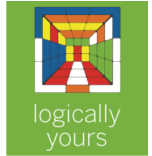


Peter Sels

Department	Department of Mechanical Engineering
PhD defence	03 May 2016
Supervisor	Prof. dr. ir. Pieter Vansteenwegen
Co-supervisor	Prof. dr. ir. Dirk Cattrysse
Funding	Logically Yours BVBA
E-mail	sels.peter@gmail.com



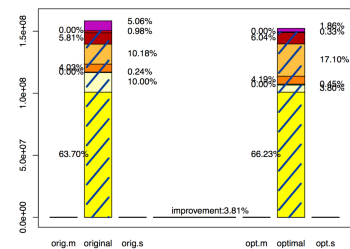
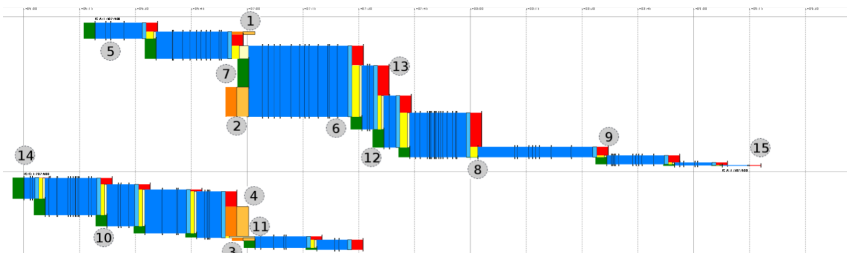
Large-Scale, Passenger Oriented, Cyclic Timetabling & Platforming & Routing

Introduction / Objective

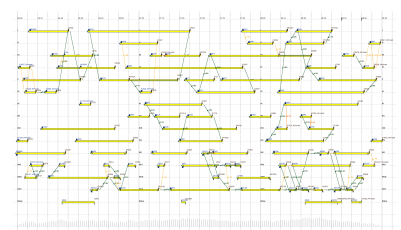
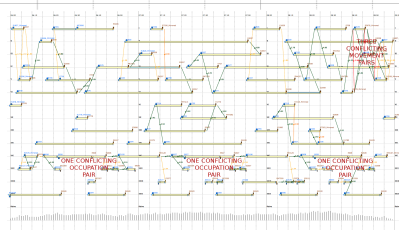
At Infrabel and in general current railway practice today, both the train timetable and the assignment of trains to platform tracks and corresponding routes in stations are still done manually. We developed two tools to automate this. Especially for timetabling, the state of the art in research had to be advanced to make this possible. It is the first time that a timetable that minimises expected passenger time in practice has been automatically produced for an entire country.

Research Methodology

Timetabling was tackled via first (i) *reflowing* all passengers over the graph of trains via a parallel modified Dijkstra algorithm and then (ii) *retiming* via a Mixed Integer Programming Linear (MILP) Model. This model contains *constraints* as: every train should be planned so that it is repeatable with a period of exactly 1 hour and leaving 3 minutes between every pair of subsequent trains. The *objective function* is expected passenger time in practice and is minimised.



For platforming, we used a MILP model imposing train couple separation on both platforms and routes and an objective of maximisation of platformed trains.



Results & Conclusions

- Our timetable of all (196) Belgian passenger trains promises a 3.8% reduction of passenger time.
- Our timetable of all (88) Danish trains promises a 2.9% reduction of passenger time.
- For both, the average probability of a passenger missing a transfer is reduced from more than 10% to less than 3%.
- Automatic generation takes 2 hours and 1 hour respectively.
- All Belgian stations can now be platformed and routed in just 10 minutes.
- Our tools produce flawless plans, will save human planners time and allow them to try out more different configurations.

Major publications

P. Sels, P. Vansteenwegen, T. Dewilde, D. Cattrysse, B. Wacquet, A. Joubert (2014). "The train platforming problem: The infrastructure management company perspective". *Transportation Research Part B: Methodological* (61), pp. 55-72.

P. Sels, T. Dewilde, D. Cattrysse, P. Vansteenwegen (2016). "Reducing the passenger travel time in practice by the automated construction of a robust railway timetable". *Transportation Research Part B: Methodological* (84), pp. 124-156.

