The fact that there are many existing SATURN highway models still in use is perceived by some as a reason for not using OmniTRANS.....

..but this should not be the case as now SATURN highway assignment can be embedded within an OmniTRANS project.

This means that both model developers and end users have access to:

- A totally modern transport planning package with an intuitive Graphical User Interface
- Integration with comprehensive demand modelling, matrix estimation and public transport assignment functionality
- An elegant project/scenario data management system
- Excellent graphical and report based outputs
- Access to a fully programmable modelling environment

However, there are many ways in which integration can be viewed, depending on the starting point and modelling objectives.

The prime options are:

- converting a SATURN network to OmniTRANS and using OmniTRANS highway assignment
- importing a SATURN network to OmniTRANS as a validation exercise
- running SATURN assignment in conjunction with OmniTRANS in a hybrid model

These are considered below.

Highway Assignment in OmniTRANS

In the first instance, it should be appreciated that OmniTRANS provides in its own right, two forms of highway assignment model: namely Static Highway Assignment and Dynamic Highway Assignment.

These recognise the fact that two methodologies are quite different, and that
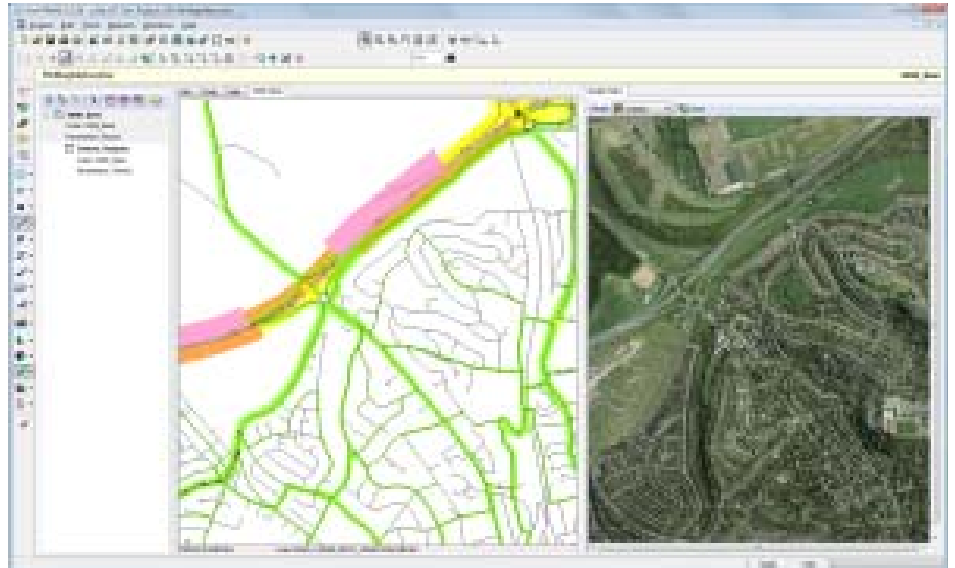
trying to model phenomena such as blocking back and ramp metering cannot be done sensibly within a Static Model.

Consequently, the static model provides a conventional approach to assignment modelling, supporting multi-class assignment without trying to 'fudge' the effects of blocking back in the network.

The dynamic model provides a different view of the world; this operates by macro (not micro) simulation of the network dynamically through time.

This allows a wide range of network controls to be modelled; these might include dynamic changes in speed limits, ramp metering, lane restrictions, incident effects, and so on. An outcome of this modelling is the build up of blocking back at congestion points in the network.

So, the first option for the modeller is to use the provided OmniTRANS methodologies for highway assignment.

Importing a SATURN Network into a new OmniTRANS Project

Tools exist for importing a Saturn network into an OmniTRANS project, noting that there are some philosophical differences in how the two packages deal with network data.

SATURN uses a separate data file for each modelled time period, for each scenario, for the input network and output loaded network.

OmniTRANS has a single, unified database environment where all of this data is stored in an integrated manner.

An OmniTRANS 'class' is provided to import a single SATURN network (with loads if required) into an OmniTRANS project.

This is run once per time period in the scenario, and tools are provided to both identify differences between the time period networks, and merge them into one network structure, as required by OmniTRANS.

The validation checks on the input SATURN files appear to be stricter than those found in SATURN itself, and it not uncommon for what might be considered to be errors in the SATURN network to be picked up by OmniTRANS.

If nothing else, OmniTRANS can be used to improve the validation and quality of a SATURN network, even if the modelling continues to be done in SATURN.

Once the networks have been imported into an OmniTRANS project, they move into a superior data management environment where network edits can be done consistently across scenarios, and the

possibility for error or inconsistency in the data across 'network files' is removed.

Running SATURN in conjunction with OmniTRANS

Despite the native facilities provided by OmniTRANS, there may be a requirement to continue the highway assignment in SATURN, but it needs to be run in conjunction with a demand, and/or public transport model.

OmniTRANS of provides all of this additional functionality, but we now move into the realm of building a hybrid model where different tasks are undertaken by different software packages with data passing between the two. This is not an uncommon scenario; equally it is one fraught with a high probability of error being introduced into the modelling.

A common scenario is where a Public Transport Network is built within OmniTRANS, most likely using a geographically correct imported digital network. This network needs the calculated highway assignment speeds so the transit services using the highways can operate at congested, rather than timetabled speeds.

Further, the possibility of using the OmniTRANS graphical outputs and reports to show the results of the SATURN assignment has merit, so the challenge is to be able to map the two networks, SATURN highways and OmniTRANS (PT) together.

The ease with which this can be done varies according to the starting point of the process.

- If the project starts with a 'clean sheet', the preferred starting point would be to import the digital network into OmniTRANS, build the Public Transport network on that; add any other data objects that might be relevant (say Count Sites), and *then* export the network for use by Saturn. Although some network edits may be required to obey SATURN's rules, the two networks are going to be topographically identical, or nearly identical. This makes data transfer (link and turn, times and flows) between the two a relatively simple exercise.

- If the project starts with an existing SATURN network, the topographical differences between the two network forms are likely to be substantial, making the mapping process more complicated. Examples include:
  - where roundabout are coded as full 'gyratories' in OmniTRANS, but as single nodes in SATURN
  - where a dual carriageway may be coded as a single, two way link in SATURN, but as two one-way links in OmniTRANS
  - where the level of detail in SATURN has been simplified compared to the full underlying network that might be present in OmniTRANS
  - where network coding errors exist in the SATURN network, e.g. one way links coded in the wrong direction.

Overall, the challenge is to provide a set of tools which:

- provides a set of operational 'rules'
- minimises manual intervention
- establishes a repeatable, mechanical process

all of which contribute to providing a robust, error free, data transfer mechanism.

Once a 'mapping' has been established between the two network structures, the requirement is to:

- embed Saturn within an OmniTRANS model
- pass matrix data from the OmniTRANS demand model to SATURN
- pass back to OmniTRANS the output assigned link and turn flows and speeds
- pass back to OmniTRANS the output SATURN skim matrices for use in the OmniTRANS demand model.

Mapping the Networks

A one-off process is required to establish the mapping between the two network topographies:

- Determine the correspondence between the two node systems, i.e. which node in the OmniTRANS network corresponds with a Saturn node; if any.
- For each SATURN link, see if there is an equivalent OmniTRANS link. If not, build a shortest path between the equivalent OmniTRANS nodes to see what the equivalent OmniTRANS links are.

- In most circumstances, this link mapping will be correct, but for the topographical reasons noted above, illogical paths might be built, highlighting a network inconsistency.
- A manual intervention is now required; to provide override data which corrects these mismatches.

Once these steps have been undertaken, a 'link equivalence' file is constructed between the two networks. This allows data to be transferred from the SATURN assignment back into the OmniTRANS project on a repeatable basis.

Turn data undergoes a similar process, although some specific information about roundabout configuration is required.

Running SATURN

Once the mapping has been established, SATURN can be run 'in production mode' from within the OmniTRANS modelling environment, and included in a seamless manner as part of the standard model run.

Trip matrices are constructed by the OmniTRANS demand model and 'exported' to SATURN for assignment; the outputs are imported back into the OmniTRANS database. Specifically, the Public Transport assignment done in OmniTRANS now uses the congested link and turn times calculated by the SATURN model.

Benefits

Running a model of this form has several significant advantages and benefits:

- In the first instance, OmniTRANS and these tools provide an audit of the quality of the SATURN network coding.
- OmniTRANS provides the powerful data management environment for the overall model
- SATURN assignment is integrated within the advanced modelling environment provided by OmniTRANS in an **efficient and cost effective manner**