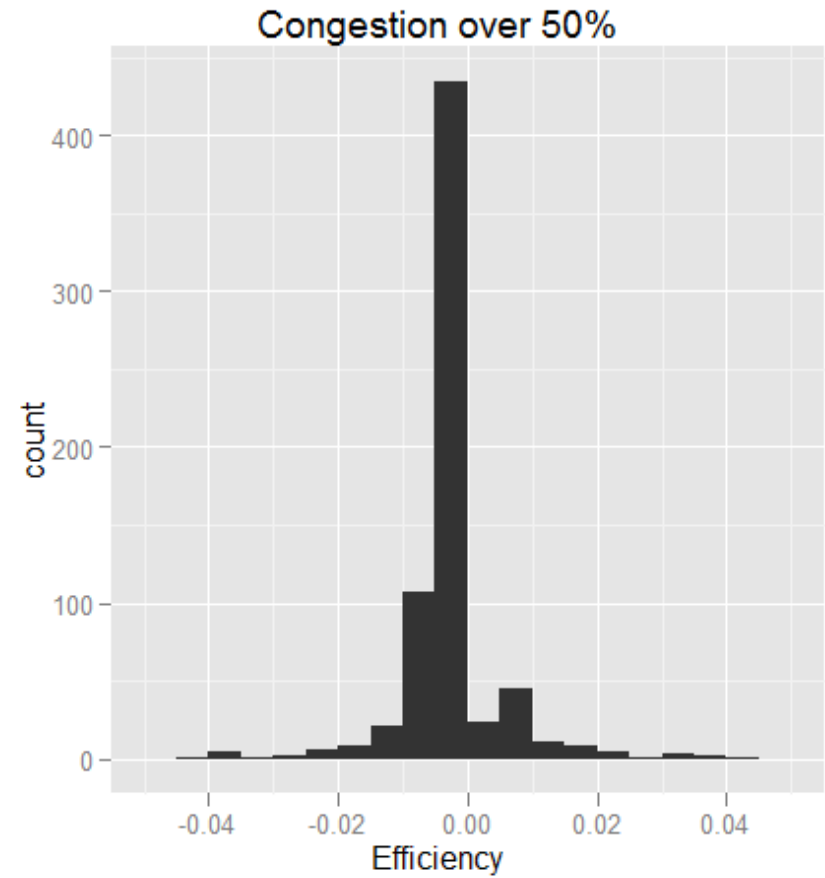
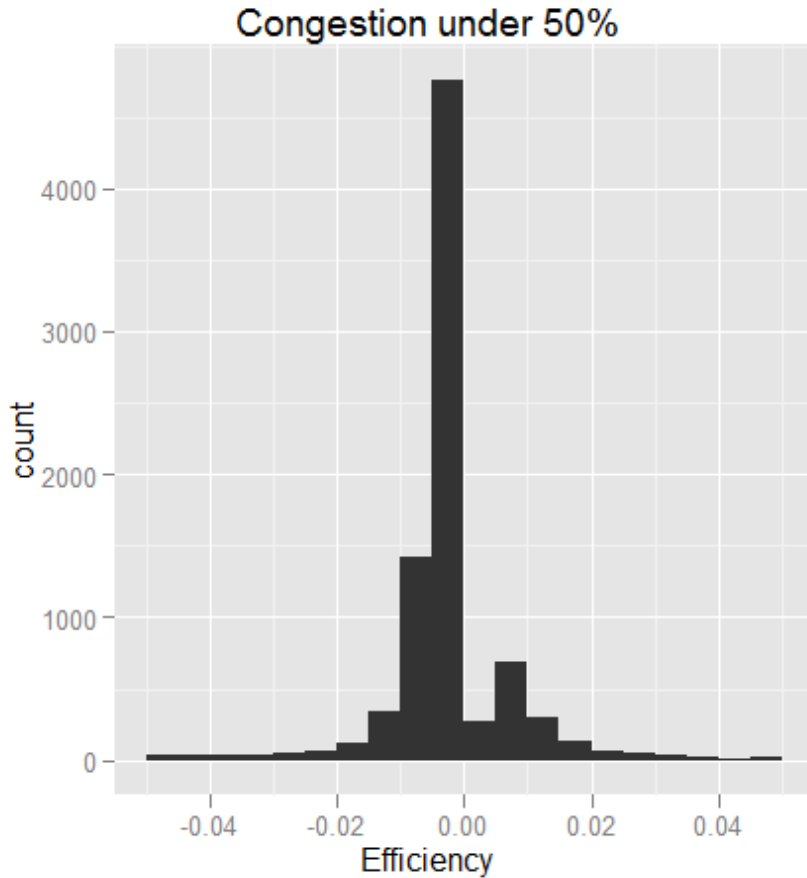
Results

- The data for both the SCOOT links/loops and the vehicle data is time-stamped and geo-coded
 - This allows for a search to be done for data which is coincident both spatially and temporally
- Blocks of data coincident are then statistically analysed

Similar, but subtly different values for power usage



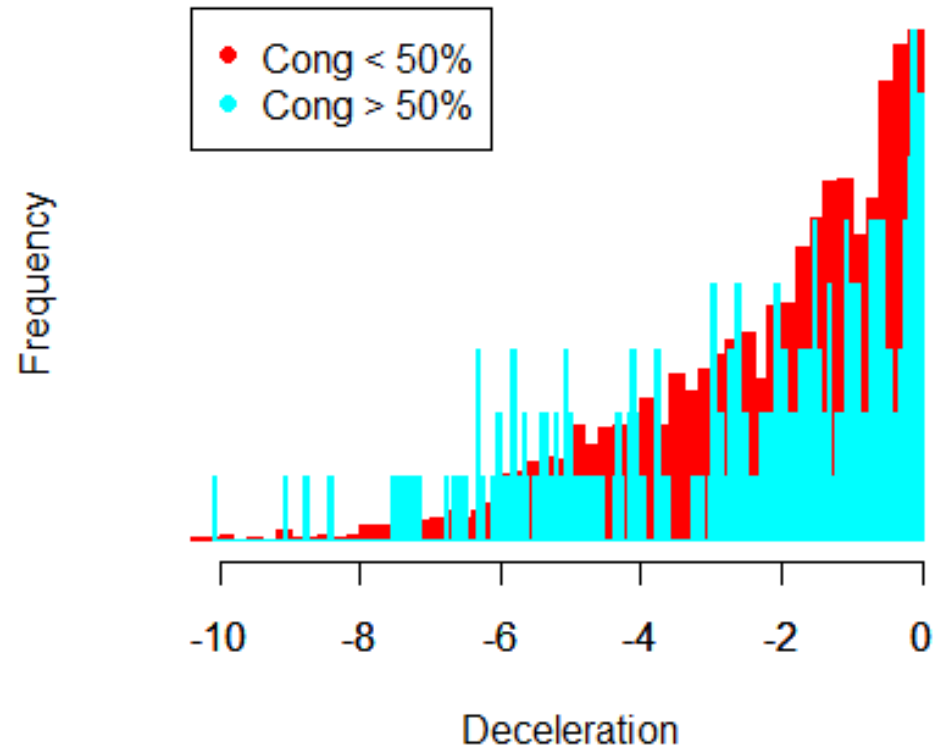
Again, similar but slightly different efficiency values



Deceleration

- High congestion appears to show a flatter profile for deceleration events indicating that a greater percentage of deceleration is at higher values
- The statistics should show this

Histogram of Braking for Different Congestion Regimes



Statics for speed variation events

	%Time Spent Braking	Mean Deceleration Event
Congestion <50%	27%	-2.28
Congestion >50%	33%	-2.52

	%Time Spent Accelerating	Mean Acceleration Event
Congestion <50%	31%	2.05
Congestion >50%	40%	2.18

What does the data tell us?

- The EV accelerates and decelerates for a greater proportion of the time with a higher average deceleration and acceleration
- High congestion means less time is spent “cruising”
- This fits in well with the instinctual understanding of congestion
 - Stop/start movement of vehicles leading to a reduced opportunity for stable speeds

Conclusion

- No Statistical Difference:-
 - Power Usage
 - Efficiency
- Statistical Difference:-
 - Deceleration Duration
 - Mean Deceleration
 - Acceleration Duration
 - Mean Acceleration
- This can be reconciled through the EV's regeneration. An acceleration and deceleration event does not lead to the same energy loss as in an IC engine

Any Questions?