Model development

Building models from the ground up

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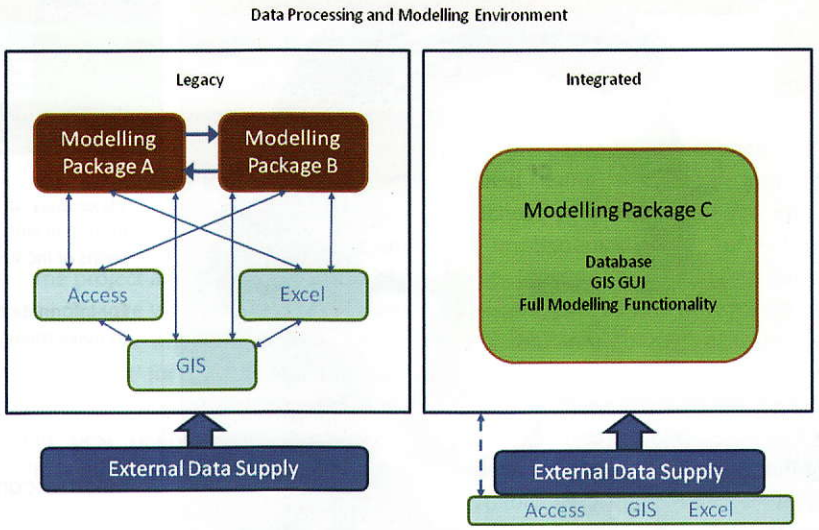


Developing transport models is expensive, and the current 'difficult' times mean that this is a situation that we must make the best of – somehow, say Martin Bach and Miles Logie from consultant Minnerva. "They also provide a further impetus, if one were needed, to review how we build our transport models and to make us think about how we can do this in a more efficient and productive manner," Bach and Logie add.

General purpose transport models, as we know them, they say, have their genesis in early 1960s formative work by the US Bureau of Public Roads and the Federal Highways Administration, which was embodied in the UTPS (Urban Transport Planning Software) package. In the early 1970s this led to the generation of TRIPS, MinUTP and Tranplan, all originating in the US. Subsequently, more ubiquitous packages such as MicroTRIPS, SATURN, and EMME emerged and were used in the UK. "These packages have continued to develop, metamorphose and survive (sometime with new names, such as Cube), but their heritage can still be seen, understandably given that re-engineering any software package is a daunting and expensive task, especially for specialist software such as transport modelling, with its relatively small user base," Bach/Logie say.

Newer packages have been developed, based on a more modern software architecture, including VISUM, TransCAD and OmniTRANS. These have been applied successfully in a number of areas and in some countries are the dominant software of that kind but the majority of transport models in the UK are, however, still affected by 'legacy software issues', as is often revealed by their dependence on 'DOS' operating system practices.

"It might seem that the newer software packages have limitations in their breadth and features if they have not swept aside the older packages, but a comparison of their basic capabilities are not sufficiently different to fully explain this," Bach/Logie say. "One explanation is that only a few models are developed from scratch and, even when this is the case, prior training, existing software licenses and institutional inertia mean many models are often amalgams of software – picking specific functionality from each; resulting in hybrid models. In terms of a model and its modelling team's history this might be understandable but the ongoing costs are high, which in current circumstances is hardly sustainable."

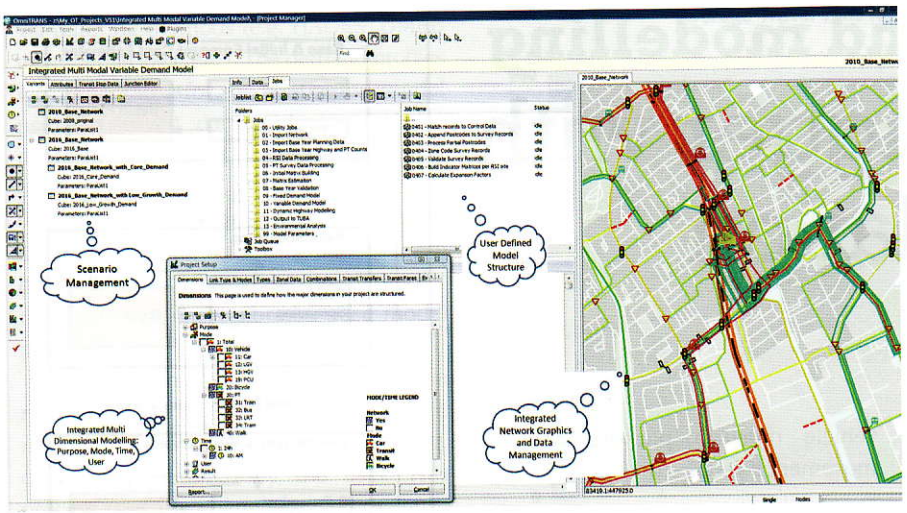
Problems, problems

Bach and Logie see the issue of the data used in models and its processing as key. "Much of the processing of the demand data needed by transport models, such as traveller intercept and household survey data, is not handled by these packages, and MS Office tools such as Access and Excel are widely used to undertake these tasks," they say. "But all this serves to increase the nexus of software used in building a model and, in many cases, introduces further inefficiencies and 'traps' for the unwary."

As well as Access and Excel, a GIS is often used to introduce some form of spatial context for data processing, they add. "But consider – much of the validation and manipulation required of this data would be improved if, where relevant, it was validated within the context of the transport model in which it is to be used. But none of these 'adjacent' software packages know anything of the transport model."

This situation is not inevitable, the Minnerva pair suggest; some of the newer packages do support the notion of undertaking such data processing within the transport model itself and offer significant efficiencies as the data is validated against the data structures (zoning system, network, land use data) used in the model itself – everything is consistent and the data validation procedures can be specified using rule-based systems that are transparent and can be repeated and audited.

Further, transport modelling tools can be used to help in the process; for example, to build a trip matrix for a roadside interview site (RSI) from the 'raw' survey data and check the origin-destination (O-D) behaviour relative to the network and the O-D pairings that would be expected to pass through the interview site –



determined by select link analysis. The same can be done for a public transport survey to check O-D patterns for individual routes and services.

"These tasks are not radical in themselves but the way in which they are done is," Bach and Logie say. "By encompassing the data processing within the transport model, everything becomes 'tighter', of better quality and ultimately cheaper, as the process has become more efficient. The data passes seamlessly into the transport model development phase, with a higher level of confidence."

A further problem area highlighted by Minnerva concerns hybrid models. These offer a means of accessing particular features and functionality that are valued by the modelling team, whether on the basis of familiarity or special modelling need, but the cost of 'hybrid' models is high in terms of efficiencies. "Consider a not uncommon example, that is a model where the highways component is built with SATURN, the public transport component built with Cube and the demand model component built with EMME, or variations on that theme," Bach and Logie explain. "Interfaces have to be developed to pass network and matrix data between them; while these may exist and operate satisfactorily, the process itself is inherently inefficient and error prone. Networks have to be synchronised across the platforms and how many times and in how many models has an edit been made to one network – but forgotten in the other? And, as argued previously, passing data back and forth is a recipe for disaster. All in all, costs are increased, as has risk."

Unnecessarily complicated hybrid models occur partly because of a perceived need to use an existing 'inherited' model where to throw it away seems wasteful, they add. Sometimes they occur because different organisations with 'package-specific skills' come together to work on the same project and each wishes to work with the package with which they are most comfortable, or argue that a particular package is 'best' for the application. "That is reasonable – but raises the question as to what 'best' really means," Bach/Logie say. "It is all very well to argue over the niceties of a specific modelling technicality (package 'a' does it better than package 'b') but it rarely stands up to the scrutiny of the overall framework, context and effort put into building the model.

"Institutionally, it would seem that investing in a new product is seen as a difficult thing to do; the cost of new licenses, the cost of training, getting up the learning curve, and so on. And there is a pool of trained expertise in the market to fish from when it comes to staff recruitment. At an individual level, if you have been using a particular software package for many years then to put that experience to one side might be perceived as an odd thing to do – why go back to square one? So the process can be self-perpetuating."

The best way forward

"A culture of risk aversion, and the fact that efficiency savings accumulate over time while costs are more immediate, provide strong barriers to change but adopting new ways need not be too difficult," Bach and Logie say. "For example, at Minnerva we have successfully used OmniTRANS as the host transport modelling package to process data, provide WebTAG-compliant multi-modal modelling and to provide modelling systems readily used by others. We have also developed a range of complementary tools that process raw, multimodal intercept survey data through the stages of grid referencing, zone coding, validation, manipulation, spatial sense checking, all within the framework of the model in which the data is to be used, with all of the benefits noted."

Modelling's value is only fully realised when it becomes accessible to a much broader group. Bach and Logie suggest. "Some aspects of modelling are complex but it should be possible to use the model as a system that is open to inspection," they say. "Reading and understanding the workings of a model need not be made daunting." Models are variously formed using pre-packaged functionality that is invoked using parameter and option 'switches', or with functionality specified and implemented using some form of script. 'Elegant' modelling is coherent, consistent, concise and transparent, which translates into better efficiency and approachability by a wider range of people. Most modelling software is developed with these objectives but changes over time in hardware and software technology inevitably mean that compromises are required as software is updated. These do not stop the software from performing but mean that it cannot offer the same level of overall efficiency.

"For many models development costs and levels of value are established in relation to achieving standards such as WebTAG," Bach/Logie note. "This guidance continues to evolve, so modelling systems need to be adaptable but also ensure that the required functionality is available. Most models that are WebTAG compliant can offer templates for how to form such models but involving new and often less experienced staff in developing such models places a premium value on 'elegance' and its implications.

"The enhanced functionality of the newer tools also means that value can be added; the model can act as a host for count data, allowing it to be displayed in the context of the transport model, rather than it being lost in count databases, or the provision of a 'viewer' can let the 'casual user' browse a model – so the model reaches a wider audience."

"There is no reason why modelling should be as inefficient as is usually the case," Bach and Logie conclude. "But there is an onus on those who commission and advise on the building of models to understand the need for change and the benefits that are available." ■