
Recyclable Waste Collection Routing Problem, formulation and solution

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Abstract

In this work we deal with a routing problem arising in recyclable waste collection. The problem motivated by a real application in the island of La Palma (Canary Islands). There is a fixed set of containers with the same capacity scattered in the island. From a large set of historic data we obtain a filling waste rate for each container (the average quantity of waste collected per day). The fill level of each container any given day is estimated using the filling rate and the number of filling days. The managers want to collect as much waste as possible avoiding overflowing of the containers to increase the recycling of waste. The problem consists of designing the optimal routes for a fleet of vehicles in a given horizon of days (typically from Monday to Friday). We formulate the problem by a series of MILP problems corresponding these days. The problems include the usual constraints that characterize a set of routes including capacity and time limitations for each route. Some additional constraints, like time windows or due containers, could be added for a few containers. In addition to the total distance or time, several objective functions appropriated for the purpose of the managers can be stated as linear functions, like the total waste collected or the number of overflowing of the containers. In addition to the multistage MILP, a GRASP is designed and tested to provide high quality solutions. The solutions are compared using the performance indicators provided by the waste managers.

Keywords: Recyclable Waste Collection Routing, GRASP, MILP

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