

IMPETUS



East Midlands Intelligent Mobility Partnership



The University of
Nottingham

UNITED KINGDOM · CHINA · MALAYSIA



CATAPULT
Transport Systems

50



A 3 year project between the University of Nottingham and the University of Leicester

64%

Jointly funded by the Transport Systems Catapult

Promoting collaboration with businesses and councils

Focussing on developing products and solutions in the area of Intelligent Mobility





How can you get involved?

PhD students and qualified researchers can work with you to create feasibility studies to enable intelligent mobility concepts move towards market-readiness

Join us to submit collaborative proposals to funding bodies to develop products and services

Come and see what we do by joining us on a short placement in an area related to your work

Take part in workshops and events

The following slides detail some of the current IMPETUS placement projects . . .



Integration of GIS, Open Source information and pollution measurements

Dr Teresa Raventos, Air Quality Specialist, University of Leicester

- A feasibility project to understand air quality issues in urban areas using geographical information systems, open source and emissions data and further, to use novel methodologies to visualise areas and concentration levels of air pollution.

Activities so far . . .

- Acquisition of air quality data for a real case study
- Involvement of Leicestershire County Council for management of traffic measures
- Successful links that expand the project beyond study
- Geotech company provision of air quality sensors

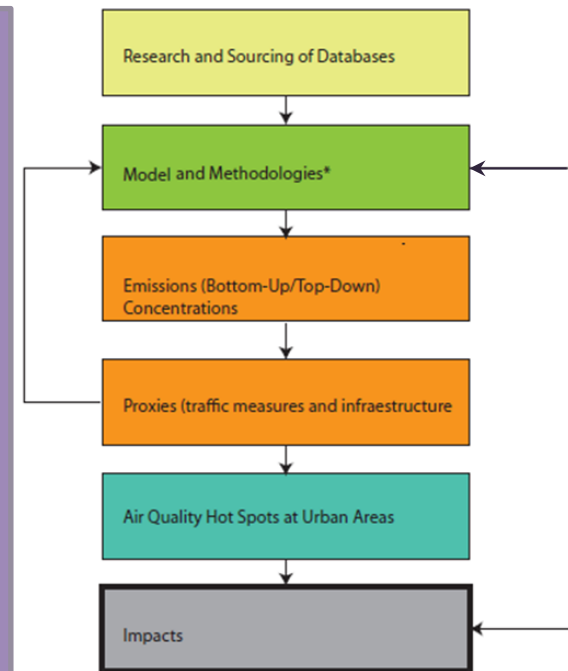
Objectives:

- Feasibility study to understand the anthropogenic impact to the air pollution levels in urban areas.
- Air quality data differentiation of background and sources of emissions
- Novel use of methodologies to visualise areas and concentration levels of air pollution



Activities so far . . .

- Assessment of Leicestershire County Council model for management of traffic measures
- Impact of measures (infrastructure changes) in strategic geographical locations to air quality
- Visualisation of knock-on-effect of implemented policies to urban traffic, possible reduction of air pollution while increase the traffic flow



Activities so far . . .

Leicester North West Scheme – Transport Planning at the Leicester and Leicestershire County Council

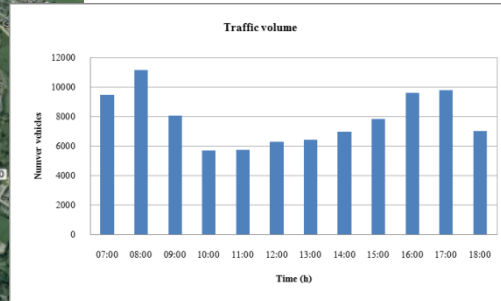
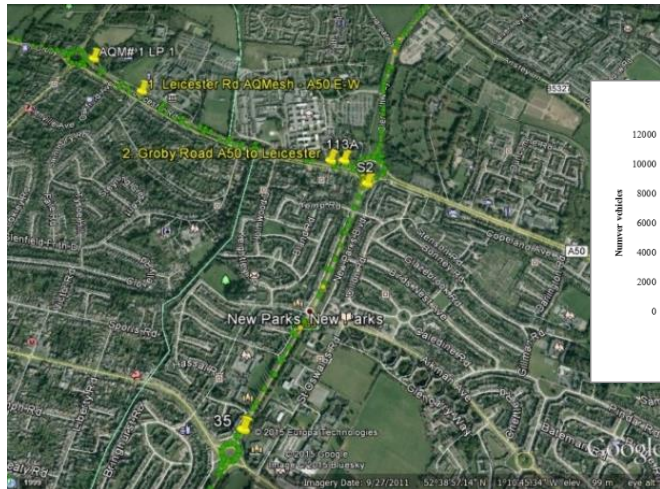
- The focus is in the North West area, where a scheme for improvement of traffic flow has been delivered by Leicester City Council and Leicestershire County Council.
- The five year project is designed to contribute towards meeting Leicester and Leicestershire’s future transport needs. As the population and economy grows, it requires an improved road network for drivers, as well as public transport, walking and cycling.

Air quality in areas of measures implemented:

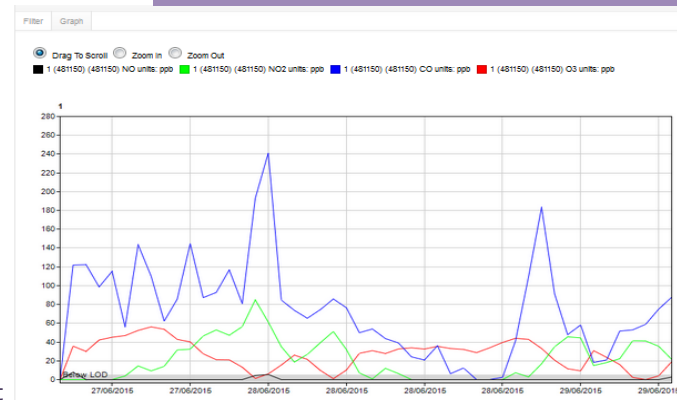
Provide evidence to policy makers

Geo-reference areas affected by urban emissions

Congestion hot spots can be identified in terms of delays at junctions or on links

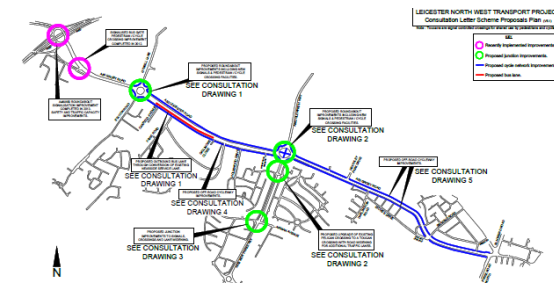
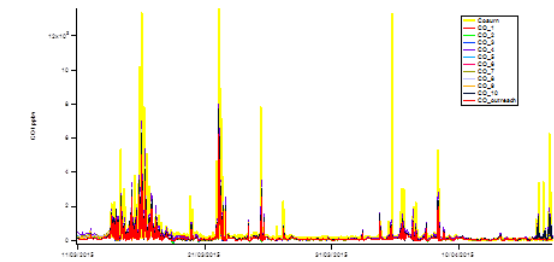


Data analysis
AQM#1 – Leicester Rd/ A50 roundabout



Future work . . .

- Integration of data: Modelling should be used in conjunction with other evidence to highlight the pros and cons of different decisions
- Visualisation with georeference
- Workshop with SME and TSC



Twitter and Passenger Disruption (TaPD)

Dr David Golightly, Senior Research Fellow, Human Factors Research Group, University of Nottingham

- A feasibility project to model how Twitter is used by passengers and transport operators during rail disruption, the aim being to inform cross-industry strategy and processes for passenger information-during disruption.

Activities so far . . .

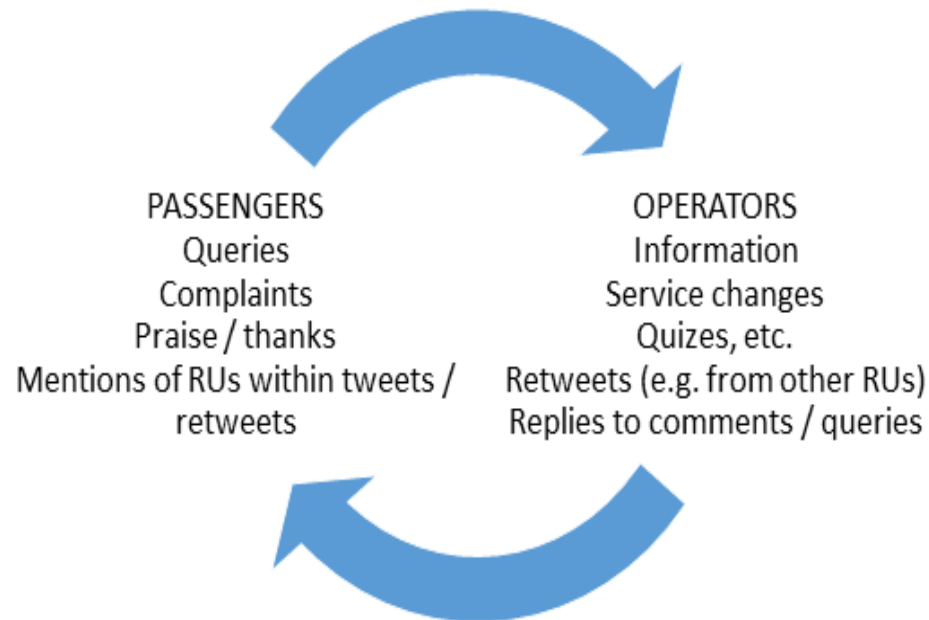
- TaPD is understanding how rail stakeholders (eg TOCs, ATOC) are aligning processes to effectively utilise twitter during passenger disruption.
- Work so far has been workshops, interviews and observations with rail twitter teams and stakeholders, to provide feedback to ATOC.
- Current work involves, post-incident analysis of content of twitter during major service disruption.



"All TOCs, plus Network Rail and National Rail, between them have 1.5m twitter followers"

Future work . . .

- Output will be a contribution to industry code of practice, plus early discussion of follow-on funding through Innovate UK.



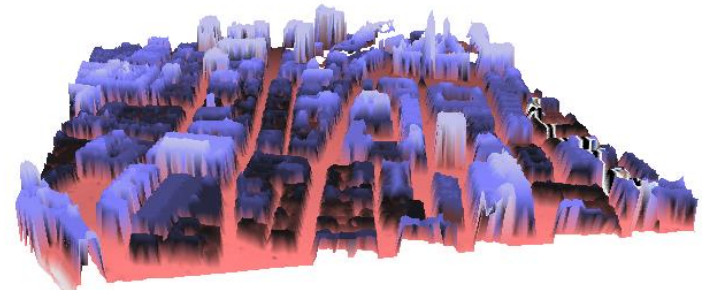
Mapping Obscuration of GNSS in Urban Landscapes (MOGUL)

Dr Simon Roberts, Research Fellow, Nottingham Geospatial Institute, University of Nottingham

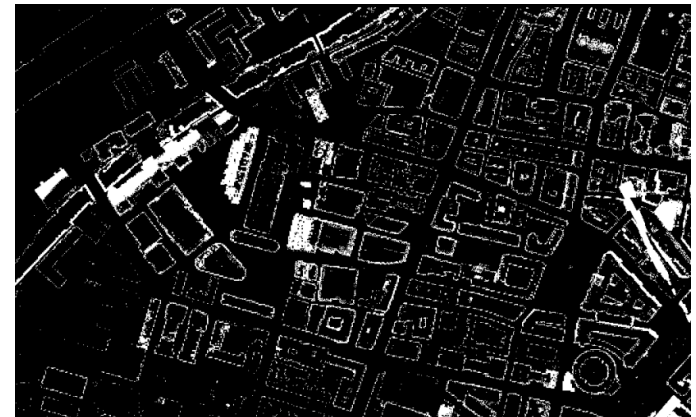
- A study into methods for predicting and mitigating obscuration effects on GNSS signals in urban canyons.

Activities so far . . .

- Within urban areas the poor performance of Global Navigation Satellite Systems (GNSS) has a deleterious effect on accuracy and solution availability for position / navigation
- Mapping GNSS obscuration using LiDAR terrain models can be expensive (e.g. £110 per km² for commercial LiDAR data)
- Uncertainty exists in the accuracy of LiDAR data at different resolutions



- 25cm LiDAR surface model of Salford

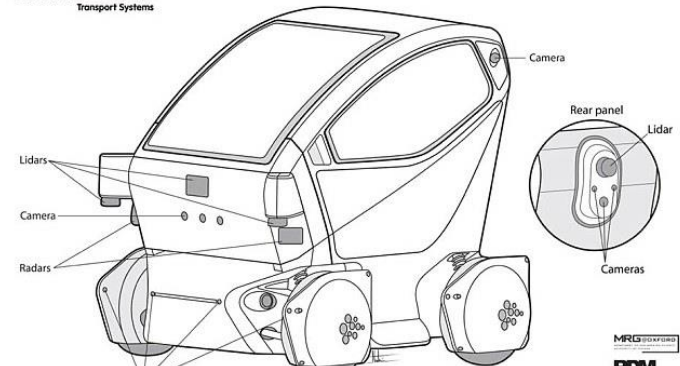


Comparison of 25cm DSM and 2m DSM for Salford (areas in white represent $\pm 5m$ differences in height between digital surface models)

Activities so far . . .

- Autonomous vehicles will use ancillary sensors (e.g. on-board cameras & computer vision) to assist in fixing position / direction
- The Nottingham Geospatial Institute has undertaken research into developing cost effective algorithms for deriving elevation masks and sky view percentages from on-board cameras

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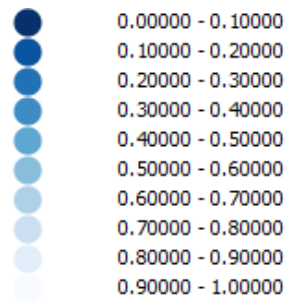
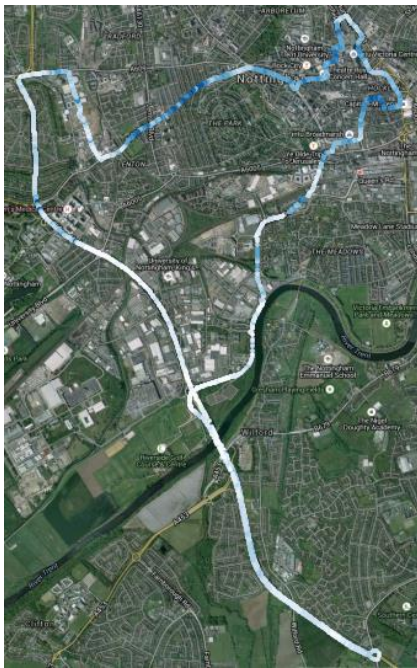


MRC
RDM GROUP
MILTON KEYNES



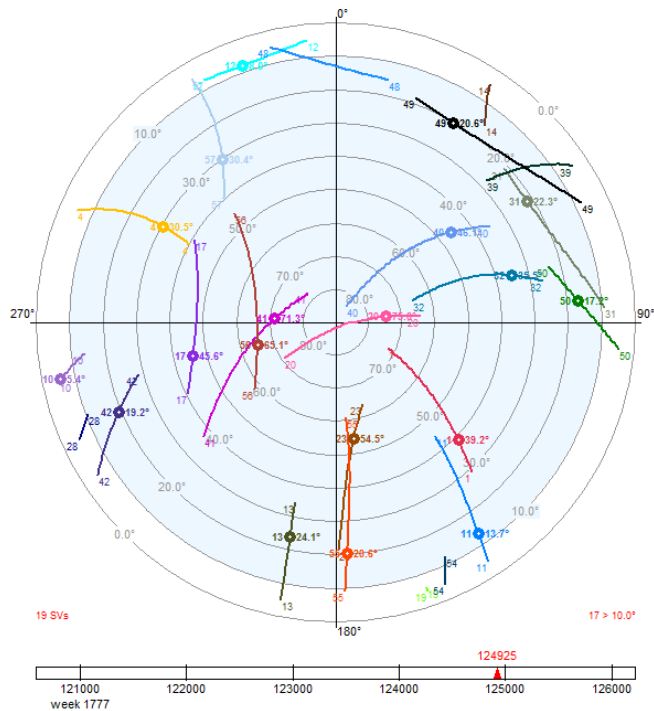
System utilises camera systems capable of acquiring imagery with a 360° field of view

Activities so far . . .

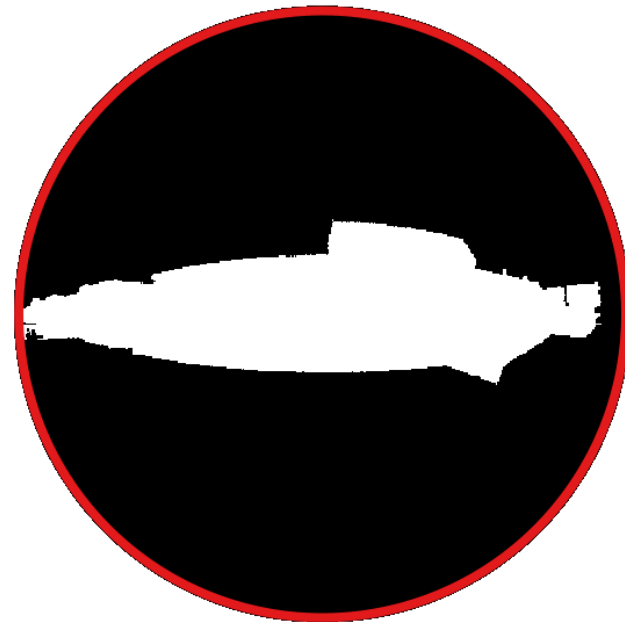


Map of sky view percentage for city of Nottingham test bed

Activities so far . . .



GPS Satellites visible without elevation mask



GPS Satellites visible with elevation mask applied

Future work . . .

- The elevation masks and sky view models developed in the first phase of the Impetus placement will also be incorporated into scenarios using the NGI's Spirent simulator to model and mitigate obscuration and multipath effects on GNSS signals.
- This information is vital to predicting and warning on-board systems of the likelihood of loss of GNSS signal and the possible multipath errors arising from the reception of signals from GNSS satellites with an elevation below the modelled elevation mask.
- The output from the simulations will form the basis of an investigation into the minimum standards required for the deployment of connected and autonomous vehicles in a real world environment.

Transport for London (TFL)– Buses as Sentinels

Dr Oluropo Ogundipe, Research Fellow, Faculty of Engineering,
University of Nottingham

- The aim is to assess whether GPS data from the 8500+ London buses can be used to derive insight from the bus movement characteristics with respect to the driving and influencing forces in the city and how they impact on traffic congestion, people movements, resource deployment.

Activities so far . . .

- Vast amount of data is collected daily by TFL's iBus system.
- Area of interest for this feasibility narrowed to Wembley and surrounding areas. 10 routes serving this area were analysed.
- Data collected for the 1 week period, 2 weeks before the FA cup final. 1 week period of the FA cup final.
- FA Cup Final – Sat 30th of May, Start 17:30, Gates Open: 15:30
- GPS data including position and velocity collected every 5 secs.
- Door event data, which provided a timestamp and position when the bus door opened and closed.
- Complementary data on road works in the area also collected.
- The data collected was noisy and had to be cleaned before analysis.

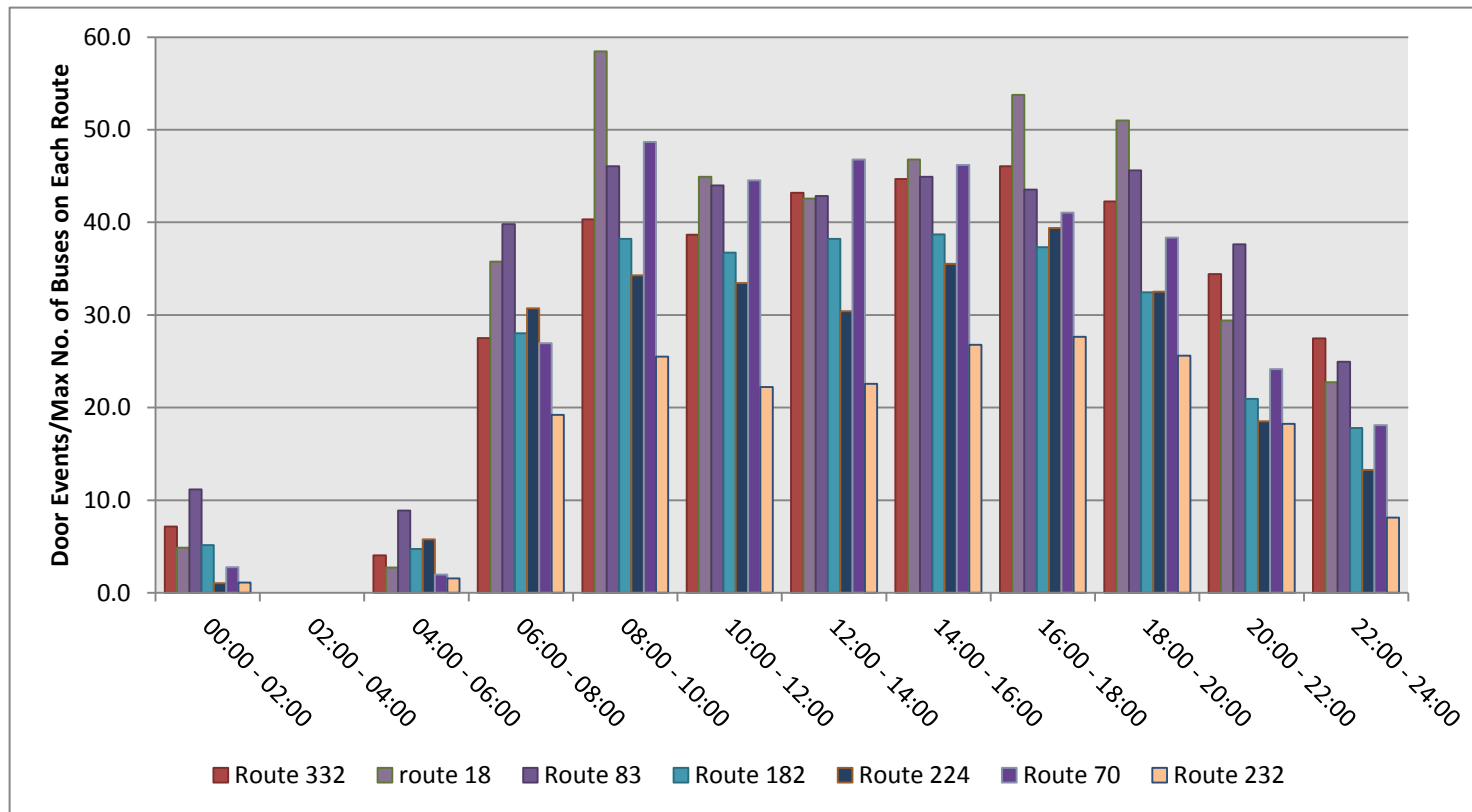
Activities so far . . .

METHODOLOGY

- Data parsing
- Data cleaning
- Statistical analysis
- Pattern analysis (macro)
 - Self learning algorithms
 - Neural networks
- Geospatial analysis



Activities so far . . .

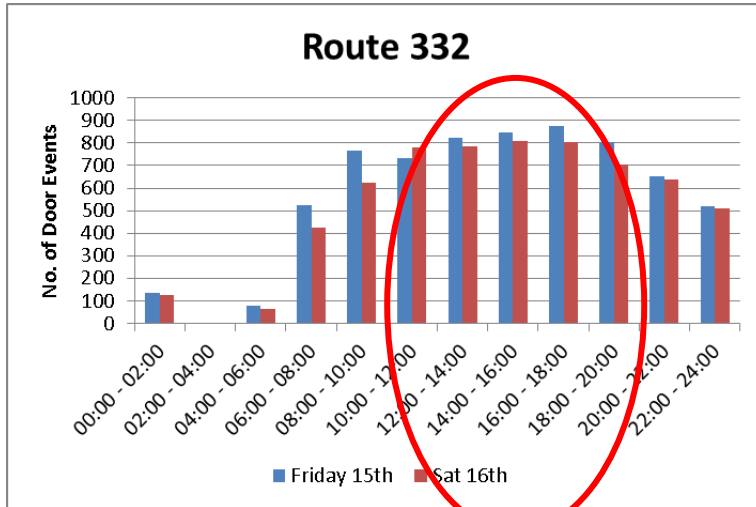


Door Events on the 15th of May

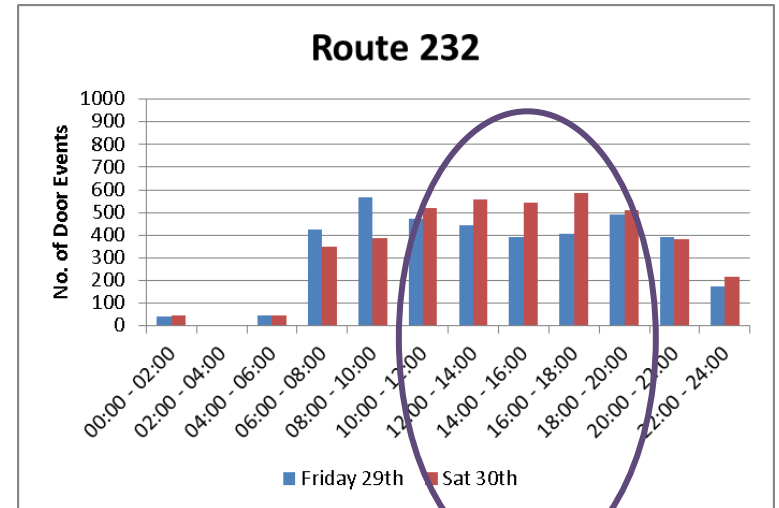
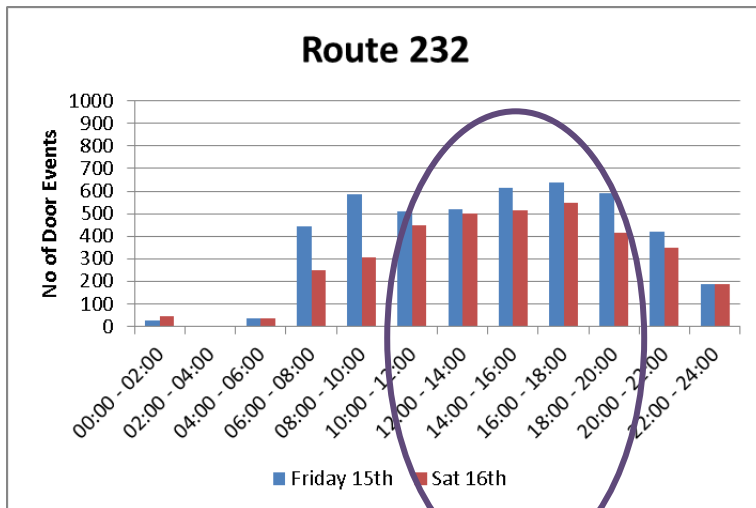
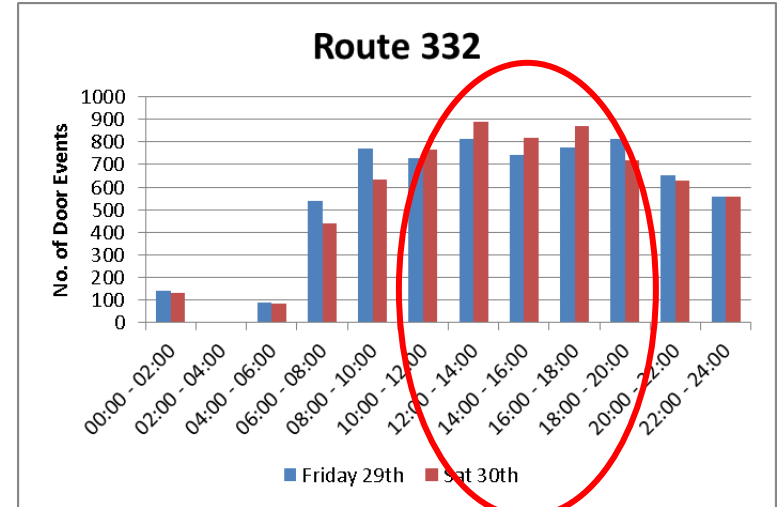
Activities so far . . .

- The peak demands of the morning and afternoon rush hours can be seen in the door event data.
- Routes with high demand such as Route #18 also stands out in the data.
- Comparing the FA cup weekend data, on some routes a distinctive change in pattern between the Friday and Saturday data sets can be observed.

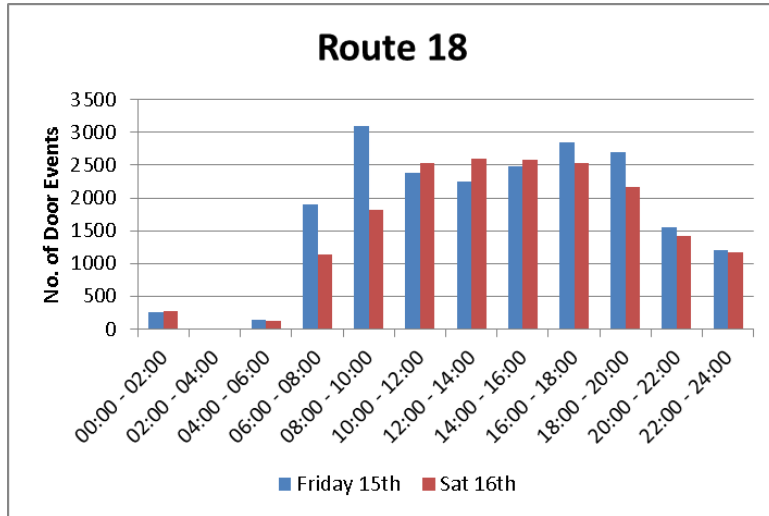
'Normal' Weekend



FA Cup Final Weekend



'Normal' Weekend



FA Cup Final Weekend

