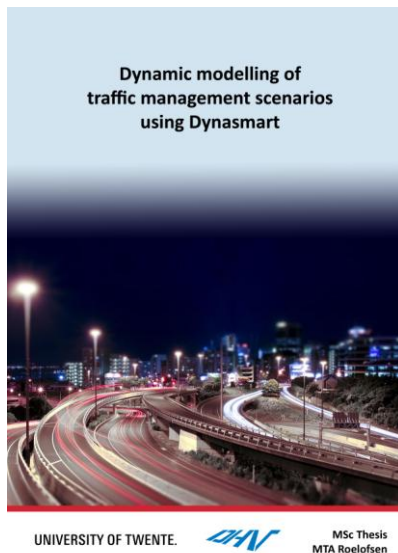# Dynamic modelling of traffic management scenarios using Dynasmart

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The Dutch national government aims towards a more efficient use of the current infrastructure network in order to resist the increasing traffic issues that arise from our growing urge for mobility. Nowadays, dynamic traffic management (DTM) shows to be an effective means to optimize the use of current network capacity by better distributing traffic in time and space. A script that prescribes how, when and under what circumstances a coherent set of traffic management measures is activated is referred to as traffic management scenario or Traffic Responsive Plan Selection (TRPS, Dutch: *Regelscenario*). The current Regelscenario design process is developed by Rijkswaterstaat and comprises a qualitative approach of expert knowledge and experiences. This qualitative method particularly aims for stakeholder involvement and satisfaction. However, without undermining the importance of the qualitative procedure, additional quantitative input might benefit both the course of the process and the process outcome. Therefore, the goal of this research is to find out how the dynamic traffic model *Dynasmart* can be a functional tool for ex-ante evaluation of Regelscenario's.

The first step in the research method is to provide an overview of the functionalities that Dynasmart offers regarding the modelling of Regelscenario's. In dynamic modelling, it shows that model functionality largely depends on the representation of driver's individual route choice behaviour. A literature based analysis benchmarks the functionalities of Dynasmart in modelling route choice behaviour. A case study on the port of Rotterdam area is then executed to find out how Dynasmart can realistically model Regelscenario's. The Regelscenario's that operate in practice are also implemented in the model in order to define a method for the dynamic modelling of Regelscenario's. Additionally, interview sessions with stakeholders and future users are held to identify the applicability of the Dynasmart model in the different process steps for designing Regelscenario's. Finally, these interview session were also used to determine the benefits of the model in these process steps.

The key factors that affect route choice are static driver characteristics, inertia and travel information. These factors are satisfyingly covered in the Dynasmart algorithm via respectively the introduction of users classes, the boundedly rational decision rule and the deployment of VMSs. Other less significant factors are however underrepresented in the model. The individual route choice mechanism enables the model to actually simulate the effects of DTM measures, whereas in certain other dynamic models the estimated effects have to be provided as model input. Nonetheless, the user still needs to define the driver's knowledge level as model input, which indirectly affects route choice behaviour.

Interpretation of the case study model output reveals that Dynasmart is able to significantly capture the effect of guidance measures with a seemingly plausible order of magnitude. Simulated VMS effectiveness is however reduced due to the driver's omniscient and fully rational actual shortest route

selection upon departure. Furthermore, the Dynasmart route choice algorithm serves an increase of scale from simulating a single DTM measure to simulation of a coherent set of measures. (i.e. a complete Regelscenario). However, a pragmatic iterative procedure via the introduced scenario manager is proposed in order to correctly simulate the effect of triggers, which concerns (de)activation of measures. Regarding the interpretation of model output, this research explains that a statistical analysis is preferred in order to anticipate to model randomization, which represents day-to-day variations in traffic flows.

From the interview sessions, we conclude that Dynasmart can be beneficial in both the process outcome and the course of the process. Compared to current practices based on expert knowledge and experiences, Dynasmart can contribute to a better process outcome by revealing negative side effects on the secondary road network that result from DTM deployment elsewhere in the network. Additionally, estimating the effects that the interactions between multiple measures have, goes beyond the rational capacities of the involved stakeholders. In this way, Dynasmart can support the project team to develop a set of measures that shows synergy. A remark is that a model will always be a simplified representation of the complex traffic interactions, which limits its role to a decision support tool rather than a decisive factor for policy development. Regarding the course of the process, Dynasmart can operate as a mediator between different stakeholders of the project team. Besides, Dynasmart can provide extra persuasiveness in the communication towards decision makers. These benefits can particularly play a role on a tactical and operational level. Translated to the Regelscenario design process this means that Dynasmart can be supportive in the *prepare* and *develop* steps. However, a practical issue is that increasing the simulated network size also leads to a rapid increase of computational efforts. Simulation times can consequently easily increase from 10 to more than 90 minutes per model run. This finding hampers application of the model during workshop sessions of the project team. A possible solution is to work with both a fast conceptual model for a first impression of DTM effectiveness during workshop sessions, and a detailed version that provides comprehensive output during further analysis. Alternatively, the Regelscenario design process can be adapted to fit to these practical preconditions. From this discussion we conclude that the costs and benefits for applying Dynasmart depend on the project specification. Dynasmart application should thus be specifically reconsidered for every DTM project.