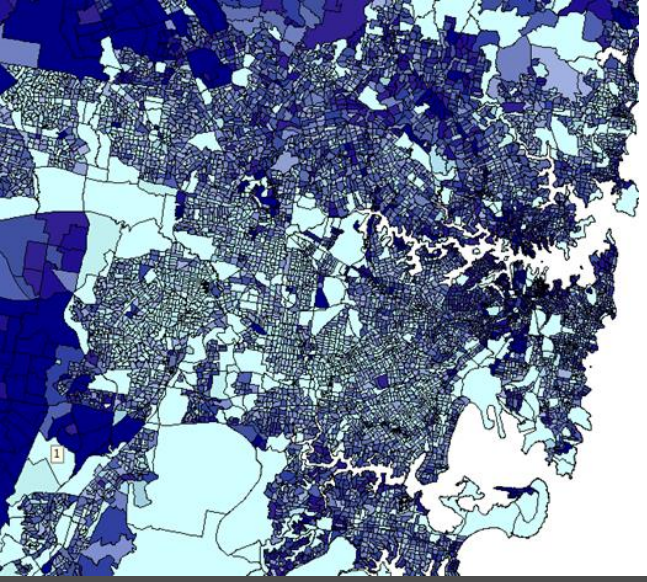
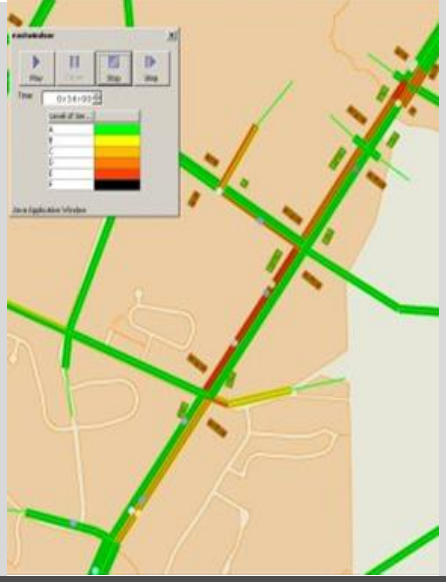




# Integrated Smart Mobility Systems


**Professor Vinayak V. Dixit**
Director, rCITI
Director TRACSlab
Academic Director IAG
Email: v.dixit@unsw.edu.au

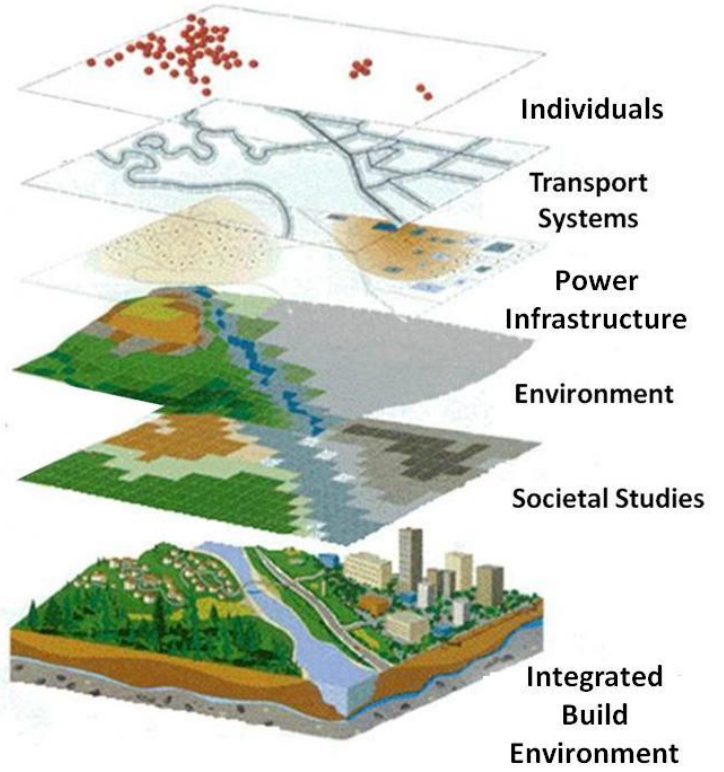
# Evolution from Intelligent to Smart Transport

*Intelligent Transport Systems* that was driven by new sensor tech and data analysis to measure transportation systems.

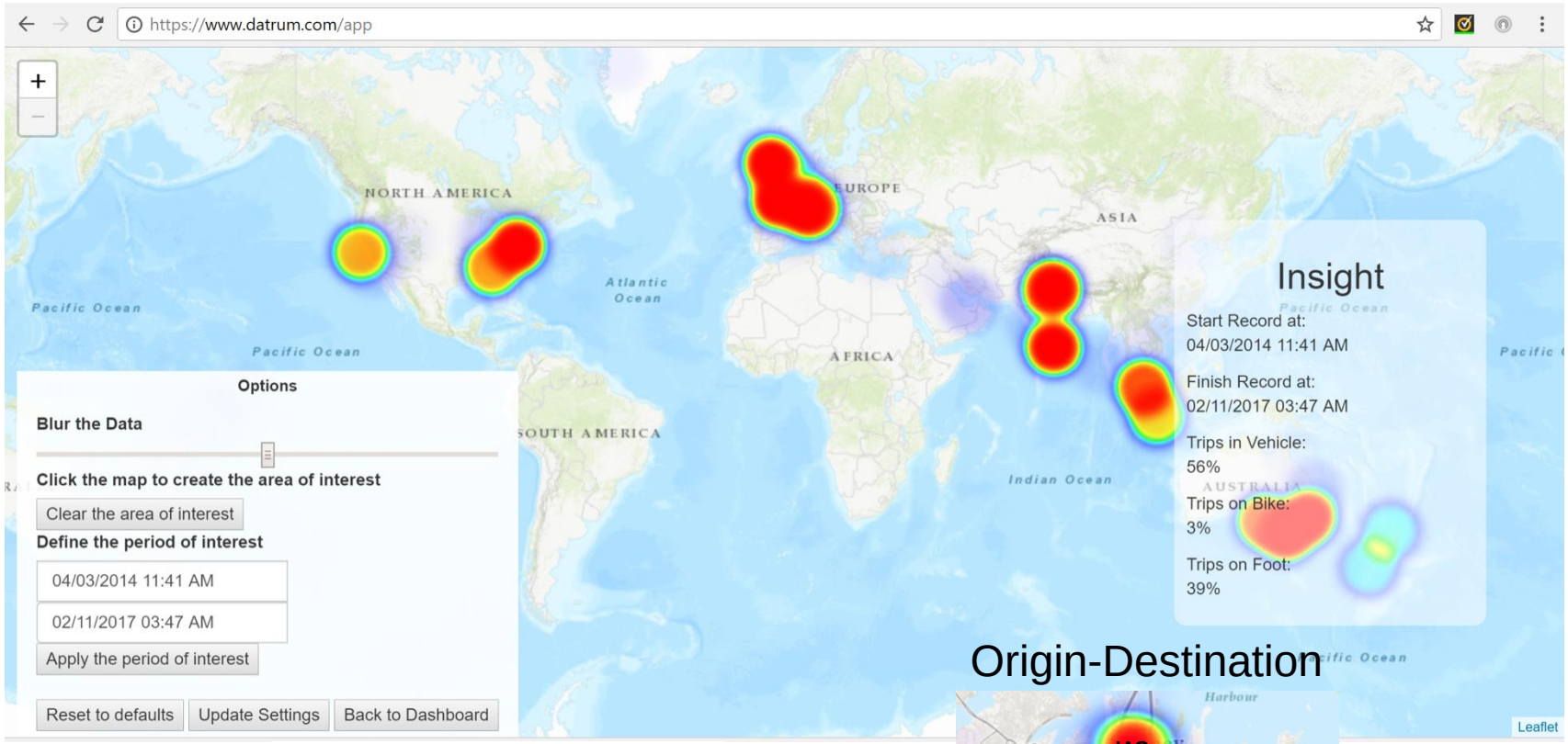
Now Intelligent is evolving into *Smart Transport Systems* which involves taking the appropriate proactive actions to safely and efficiently manage transport systems.

Built on the system integration of multiple pillars

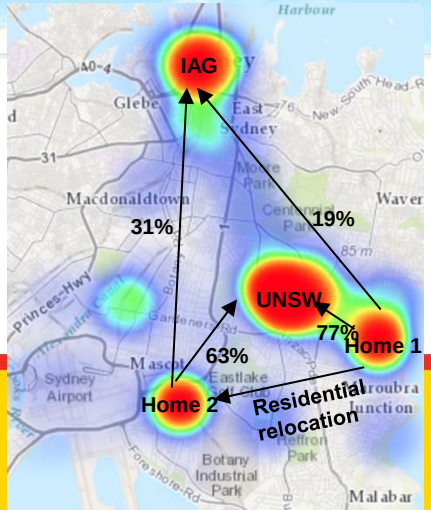
- Ubiquitous Connectivity
- Ubiquitous Data
- Reliable Models

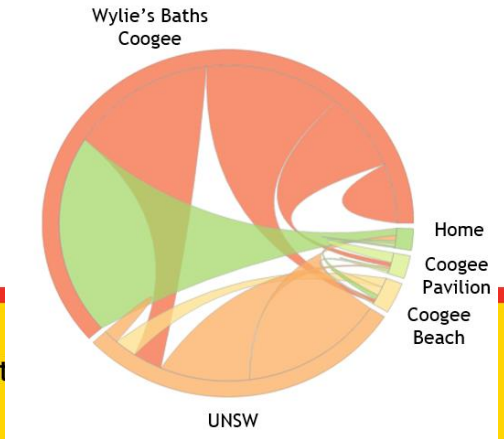


# Big Data Analytics for Transportation

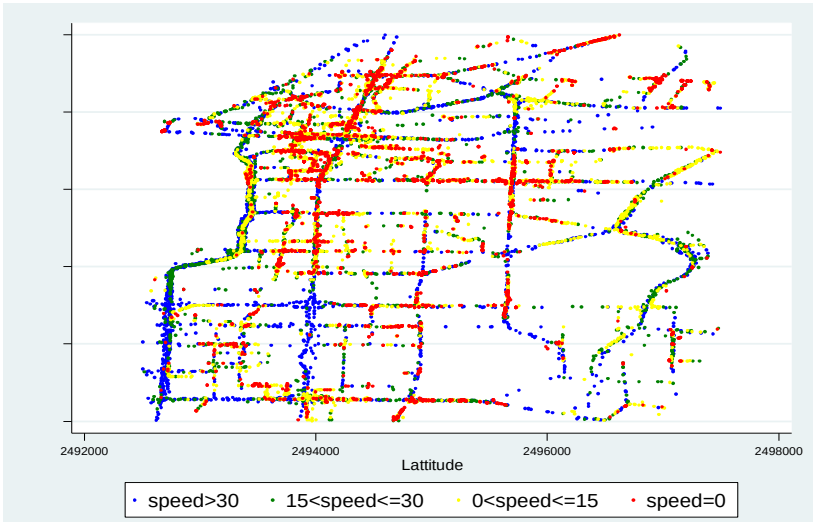


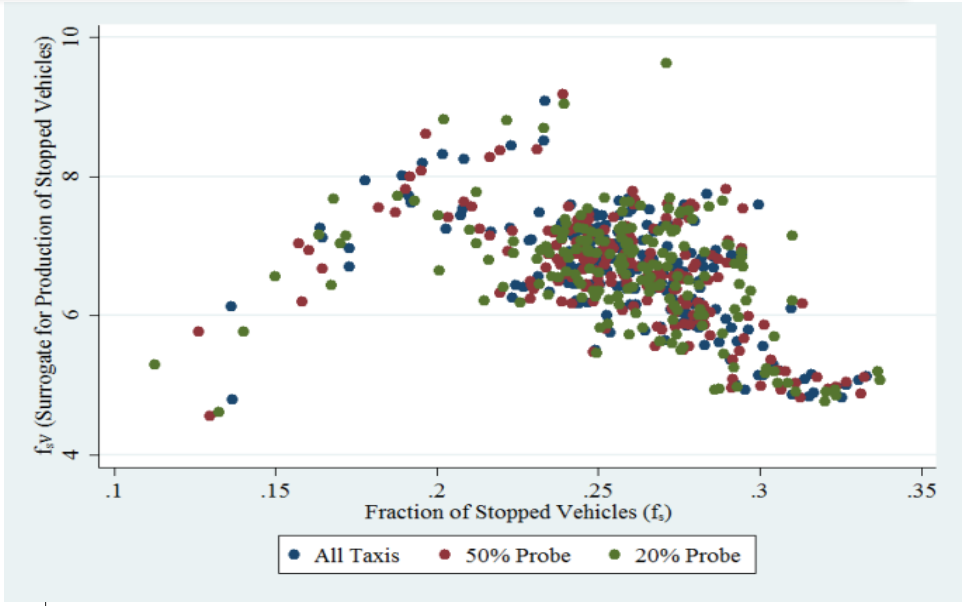

Origin-Destination

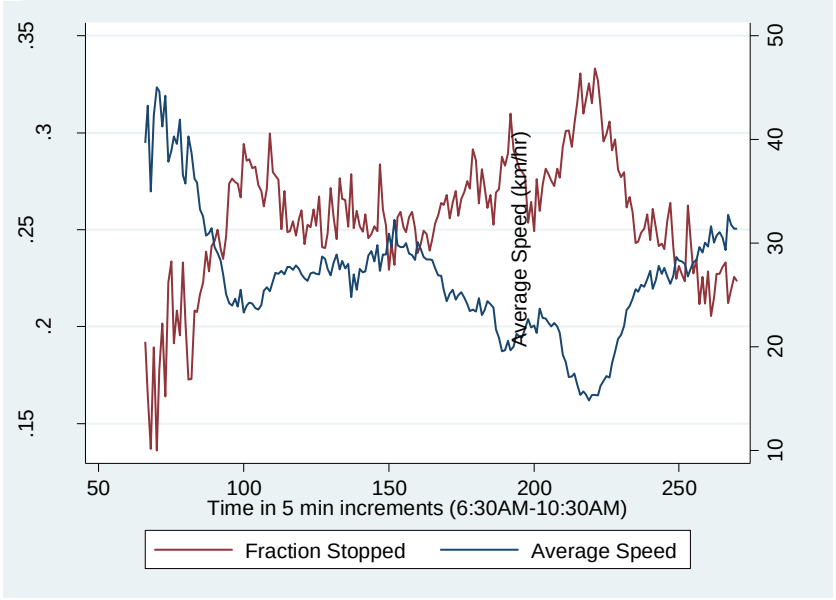


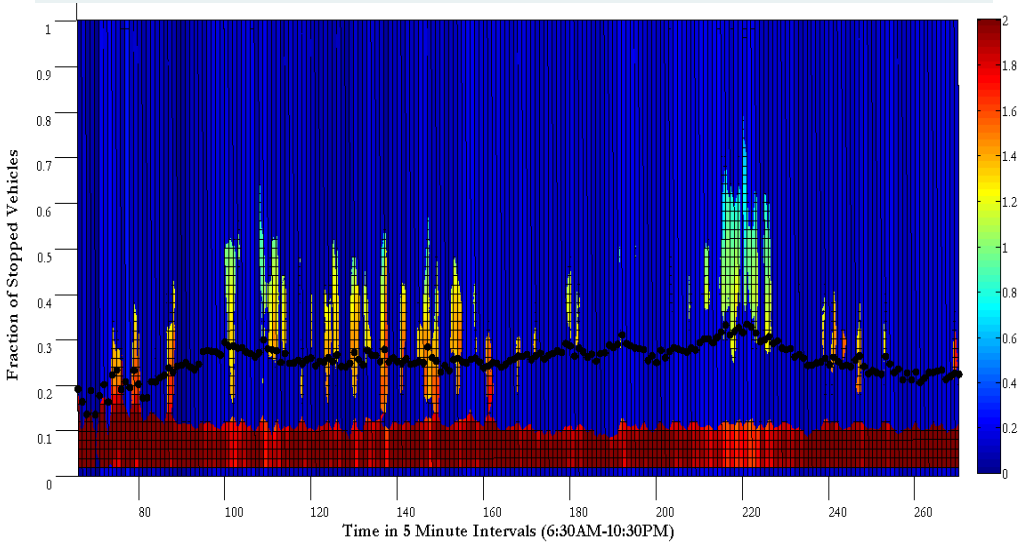



# Urban Transport Network Monitoring-Shenzhen, China



# Smart Cities Development

## Successful application: Transport Network Analysis Software Platform

Sai Chand, Neeraj Saxena, Nima Amini, Melissa Duell, Hanna Grzybowska, S. Travis Waller
*Research Centre for Integrated Transport Innovation (rCITI), UNSW, Sydney*

**Introduction**

- *Objective:* Developing metropolitan area dynamic assignment model (MADAM) for Sydney which is a simulation based dynamic traffic assignment (DTA) model
- *Applications of DTA models:* Congestion pricing, lane management, VMS and dynamic toll pricing, infrastructure project evaluation, ITS policy analysis

**Challenges**

- Managing large scale databases and fusing different data sources
- Conversion of data to mesoscopic paradigm and alignment to real network
- Visualisation of network elements and overall performance
- Overcoming computational limitations due to large-scale size of network

### Network Details

Study area (Sydney city)
- 4.8 million population
- 12,145 sq. km.
- Worldwide congestion rank-21

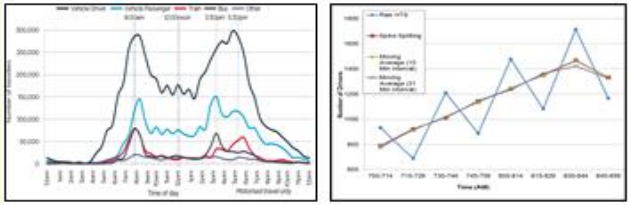
Network statistics
- 2,200 traffic analysis zones
- 1.27 million trips during 7-9 AM
- 20,000 nodes
- 58,000 links
- 1,059 bus routes
- 490 signals

### Travel Demand

Challenge: High processing time due to large number of zones

Solution: Aggregated neighbouring zones with less demand

### Departure Time Profile



Purpose: Capturing the impact of a time-varying travel demand

Data used: The Household Travel Survey (HTS) data from 5 survey waves (08/2009 to 12/2013)

### Transit

Challenge:
Identifying the nearest link to a bus stop and lack of bus dwell time information

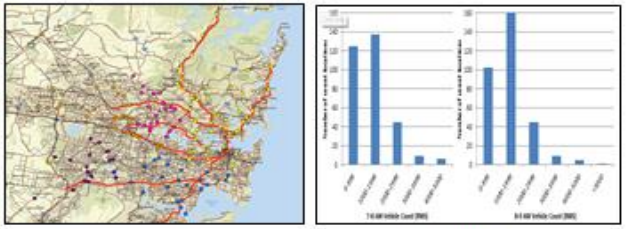
Solution:
- Dwell time evaluated from bus stop survey data
- Using bus route data to determine stop location

### Signals

Challenge:
Obtaining signal phase information from SCATS data

Solution:
Evaluated green time and turning movements for each phase using an algorithm

### Calibration



Major corridors, counter locations and traffic volume

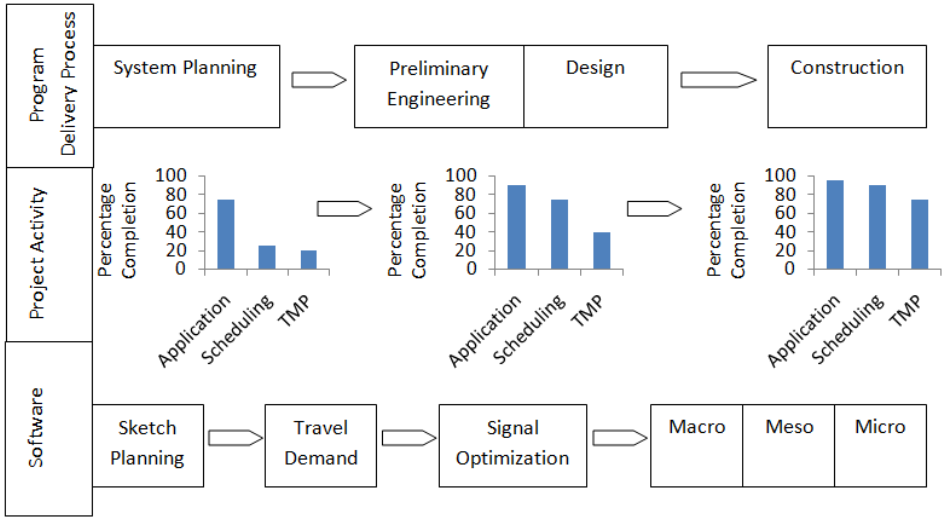
*Tools used:* VISTA, ArcGIS, PL/SQL and C++

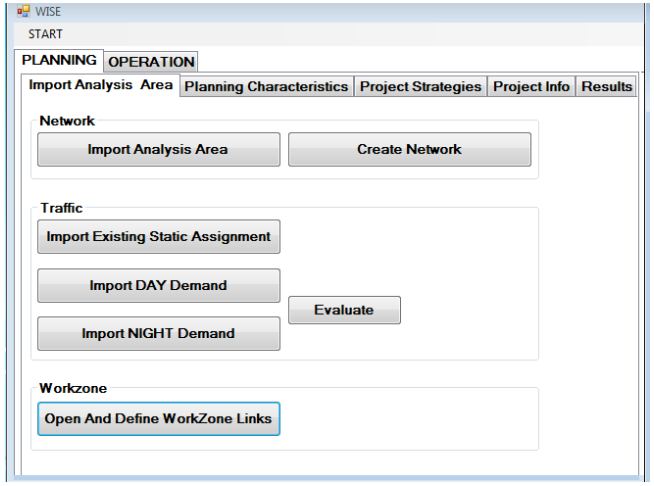
*Work in progress:* Model calibration, new data, and accounting for demand stochasticity

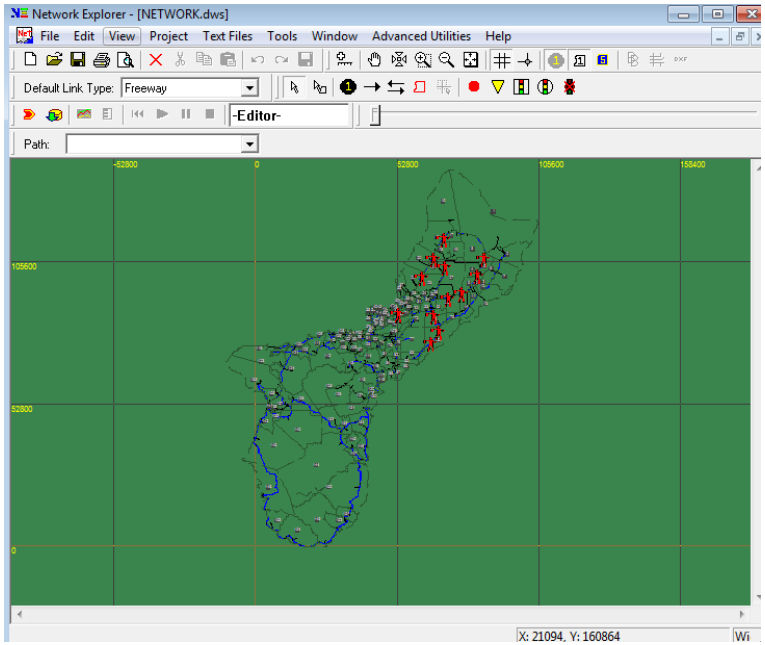
*Contact:* saichand.chakka@student.unsw.edu.au

# Workzone Impact and Strategy Estimation Tool

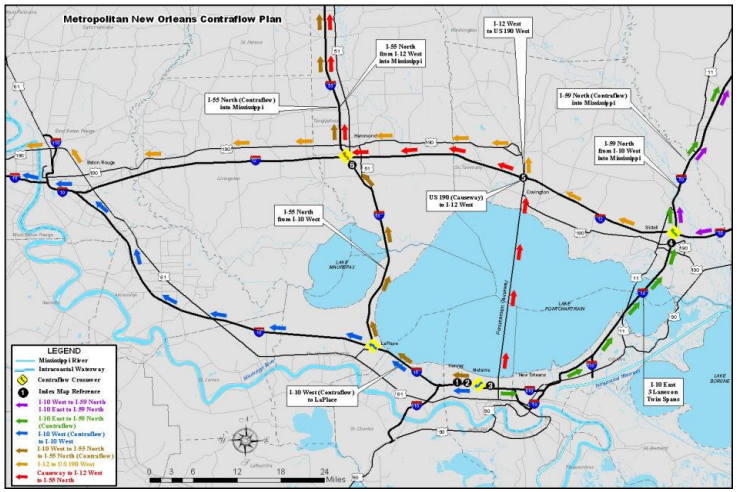
Zheng, H., C. Cai, E. Nava, V. V. Dixit, Y. C. Chiu, E. Radwan and D. Ismart (2012) "Optimization of Renewal-Based Project Scheduling in an Urban Network" *91st Transportation Research Board Meeting, Washington D.C.*

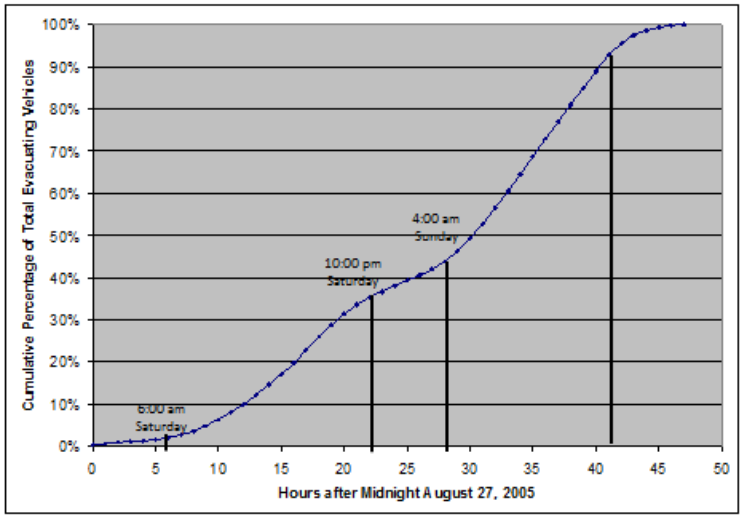


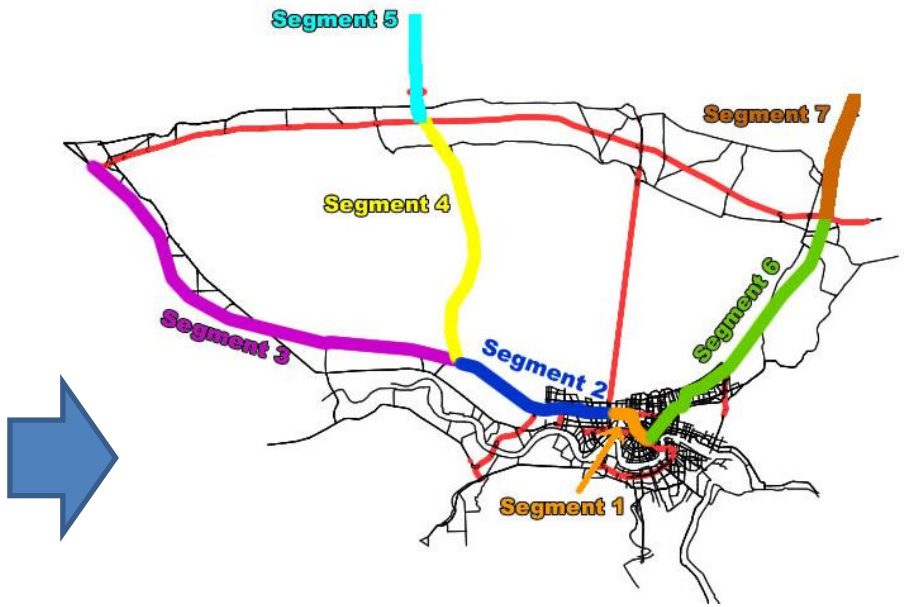



# Natural Disaster Resiliency Plans



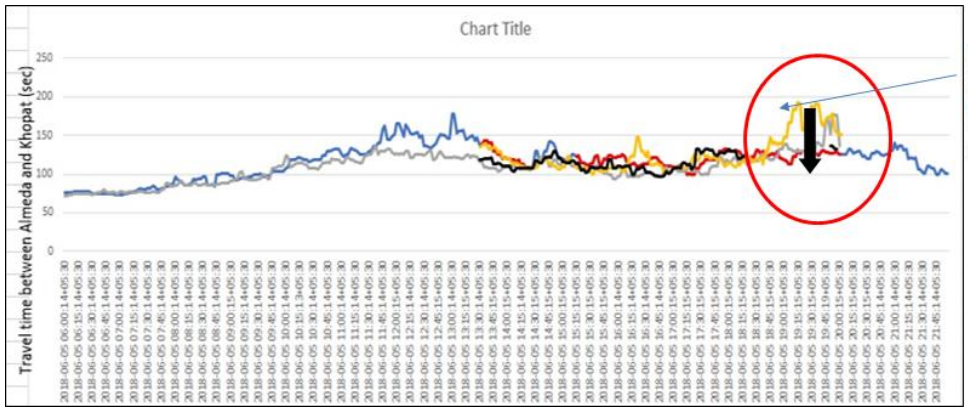



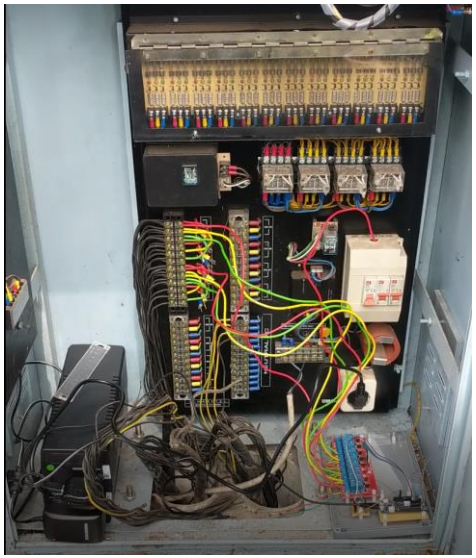

**Critical to understand vulnerabilities in transportation networks due to floods, cyclones, earthquakes and climate change to plan for transportation resiliency for freight, evacuation and transport connectivity.**

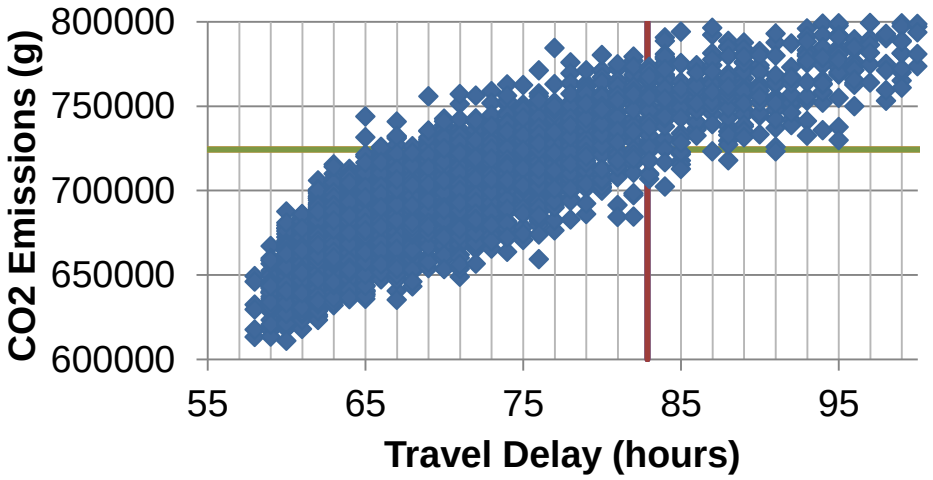
# Smart Cities Development

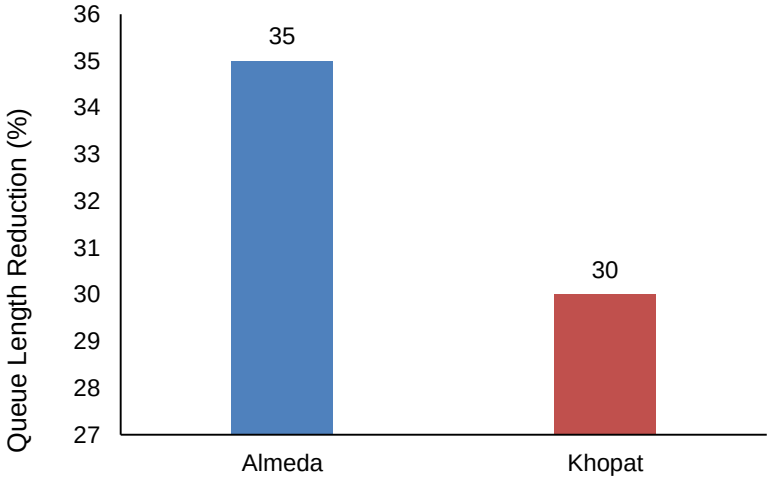
## Successful application: Adaptive Traffic Signal




Removed evening peak through synchronization.

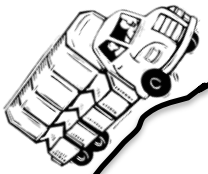




# Food Rescue and Delivery Operations


Warehouse



Agency

Challenges:

- Cost-effective Operation
- Uncertainty in donation and donors
- Gap between Supply and Demand
- Wastage of food
- Fairness and Satisfaction in allocation

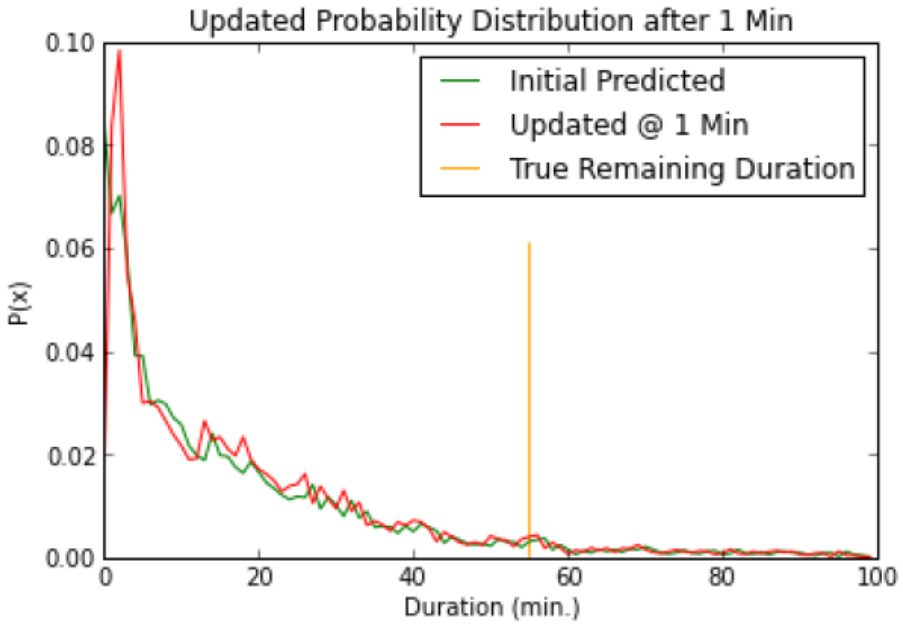

Grocer

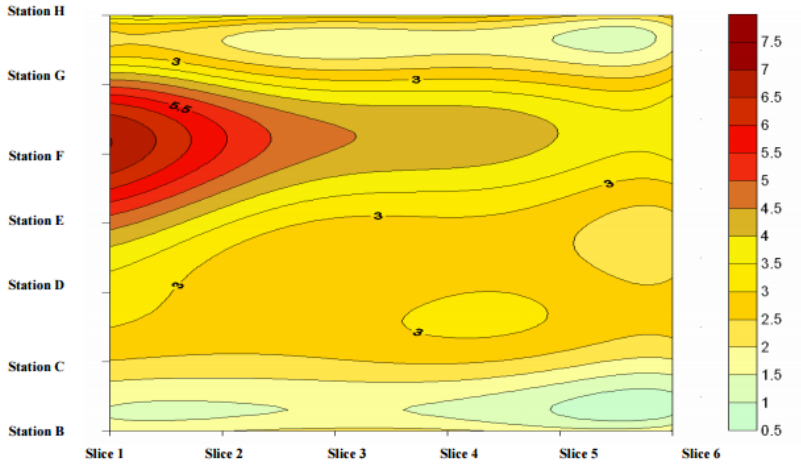
Agency

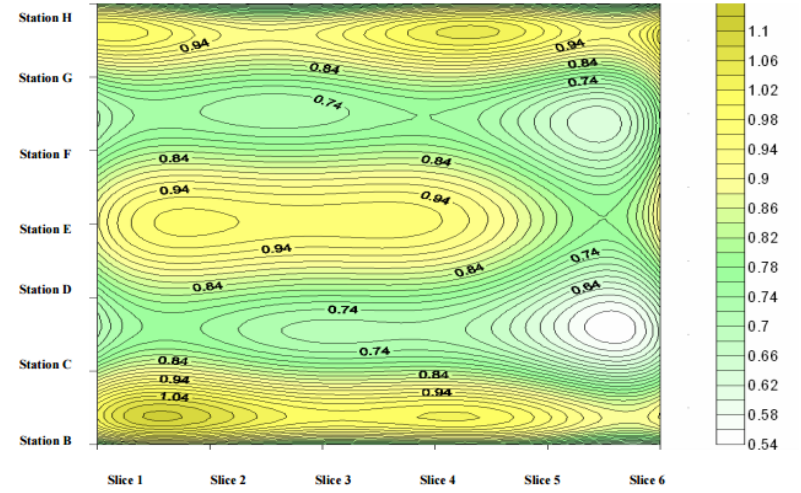

Supermarket

# Crash Prediction and Modelling

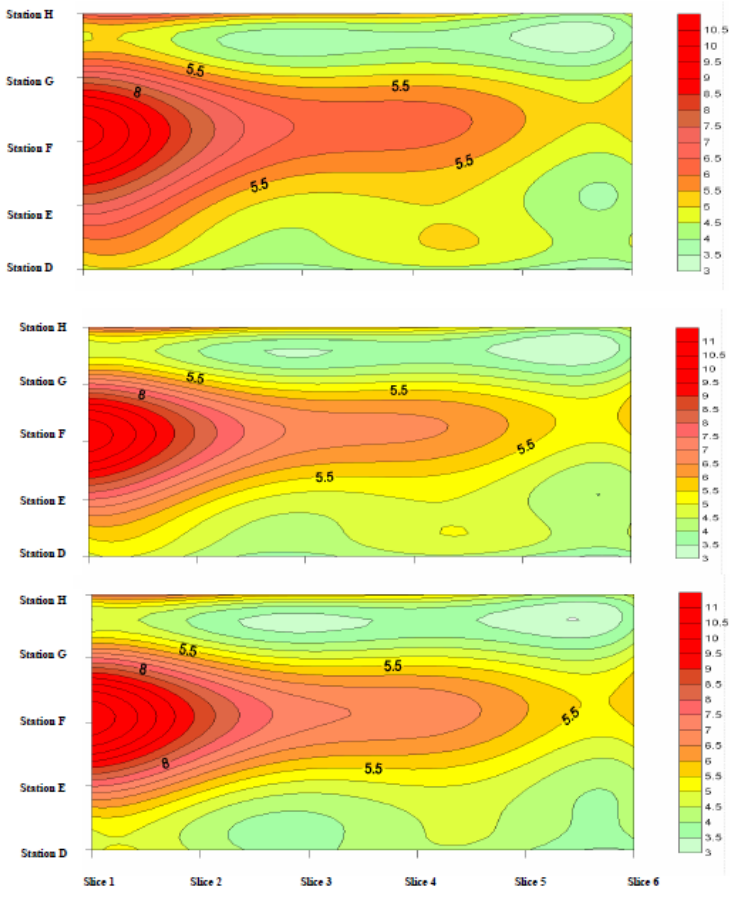
- How can we avoid incidents?
- When will an incident happen?
- How long until that incident clea



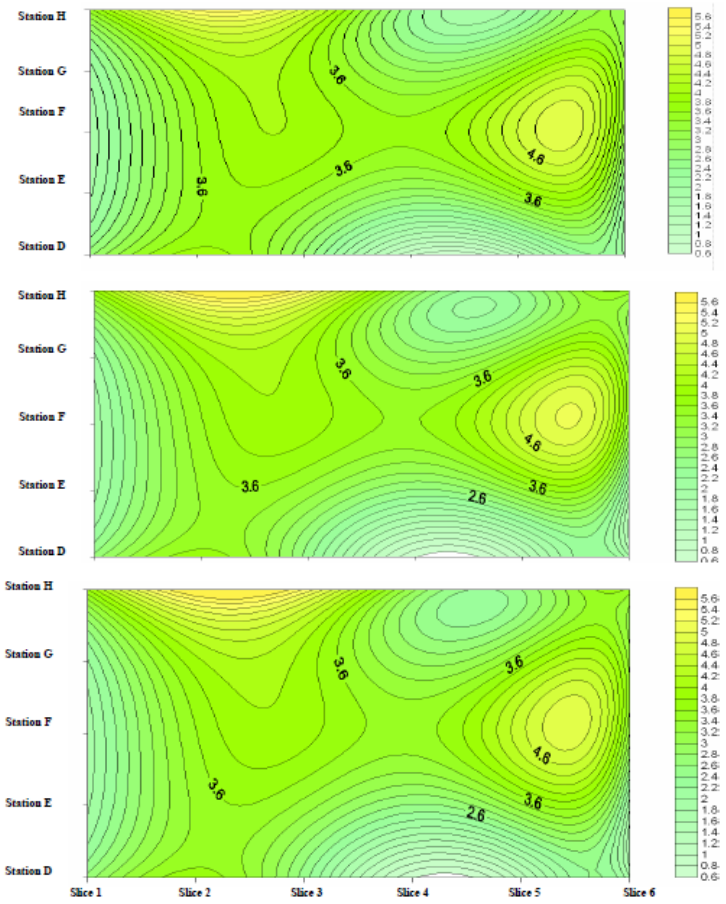



# Crash Prediction With Traffic Flow Parameters



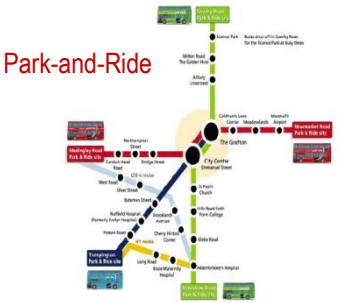

**With Crash**

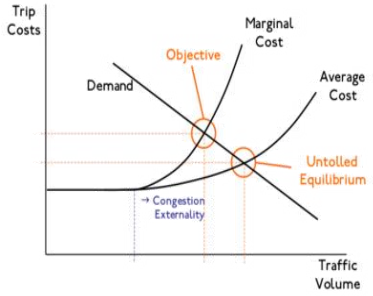


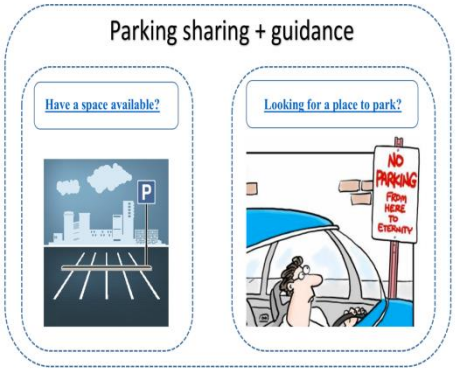

**Without Crash**

**Prediction accuracy of 62%**

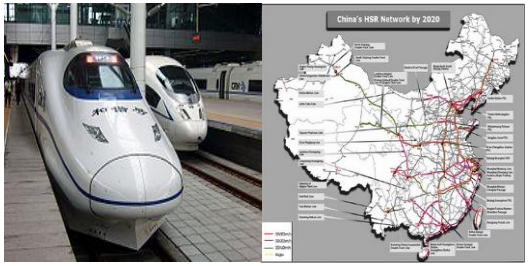
# Shared Mobility Systems

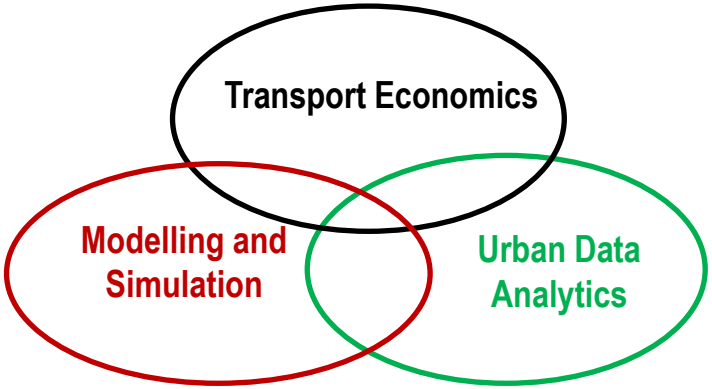


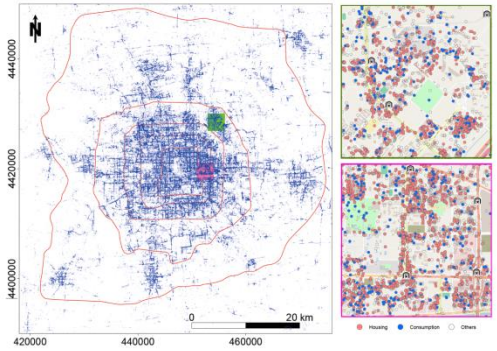



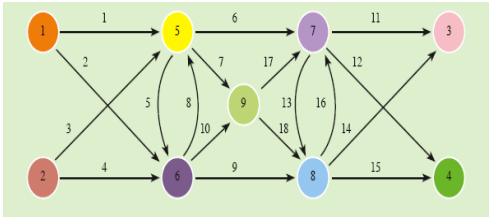








$$\sum_{a\in A}\left(t_a\left(v_a^{so}\right)+v_a^{so}t'_a\left(v_a^{so}\right)\right)\left(v_a-v_a^{so}\right)-\sum_{w\in W}B_w\left(d_w^{so}\right)\left(d_w-d_w^{so}\right)\geq 0,\qquad \forall(d,f,v)\in\Omega$$