DTU Management Engineering
Department of Management Engineering

Robustness in Railway Planning

Simon Bull, PhD project

Project context

This PhD project is part of the larger RobustRailS project, which is concerned with improving punctuality and reliability of the rail transport system. Rail is a green and efficient mode of transport, and to sustain future growth in passenger journeys rail must be a valid alternative to travelling by car. RobustRailS considers all aspects of rail operations, and the research is performed by several departments across multiple fields with strong links with rail operators.

RobustRailS has a clear focus on the robustness of rail systems. Generally, a system's robustness is its capacity to operate when faced with unexpected occurrences, but this may be defined or measured in many different ways.

This PhD project applies operations research methods to planning problems in passenger railway operations, with the goal of facilitating the inclusion of robustness when creating plans. The project works closely with the Danish rail industry, using real data for DSB and DSB S-Tog.

Investigating Robustness

There are several planning problems in rail that are often solved sequentially, with different objectives used for each. No single definition of robustness can be given that is appropriate across all problems, and in fact for any particular problem there are many different definitions used by researchers and in the industry. We investigate how these different measures of robustness are used and how they are incorporated into planning, and consider how they may fit into a larger framework of rail related robustness.

Incorporating Robustness

The rail planning problems themselves are complex optimization problems, with many stakeholders and unclear objectives. We consider the following planning problems in railway operations:

- Line planning
- Timetable generation
- Rolling stock planning

We apply operations research methods to the solving of these problems, in the case of line planning developing an optimal method for finding line plans that are favourable for passengers.

We develop a framework for integrating line planning and timetabling, addressing the concern that optimal line plans may only facilitate the creation of sub-optimal timetables, or timetables that lack robustness.

In rolling stock planning we consider two specialized sub-problems and again apply operations research methods to solve these, with consideration given to robustness.

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Collaborating partners:

DSB

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1 May 2013 to 31 April 2016

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