

An Integer Programming for the Capacitated Hub Location-Routing Problem

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Abstract

In this paper we consider a capacitated hub location-routing problem (HLRP) which combines the hub location problem and multi-hub vehicle routing decisions. The HLRP not only determines the locations of the capacitated p -hubs within a set of potential hubs but also deals with the routes of the vehicles to meet the demands of customers. This problem is formulated as a 0-1 mixed integer programming model with the objective of the minimum total cost including routing cost, fixed hub cost and fixed vehicle cost. An optimal solution is obtained by using Xpress-MP for the small sized problems. The experimental results show that the proposed mathematical programming approach can be a viable solution method for the intelligent mobility in supply chain network.

Key Words: Hub Location-Routing Problem, Mixed Integer Programming, Supply Chain Network

1. Introduction

The design of distribution networks is one of the most important issues because it provides a great potential to reduce costs and to enhance service quality. In many cases arising in real practice, the demand of each customer may be less than a truckload such that multiple customers are served in a single route and distribution cost depends on the sequence of customers on the route. Therefore, the location and routing problem should be solved simultaneously in order to reflect the distribution cost of routes within a location model. The location routing problem (LRP) deals with determining the location of facilities and the vehicle routes under some constraints such as facility and vehicle capacities, limits of route length, etc. to minimize the total cost including routing costs, vehicle fixed costs, facility fixed and operating costs. For a sound review and classification of LRP see Mara et al. [1] and Arslan [2]. Different LRP extensions have been considered by Aslan et al. [3] and Wang [4].

This study is motivated by the observation encountered in the postal delivery service. In postal delivery system, hub-and-spoke structure is a well-known network configuration. It provides economies of scale by consolidating the traffic flows at the hubs as opposed to