Developing Railway Timetables that Guarantee a Better Service

P. Vansteenwegen (speaker) and D. Van Oudheusden

Pieter Vansteenwegen, Research Assistant at Centrum voor Industrieel Beleid, Katholieke Universiteit Leuven, Celestijnenlaan 300A, 3001 Leuven, Belgium

Pieter.Vansteenwegen@cib.kuleuven.ac.be

Prof. Dirk Van Oudheusden, Professor at Centrum voor Industrieel Beleid, Katholieke Universiteit Leuven, Celestijnenlaan 300A, 3001 Leuven, Belgium

Abstract

The goal of this research is to develop a good technique for creating robust railway timetables. A good timetable in this case, must provide a good service for the passengers. In order to obtain a good service, a waiting cost function is constructed and minimised. This cost function weighs the different types of waiting and late arrivals by using some value of time measurement. The technique is developed for a small part of the Belgian Railway Network.

A first step assures that all the important connections are scheduled well as far as possible. A well scheduled connection ensures that changeover passengers do not have to wait too long before leaving on the connecting train. The disadvantage of well scheduled connections is that any late arrival of a train may cause a missed connection.

For this reason, ideal buffer times are calculated for the connections. Where necessary, these buffers will safeguard the connection if the arriving train is a little late. These buffer times are based on the distribution of the delays of the arriving train and on the weighing of the different types of waiting. Different types of waiting, by different types of passengers are weighed to determine the ideal buffer time. With a larger buffer for instance, passengers staying in a certain train will have to wait longer and passengers changing over will have a smaller chance of missing their connection.

In a third step, a new timetable is built by linear programming. This timetable has well scheduled connections and includes, where possible, the ideal buffer times. The objective function of the linear program is a waiting cost function. Waiting of trains in a station and deviations from the ideal buffer times are important factors in this cost function.

The result is a timetable with well scheduled connections and a waiting cost that is 40 percent lower than with the current timetable. This technique is also very promising for developing better timetables for very large railway networks since the LP model can be efficiently solved in an acceptable computational effort.

Keywords: Timetabling, Robustness, Linear Programming, Railway Connections, Buffer Times