

# Integrating traffic planning and management

## Microsimulation modelling

Timely application of modelling enables critical operational aspects to be reflected in scheme planning.

Microsimulation modelling assists in the identification of planning and operations benefits by accurately representing road network performance. These techniques can assist with the adoption of new ITS technologies by testing plans and responses in an adaptive control environment prior to roll out in the real world network.

### What is microsimulation?

The point of difference for microsimulation modelling is that *individual vehicles or pedestrians are modelled* rather than a generalised representation of traffic flow behaviour.

Using three key algorithms: car-following; lane changing; and gap acceptance - individual vehicles are moved around the modelled network incrementally so that the main traffic behaviours experienced in the real world can be adequately represented.

Particular non-standard situations can also be dealt with by adding additional rules such as lane restrictions, bus stops, pedestrian crossings or car parking manoeuvres. In this way most real world situations can be analysed.



Sydney CBD Bus Lane, VISSIM

### Why use microsimulation?

Microsimulation offers distinct advantages over traditional models because it includes non-standard behaviour, providing more accurate representation of traffic in congested conditions. The secondary effects of congestion such as queue spill-back and random delay can be modelled directly, which greatly improves the accuracy of model results.

The random nature of microsimulation models provides valuable insight by examining interactions between different road users and correctly representing congestion levels that are experienced.

Microsimulation also has the ability to:

- Accurately represent network control systems and realistic vehicle response;
- Quantify network performance to assist in system optimisation;

- Identify system constraints and alternative modes of operation.
- Present complex transport systems interactions to decision makers and the public to inform discussion and highlight key constraints and opportunities; and
- Provide inputs into economic and environmental studies to quantify benefits and attract funding.

### Minimising risk in modelling

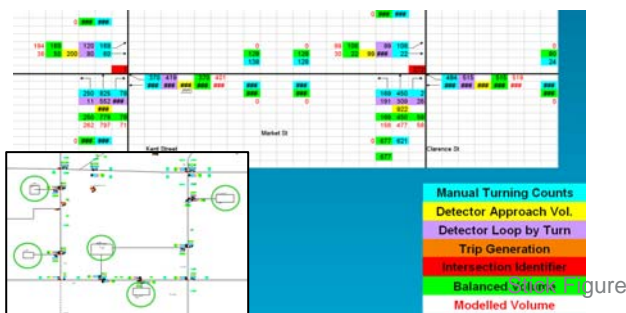
Halcrow has been a pioneer in microsimulation modelling since 1993. In that time we have acquired a wealth of knowledge that helps us minimise risk and total cost for our clients.

At Halcrow, we recognise that the synthesis of data from sparse data sets is often necessary and by using statistical techniques, model calibration, validation and scenario testing can be achieved within client cost and timeline constraints.

### Data Collation

Microsimulation models are data intensive, with the quality and realism of the model dependant on the data uses. Halcrow has developed processes that enable full model calibration and validation while minimising the amount of data that needs to be collected.

### Stick Figure Balancing



Traffic volumes are balanced to account for any losses or gains that impact the network. This is achieved by identifying and collating all available data sets in a single spreadsheet (stick diagram), providing a powerful tool from which to develop representative traffic volumes across the network.

### Prior Matrix Development

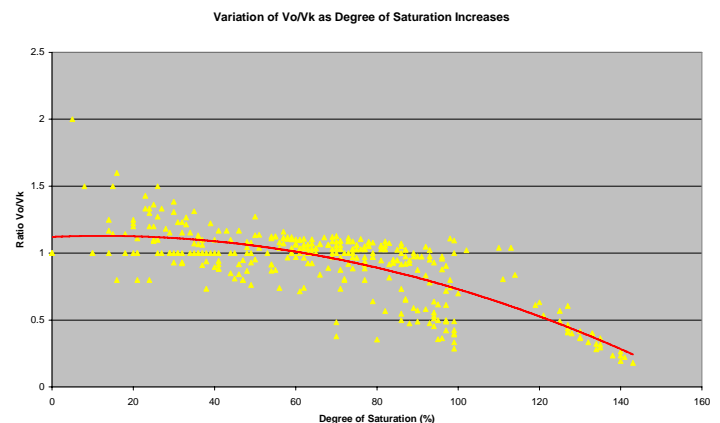
The most difficult task in the modelling process is to derive an origin/destination matrix of traffic movements that adequately reflects the actual traffic patterns across the study network. Halcrow has successfully applied the prior matrices developed by High Range Analytics to utilise all available data sources including:

- OD Counts
- Turning Counts
- Link Counts
- Strategic model sub area matrix;
- Household travel data; and
- Journey to Work data

This method utilises genetic algorithms to automatically provide a good prior matrix match and has been shown to provide a 40-80% reduction in time required to estimate traffic matrices.

### SCATS Loop Saturation Flow

By building models in a SCATS detector rich environment we can utilise degree of saturation data for validation of saturation flow at critical network intersections – in this way microsimulation models can be readily validated against available data with no additional collection costs.



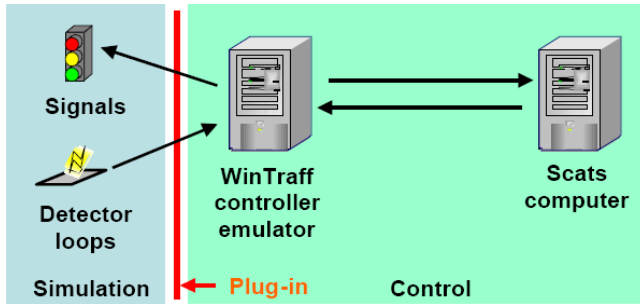
Relationship of Vo, Vk and Degree of Saturation

## Innovation in microsimulation modelling

Halcrow has had a central role in pioneering new applications of microsimulation modelling techniques.

### ■ SCATSIM Modelling

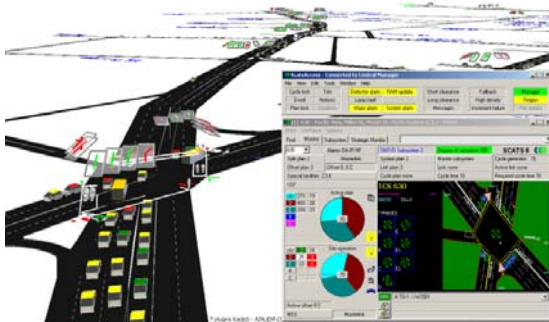
SCATSIM (**SCATS In Microsimulation**) is a suite of software that consists of WinTraff (emulation of the local controller personality logic) and SCATS (**Sydney Coordinated Adaptive Traffic System**) software in simulation.



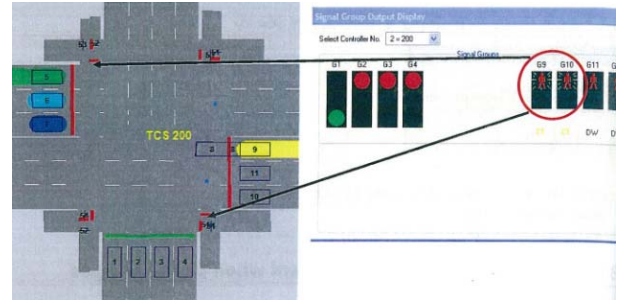
SCATS in Microsimulation

By combining SCATS with traffic microsimulation Roads Authorities can:

- Conduct realistic training in SCATS systems;
- Test network, operations or tactical changes without impacting on real life;
- Evaluate the impacts of new developments, road construction or pedestrian activity; and
- Evaluate and demonstrate the benefits of large projects for high level decision makers and public consultation.



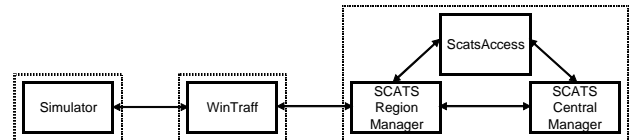
SCATSIM Paramics Model



SCATSIM VISSIM Model

SCATSIM operates by using WinTraff instead of real-world controllers. WinTraff:

- receives detector messages from the simulator;
- emulates controllers and sends volume, non-occupancy to SCATS;
- receives phase changes from SCATS; and
- sends signal group colours to the simulator.



SCATSIM Overview Architecture

As well as being instrumental in RTA development and testing of suitable interfaces for the main commercially available microsimulation software packages, Halcrow staff have also provided training to RTA and other consultants on its application.

Halcrow staff have more experience in the application of SCATSIM modelling than any other organisation in the world, a combined total of over 30 years, in applying these techniques for various clients but most frequently for RTA projects.

### ■ Microsimulation Modelling of ITS Applications

Roads authorities are focusing on maximising the life of the road network through using Intelligent Transport Systems (ITS).

Halcrow has a diverse range of technical experts experienced in the real world application of ITS technology in congested urban networks. These take into account the complex interactions of pedestrians, cyclists, buses, trams, light rail, delivery trucks and general traffic.

## Public Transport Priority

Halcrow has been working in developing passive and active bus priority through testing bus and tram priority measures in microsimulation.

The RTA is using GPS to track buses in real time and provides priority at signals using SCATS when required. As part of the evaluation of Strategic Bus Corridors in Sydney, a Public Transport Information and Priority System (PTIPS) was evaluated by Halcrow.

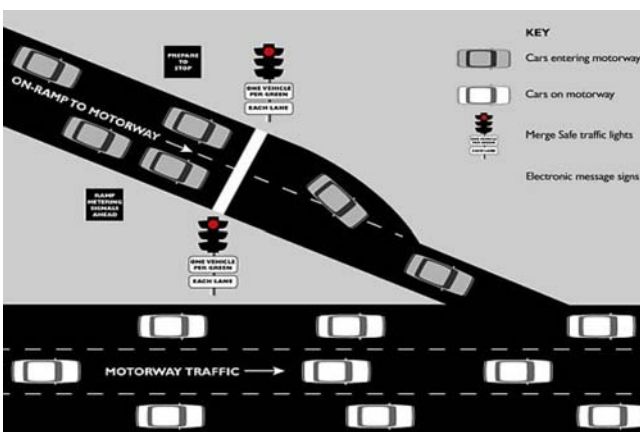
This involved providing the specification, testing and acceptance of “phase extender” and “PTIPS” plugins developed by Azalient as well as taking the lead modeller role in Australia’s biggest microsimulation modelling job.



Public Transport Information and Priority System (PTIPS)

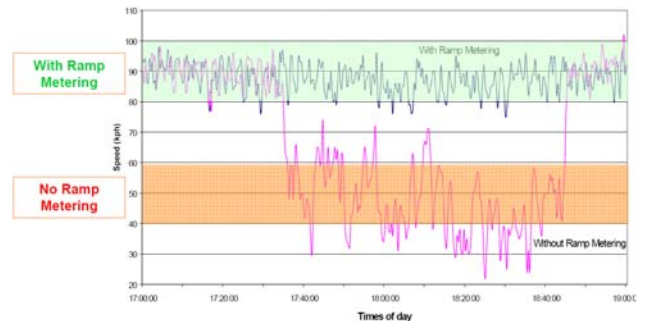
## Ramp Metering

We have previously been involved in the testing and application of RTA’s SCATS Ramp Metering System (SRMS) and assisted the RTA with the testing of early applications of the system using plugins developed by Azalient for Q-Paramics.



SCATS Ramp Metering System (SRMS)

SRMS is fully adaptive, employing similar techniques to SCATS and can be integrated with SCATS. It adaptively controls the metering signals on motorway entry ramps by varying the length of the red signal and can initiate the ramp-meter in response to actual traffic demand or incidents on the motorway.



Auckland SRMS Application (source: RTA)

## A Technical Edge

Halcrow has developed a technical edge in the application of microsimulation modelling techniques, particularly those associated with SCATS in simulation. It is likely that to successfully secure ITS scheme funding, or to demonstrate scheme benefits of ITS technologies, there will be an increasing need to demonstrate operational benefits at the planning stage.

Halcrow expertise in microsimulation gives our clients the right test bed from which to assess this diverse range of technologies, as the offline analysis prior to real world implementation yields valuable insight into overall network performance.

## Contact us

- **Simon Kinnear – Sydney**  
tel +61 (0)2 9410 4100  
email [KinnearS@halcrow.com](mailto:KinnearS@halcrow.com)
- **Scott Benjamin – Melbourne**  
tel +61 (0)3 8682 3900  
email [BenjaminS@halcrow.com](mailto:BenjaminS@halcrow.com)
- **Ellery Salida – Melbourne**  
tel +61 (0)3 8682 3900  
email [Salidaee@halcrow.com](mailto:Salidaee@halcrow.com)

For your nearest Halcrow office, visit [halcrow.com](http://halcrow.com)