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# A mathematical model for two echelon location routing problem with simultaneous pickup and delivery

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## Abstract

Globalization and increasing competition make logistics an important part of life. Companies required to keep costs as low as possible in order to maintain their existence in this competitive environment. Companies want to decrease their logistic costs related with the location of the facilities and routing of the vehicles. This study focuses on Two Echelon Location-Routing Problem with Simultaneous Pickup and Delivery (2E-LRPSPD) which is a variant of the well-known Location-Routing Problem (LRP). The 2E-LRPSPD seeks to minimize total cost by locating the secondary depots and routing the vehicles between main depot to secondary depots and secondary depots to customers which satisfy pickup and delivery demands of customers and/or secondary depots at the same time. To solve the problem we propose a node-based formulation and use a family of valid inequalities to strengthen the formulation. An experimental study on the instances derived from the literature is conducted to investigate the effects of valid inequalities in terms of reaching tight lower bounds.

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