TRANS-TOOLS – TOOLS FOR TRANSPORT FORECASTING AND SCENARIO TESTING

CLIENT: *European Commission, DG TREN*

YEARS: *2004 – 2008*

DESCRIPTION OF ACTVITIES

Objectives of the project

TRANS-TOOLS is a European transport network model covering both passengers and freight, as well as intermodal transport, which overcomes the shortcomings of current European transport network models. The model has been developed starting from the ideas consolidated in the experience of the consortium partners selecting the model features essentially on the basis of the policy needs addressed by the European Commission services.

This results in the following clear innovations obtained from TRANS-TOOLS:

- New set up of a demand/supply model
- Full coverage of Central and Eastern Europe (accession countries and the countries at the borders of the enlarged Union).
- Intermodality for passenger/freight as this is part of the national and European transport policy to promote intermodality through different measures.
- Logistics/freight chain explicitly included.
- Coupling with local traffic in order to address the effect of road congestion.
- Feedback infrastructure development-economy.
- A software approach which results in a modelling tool on network level and GIS based interfacing.

The model structure

The TRANS-TOOLS Model is similar to a traditional four step model including freight and passenger modelling. The main sub-models are:

- Freight demand model
- Passenger demand model
- Assignment model

In additions to these main elements of the model system, the TRANS-TOOLS Model also includes an economic model based on CGEurope and impact models.

The model framework allows feedbacks between the sub-models to achieve equilibrium between supply and demand.

The freight model

For the TRANS-TOOLS trade model, the ETIS O/D freight transport matrix is used as a generation and attraction pattern of the trade flows in the chosen basis year. The ETIS matrix describes the generation and attraction of physical flows of goods between the trading countries and geo-clusters given the economical and institutional determinants of the year 2000. The output of the TRANS-TOOLS trade model is a forecast O/D matrix for freight including origin region, between transhipments and destination region as well as transport mode at origin, between transhipments, and at destination, commodity group and tonnes.

The TRANS-TOOLS modal split model for freight transport is based on the modal split model in NEAC; the modal split model adjusts the stable modal split resulting from the trade model. Output of the TRANS-TOOLS modal split model is a freight matrix, which consists of a forecast O/D matrix including forecast modal split. In the modal split model the market shares of the different modes of transport are estimated for every O/D relation and commodity group. Within the model there are four modes of transport available (road, rail, inland waterway, sea). Choice probabilities of the available modes per commodity group for every O/D relation are determined by using a multinomial logit model. The working of the TRANS-TOOLS logistic module is based on SLAM. This module makes it possible to evaluate the impacts of changes in the logistic and transport systems within Europe on the spatial patterns of freight transport flows, through changes in the number and location of warehouses for the distribution of goods. The logistic module produces output that is to be used in the assignment model as well as in the economic model. For the assignment

model the logistic module produces unimodal transport matrices (Origin, destination, mode, tonnes, vehicles). The economic model needs generalized and monetary costs per origin, destination and commodity type.

The passenger model

The passenger demand model, mainly based on experiences of VACLAV and ASTRA, covers the first three steps of the classic four-step-approach, which are trip generation, trip distribution and modal split. The trip distribution process in ASTRA depends on results of the modal split stage. Hence a feedback mechanism from VACLAV to the trip distribution module is prepared to transfer average generalised times to the trip distribution logit function. Trip generation as the first stage of the classical four-step transport modelling approach is implemented in ASTRA. After the generation of trips emanating from European NUTS3 zones these trips are distributed among destinations. The spatial trip distribution is represented by the second stage of the IWW transport modelling approach.

In the third step the mode for the travel is chosen. Hence impedance data from the TRANS-TOOLS assignment model as well as O/D matrices per trip purpose from the ETIS database are applied. Travel costs, travel time and information about the trip itself like frequencies and number of transfers are used to split the trips between the modes for each origin-destination pair. A non-linear logit function is used in order to calculate the choice probability. Output of TRANS-TOOLS passenger demand model to assignment model are unimodal passenger O/D transport matrices at NUTS3 level in number of passengers per mode (rail, road, air) and trip purpose as well as unimodal passenger O/D transport matrices at NUTS3 level in number of vehicles for road relations per trip purpose. The level of service-matrix with generalised costs per O/D relation represents the output from TRANS-TOOLS passenger demand model to the economic model.

The assignment model

The network assignment module produces the direct output from the TRANS-TOOLS Model. However, the model also generate level-of-service data (LOS) as input to passenger, freight, and logistic models in a feed back loop. In the TRANS-TOOLS Model, transport networks are defined at unimodal level. Four assignment models are thus developed within the TRANS-TOOLS Model: the road assignment (passenger and freight), the rail assignment (passenger and freight), the inland waterway assignment (freight) and the air assignment (passenger).

Passengers by rail and air and freight by rail and inland waterways are assigned based on an average day, since congestion is not considered and information on service data differentiated by time and day is not available. LOS in the road assignment is calculated by time period. In TRANS-TOOLS, a stochastic assignment procedure is applied being founded on probit-based models.

The economic model

The future developments by NST/R related sector of the economy of each region of the EU are the outcome of the TRANS-TOOLS economic model CGEurope. Sectoral developments, as effects of policy scenarios, are predicted by the model in monetary terms. The computed relative changes of economy by sector with respect to the baseline scenario are passed on to the NEAC model. Policy evaluation measures, in particular real GDP impacts and equivalent variation, by region, year and scenario are further outputs of the TRANS-TOOLS economic model.

The impact models

The impacts models are used to calculate energy consumption, emissions, external costs and safety based on output from the assignment model.

The role of TRT

Within the project, TRT has been the leading partner for the implementation of data input and co-operated also in the definition of modelling procedures and the development of the freight module.

The Consortium

The TRANS-TOOLS project is led by TNO-INRO (NED); other members of the consortium are TRT Trasporti e Territorio (ITA), Christian-Albrechts-Universität zu Kiel (DEN), Universitaet Karlsruhe (GER), Joint Research Centre – IPTS Seville (SPA), Danmarks Tekniske Universitet (DEN) and ISIS - Istituto di Studi per l'Integrazione dei Sistemi (ITA).