Improving a city road network for the Multi-Depot Vehicle Routing Problem

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Abstract

In this research, a number of Multi-Depot Vehicle Routing Problems, in which only a subset of the customers has a demand, are considered in an incomplete network. We will propose two solution approaches to determine the best single improvement or best set of improvements of this incomplete network, such that the total travel time of the vehicles in these routing problems is minimized. This problem originates from the situation in a number of (Dutch) cities where a large part of the logistics within the city area are performed by one transport company. In this case, this company will be able to suggest its most beneficial improvements to the network to the traffic manager. Favoring this transport company will reduce the traveled vehicle kilometers within the city area. In this research, three possible network improvements are considered: (re-)opening pedestrian zones for vehicles, widening existing roads and converting existing roads into one-way roads with a higher speed. The first approach is a Three-Phase Heuristic, which consists of a construction phase, an analysis phase and a testing stage. The second approach is an Adaptive Large Neighborhood Search (ALNS). This ALNS consists of a unique set of destroy and repair methods. The performance of our heuristic is evaluated on a set of benchmark instances based on a realistic road network with a varying number of customers and vehicles. Additionally, the solution quality is compared to that of solutions obtained using exact solution techniques.

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