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A Population Simulator and Disaggregate Transport Demand Models for Flanders

Michiel de Bok^{a*}, Gerard de Jong^a, Jaap Baak^a, Eveline Helder^a, Cindy Puttemans^b, Kurt Verlinden^b, Dana Borremans^c, René Grispen^c, Joris Liebens^c and Marthe Van Criekinge^c

^aSignificance, Koninginnegracht 23, 2514 AB The Hague, the Netherlands

^bMINT, Hendrik Consciencestraat 1b, 2800 Mechelen, Belgium

^cVerkeerscentrum, Department MOW, Flemish Authorities, Lange Kievitstraat

Abstract

The Fourt Generation of Strategic Passenger Transport Models for Flanders are being developed to meet three objectives. It includes a Population Simulator to generate reliable population inputs for a disaggregate demand model, the demand model is based on disaggregate tour-based mobility demand model, which also includes a departure time choice model to improve the sensitivity to increasing congestion and congestion charging. Finally the model is updated to the base year. This article describes the development of the population simulator and mobility demand model. The population simulator simulates the demographic evolution of the Flemish population from 2001 to the new base year 2013 and subsequently for a given year in the future. The disaggregate choice models in the mobility-demand model are estimated on the OVG and OWoWi surveys. The presented demand models are being implemented in a microsimulation application. In effect, the passenger transport model is sensitive to changes in the composition of the population and infrastructure developments.

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* Corresponding author. Tel.: 31-70-312-1541; fax: +31- 070-3121531.
E-mail address: debok@significance.nl

1. Introduction

The Flemish Authorities use five provincial passenger transport models as a planning tool to support decision making on middle to large scale infrastructure projects, public transport schemes, land use plans and general mobility policy measures. The provincial models are continuously updated and currently the fourth generation is under development. This fourth generation is developed to meet a broad set of objectives and purposes: at first, the overall transport model needs improvement of all sensitivities in order to meet upcoming evaluation requirements. This includes flexible implementation of all choices on tour level with integrated destination, time and mode choice, as well as the inclusion of attributes on individual and household level explaining the global sensitivities. In this process, the dependency of observed origin-destination data from census data as a structural component of the model needs to be alleviated. Moreover, a make-over of both base and reference forecast years is necessary, as well as an update of both networks and assignment techniques.

The fourth generation strategic passenger transport models for Flanders is currently under development and will qualify as disaggregate tour-based models, meaning that most of the submodels refer to round trips. Both home-based and non-home-based tours are distinguished and also the distinction is made between primary and secondary tour destinations. In application of the model system, these choice models are applied at the level of individual persons using discrete micro-simulation instead of sample enumeration on a prototypical sample (Daly, 1998), which is common practice in most existing tour-based models. For this purpose, the fourth generation models include a newly developed population simulator that simulates the evolution of the size and composition of the population over time.

First the paper will present the origin, development and applicability of the Flemish strategic passenger transport models (Section 2). The paper will present an international review of the work done in transport on dynamic population simulators and a description of the new population simulator for the Flemish situation (Section 3). It will also present the tour-based demand model (Section 4). The functionalities in the demand model and process of model estimation are illustrated by discussing the estimation results for the mode/destination/time-of-day choice models and some key results (e.g. elasticities) of a selection of choice models. Finally, the paper concludes with a discussion and outlines further research (Section 5).

2. The Flemish strategic passengertransport models

2.1. Provincial traffic models version 3.6.1

At this moment, the Flemish Authorities use the five provincial traffic models version 3.6.1 (Verkeerscentrum, 2013) for the preparation and support of decisions on large scale infrastructure projects or transport policy measures. These traffic models are frequently and successfully applied in planning studies of large scale infrastructure projects. Some examples are the study on the environmental effects on planning level (Plan-MER) for a completion of the bypass around Antwerp (Verkeerscentrum, 2014) and for the enlargement of the bypass around Brussels (Verkeerscentrum, 2010), as well as a study on the strategy on mobility and transport in the region of the airport of Zaventem (close to Brussels). Most of the applications deal with a rather more operational level than a strategic one. Therefore the provincial traffic models, where the study area is more or less the province, are built with detailed zones (2000 to 3000 zones per model), a rather fixed commuting pattern based on the population census 2001 and an assignment with junction modelling.

The provincial traffic models version 3.6.1 have base year 2009 and forecast year 2020. Their network and zoning system covers Belgium and a part of France, the Netherlands and Germany. These models are based on classical four-step traffic models, but contain a lot of detailed data and further developments, such as a supply-demand equilibrium, a combination of techniques for the production-attraction, etc.

On the real strategic level, a passenger transport model for the whole of Flanders version 1.1 was built in the late nineties. It was used for a study on the strategy on traffic policy in Flanders (the first design 'Mobiliteitsplan Vlaanderen'). This strategic model at the level of Flanders was not developed further and is outdated at the moment.

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