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Improving projects evaluations in analyzing transport models ability to explain the past

Crystal Langlois^{a,*}, Vincent Leblond ^a

^a RATP, 54 quai de la Rapée, 75 599 Paris Cedex 12, France

Abstract

GLOBAL, the RATP transportation model, was recently updated to its 9th version. This was the opportunity to reconsider its methodology, and, more generally, the relevance of four-stage models for medium-to-long term planning studies. Indeed, a model's validity is generally assessed through its ability to replicate traffic counts. Considering that a good replication of the present leads to an accurate forecast of the future is an important assumption. It mainly implies a hypothesis of stability of mobility behavior, which could be questionable, and even more when many parameters are used, as it is the case for a large and complex network. The issue was addressed by carrying out the exercise in reverse, that is to say by analyzing the model's ability to explain the past. GLOBAL 9th version, estimated using the 2010/2011 Parisian household travel survey has been applied on all the past household survey years (1976, 1983, 1991 and 2001). This way, estimates could be compared with survey results in terms of demand volumes, mode shares and also with past public transport counts on main railway lines.

The analysis of the discrepancies between the estimates and survey results clearly shows the limits of the mobility behavior stability hypothesis. Indeed, this assumption gives the model a high inertia, which is important to keep in mind when examining and interpreting modelling results. However, the discrepancies of predicted demand flows versus observed ones stay within an acceptable range. The exercise was then a good illustration of the uncertainties associated with the modeling results.

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* Corresponding author. Tel.: +33 (0)1 58 78 24 17; fax: +33 (0)1 58 78 23 10.

E-mail address: Crystal.Langlois@ratp.fr

1. Introduction

In the 1970s, RATP began the internal development of GLOBAL, its transportation model (Labbe & Scherrer, 1975; RATP, 2013-2014). It is an aggregate 4-stage multimodal model. Since then, while the public transportation network was evolving, the model has been greatly improved and new features have been added. It has been used in many projects of urban railways, subway extensions and recently for trams.

However, the development of a model involves finding a balance between its complexity and its ease of use and interpretation. Indeed, it is very important to keep it understandable to the users. In order to guaranty the model relative simplicity, some simplifications in algorithms have been made. For instance, one of the main simplifications is probably the stability hypothesis of mobility behavior over time. Indeed, the model parameters are only estimated for the calibration situation, using the data of the last travel survey available, considered as the most representative of the mobility practices (Cabrera Delgado & Bonnel, 2012). Most of time, no variability is taken into account when future horizons are modelled, even though the analysis of travel surveys reveals changes in behavior over common forecasting horizons, that is to say ten to twenty years. This stability assumption could thus be questionable, and even more when many parameters are used, as it is the case for a large and complex network like the Parisian one. The consequences of these simplifications on modelling results are still poorly understood. Yet it seems important to keep them in mind, especially as traffic forecasts help evaluate the effect of a new policy or estimate the size of the future infrastructure over (very) long-term horizons.

In this context, GLOBAL update to its 9th version was an opportunity for us to reconsider the methodology of our model, and, more generally, the relevance of four-stage models for medium-to-long term planning studies. In this paper, it is proposed to address this issue by carrying out the exercise in reverse, that is to say by analyzing our transport model ability to explain the past. GLOBAL, which 9th version has recently been estimated using the 2010/2011 Parisian household travel survey (Enquête Globale Transport – EGT), has been applied on all the past household survey years (1976, 1983, 1991 and 2001). This way, estimates could be compared with survey results in terms of volumes, mode shares and also with past public transport counts on main railway lines.

2. The back-casting analysis

A back-casting analysis consists in testing a model's capability to correctly predict observed changes in the demand pattern. In Ile de France, the six household travel surveys allow monitoring the evolution of mobility practices in the region. They display several changes in behavior, making appropriate this exercise. Thus, the volume of trips during morning peak hours significantly increased between 1976 and 2010 (about +1% per year). This evolution has been accompanied with both changes in the geographic distribution of the trips (the weight of suburbs-to-suburbs trips has been risen since 1976) and, more recently, a trend break regarding modal share. Indeed, 2001 marked the end of the increase of car use in favor of public transports (Observatoire de la mobilité en Ile-de-France; Simeon, 2014)

2.1. Literature review

A backcasting analysis may follow two different approaches. The first one consists in “predicting the past” by applying the model to a horizon preceding the calibration one. This is the exercise described in the paper. The second method is to “predict the present starting from the past” applying the model, calibrated on past data, to the present year, for which observed data are also available for comparison.

Regarding the first method, we can mention that the TMIP manual on travel model validation underlines the importance of temporal validation, and considers that, to do so, backcasts can be used (Federal Highway Administration TMIP, 2010). As stated in the manual this validation is all the more important as the horizon of study is long-term, or as changes of the transport systems are important.

In addition, two examples of backcasting analysis can be named. The first one was conducted as part of the validation of the UK National Transport Model (NTM). This analysis was “judged the most valuable source of validation evidence of the general forecasting reliability (strengths and weaknesses) of the NTM” (Gunn, Miller, & Burge, 2006). The NTM was applied on two backcast periods: 1991, which corresponds two a ten-year retrospective,

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