

M.Sc. Thesis Internship “Dynamic Traffic Management and Road Pricing”

Company: Centrum Wiskunde & Informatica (CWI) Amsterdam and De Verkeersonderneming
Supervisors: Prof.dr. Rob van der Mei (VU/CWI) and Prof.dr. R. Nunez-Queija (UvA/CWI)
Location: CWI, Science Park 123, Amsterdam
Timeframe: Spring 2019 (6 months)



Problem description

Road congestion is one of the main problems in our modern society, and an often talked-about subject. An effective means to reduce and mitigate road congestion is to steer traffic toward minor roads in the network. Recently, this so-called **dynamic traffic management** (DTM) has been successfully applied in the Rotterdam area, leading to some 14% reduction of congestion hours. However, despite the progress that has been made, many challenging questions remain. For example:

- “What will be the effects of imposing tolls on roads (road pricing)?”,
- “What is the impact of time-varying toll?”,
- “How does flexibility in the arrival times influence departure-time choices of people?”, and
- “How to choose a route and a departure time to reach the dynamic user equilibrium?”.

Research project

In this project, we aim to develop and analyze new bottleneck models, in which we aim to minimize ‘travelling cost’, which involves penalties for deviations from individual travellers’ preference time and for delay. The cost parameters can be obtained from real data provided by De Verkeersonderneming. We assume that individuals attempt to minimize travel time and scheduling delay up to the point that no one can decrease his/her cost by altering his/her departure time from home. Moreover, in a network of roads, we can let the drivers update their choices of route (from A to B) as well. Interestingly, it has been shown that commuters tend to adjust departure times more readily than they do routes. In this context, typical research questions that we aim to tackle are:

1. How to develop a quantitative optimization model that includes individual preferences and flexibility of travelers with respect to early or late arrivals and that determines the best choice of the route and the departure time of travelers?
2. What will be the game-theoretical equilibrium depending on the ‘strategy’ and preferences of travellers?
3. How to develop a model for road pricing with time-varying tolls that provides the right incentive for travelers?

Collaboration between De Verkeersonderneming and Centrum Wiskunde & Informatica

The internship is part of a research collaboration between De Verkeersonderneming and the National Research Institute for Mathematics and Computer Science in the Netherlands (CWI) in the context of the research project DYNAFLOAT. You will receive an internship contract with CWI, but will also work at De Verkeersonderneming for once per week. You will be supervised by Prof. Rob van der Mei, Prof.dr. R. Nunez-Queija and Sara Ghazanfari (CWI).

Requirements

1. The student should have a background in mathematical modeling and statistical analysis.
2. The student should be comfortable with computer programming and comfortable with exploring datasets in order to analyze and model historical trends.
3. The student should be able to take initiative and work independently.

4. The student should enjoy applying mathematical knowledge to real-world practical problems.

Compensation

The student will receive an internship contract via CWI and will receive standard internship compensation per month. For more details about the assignment, please phone or mail to Prof.dr. Rob van der Mei (mei@cwi.nl, 06-13492229).