

# Models United: Using SATURN and TRANSYT within an AIMSUN micro-simulation environment

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## *Introduction*

Road traffic micro-simulation models are the latest generation of traffic models. They model the movements of individual vehicles travelling around road networks by using simple car following, lane changing and gap acceptance rules. Microscopic simulation models are becoming increasingly popular for assessing the effects of new traffic schemes.



Figure 1: An AIMSUN micro-simulation model

AIMSUN (**A**dvanced **I**nteractive **M**icroscopic **S**imulator for **U**rban and non-urban **N**etworks) ([www.aimsun.com](http://www.aimsun.com)) is easily the most advanced, user friendly and cost effective micro-simulator in the world. It has been developed at the Universitat Politècnica de Catalunya in Barcelona since the mid 1980s to simulate urban and interurban traffic networks containing a wide range of intelligent transportation systems. It is marketed by a specialist company called TSS, which was set up by the research group that developed the original model. The package has more than 500 users worldwide with an increasing number in the UK. AIMSUN has a flexible Application Programming Interface (API) that enables the AIMSUN model to interact with external applications, such as signal control systems (SCOOT, MOVA etc), ramp metering systems, dynamic route guidance systems, incident management systems etc. The API can also be used to incorporate simple signal control logic, such as selective vehicle detection or vehicle actuated signals, within the micro-simulation model.

## ***Traffic assignment in AIMSUN using SATURN***

Building any traffic model takes a lot of effort. Detailed mapping needs to be used to enter the network geometry, traffic flows need to be collected and converted into consistent datasets – often as O/D matrices, signal plans need to be obtained and interpreted, public transport routes, stops and timetables need to be added to the model, validation data such as travel times, queue lengths and link flows need to be collected and processed.

Huge amounts of effort have been spent on building well validated traffic models in the UK with tools such as SATURN. These traditional assignment models are excellent at assessing the effects of traffic schemes in large road networks where drivers can respond to changes in the network by finding new optimal routes to their destination. The algorithms used are based on the concept of Wardrop equilibrium. They are tried and tested and produce robust results.

If a micro-simulation tool has been chosen to carry out a traditional traffic impact assessment, then an equilibrium approach is essential to determine route choice. However, very few micro-simulation models have any built-in equilibrium assignment models (AIMSUN NG being a notable exception). Micro-simulation packages vary in their treatment of route choice. Many of the leading micro-simulation models have a built-in “dynamic assignment” model. These are different from the equilibrium assignment models used by traditional models. They have usually been designed to provide immediate vehicle route choices for individual vehicles as they travel through a dynamically changing network. For example a car might decide, perhaps in response to information received from a route guidance system, to divert away from its chosen route to its destination in response to an incident that would cause delays if the vehicle stayed on its original course. These clearly differ from the traditional equilibrium approach to route choice that tries to determine the routes that traffic will settle down to using in the months following a change to the road network, such as the addition of a new road. In practice, the dynamic assignment methods used by micro-simulation models often have problems, especially in congested networks. They can easily become unstable and fail to converge.

AIMSUN has recently added new facilities for making the most of existing traditional traffic models built with SATURN. It is now possible to import an existing SATURN network into AIMSUN NG. The importer translates:

- the network geometry including give ways, link cruise speeds
- signal plans
- bus routes
- reserved lanes
- matrices
- assignment results

So with a few clicks of the mouse it is possible to go straight from an existing SATURN model into the equivalent AIMSUN NG micro-simulation model. Most importantly the importer also brings in the results of the assignment from the traditional model. Obviously the micro-simulation model will need some adjustments made to it before it works perfectly. For example in a traditional model the precise position of stop lines at junctions isn't usually specified, but with its user friendly network editor, it is quick and easy to make the required adjustments with AIMSUN NG.

The new importer makes it very easy to make the most of existing validated SATURN networks. Much of the effort that has been expended in building and validating the traditional

models is no longer wasted when a new micro-simulation model of the same area is required. The tried and trusted assignment results from the strategic models can also be fed into AIMSUN NG, negating the need for the use of a tricky dynamic assignment method that may prove difficult to validate.

An exporter has also been produced so that existing AIMSUN networks can be converted into the equivalent SATURN networks - allowing SATURN users to take advantage of the user friendly network builder available to AIMSUN NG users and AIMSUN NG users to take advantage of the robust assignment algorithms in SATURN.

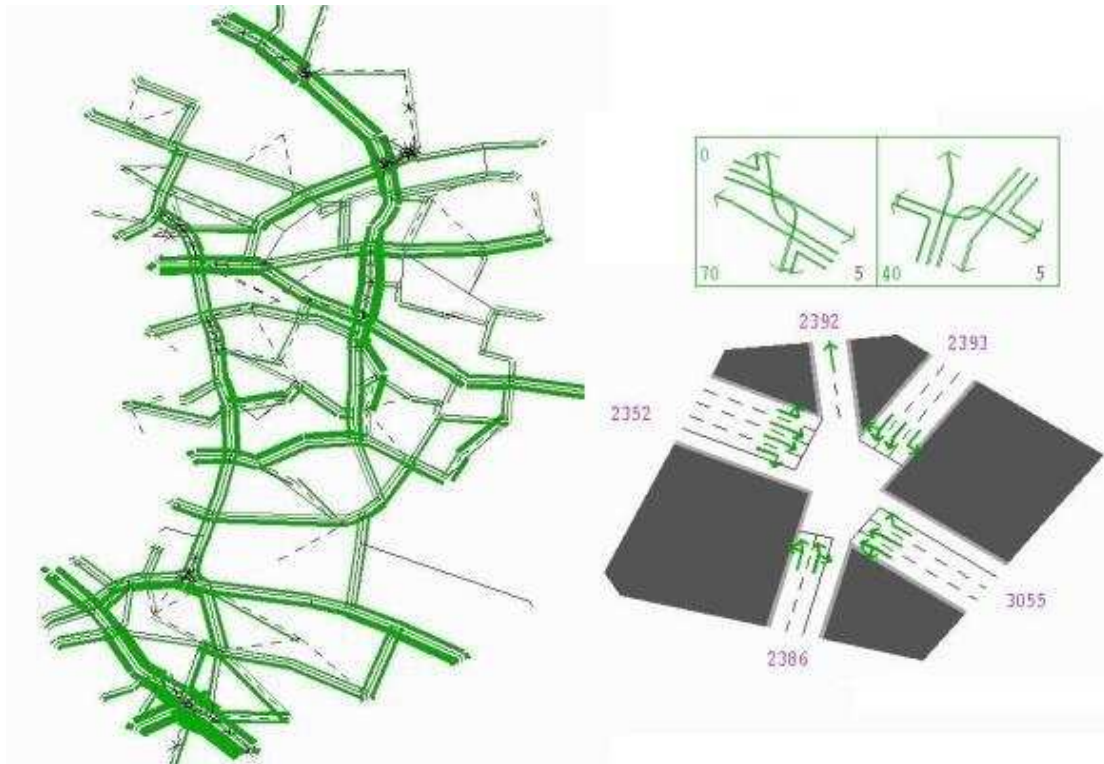


Figure 2: From a SATURN network to ...

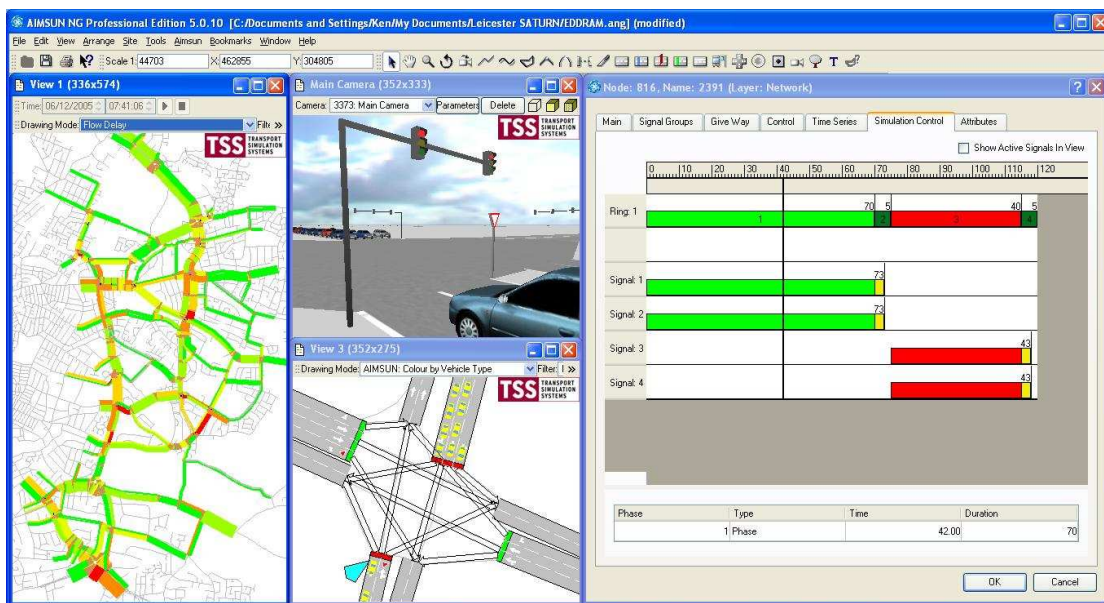


Figure 3: The equivalent AIMSUN NG network in a few clicks of a mouse

## Optimal signal settings in AIMSUN using TRANSYT

Producing optimal signal settings in a traffic model can be time consuming. One of the best ways of obtaining optimal signal plans is through TRL's TRANSYT program. AIMSUN has an interface to the TRANSYT signal optimisation program. The TRANSYT interface allows networks developed using AIMSUN to be translated into the equivalent TRANSYT network model. TRANSYT can then be run within AIMSUN NG and the optimised signal plans automatically imported back into AIMSUN.

TRANSYT consist of two elements: a traffic model and a signal optimiser. The traffic model represents the traffic behaviour in the network and calculates the Performance Index (PI). PI is a measure of the overall cost of traffic congestion and usually weighted with a combination of overall stops and delays experienced by the traffic. The signal optimiser seeks to adjust the signal timings. It makes slight adjustments to signal timings, checks the PI, and seeks a lower PI to improve settings.

AIMSUN NG will translate and create approximately 90% of the required TRANSYT data file. The other 10% is applied manually by the user within AIMSUN NG. In a TRANSYT model the network is represented by a series of "links" and "nodes". Links represent a one-way traffic stream on the approach to the junction. A relationship is determined between the traffic lanes and how traffic uses the lanes on the road. A single lane may represent one or more traffic lanes. "Sections" in AIMSUN NG are automatically translated into the appropriate TRANSYT "links". Nodes are referred to as signal controlled junctions. Priority junctions are treated as bottlenecks. Signals are treated as stages within TRANSYT. AIMSUN NG automatically translates the phases into signal groups giving the appropriate stage start, start lag, stage finish and end lag. In a TRANSYT network, significant priority junctions should be modelled. AIMSUN NG will produce the required bottleneck junctions, however the user must input the parameters that govern the performance of the give way junction in the TRANSYT model. AIMSUN NG will automatically calculate the saturation flows required by TRANSYT by applying the TRL RR67 formula.

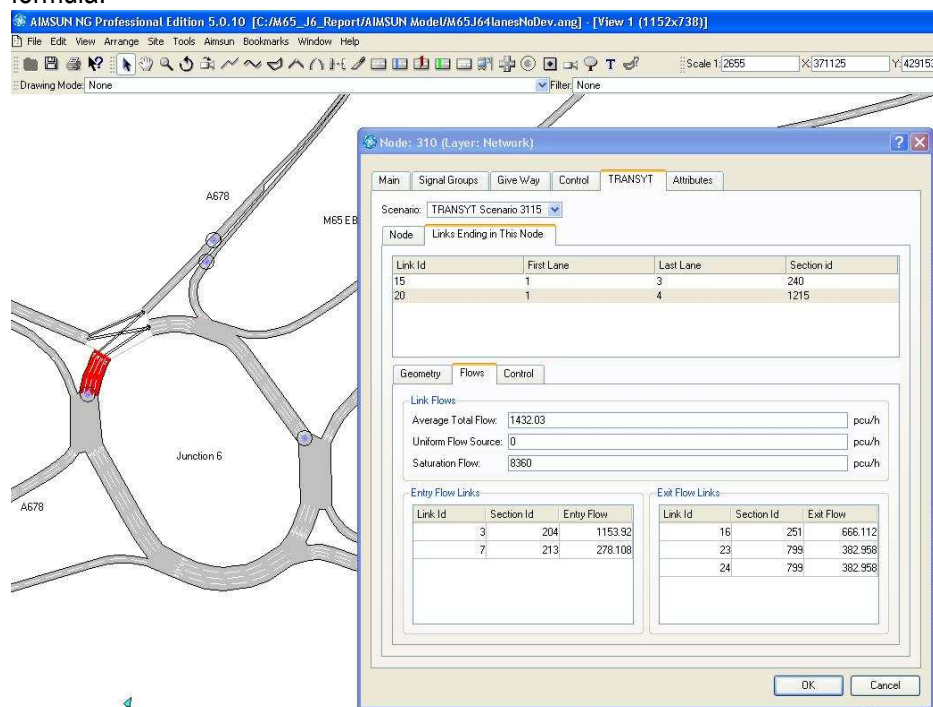


Figure 4: A TRANSYT model in AIMSUN