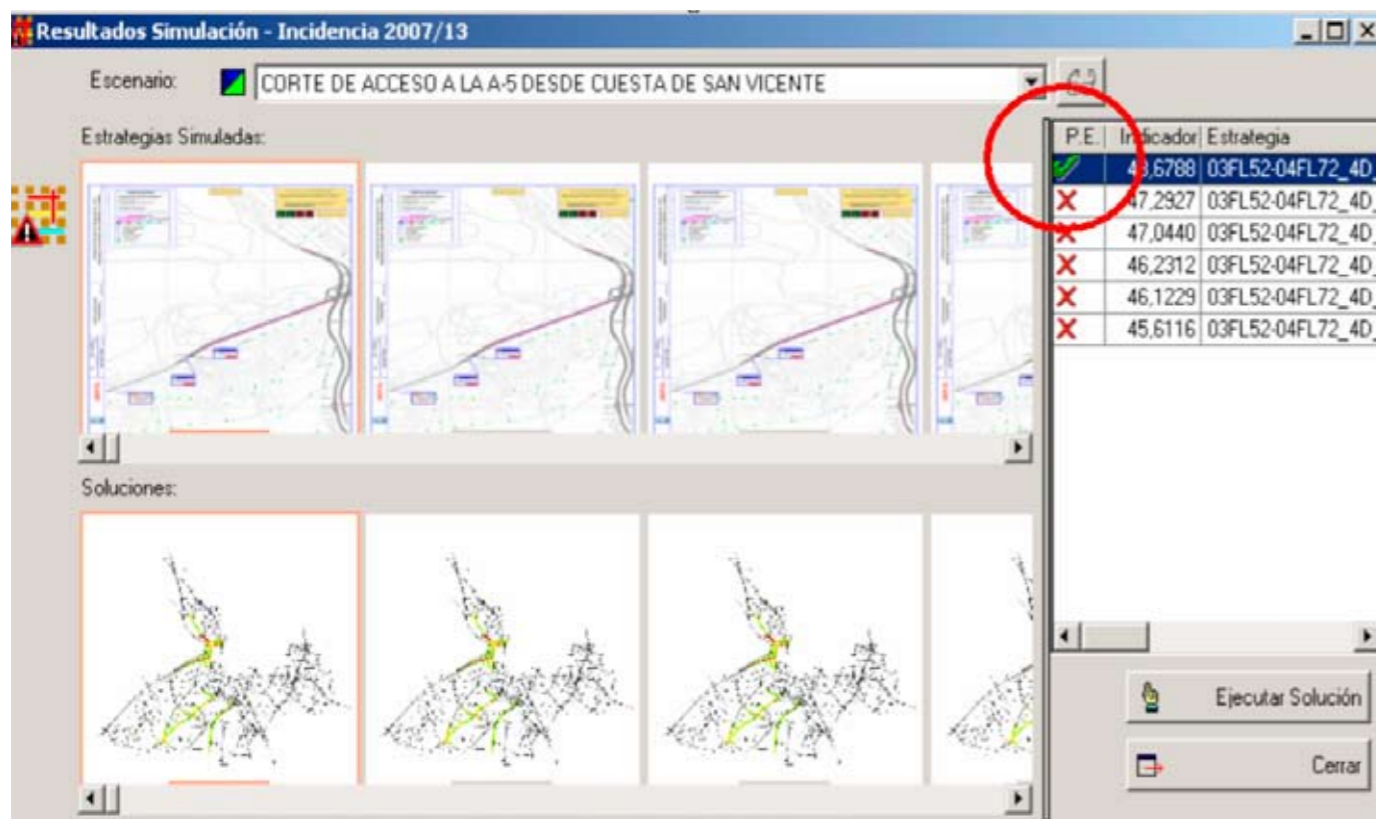




As it happens...



Left: Comparison of strategies for online incident management in Madrid with Telvent's SICTRAM interface



Traffic simulation has reached a whole new level. ALEX TORDAY and ALEX GERODIMOS send this live report

In the world of transport modelling, the word “planning” is instinctively associated with static traffic assignment software.

On reflection, the overwhelming majority of traffic simulation software packages are also used *offline* to support planning decisions, although in a more dynamic and detailed way. What happens *online* during a normal day in any city belongs to the thus far separate realm of traffic operations.

In a traffic control centre simple models are sometimes used to complement human expertise. These models typically extrapolate on historical information and in so doing disregard the sort of variations and non-recurring events that make congestion appear at one particular location and not another. If you have arrived late at a meeting after attempting to beat the traffic based on “up-to-date traffic information” then you will know what we mean.

Vision on

The obvious question is why not use simulation online, making it a decision support system for the traffic control centre? The benefits are evident: you can use simulation outputs to fill in knowledge gaps in space (in parts of the road network where little is known about the current traffic flow) and in time (in the future).

A good model can include advanced traffic management, public and private transport and adaptive signal control leading to a very realistic picture of a city's traffic operations. You can navigate around the model in 2D and 3D or, more likely, hide the model completely and build complex measures of effectiveness that capture the essence of a scenario in one image and number.

Actually, the usefulness of simulation in this regard is not what's disputed. Ministries of transport and city councils already know how valuable it would be to route emergency vehicles around congestion to get to an incident site; inform citizens as to the best times to travel; control emissions by creating green corridors where and when needed; implement dynamic and effective congestion pricing; effect a safe emergency evacuation - the list is endless.

What we tend to hear is that “it would be nice to...” implying “sadly it is not yet possible to...”. Yet, this perception is now changing, thanks to a number of new technologies and a few pioneer cities/regions that have taken simulation online. The process is exciting and challenging at the same time. “Can the challenges really be met?” is the question we most often hear. The answer is yes - but not without some effort and commitment, we have learnt.

A question of time

The first challenge (and the first objection you are likely to hear from sceptics) is computation requirements - time, that is. To make meaningful decisions in real time, any decision support software should take a couple of minutes to provide a concrete, possible-to-implement recommendation.

Jaime Salom of Trakteplan, Project Manager of the online simulation project completed by Telvent in

Traffic Simulation

Madrid, comments: "When we completed the first phase of the project concluding that 25 per cent of the Madrid metropolitan area needed to be included in the Aimsun Online system for incident management, some of us began to wonder whether we were going to run into trouble. But the system now takes 2-3 minutes to prepare, load, run and report back a recommended action based on simulation of various options for the next 30 minutes."

Performance enhancing

So why is this suddenly possible? Granted, processor speeds have improved – but not that much. What has changed much over the last few years is the way in which hardware manufacturers accomplish performance improvements.

Advances in multi-CPU technology clearly favour software designed primarily to support parallel execution: importantly, parallel on a single computer, not across computers. The ability to buy a 4-, 8- or even 16-CPU computer for a modest amount of money means that, with the right software, you could be looking at significant performance gains.

Still, the question lingers: what if I need to model an even larger area? A micro-simulation model of an entire metropolis that takes 20 minutes to run may be impressively efficient given the amount of computation involved but is, mildly put, not very useful for real-time decision-making. Focussing where it matters becomes important.

Yannis Stogios of Delcan Corporation who is responsible for the design and implementation of a meso/microscopic simulation framework for one of Delcan's major clients explains.

"The main premise behind our approach in a number of projects we carry out these days is that there is no need for micro-simulation all the time at all locations across a fairly large road network."

Cue mesoscopic simulation: detailed enough to deal with traffic control plans and changing demand, yet rapid enough to deal with huge networks and easier to calibrate. Combine the two models at the same time into a hybrid simulator and you have something quite powerful and scalable without losing accuracy where it's needed.

Lifting the gloom

The second hurdle to overcome when taking simulation online is data requirements. We quite often hear, "we'd love to do something like that but we have no

data". The simple truth is that simulation modelling, be that offline or online, cannot have a meaningful impact in the extreme case that there is no data at all. The good news is that this gloomy scenario is rarely what actually happens.

What is far more common is that the detection layout covers some areas but is not quite adequate; some detectors produce erroneous data; and it's difficult to know where to start to derive meaningful patterns out of

historical data.

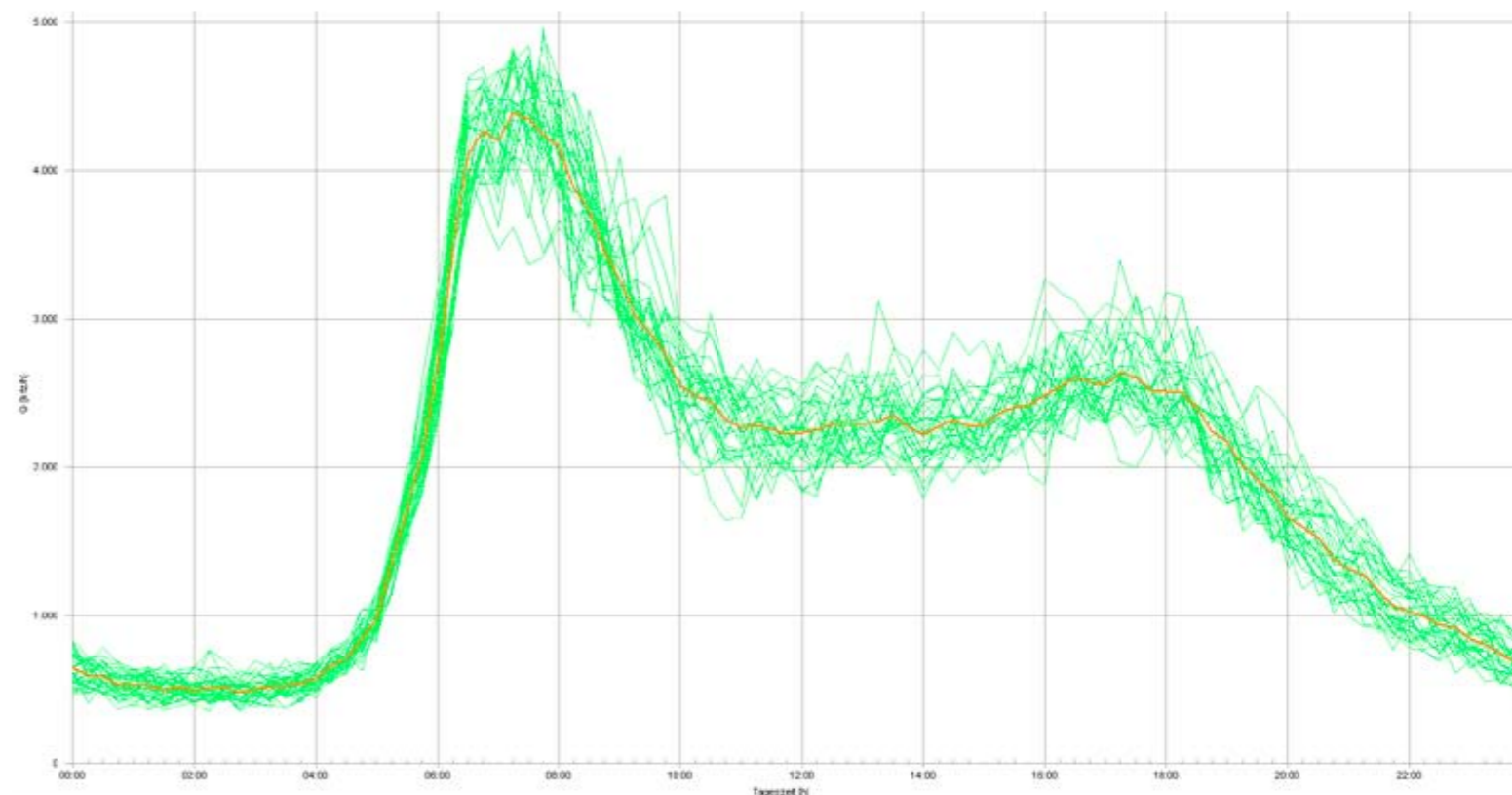
Whilst serious, these hurdles are not insurmountable, thanks to new algorithms and software. In Aimsun the quality of the coverage afforded by detection layout can be analysed, and additional detector locations can be identified to optimise the amount of traffic flow captured. As for pattern matching and historical data analysis, specialist software can help a great deal.

Heribert Kirschfink of German momatec GmbH, the company behind the ALMO® software, explains: "We now have accumulated significant experience collecting, cleaning up and making sense of traffic data from various regions and cities. With the help

"What has changed much over the last few years is the way in which hardware manufacturers accomplish performance improvements"



Madrid project scope



Analysis of workday detector count data from Madrid using the ALMO® software

of additional information such as weather data and a calendar of special events, we are able to group historical data in typical daily patterns.

"Although it would be wrong to speak of general rules, experience so far shows that, in most networks, all yearly traffic demand can be grouped in a couple of dozen traffic patterns with limited internal variability."

Emulator, too

Alas, the challenges are not over: signal information is next. In most cities, control plans are dynamically changed during the day so the status of the signal groups at any one time has to be found. This can be done relatively easily by reading in, in real-time, the information from the controllers and feeding it through an interface to the simulation. If adaptive control is in place, the best option by far is to emulate the logic – as the simulation advances in the future, the emulator takes care of the signal changes.

The aspiring adopter has more to think about. To make useful comparisons the traffic management strategies to be assessed have also to be loaded in the model – on the spot. These strategies are composed by a group of actions – such as a lane closure, rerouting with VMS, speed limit variation or ramp metering.

Expertise sought

The view of Martin Wylie at Southampton ROMANSE is that doing one's homework offline is the best initial approach for demonstrating the likely operational baseline status of the network:

"The aim is for ROMANSE to expand its ability to manage the network through the use of pre-modelled scenarios providing the network operator with options for strategic control which have a level of confidence based upon its modelled outcome and providing confidence in the selected method of control.

"While this approach is very pragmatic and, frankly, the only readily applicable one, we cannot help but look forward to the scenario where the model becomes homogeneous with the traffic control system and generates strategies dynamically based on abstract rules and historical results."

Reflecting on the above, whilst an exciting and rewarding prospect, taking simulation online is no mean feat and requires commitment and perseverance. Then again, 30 years ago the notion that it would be possible to forecast demand for passenger flights by origin and destination, day of the week and time of the day and on that basis overbook flights and dynamically vary ticket prices was seen as a nice dream.

Today, yield management is so widely adopted as to be unnoticeable. Yet the challenges faced by the airline reservation centres at the technology level were not dissimilar in nature: incomplete or "dirty" historical data, a very short time window in which to make a decision and (lots of) disparate systems talking to each other.

However, the most striking similarity, we think, is at the people level: successful adopters saw yield management as a programme and combined it with change management initiatives which allowed them to develop modelling expertise in-house and really be on top of the models. In that way yesterday's empirical experts evolved into modelling gurus.

It seems a fairly safe bet that simulation will see a similar sort of adoption pattern in traffic control centres in the next few years; whether this will/should be combined with dynamic congestion pricing ... that merits a separate discussion. **TH**

"Yesterday's empirical experts will evolve into modelling gurus"

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