Vehicle routing for trunk delivery applications

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Abstract

The growth of the e-commerce sector with the ever-increasing push towards online-shopping poses a major supply chain challenge for many companies. Usually, last-mile delivery; i.e., the delivery of goods to the consumers is the most expensive and inefficient part of the supply chain. Year-over-year growing sales volumes, huge number of delivery locations, and the aggressive service levels promised to customers drive companies to seek innovative strategies to increase the efficiency of last-mile delivery operations. Among these is the trunk delivery service introduced recently by Amazon, Audi and DHL. Motivated by the interest in trunk delivery services, we study a variant of the vehicle routing problem, called the vehicle routing problem with roaming delivery locations (VRPRDL), in a dynamic setting. In the static version of the VRPRDL, each customer has an itinerary specifying one or more locations with corresponding time windows where the customer's order can be delivered to the trunk of his/her car, and customer itineraries are assumed to be known with certainty and remain unchanged throughout the day. We consider a dynamic version of the problem where there may be deviations from the original customer itineraries that can render the planned delivery schedule infeasible or suboptimal. We propose a rolling horizon approach to solve the problem in which the delivery routes are re-optimized every time there is an itinerary change using the branch-and-price algorithm we developed for the static VRPRDL. We perform a computational study to test the efficiency of our solution approach and report the results.

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