

# Generation of Collection Routes using an Ant Algorithm

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## Abstract

Problems arising on Urban Waste Management are broad and varied. This paper is focused on designing collection routes for urban wastes. The relationship between the real world problem and the Arc Routing literature is established, and the Capacitated Arc Routing Problem is extended to comply with traffic rules. Afterwards, an Ant Algorithm designed to solve this problem is shown.

**Keywords:** Urban Waste Management, Metaheuristics, Arc Routing.

## 1. Introduction

During the last years, social concerns regarding the environment has acquired great relevance. In the EU a growing body of community directives, the basis of each country legislation, obliges its members to recover and recycle many products and components (e.g. containers, glass, paper, plastic, consumer goods, automotive components, electronics, etc.). From the Municipal Waste Management perspective, the problems related to the recovery and recycling of waste, as well as the design, management and control of systems oriented towards the return and treatment of disposable goods should be studied.

Waste generated in urban areas is collected by municipal organizations or its collection is adjudicated to private companies. It is their responsibility to collect the waste and transport it to its final destination.

Collection techniques have evolved in consonance with technological advances, and the adaptation to the particularities of each city, trying to offer an optimal service with minimum cost. The population of the EU is highly concentrated in cities with a very high population density, as people usually live in apartment buildings. As a result, the collection technique has evolved away from door-to-door collection, very common in the USA, opting in the majority of cases for the establishment of curbside collection points where citizens leave their refuse. Each collection point is made up of one or more refuse bins (with dimensions ranging from 1 to 3.2 m<sup>3</sup>). Different trucks collect each fraction of waste and transport it to their final destination (a refuse dump, an incinerator or a recycling plant).

One key factor for proper operation of collection systems is to design collection routes for fractions, which are separately collected under some cases due to technical design constraints and different treatment processes. The present research work focuses on the study of models and methods to design collection routes, [4]. Firstly, arc routing literature is studied as starting point for solving the problem, and a modified Capacitated Arc Routing Problem (CARP) model is established to take into account traffic constraints. Afterwards the literature devoted to solve the CARP is studied, [3], and an implementation of an Ant Colony Optimization algorithm, [2], is proposed. Finally, a computational experience is conducted to assess the quality of the proposed algorithms, and the integration of the proposed method in a Decision Support System is shown [1].

## 2. Acknowledgement

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## 3. Bibliography

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