Designing a Recyclable Household Waste Collection System in an Urban Area in Santiago, Chile

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Abstract

Due to the exponential increase of waste generation worldwide, there is an urgent need for systematically addressing waste collection, especially for recyclable waste generated in urban areas. This situation is even more relevant in Latin America, where scarce robust sustainable initiatives are observed. This study proposes a multi-objective mixed integer programming-based approach to deal with the recyclable household waste collection problem in the commune of Renca in the city of Santiago, Chile. The proposed model optimizes the number and location of waste bins to be placed within the studied area, the demand zone assignment to the selected bin locations, and the visit sequence of bin locations (i.e., vehicle routing decisions). The objective function of the model minimizes bin investment costs, vehicle transportation costs to collect the waste, and total distance traveled by inhabitants to transport their waste to the bin locations. The commune was previously divided in zones according to practical criteria that includes truck capacity, road network issues, and administrative boundaries. Thus, each zone is solved with the proposed formulation. Results consist of solutions that successfully balance the different problem objectives, while serving the expected recyclable waste generated in the commune.

Keywords

Waste collection, recycling, sustainability, bin location, vehicle routing.