
The Waste Collection Vehicle Routing Problem with Time Windows and uncertain demands : Model and solution approaches

Quentin Tonneau*^{†1}, Nathalie Bostel², Pierre Dejax¹, and Thomas Yeung¹

¹Institut de Recherche en Communications et en Cybernétique de Nantes (IRCCyN) – École Nationale Supérieure des Mines - Nantes – 1, rue de la Noë BP92101 44321 Nantes Cedex 03, France

²Université de Nantes- IRCCyN – Université de Nantes – 58 rue Michel Ange, BP 420 44606 Saint-Nazaire cedex, France

Abstract

With more than ten billion kilograms of waste produced every day in the world, waste logistics management has become a major cost reduction and optimization challenge. We address a vehicle routing problem to collect waste (e.g., glass, paper, plastic, etc.) from recycling bins in public spaces or from industrial companies. This problem considers a single depot for the vehicles and a set of intermediate facilities (i.e., disposal sites) where trucks can dump their content in order to continue their collection tour. Each bin must be fully emptied when visited and trucks must also to visit a disposal site before returning to the depot in order to arrive empty. Each node (i.e., depot, facility and bin) is characterized by its own service time and accessibility hours.

This problem is known as the Waste Collection Vehicle Routing Problem with Time Windows (WCVRP-TW). We propose a mathematical model and solution methods in order to solve the deterministic version of this problem. A stochastic approach where quantities of waste brought to containers are uncertain is also proposed to improve the solution robustness in real applications.

We compare our approach with existing deterministic benchmarks and test realistic scenarios of alternative demand to measure the solutions' flexibility and robustness. In particular, we apply this approach on real data provided by a French waste transport and logistics company.

*Speaker

[†]Corresponding author: qtonneau@gmail.com