Multi-period railway timetabling to serve time-dependent demand

van der Knaap, Renate J.H.; van Oort, Niels; Goverde, Rob M.P.

Publication date
2025

Document Version
Final published version

Citation (APA)
van der Knaap, R. J. H., van Oort, N., & Goverde, R. M. P. (2025). *Multi-period railway timetabling to serve time-dependent demand*. Abstract from RailDresden 2025: 11th International Conference on Railway Operations Modelling and Analysis, Dresden, Germany.

Multi-period railway timetabling to serve time-dependent demand

Renate J.H. van der Knaap, Niels van Oort, Rob M.P. Goverde
Delft University of Technology, The Netherlands; r.j.h.vanderknaap@tudelft.nl

Passenger railway demand fluctuates daily, peaking at the start and end of the workday due to commuting to school and work. During the off-peak the volumes drop and most people travel for other purposes, like leisure and social visits, which results in different travel destinations. Despite this, many European Railways use fixed line plans and cyclic timetables that remain constant throughout the day. While this approach makes schedules easy to remember and provides ample off-peak travel options, it is primarily designed for peak-hour demand, making it less efficient. Furthermore, due to the different mix of travel purposes, a schedule based on peak-hour demand is not necessarily optimal for off-peak demand. This paper aims to combine the benefits of a cyclic timetable with the flexibility of an acyclic timetable in order to follow the time-dependent demand more closely. We propose a mixed-integer linear programming model that finds a timetable for a day consisting of several periods which each have its own line plan. The resulting timetable is required to be cyclic within each period and provide a good transition between the periods. The model is successfully tested on a case study with changing stopping patterns using data from the Dutch railway network, for which an optimal timetable is found. In this timetable, the transition between cyclic schedules can be done without cancelling trains or shifting trains from the new cyclic times.