Goudappel

MOBILITY MOVES US

VACANCY: Hybrid traffic assignment approach

ABOUT GOUDAPPEL

At Goudappel and Dat.mobility we are experts in the field of mobility. We connect our expertise on integrated solutions for the journey of today and the world of tomorrow. We contribute to accessibility, quality of life, safety, sustainability and economic vitality in the Netherlands and abroad.

Within our organization, we think highly of students and attach great value to interns and graduates. New ideas arise and innovative research is carried out by the new generation of mobility experts. This keeps our organization fresh and ensures that knowledge can be shared. In addition, your internship or graduation theses can be an interesting start to your career. You might be our future colleague!

INTRODUCTION

Transport models are important decision tools on strategic, tactical and operational level to determine the impact of measures and to forecast the future usage of the mobility system. These models model the behavioral choices of travelers via several steps. The traffic assignment model is typically the last step which determines the routing of travelers within a network based on the utility (of which travel times is an important aspect) of the routing options available and therefore the resulting traffic operation. Within strategic models we traditionally use the economic principle of utility maximization formulated by the Wardrop user equilibrium principle. Next to the fact that this reflects the way travelers in general behave within a transport system to a large extent, the advantage is that when comparing scenario's the system behavior is the same and therefore the impact found is the result of scenario differences. However, there are several assumptions of this principle, like rationality in behavior, which in practice are proven to be less true. Although traffic assignment is the last step other behavioral models within the transport model could, depending on the model architecture, also need input which is typically the outcome of this

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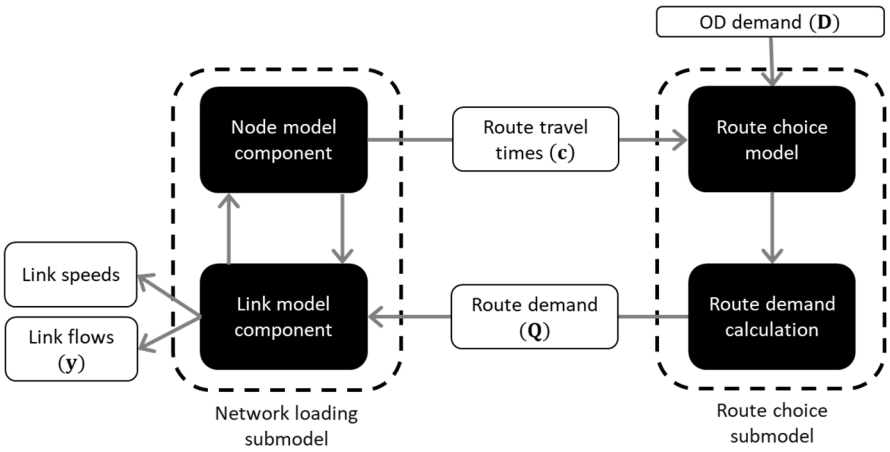
assignment (i.e. travel times) when feedback loops are taken into consideration. The assignment can be formulated as an optimization problem and consists in general of two submodels (see figure below). The route choice submodel (right) which determines the route demand and the network loading (left) submodel which determines the travel times, given the route demands.



PROBLEM DESCRIPTION

To be able to determine the user equilibrium within transport models various algorithms exist which in general needs most computation time of a transport model. In fact, these computation time can be very high resulting in several hours of computation time to run a single traffic assignment in a large model. In most cases the assignment model algorithm uses an iterative approach of route choice and network loading to approximate the equilibrium.

Especially when the network loading model includes detailed phenomena like congestion and junction delay, the required number of iterations increases, whereas these more advanced network loading models also need more computation time per iteration to be able to provide more accurate description of traffic operation and thereby travel times. Furthermore, inclusion of these detailed phenomena can result in conditions in which there exists multiple equilibria and difficulties with convergence.

When using simple network loading models (i.e.: link travel time functions as assumed since (Beckmann et al., 1956)) these latter problems do not occur and in addition several time efficient assignment algorithms for these models have been

developed in the recent past (e.g. origin-based assignments (Bar-Gera and Boyce, 2002), TAPAS (Bar-Gera, 2010) and LUCE (Gentile, 2009)).
Given this knowledge the question is can we combine the benefits of using a simple network loading model to determine the user equilibrium with an efficient algorithm and use the resulting routing to run a more realistic network loading model as a next step to determine the final resulting traffic operation within the network.

RESULT / OBJECTIVE

The objective is to determine if such hybrid approach should be considered in practice to be used, given the inevitable inconsistencies between route choices (from the simpler model) and traffic operation (from the more advanced model). Algorithmic descriptions of the candidate 'simple' models to be used for route choice, along with their performance on various instances are given in (Perederieieva et al., 2015, 2013); software implementations are available from https://github.com/olga-perederieieva/TAsK.
Ideally, two 'more advanced' network loading models are to be considered: STAQ (Brederode et al., 2019) and eGLTM (Bliemer and Raadsen, 2018; Raadsen and Bliemer, 2018); both models are available to the student through our OmniTRANS transport planning software.

ASSIGNMENT

Development of a hybrid traffic assignment procedure and investigation of the advantages and disadvantages of such approach in practice. Research should focus on benefits in terms of computation time, convergence and existence of one equilibrium and the consequences for calibration and the resulting non-equilibrium conditions due to the final run. If time allows a comparison of these non-equilibrium conditions with reality could be conducted.

INFORMATION

When interested in this internship assignment please contact: Luuk Brederode or Luc Wismans lbrederode@dat.nl or lwismans@goudappel.nl.
More information on Goudappel and DAT.Mobility can be found via www.goudappel.nl and www.dat.nl.