Railway Depot Planning

Development of a Decision Support System for Railway Depot Planning

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Introduction: A critical part of the planning process of any railway passenger operator is the operational depot planning. This task is extremely dependent on the preceding planning processes, such as rolling stock planning and timetabling, and is highly sensitive to changes. Therefore, it is carried out as late as possible, which leads to high time pressure. Moreover, efficient depot planning will become even more crucial in the future due to an emerging increase in passenger rail traffic and the associated increase in rolling stock.

Problem: The operational depot planning problem can be divided into five subproblems: matching of arriving and departing train units, parking, routing, cleaning, and crew planning. In this research, we focus on the parking problem, often denoted as the Track Assignment Problem (TAP). The topology of the shunt yard and the arrival and departure times of all train units are inputs to the TAP. Objective is to assign train units to tracks, such that the depot plan is feasible and minimizes some user-defined cost-function. For a track assignment to be feasible, departing train units may not be blocked by parked train units and the capacity of each shunt track might not be exceeded (among other constraints).

Approach: In existing literature, TAP are often formulated as a Set Partitioning Problem and solved using column generation to overcome the problem of the exponential number of decision variables. We have developed an MIP formulation with a quadratic number of decision variables and we have used Google OR Tools to solve the MIP model. We show the performance of the MIP model on real-life test cases from a European railway company.

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Subject Area
Innovation in Products, Processes and Materials - Business Engineering and Productions

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