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Summary report

Objective

Travel demand models are an important tool for transport planning. They are used in cities and regions to reproduce existing conditions in a transport network and to evaluate the impacts of future developments or planned transport measures. Thus, travel demand models support transport planning, operational planning, traffic engineering and transport policy decisions.

A travel demand model is a model that uses the transport supply, socio-economic data and behavioural parameters in a study area as input data and, based on this, reproduces all traffic-related decisions leading to movements in passenger and freight transport. Passenger transport results from the need or the necessity of people to participate in activities (e.g. work, education, shopping or leisure). In private passenger transport and commercial passenger transport, the decisions therefore include the choice of activities which are then linked to an activity location by a destination choice. Decisions on the choice of means of transport, the choice of departure time and the choice of route then specify the process of moving to the activity location. Freight traffic is the result of logistic decision-making processes that organize the flow of materials and goods between companies and the final customer, including disposal. As a primary result, a travel demand model provides matrices of the supply quality (indicator or skim matrices), travel demand matrices, traffic flows on network elements and routes as well as indicator values of the transport performance (passenger kilometres, vehicle kilometres, passenger hours, loss times). These primary results can be used as input for further model calculations, for example to determine noise and pollution emissions or revenues from ticket sales.

Since the model results are the foundation for a variety of decisions, the users of such models expect an appropriate quality of the results. Based on the observation that different travel demand models are used in practice, whose resulting quality is usually not verifiable by the user of the model results, the

project aims to formulate requirements for the structure and quality of travel demand models. This should serve as a common basis for the practitioners and the developers of travel demand models.

Contents of the project

The structure of the project report is based on the process of developing a model and the subsequent model application. The project report

- gives an overview on travel demand models,

- summarizes the state of research and practice in travel demand modelling,

- describes the scope of travel demand,

- gives recommendations for the development of travel demand models,

- documents suitable data sources for model building,

- formulates requirements for the modelling software,

- proposes quality measures for the verification of model quality,

- formulates requirements for the documentation of travel demand models,

- gives instructions for model application.

In addition to the report, several files are provided as project results to support the model building process. They include three checklists, two documentation templates, one technical specification template, and two Microsoft Excel tools. One tool contains the formulas for the quality measures, the second tool allows you to create application-specific specifications.

Scope of travel demand models and desired model results

A travel demand model is developed for a specific purpose. It should deliver indicators of transport supply and travel demand for the current and for future states. In this way it shall provide a foundation for transport planning decisions. To ensure that a travel demand model fulfils its purpose, model users must formulate their expectations on the model, the developments and measures that are to be modelled as well as the desired outcomes. A checklist is provided for a systematic recording of the requirements.

Information and recommendations for the development of travel demand models

The report focuses on information and recommendations for the development of travel demand models. For 20 topics of travel demand modelling (choice models, trip generation models, destination choice models, mode choice models, simultaneous activity and mode choice models, simultaneous destination and mode choice models, departure time choice models, assignment models for private and public transport, feedback loops between the model stages, use of correction techniques, determination of study and examination area, modelling of socio-economic structure, modelling of transport supply, modelling of travel demand in passenger transport, freight transport and event transport, consideration of sharing services and external transport, forecasts) a collection of information and recommendations is provided to reflect the state of the art in travel demand modelling. The content addresses concrete practical questions which are not dealt with so far. This collection may serve modellers as a reference source for the development of model specifications as well as for the implementation of models.

Data and data sources

For the development and validation of a travel demand model, a variety of data is required: data on transport supply, on the population and land use in the study area, on the mobility behaviour of the population in the study area, on traffic flow in the network (traffic flows and travel times) and travel demand data not calculated by the travel demand model. The data and suitable data sources are described and a checklist for the input data is provided.

Requirements for the modelling software

Travel demand models are implemented by the model developers with the help of modelling software. The validated model is then used by model practitioners for transport planning purposes using the modelling software. The project report formulates requirements for a modelling software and recommends a procedure for a software update.

Quality assessment of travel demand models

A second focus of the report is the formulation of requirements regarding the quality of travel demand models. In contrast to the information and recommendations for the development of travel demand models, there are a number of studies and guidelines for quality assurance.

For the validation of the model results, a new quality indicator SQV is proposed for individual values (e.g. traffic strengths), which builds on an existing quality indicator (GEH). The Coincidence Ratio (CR) is recommended for the assessment of travel distance and travel time frequency distributions and specifications are made for the selection of the indicator (mode-specific or mode-independent travel distance and travel time) and classification (number of classes and class width) of those distributions. With the help of these quality indicators, the match of modelled and observed values for selected values of travel demand (number of trips, travel performance, travel time expenditure, traffic flow) shall be assessed. For the assessment of quality, there is no minimum value specified, but quality ranges ranging from very high to insufficient agreement.

In addition to checking the model results the model behaviour should be checked as well. Therefore, the concept of reality tests and sensitivity tests is adapted from WebTAG and the Travel Model Validation and Reasonableness Checking Manual. Reality tests check the predictive capability of a model by changing the variables of the model. Sensitivity tests examine the influence of the model parameters on the results. This ensures that a model is sensitive to measures and estimates the effects of developments and planned measures as well as possible.

The proposed approach to quality assurance is only partly in line with current practice and more complex than the model tests commonly used today. However, the proposed approach has the advantage that the quality of travel demand models is assessed uniformly and different models can thus be better compared with each other. At present, there is uncertainty as to which quality indicator values can actually be achieved and thus required in tenders. If in future uniform quality indicators are specified and published in model reports, the existing uncertainty can be reduced.

Requirements for documentation

Providing a documentation of the travel demand model is essential to meet the demand for transparency and reproducibility. As with model development and calibration, there are also requirements for model

documentation. In general, all parts of the travel demand model such as scope of the model, model structure, data basis and model validation should be documented. The documentation should include a model manual and a calibration and validation report.

Guidance on model application

The result of the model development is a travel demand model calibrated and validated by the model developer, which can now be used by the model user for transport planning purposes. In the model application, the model variables are changed and the resulting demand effects are calculated. A travel demand model can be used in two ways: for the analysis of the effects of given planning cases and for the development of measures and planning cases.

The project report provides information on the analysis of the effects of given planning cases. The main objective is a model application that is reproducible and comprehensible for third parties.

Conclusion

Good transport planning requires good travel demand models. The project report provides information on what a good travel demand model is and how it should be developed. For such a travel demand model, however, further prerequisites should be fulfilled:

- A detailed model specification that contains all the requirements of the model users and shows how the model should be constructed.

- A comprehensive data base that includes all relevant input data (traffic survey data, settlement structure data and transport supply data).

- An experienced modelling team that can handle data efficiently, understands statistical methods, can estimate model parameters and has already developed travel demand models.

- Clients should allow sufficient time for project work and contractors should schedule sufficient time for project work.

- Technical support by third parties: If not only the finished model is approved by a third party, but also intermediate model stages and the associated model documentation, any shortcomings or misunderstandings can be identified earlier and corrected more easily.