Traffic Software News

Issue No.38 | June 2006 | www.trlsoftware.co.uk

OSCADY PRO

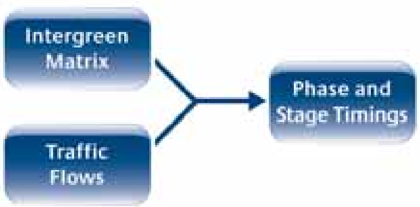
Phased-based Rapid Optimisation of traffic signals

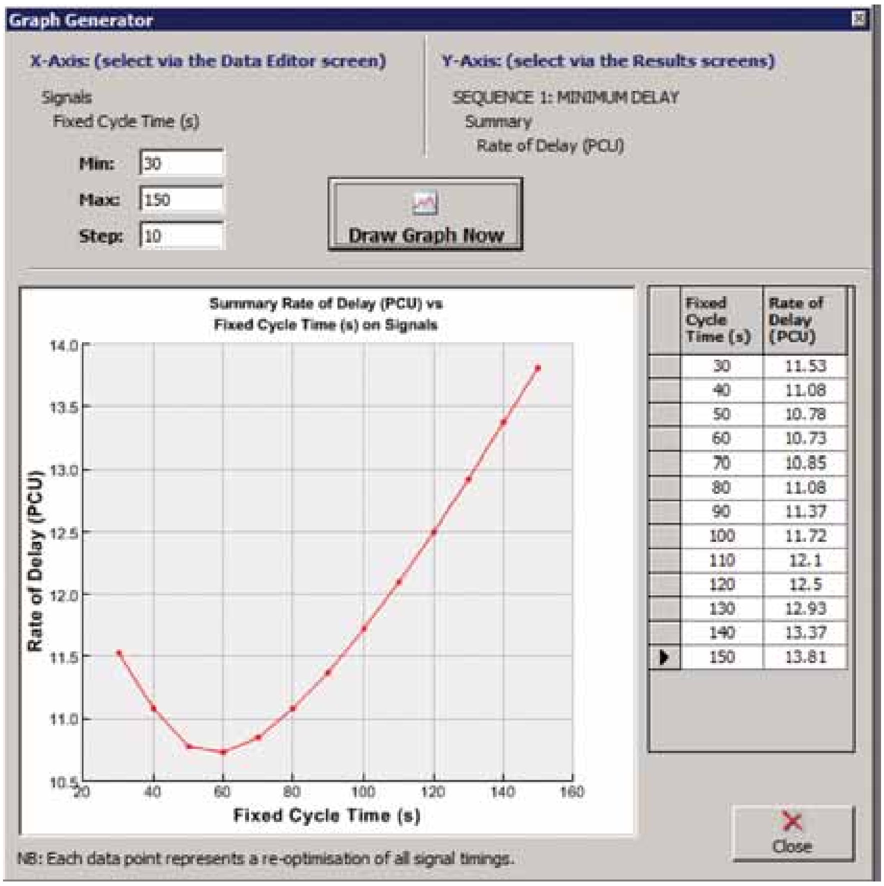
OSCADY PRO development is nearing completion and we can now reveal more details of TRL's latest state-of-the-art software product.

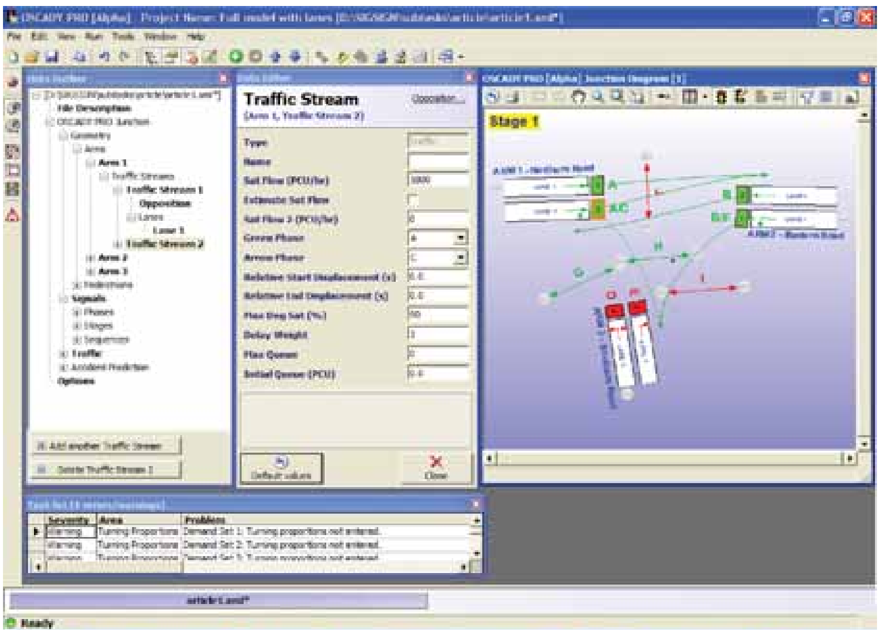
OSCADY PRO is a **phase-based** traffic signal optimisation program, and will complement TRL's existing signals program, OSCADY 5. OSCADY PRO has been developed in conjunction with the Centre for Transport Studies at University College London (UCL). The software makes use of a number of unique optimisation techniques and can be used for isolated junctions, or the results can be exported into TRANSYT for use in linked systems.

A significant advantage of OSCADY PRO is that it can **automatically generate stages and stage sequences.** All that is needed is for the user to supply minimum intergreen times in the form of an intergreen matrix; the program does the rest and calculates all possible optimum stages and stage sequences. From this starting point, the program then produces sets of individual phase timings that maximise capacity and/or minimise delay. Phase delays and double greens are automatically handled by the program.

In its simplest form, therefore, the user can produce phase and stage timings very easily **simply by providing an intergreen matrix and traffic flows.** This removes the need for the user to manually input stages and sequences. At large or complex junctions, the best stage sequence can be very difficult to find manually, and so OSCADY PRO's automatic system should prove invaluable. Furthermore, it can often identify solutions that may otherwise have been overlooked but that give **superior performance in terms of capacity/delay.**



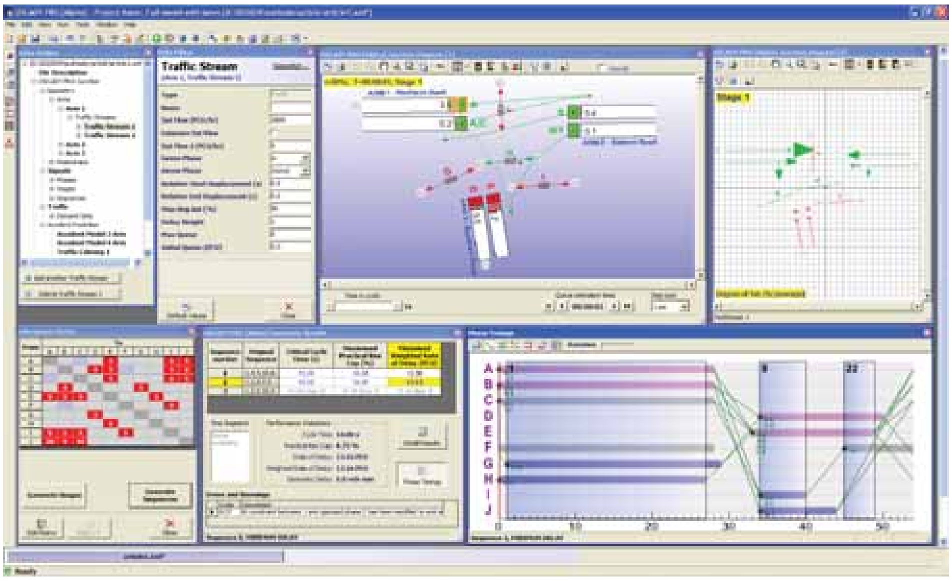




OSCADY PRO

Of course, OSCADY PRO allows the user to input stages manually when an existing junction is being evaluated or when it is necessary to force a particular stage.

There are a large number of other new features and functions, a selection of which are listed below.



Key Modelling Features

- Up to 20 arms, with 20 traffic streams on each arm, plus up to 20 pedestrian streams and 20 phases can be modelled
- Optimises for three objectives: critical cycle time, maximum capacity and minimum delay
- Filter lanes / indicative arrows, short (flared) lanes and opposed right turners can all be modelled
- Geometric delay – can be calculated for each traffic stream
- Accident prediction for 3 and 4-arm urban junctions, including traffic-calming
- Phase constraints can be added to force pairs of phases to start/end together
- Works with fixed or maximum cycle time; each stage and phase can have min/max greens applied as well as various other restrictions such as maximum acceptable queue and degree of saturation.
- Demand sets – multiple demand sets can be defined, with each allowing a profile type such as ODTAB, LEVELS or FOUR, as well as DIRECT and FLAT profiles. Each demand set can be defined in terms of a relationship to another demand set, which is automatically re-calculated.
- Automatic lane grouping – the program can analyse traffic streams and flows and suggest the optimum arrangement of lanes and streams.
- Time varying flows can be modelled
- Evaluation mode (allowing existing sets of timings to be analysed)
- Drive-on-the-left / drive-on-the-right
- Saturation flow estimation for each traffic stream
- Phase timings can, if required, be shown to an accuracy of 0.1s.
- Provides an output compatible with the TR2500 form used to specify controllers

Graphical User Interface Features

- Highly visual and dynamic GUI. In contrast to OSCADY 5, any number of windows can be shown at once, all of which are automatically updated (and the file re-run) whenever data changes.
- **Junction diagram** – shows the junction in graphical format and includes queue animation, signal states, phases, stages, and results such as delay for each stream. The junction diagram allows access to all data for traffic streams and phases etc, and enables a new junction to be built graphically.
- **Phase timings diagram** – shows phase and stage timings graphically, along with phase delays and intergreen times.
- **Graph generator** – allows any result (effective green time, delay, etc) to be plotted against any input parameter (cycle time, sat flow, etc). This serves as a very flexible sensitivity analysis tool.
- **Report generator** – reports are generated in HTML, in a format that can easily be pasted into a word processor or spreadsheet. The main diagrams are inserted in vector format rather than bitmaps, meaning that print-outs are very high quality.
- Undo/redo allowing stepping back through up to 100 changes
- Quick edit mode – allows main data to be edited in spreadsheet format
- All data can be accessed via a 'treeview' system and is therefore accessible from anywhere in the program
- Errors/warning list – dynamically updated to show tasks remaining
- Export results to TRANSYT 12
- Import files from other well-known products including OSCADY 5

OSCADY PRO is due for release in July 2006. Pricing will be confirmed shortly on the TRL website at www.trlsoftware.co.uk. TRL will continue to support and develop OSCADY 5 for the foreseeable future, and we welcome customer feedback on both products. Contact the Software Bureau to register your interest early.

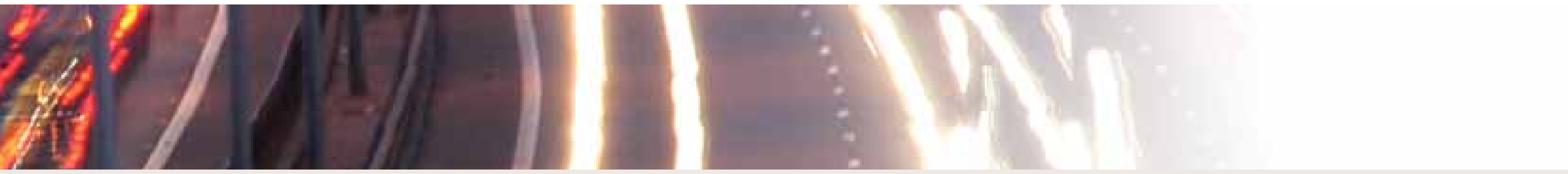
TRL wish to acknowledge the valuable support of our partners at the Centre for Transport Studies at UCL in the development of this new and exciting product.

About UCL

Founded in 1826, UCL was the first English university established after Oxford and Cambridge, and the first to admit students regardless of race, class, religion or gender. In the government's most recent Research Assessment Exercise, 59 UCL departments achieved top ratings of 5* and 5, indicating research quality of international excellence.

The Centre for Transport Studies at UCL was founded 40 years ago as the Traffic Studies Group, and since then has been the base for analytical and theoretical research in transport. Staff at the UCL CTS undertake research in a wide range of areas, including the theory and practice of traffic control, and have contributed substantially to the underlying theory of signal control and its application in traffic management.

Graham Burtenshaw
email: gburtenshaw@trl.co.uk



Improvements to pedestrian control in SCOOT

TRL was contracted by the Department for Transport (DfT) to improve the control of Puffin crossings within SCOOT (Split Cycle Offset Optimisation Technique, scoot@trl.co.uk). There were two main objectives identified; to correctly model variable intergreens within SCOOT, and to develop strategies to give greater priority to pedestrians at crossings under SCOOT control.

At present, when SCOOT is controlling a Pelican crossing the feedback logic in SCOOT assumes (correctly) that the pedestrian stage is a fixed length, although some of it may be used by vehicles. With the introduction of the Puffin crossing as a replacement for Pelicans, the length of time that vehicles are stopped due to pedestrians again is not fixed and depends on the time taken by pedestrians to cross the road. However, the vehicle stopped time is directly controlled by the signals through the use of a variable intergreen following the pedestrian stage.

The SCOOT kernel has now been modified to model accurately all variable intergreens, which allows better optimisation of the offsets and cycle times at Puffin crossings. It is also applicable at junctions with Puffin type pedestrian facilities, and enables considerably improved optimisation of the green splits at such junctions. The largest benefits of the new modelling will be at these junctions, where simulation results have indicated delay savings of up to 20% are possible. At a junction in a SCOOT network where the pedestrian stage is called every cycle, the benefits are likely to be in the order of a 10% reduction in delay to vehicles. With the annual cost of delay at a typical junction under UTC control being in the order of £500,000, the improved modelling could give a saving of £50,000 per junction per annum. At junctions where the pedestrian stage is not called every cycle, the benefits will be less than this and will be roughly proportionate to the frequency that the pedestrian stage is called. The improved modelling of variable intergreens is included in the recently released SCOOT MC3.

The second phase of the project was to investigate the requirements of local authorities for pedestrian priority strategies at Puffin crossings, and then to develop and test the feasible desired strategies. Although designed with Puffin crossings in mind, the strategies developed are equally applicable to Pelican crossings.

Current versions of SCOOT do not consider pedestrians during the optimisation. The SCOOT kernel was modified to offer five levels of pedestrian priority, including the current 'level 0' plus four priority strategies. Depending on the priority level chosen, pedestrians are given greater consideration in the modelling based on the degree of saturation of the node, the length of time a pedestrian demand has been registered, and the number of pedestrians waiting (if available).

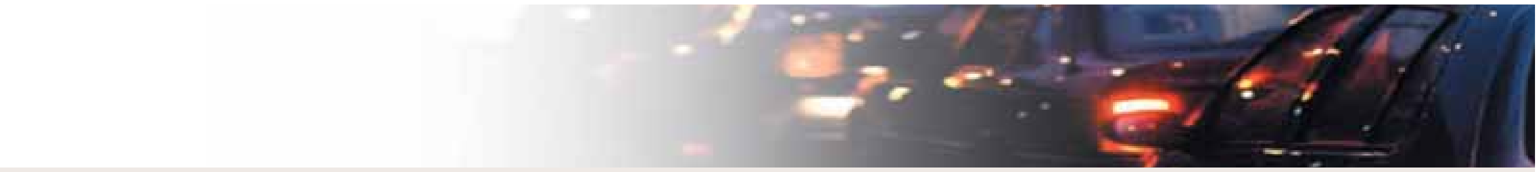
Priority is given by allowing the pedestrian stage to begin earlier in the cycle than would normally be the case. It is conceivable that in the case where pedestrian demands occur in many consecutive cycles, SCOOT would effectively be running as it does now but with a less optimal offset. This would of course be undesirable, therefore the priority algorithm also monitors the frequency with which the pedestrian stage is being called and accordingly restricts how much earlier the pedestrian stage can begin. During periods when the pedestrian stage is called every cycle it will not be possible to start it early.

All strategies were thoroughly tested by simulation, and the most promising were then tested on-street at seven Puffin sites in Southampton. It was clear from the initial weeks of testing that pedestrian priority level 2 (PPL2) offered the best compromise between pedestrian benefits and extra vehicular delay, and was the most likely to be used in practise. With this strategy, pedestrian benefits are limited by the saturation of the node but enhanced by the waiting time.

The results showed that with SCOOT PPL2, pedestrian wait time decreased by an average of 19%, or 5 seconds per person, when compared to standard SCOOT (PPL0). The 95th percentile wait time, that is the time that only 5% of people had to wait longer than, was decreased by 16%, 9 seconds per person. The strategy helped those who waited longest as well as giving a benefit on average. Although there is also an increase in vehicle delay, this is constrained since the node saturation is taken into account, and was measured at 0.2 seconds per vehicle per crossing during the trial.

Although much larger benefits to pedestrians can be achieved by using vehicle actuated (VA) control, the corresponding increases in vehicular delay are also much larger. Whilst this may be acceptable in some cases, it will not always be. During the trial, delay at one particular crossing increased by 3 seconds per vehicle. Using the SCOOT pedestrian priority strategy offers benefits to pedestrians where possible whilst still constraining vehicular delay.

Andy Kirkham
email: akirkham@trl.co.uk



Street mobility audit tool… making life better

TRL has been commissioned to develop the software for an auditing tool for **the assessment of street spaces** (e.g., high streets), as part of a study for the Department for Transport's Mobility and Inclusion Unit involving UCL and the University of Westminster. The tool enables local authorities to map and record data relating to aspects of the pedestrian environment of concern to different **mobility impaired groups,** for example, people with difficulty using steps. The project forms part of DfT's ongoing aim to improve the accessibility of street spaces for people who may otherwise have difficulty accessing, using and enjoying such areas.

The tool draws upon current guidance on the minimum level of provision for user groups in the pedestrian environment, using this as a basis for identifying particular street furniture or street sections that might present an obstacle to groups of people, to derive estimated levels of capability to negotiate pedestrian spaces. It also incorporates information derived from PAMELA, the Pedestrian Accessibility and Movement Environment Laboratory (part of the Centre for Transport Studies at UCL), which will provide distributions of 'capability profiles' for different types of pedestrian, to be matched against data from the street audit.

The software system is designed to enable a local authority to map and review a chosen street environment in terms of provision for all different mobility groups, and to **highlight areas for targeted improvement.** The user is able to map and assess each street place feature, such as post boxes, traffic signs, guard railings and then use the tool to provide an overall assessment of each section of footway and crossing point. In particular, the tool draws upon established guidance on providing for pedestrians in order to assess whether current access to both the network and particular facilities is acceptable. The tool enables the user to audit frontage access, footways, bus/tram stop areas, kerbside provision and features in the carriageway, as well as formal and informal crossings. Applying **capability profiles** for particular types of user enables a separate review of access for each mobility group.

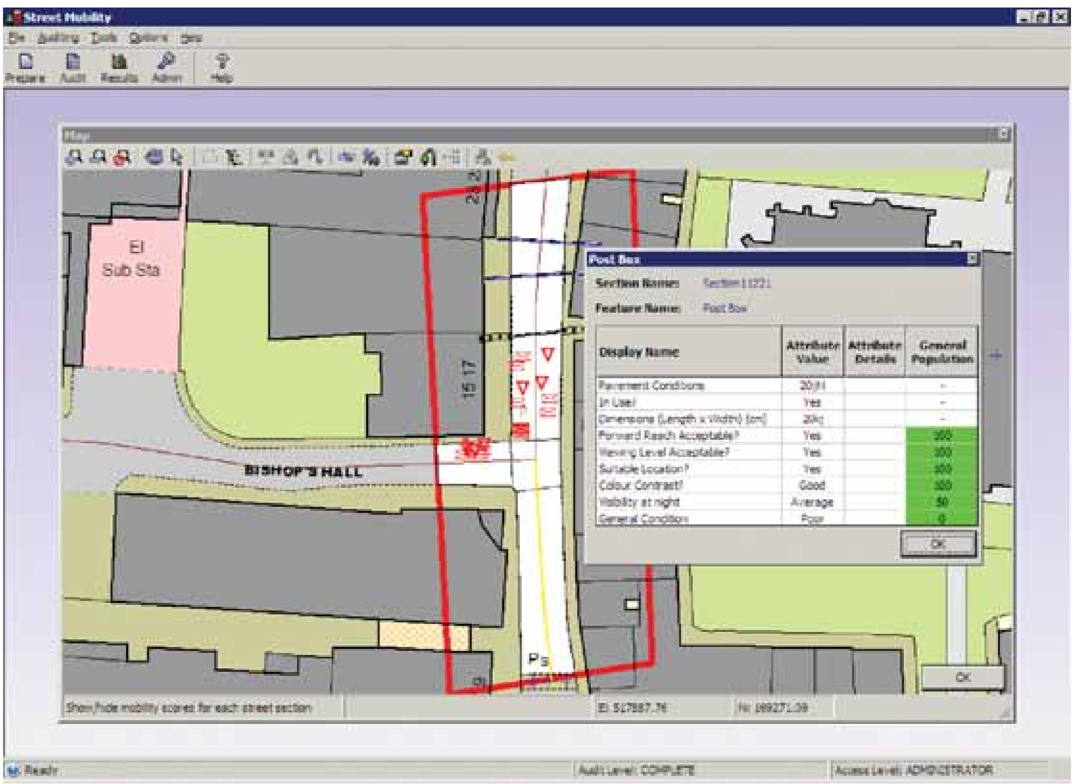
In general, the software is divided into three stages: preparing the audit, undertaking the audit and reviewing the results. In the first stage each road is split into sections where a change of use or physical characteristics is identified. In the simplest case the road would be split where crossings (or potential crossings) exist. The next stage involves collecting the data for a pre-defined list of street place features on-site for each section. It is here that the section boundaries can be 'fine-tuned' to reflect the current situation by adding section breaks which signify a change of use or at crossing points. Finally, by using information in the software about the capability requirements, the capability profiles are determined for each feature, and taking account of the capability profiles of different population groups, a final mobility rating is determined.

Some of the software features include:

- HTML web browser style presentation of data.
- Using MasterMap layers to define sections and the positions of street place features.
- Ability to assess specific street place features of interest (e.g. post boxes).
- Various different audit levels including from 'full' auditing to 'exception reporting' which allows only street place features causing accessibility problems to be recorded.
- Integrated display of photos.
- Summary screen for quick browsing of audits.
- Placement of street place features on the MasterMap layers using a built-in GIS system
- Summary tools to help determine audit progress
- Date/Time stamping for each street place feature assessed.

The system is a powerful tool enabling local authorities to make a real difference in the way that accessibility improvements are made within the pedestrian environment. Future developments of the software include 'routing'. This will enable users to assess potential journeys across the network and help identify problem areas to accessibility in the system.

The software tool is planned to be released this Autumn.



James Mason
email: jmason@trl.co.uk

Driving simulator and micro-simulation – a new synergy

Micro-simulation of traffic can provide incredibly useful insights into the likely impact of new or revised road schemes. However, the power of the observations that can be made using a given micro-simulation traffic model are limited by the assumptions made about the behaviour of traffic vehicles on which the model is based. The use of more realistic actors or virtual agents (i.e. software entities) within a micro-simulation model allows more detailed predictions to be made about the effect of a change to the road system.

THE TRL DRIVING SIMULATOR

In a recent TRL-funded project led by Dr Abs Dumbuya, a novel technique for improving and verifying the realism of a new micro-simulation technique was developed. The micro-simulation model under test used an artificial neural network to control the behaviour of a vehicle in a simple lane changing task. Artificial neural network models use a mathematical model for information processing with a functional architecture that resembles the neuron structure of the human brain. The aim of the project was to find whether the vehicle control of the new model was an improvement over a more traditional rule-based algorithm. Innovative use of TRL's driving simulator was made in the development and evaluation of the micro-simulation models.

TRL's driving simulator uses a real Honda Civic family hatchback that has had its engine and major mechanical parts replaced by a sophisticated electric motion system that drives rams attached to the axles underneath each wheel. These impart limited motion in three axes (heave, pitch, and roll) and provide the driver with an impression of the acceleration forces and vibrations that would be experienced when driving a real vehicle. All control interfaces have a realistic feel and the manual gearbox can be used in the normal manner. Surrounding the simulator vehicle are large display screens onto which are projected the images that represent the external environment to the driver. The level of environmental detail includes photo-realistic images of buildings, vehicles, signing, and markings, with terrain accurate to the camber and texture of the road surface. The driving environment is projected onto three forward screens to give the driver a 210° horizontal forward field of view whilst a rear screen provides a 60° rearward field of view, thus enabling normal use of all mirrors.

The first part of the project was to generate the training data that would be fed to the neural network in order for the network to 'learn' how to change lanes to overtake another vehicle. Eight participants were recruited to complete a short drive on a simulated two lane motorway in the driving simulator. In this drive they were required to accelerate to a constant target speed, remaining in lane 1 of the motorway until they came across an autonomous vehicle travelling at a constant speed also in lane 1. Behaving as they would on a real motorway, the participant had to overtake this vehicle by moving to lane 2 and then return back to lane 1. This completed the simulator task. The data from each completed simulator run was used to train the network in how to control the driven vehicle. At each time step, the network evaluated a number of inputs, including current speed, current lane, and distance headway to the vehicle ahead, to generate outputs of desired speed and desired direction of the driven vehicle, which could be used to calculate the new position and direction of the driven vehicle. The network outputs were compared to the actual changes in speed and direction observed from the real drivers. With sufficient training the network was able to cause the driven vehicle to follow a realistic path at a suitable speed around the lead vehicle.

The second part of the project was to demonstrate that the neural network model was more realistic in its control of the driven vehicle than the rule-based model performing the same task. To achieve this, twelve participants were recruited to observe how each micro-simulation model controlled the driven vehicle and to rate the realism with which they thought the vehicle was being controlled. Participants each sat in the driver's seat of the simulator vehicle were effectively 'driven' by the micro-simulation models through the simulated scenario on which the neural network model had been trained. Furthermore, participants also observed a pre-recording of how a human driver had completed the same manoeuvre. The results of the study demonstrated that participants thought that the neural network model was significantly more realistic in its control of the driven vehicle than the traditional rule-based model. Furthermore, participants were unable to discriminate between the human and the neural network in their control of the driven vehicle.

Having successfully demonstrated in the simulator that the neural network micro-simulation model was significantly more realistic than a rule-based model, work is now being conducted to extend the scope of the behaviours that the neural network model is capable of modelling. In a follow-up project, information on vehicle behaviour collected from Motorway Incident Detection and Automatic Signalling (MIDAS) loops is to be used as the training information for the neural network model, to extend and improve its capabilities. The final goal is to generate neural network-based simulated drivers that can participate fully in micro-simulation models and can respond realistically in both situations to which they have been trained and novel situations. By adjusting the structure and/or connection weights of the neural network, it may also be possible to create simulated aggressive drivers, tired drivers, alcohol-impaired drivers, learner drivers etc. This will help to represent the range of behaviours displayed by real drivers in a comprehensive micro-simulation model.

Nick Reed
email: nreed@trl.co.uk

CURRENT PROGRAM VERSIONS

ARCADY	V6.0 AD/4
PICADY	V5.0 AB/2
OSCADY	V5.0 AB/2
TRANSYT	V12.0 AD/4

(ALL ABOVE HAVE RIGHT/LEFT CAPABILITY)

TPM	V2.1
STM	V4.4.5
BUNDLE 3	V3.1 Issue 4
PC MOVA	1.0
MOVA SETUP	M5.0.0
MOVA Comm	M6.0.0
CONTRAM 8	V 8.3
MAAP (for Windows)	4.3.0
SafeNET	2.03
PERS	1.1
MTV	V 2.1

Who's Who

Jennie joined TRL in November 2005 after spending 10 years in the IT industry. She works in the TRL Traffic team. Jennie has a Masters degree in Management and is currently studying for a law qualification.

Jennie recently organised the successful TRL Intelligent Traffic Management & Control Conference, and is currently the project manager for MOVA, PCMOVA and COBA.

COURSES, SEMINARS & USER GROUPS 2006

SCOOT
2 day Training Course at TRL
7th - 8th November 2006
Course Fee £775

Introduction to MOVA
October 31st 2006
Course Fee £175

MOVA Training Course
November 1st/2nd 2006
Course Fee £575

ARCADY / PICADY Training Course
November 14th/15th 2006
Course Fee £575

TRANSYT Training Course
November 21st/22nd 2006
Course Fee £575

All prices exclude VAT

For more information or Booking Forms Please contact the Software Bureau

MTV 2 - The full updates

In the last issue of TSN (TSN 37), Carole Dixon reported briefly on some of the enhancements to MTV 2. MTV 2.1 has just been released free to current licence and maintenance holders. In addition to previous features, new or improved features include:

- **Acceptance of MIDAS7 TCD files** - MTV 2.1 can now accept MIDAS7 TCD files. MIDAS7 TCD files hold additional site information, like the geographical address of each loop. Previously this information had to be "looked-up" in an MTV static database. If a MIDAS7 TCD file is supplied, the software can also now plot the corresponding traffic data without a corresponding site database.
- The **Binary Converter,** a tool designed to convert TCD Binary files into SLD (Small Loop Data) ASCII files that are human readable and that can be manipulated for analysis. This application which comes free with MTV 2.1 has also been updated to cater for the new MIDAS7 TCD format.
- **Acceptance of MIDAS signal databases with additional fields** - MTV 2.1 can now accept signal setting databases with the two extra fields named STATUS and PROPOSED SETTING. Back compatibility is also ensured, so either format of signal database can be supplied.
- **Non-standard motorway and loop names -** Motorways named using the convention Ax(M) can now be plotted by MTV 2.1. Furthermore, loop names with a numerical digit at the end (particularly prevalent on the ATM section of the M42) are plotted correctly by MTV 2.1.
- **Runtime improved -** The run-time of MTV 2.1 has been improved, particularly if only a handful of loops are being plotted.
- **Run Binary Converter from MTV** - The Binary Converter can now be run directly from MTV 2.1.

- Modified presentation and bug fixes in the **junction plot, Accident plot** and **Hard Shoulder Running (HSR) plot.**
- MTV 2.1 can now update the relevant text box in the 'advanced' option upon selecting the **'replace missing data'** option.
- **Single User Access Level -** There is now only one user access level for MTV 2.1 and Binary Converter.

MTV continues to be used in a number of projects to assess the quality of MIDAS traffic data from many MIDAS schemes on the UK network. Some of the latest applications or projects involving MTV 2 include:

- Identifying, evaluating and understanding congestion by analysing and visualising accident 'hotspots'
- TRL assistance to the HA MIDAS taskforce
- Support to the South East Operations Division – HA
- TRL assistance of HA SSR Bristol using MTV in innovative ITS controlled measures
- TRL assistance to HA SSR Bristol using MTV on the ATM (Active Traffic Management) Scheme.
- Monitoring the journeys of 'abnormal load' vehicles
- Commissioning of new MIDAS motorway sections and accident investigations

If you are interested to know more about MTV 2.1 or how to order your copy, please contact the TRL Software Bureau. We would be delighted to hear from you.

Abs Dumbuya email: adumbuya@trl.co.uk
George Lunt email: glunt@trl.co.uk