Improving utilisation of rail freight routes by optimised routing method

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Introduction

The routing and scheduling problem is a complex task and a critical challenge in the railway sector as it involves various railway stakeholders and components. Moreover, this problem directly affects railway service costs and its environmental impact (Cullinane, 2010). While numerous studies have addressed the routing and scheduling of passenger trains, less attention has been paid to the routing and scheduling of freight trains.

Therefore, the main objective of this ongoing study is to improve the utilisation of rail freight routes by minimising the travel time of freight trains. The work plan developed is to consider the travel time of freight trains from origin to destination, including handling at the marshalling yard. A mixed-integer linear optimisation model is developed to determine optimal train paths and travel times while identifying the critical operational and infrastructural factors that influence the travel time of freight trains.

First Results and Future Work

The first version of the model is tested on a part of the Swedish railway network. The results are used to determine the optimum route and travel time for a train.

For example, to travel from Järna to Stockholm, the optimal route is Järna -> Södertälje syd övre -> Flemingsberg -> Älvsjö -> Årstaberg -> Stockholm södra -> Stockholm central. This 20 km route has an optimum travel time of 38 minutes.

However, operational and infrastructural conditions have not been included in the first test due to data availability. This limitation will be taking into account in future work. In addition, various technological improvements to the marshalling yard due to emerging technologies such as digital automatic couples, innovative wayside and on-board monitoring systems will be investigated and their impact on travel time will be assessed using various scenarios in accordance with the measuring framework proposed in the study of (Antognoli, 2020).

By addressing this topic, this research aims to contribute to the scientific and railway engineering community dealing with the operation of freight trains and to improve the efficiency of railway networks.

References

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Evaluation of train integrity concepts based on various criteria

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Abstract

The on-board function responsible for recognising the completeness of the train and checking that the train operates as a single unit is known as train integrity.
Checking train completeness and gathering information about train composition is becoming increasingly important with the introduction of more advanced signalling systems such as moving block and virtual coupling concepts. This is why railway researchers and practitioners are paying great attention to this topic. For various train control systems such as axle counters and track circuits (Jiang et al. 2020), different methods of train completeness checking are used, while for advanced signalling systems, technologies such as wireless sensors networks (Lazarescu and Poolad, 2021) and the Global Navigation Satellite System (Ji et al. 2021) and other components are considered in the literature.
There is no study that evaluates the advantages and disadvantages of current and future train integrity concepts. Therefore, in this study the train integrity concepts were analysed and evaluated according to different criteria. For this purpose, a multi-criteria decision making was applied. The concepts presented in (Rudiger and Vecker, 2021) were evaluated based on criteria such as failure rate, deployment problems, installation and maintenance costs, accessibility, accuracy and possible errors, etc. Based on these conflicting criteria, the results gave a different picture of the appropriateness of the concepts. While the current concepts have advantages with regard to one criterion, the new concepts also have disadvantages.
In addition, the study analysed technologies such as digital automatic coupling (DAC) and wayside monitoring systems such as ”Intelligent video gates” (IVGs)/Standardised European Checkpoints as concepts for monitoring train integrity on open railway lines and in freight nodes.

References

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