Vehicle Routing Problem: Simultaneous Deliveries and Pickups with Split Loads and Time Windows

ABSTRACT

The Vehicle Routing Problem with Simultaneous Deliveries and Pickups (VRPSDP) has attracted great interest in research due to its potential cost savings to transportation and logistics operators. There exist several extensions of VRPSDP, and among these extensions, simultaneous deliveries and pickups with split loads problem (SDPSLP) is particularly proposed for eliminating the vehicle capacity constraint, as well as allowing the deliveries or the pickups for each customer to be split into multiple visits. Although delivery and pickup activities are often constrained by time windows, few studies considered such constraints when addressing SDPSLP. To fill the gap, this paper formulates the Vehicle Routing Problem of Simultaneous Deliveries and Pickups with Split Loads and Time Windows (VRPSDPSLTW) as a Mixed Integer Programming (MIP) problem. A hybrid heuristic algorithm is developed to solve this problem. Solomon datasets are applied with minor modifications to test the effectiveness of the solution algorithm. The computational experiment results demonstrate that the proposed algorithm is superior to other solution approaches for VRPSDPSLTW in terms of the total travel cost, number of vehicles, and loading rate. The proposed formulation and solution algorithm for the VRPSDPSLTW problem may serve as a general analytical tool for optimizing vehicle routing in practice.

Key words: Vehicle Routing Problem of Simultaneous Deliveries and Pickups with Split Loads and Time Windows, Hybrid Heuristic Algorithm, Mixed Integer Programming