Green Hub Location Routing Problem

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Abstract

The Hub Location Routing Problem (HLRP) consists in determining simultaneously the location of hub facilities concentrating flows in order to achieve economy of scale, the allocation of suppliers and clients to hubs as well as designing the optimal routes to visit non hub nodes. We address the frequent case of less than truckload (LTL) transportation companies, where collection and delivery routes are distinct, due to logistics constraints. As the environment is an increasingly important concern in supply chain management, we consider both economic and environmental goals (CO_2 emissions) and propose a bi-objective Green Hub Location Routing Model. Our bi-objective optimization model for the Green HLRP thus aims at minimizing both costs and CO_2 emissions. The cost function includes fixed hub costs, transportation costs between hubs, local collection and delivery routing costs, handling hub costs, and fixed costs of vehicles. For the environmental objective function, we consider fixed CO_2 emissions for operating the hubs as well as the handling emissions, and the emissions relative to transportation. For collection and delivery routes, the emissions are based on the load of vehicles and distances, while for inter-hub transportation, they are only distance-dependent since trucks are assumed to be fully loaded. Experimental results will be presented by solving the model with a standard MILP solver on the basis of data sets of different sizes and characteristics, in order to evaluate the relationship between cost and CO_2 emissions using the epsilon constraint method.

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