Chapter V

DSS for Rescheduling of Railway Services Under Unplanned Events

B. Adenso-Díaz, J. Tuya, M. J. Suárez-Cabal and M. Goitia-Fuertes
Universidad de Oviedo, Spain

ABSTRACT

In the daily activity of railway transport, the need to make decisions when faced with unforeseen incidents is a common event. Quality of service may be affected by decisions that are made by delays or cancellations. In this multi-objective scenario, there is a need to combine affecting the majority of passengers as little as possible with the minimization of costs. Therefore it is necessary to design planning algorithms taking into account factors such as the availability of engines and the quality of service. This chapter presents the design and implementation experience of a practical case developed for the Spanish Railway Company. With this tool, a DSS was put into service that guides the person in charge as to which measures to adopt with respect to the events that have arisen. The information employed is obtained by means of heuristic search algorithms based on backtracking for the exploration of the solutions space.
INTRODUCTION

The constant increase in competitiveness in all systems of transport, both passenger and goods, requires improved, effective use of all the available resources, as well as permanent adaptation to changing user needs. All this is needed without losing sight at any time of service reliability and availability, since these have a direct impact on the quality perceived by the user. Thus, the development of decision-aiding systems for this type of scenario is especially interesting.

One important aspect related to the difficulty of the solution is that related to the topology of the tracks, since when an incident is produced, some of the units which were scheduled to circulate, both on the stretch involved as well as on other tracks, may be affected. At the same time, since this is a multi-objective scenario, there is a need to combine affecting the majority of passengers as little as possible with the minimization of costs.

In order to determine the best measures to take in such events, it is useful to design planning algorithms that take into account factors such as the availability of engines and the quality of service by means of an efficient search in the solutions tree.

This chapter presents the design and implementation experiences of a practical case developed for the Spanish National Railway Company, in use in its regional lines in the Principality of Asturias (Northern Spain). With this tool, an original decision support system was put into service that guides the person responsible for the network, via tables and graphs, with respect to which measures to adopt with respect to the events that have arisen. The information employed is obtained by means of heuristic search algorithms based on backtracking and pruning for the exploration of the solutions space.

This application enables the user to define the characteristics of the incident produced and the input constraints. As output, the user receives a series of solutions with their associated costs. The analyst may then select each of these solutions so as to observe the actions proposed by the system and the layout of the grid solution resulting from the application of said actions, to finally choose among them.

The chapter is structured in the following way. Similar experiences in the resolution of this type of decision problem are described next. Subsequently, a detailed description of the problem to be solved is given, as well as the algorithm designed to solve it. The chapter ends with a description of the implementation experiences and our conclusions.

BACKGROUND

As mentioned above, in the day-to-day activity of railway transport, the need to take decisions when faced with unforeseen incidents is a common event, with such decisions affecting the quality of the service due to the delays or cancellations they provoke. Given that these are complex systems of transport, the different policies
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