An Iterative Rounding approach to the Railroad Blocking Problem

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Abstract. Railway freight transportation entails a complex decision-making process, with the railroad blocking problem being one of the main issues to address. A *block* is a set of commodities that travel between two nodes of the rail network as a logical unit. Blocks are formed in classification yards where commodities are grouped or separated. Grouping commodities into blocks allows the freight-hauling company to increase efficiency in shipments. However, this means that along their journey commodities may need to be "reclassified", i.e. separated and grouped into new blocks. This is a costly and time-consuming activity, hence the railroad blocking problem consists in finding a blocking plan that minimizes both transportation and intermediate handling costs.

A suitable blocking plan must satisfy capacity constraints at each classification yard, such as a bound on the number of outgoing blocks and a bound on the amount of cars grouped in each block. Real-life instances of the railroad blocking problem typically comprise hundreds of classification yards and thousands of individual commodities, which means that this kind of optimization problems usually involves an extremely high number of variables. In our approach we tackle the railroad blocking problem with an integer linear programming formulation and a heuristic approach based on an iterative rounding procedure. This approach makes decisions supported by the solution of the linear relaxation and succeeds in significantly reducing the number of variables involved. We test this technique on data provided by a real rail transportation company, consistently finding good quality solutions (compared to the value of the linear relaxation) within a computational time of a few hours.

Keywords: Service design; Combinatorial optimization; Railway

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