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ScienceDirect

Transportation Research Procedia 11 (2015) 515 – 530

Transportation Research Procedia

www.elsevier.com/locate/procedia

10th International Conference on Transport Survey Methods

An innovative integration methodology of independent data sources to improve the quality of freight transport surveys

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Abstract

Past experiences show that data of the official Austrian freight transport statistics are often underestimated. Therefore, a methodology was developed, merging existing independent road freight transport data to a consistent and valid road freight matrix. The methodology comprises four steps, using data of the Austrian and European freight transport statistics, data of roadside interviews of truck drivers, and data of counting stations and toll gantries. The methodology was applied to data from the year 2009. Results show the reliability and plausibility of the methodology, indicated by a high correlation with high quality roadside traffic counts.

Peer-review under responsibility of International Steering Committee for Transport Survey Conferences ISCTSC

Keywords: freight transport statistics, freight transport modelling, data reliability, data validation

1. State-of-the art and state-of-practice data collection and data processing for freight statistics

Freight data are mostly based on sample data collections at a national level. To render meaningful results, the data from the sample need grossing up to the relevant population, and a weighting procedure is required. This can be done by "traditional" grossing up procedures which do not use origin-destination (OD) or route-information. The

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Peer-review under responsibility of International Steering Committee for Transport Survey Conferences ISCTSC
doi:10.1016/j.trpro.2015.12.043

results are only based on information drawn from the sampling variables, e.g. the ownership rate of heavy goods vehicles (Eurostat 2011). An alternative is a weighting and grossing up procedure which uses information about origin-destinations (OD) or route-information of trips. The required information is commonly supplied by freight transport models; however, this procedure might be associated with a modelling error. Validating the result by using independent counting data instead is an alternative, but this approach is rarely used.

Most countries use (freight) transport models for infrastructure planning as well as for any impact assessment of possible legal and fiscal transport policies. Freight transport models require an origin-destination-matrix of transport flows. These matrices can be derived from economic data showing the locations of production and consumption of goods and the commodity flows between these locations. In this context, the OD-matrix is a result mainly of three steps of a multi-step approach, including trip generation, trip distribution, and modal split, but it does not take any network assignment into account. Transport models using economic data are more suitable for predictions since forecasts of economic developments are more accurate than forecasts of transport flows. However, these models have to model logistic choices with regard to several aspects, such as size of inventory, shipment size, loading unit, or trip chains. This makes them quite complex, synthetic, and often empirically not well founded (Tavasszy et al. 2012). Alternatively, other transport models use OD-matrices gathered from commodity flow surveys. Data are processed by statistical means and fed into transport models (de Jong et al. 2012). Hereafter, a literature review of selected examples is documented, which uses freight transport models for grossing-up and weighting of freight survey data as well as for a validation by independent traffic counts. Admittedly, it is very difficult to get detailed information on the grossing-up, weighting, and validation procedures for freight transport surveys and statistics. The result of the literature review indicates a lack of published methodology for freight transport issues.

The freight transport model of the Netherlands, which is part of the national transport model, follows the traditional four-step-model approach. A particular feature of this model is the consideration of logistics activities: an econometric model describes the spatial and functional relationship between production and distribution of goods based on a gravity model (Tavasszy et al. 2010). SLAM (Spatial Logistics Appended Module) is an additional tool which enables an optimization of logistic centres in Europe. Main task of this module is the transformation of economic OD-relations between different regions (based on economic models) into freight transport volumes. Results of the SLAM module are used as input for the transport model in order to calculate a modal split and transport routes (Combes and Leurent 2007).

In France, the freight data are based on the national commodity flow survey and data provided by Eurostat. The French national transport model (MODEV) includes passenger mobility as well as freight transport and is used for weighting and validation. It uses a 4-step approach. Trip generation is the result of a regression model, using cross-sectional data for estimating purposes. A gravity model is used for the distribution, and an aggregate logit model for the modal split, taking road, rail, combined road-rail, and inland waterway transport into account. The calibration of the model is mainly based on the national commodity flow survey and data provided by Eurostat but also on freight traffic counting (de Jong et al. 2012).

The U.S. Freight Analysis Framework published by the U.S. Department of Transportation provides OD-matrices of freight transport volumes by traffic types (domestic, transit, origin, and destination traffic), transported goods, and transport modes (road, rail, ship, air, multimodal transport). The main data source is a commodity flow survey among enterprises in selected sectors of trade, conducted every 5 years (U.S. Census Bureau 2011, U.S. Department of Transportation 2015). However, certain sectors, such as the construction industry, retail, and foreign trade are not covered. These “out-of-scope” flows are estimated by including further data sources (data of industrial output, the employment rate, regional indicators etc.). For example, the freight transport volume of the retail sector is estimated based on input/output information of the national accounts. The commodity flow survey is the most important data source, but additional ones are used as well (Krieger 2011):

- roadside interviews of truck drivers,
- license plate matches at ramps of highways,
- weigh-in-motion measuring by slap detection on highways,
- GPS data of trucks, transmitted automatically and anonymously.

Missing values of the OD-matrix are calculated by using an iterative log-linear model to compensate for deviations from the total flow of goods reported in the commodity flow survey. Data of waterborne commerce,