
A decision support system for multi-compartment freight distribution with environmental considerations and real-time re-planning capabilities

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Abstract

The objective of this paper is to present a Decision Support System for planning, monitoring and adapting multi-compartment vehicle routing and scheduling decisions. The proposed system provides the following functionalities: i) addressing multi-compartment time and load dependent vehicle routing and scheduling problems taking into account the minimization of the number of vehicles used, total travel time and emissions, ii) monitoring route execution and iii) re-routing aiming to fix the remaining route of a vehicle so that feasibility of servicing customers is retained and cost is minimized taking into account real-time vehicle speed data. The paper presents the architecture and implementation aspects of the system, the mathematical models and algorithms incorporated in the system and relevant computational results. The routing model aims to determine alternative solutions capturing the trade-off between emissions and travel time for the minimum number of vehicles. Emissions are modeled by a time, load, and path dependent metric. The routing solutions provided by the system involve the routes for servicing demand, the loading pattern per vehicle used, the road path connecting each pair of consecutive stops, and the schedule of traveling across the routes. The real-time re-planning service considers a variety of possible solutions coming from either the repository of solutions determined in the pre-tip planning phase or the application of an Ant Colony System algorithm. A major feature of the rerouting service is that it searches for alternative solutions in an enhanced complete network where each pair of stops is connected by more than one alternative paths.

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