

A Mathematical Model for Multi-Trip Vehicle Routing Problem with Time Window in Transportation Business

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Abstract. This article focuses on a delivery routing problem of a transport company, located in Phuket province, Thailand. The objective is to minimize the total transportation cost. The cost is divided into two categories: first, fixed cost of rental vehicles, and second, variable cost computing from travel distance, oil price, and fuel consumption rate. According to the characteristic of delivery activities, a vehicle might travel multiple trips to deliver parcels to a set of customers due to the fact that customer demand is often higher than vehicle capacity. Moreover, customers require to receive parcel in different time window. Consequently, this study presents a multitrip vehicle routing problem with time window (MTVRPTW) represented as a Mixed Integer Linear Programming (MILP). The model is solved by using the exact method on the Lingo software. The experiment illustrates the exact method can reduce the total cost from 47,540 to 44,778 Baht or 5.81% and traveling distance from 2,255.89 to 1,867.51 Km. or 17.22 % from the operational data of the Haryak line over 21 days. However, MTVRPTW is an NP-Hard problem, implementing branch and bound in Lingo has high computational time for large size problems. The computational time exponentially increases when the number of customers increases.

Keywords: Vehicle routing problem, Multi-trip vehicle routing problem with time window, Mixed integer linear programming