Prior Matrices for Microsimulation Traffic Models – A New Approach

Context

Prior matrices are a key input to building microsimulation models by providing an initial estimate of traffic demands. They represents traffic flows between zones and are also known as pattern matrices or OD-tables. It is this prior matrix that the modeller then adjusts within the microsimulation package to produce the final demand matrix. The adjustments match assigned traffic flows with observed real world traffic volumes to meet relevant criteria, such as those specified by FHWA or DMRB.

Even for straightforward models, some demand adjustment process will be required to better match assigned and observed traffic volumes.

Microsimulation modelling suites have sophisticated tools which can assist in this demand adjustment process. If the prior matrix initially produces reasonable assigned flows (i.e., the prior is good), these tools will rapidly shape the demand matrix to a point where only a small number of adjustments by the modeller will be necessary to meet specified criteria.

If the prior matrix is not reasonably representative of the traffic patterns being modelled, then the development of good matrices can be a protracted process, even with the excellent tools available with microsimulation applications.

New approach - objectives

After grappling with this issue for a number of years, including trying different processes to develop prior matrices, we have formulated a fresh approach. The objectives of this approach were that it had to:

- produce a prior matrix that conventional estimation tools can rapidly shape into a good demand matrix, leaving the modeller with relatively few adjustments to meet criteria
- use as much of the available demand data as possible, and be able to reasonably accommodate inconsistencies between data sources
- reduce the duration of estimation campaigns, and their cost, so that modellers can get on with traffic modelling

This new approach has been applied successfully on a number of projects.

Demand data

For all but the smallest of traffic models, getting a representative demand matrix is not trivial. Typically, a set of traffic counts will be taken in the field and some origin-destination or partial origin-destination data will be collected.

In addition, there may be existing information, such as journey to work data, a household travel survey, or a strategic traffic model covering the study area. There also may be land use information for some of the model's zones, or sectors, and from these an estimate of relevant traffic generation can be prepared. Not all of this information will necessarily be available.

Demand estimation process

An illustrative conventional approach to demand estimation which is commonly applied is to:

1. collect and process field data – counts and OD information
2. improve the existing strategic highway model with this information, including fine-graining networks to better approximate the microsimulation model's network
3. take a sub-area matrix from the strategic highway model that corresponds with the microsimulation model's extent
4. use that matrix as the prior matrix in the microsimulation application, possibly with adjustments, such as splitting selected zones or patching in extra information, and then

5. start microsimulation demand estimation in earnest.

There are variants around this approach, for example, where no strategic model exists a more piecemeal process is used to prepare the prior matrix.

Our new approach has the same first three steps, and then extensively adjusts the demand matrix before placing it into the microsimulation demand estimation process in the final step:

1. collect and process field data – counts and OD information
2. improve the existing strategic highway model with this information, including fine-graining networks to better approximate the microsimulation model's network
3. take a sub-area matrix from the strategic highway model that corresponds with the microsimulation model's extent
4. analyse the microsimulation model's network
5. set up concordances between strategic model sub-area matrix, journey to work and land use-based estimates of demand and microsimulation model network
6. establish screenlines, cordons and turn count spatial identifiers
7. generate initial matrices and set about improving these to better match the various sources of demand data
8. start microsimulation demand estimation in earnest using a high quality prior matrix.

This process can be altered to use whatever demand data is available – if no strategic travel model exists, the OD data that is available can be used, even if this can only provide estimates for a limited number of key cells in the matrix.

Advantages

Weeks can be cut from estimation time as a result of starting microsimulation estimation with a good prior matrix. Our process has produced prior matrices for projects with overall GEH scores of between six and seven for models of up to approximately 175 zones, which the microsimulation application subsequently adjusted very quickly to GEH scores of between three and four, leaving modellers with a small subset of adjustments to achieve specified criteria.

Further, we can run our process in parallel, permitting two or more time periods' prior matrices to be prepared simultaneously. Our process is largely automated, which means that matrices can be improved around the clock.

While our process can save considerable time and effort, as well as reducing project risks, it does not replace the need:

- to obtain sufficient harmonised representative counts.
- to have information about trip distribution.
- to actively monitor and manage the matrix estimation process within the microsimulation application.
- to make adjustments to demands and/or networks to achieve acceptable demand matrices.

For further information about this service please contact us at:

info@highrangeanalytics.com.au

www.highrangeanalytics.com.au

High Range Analytics Pty Ltd
PO Box 1220
Mittagong NSW 2575
Australia

High Range Analytics is an independent consultancy, formed to provide clients with tailored technical services for transport and traffic planning.