



Operational Factors Affecting Municipal Solid Waste Collection Cost in Horizontal Building Cities: A Case Study of Al-Diwaniyah, Iraq

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ABSTRACT

Municipal waste collection is a critical process due to its high operational costs. This study aimed to identify the key operational factors affecting total collection costs in horizontally structured cities and to determine optimal ranges for three key operational variables. The study was conducted in three stages: spatial data collection using GIS, field surveys, and model building via Excel-based calculations across 45 scenarios. The three variables identified as most influential were collection frequency, compactor truck capacity, and crew size. The results indicate that collection frequency is the dominant factor in reducing costs, followed by compactor truck capacity and then workforce allocation. Collection frequency was limited to once every three days to prevent the degradation of organic waste. A 4-ton compactor truck was found to be the most suitable option for the street widths in the study area, while an optimal crew size of three workers per truck (excluding the driver) provided the best balance between labor efficiency and operational cost. The regression model achieved a high explanatory power ($R^2 = 0.888$), demonstrating that nearly 89% of the cost variability is explained by these parameters.

Keywords: Compactor truck, Crew size, Frequency, Cost, Collection, Waste.

INTRODUCTION

Solid waste management poses significant environmental and economic challenges for local governments, especially in medium and large cities experiencing rapid population growth and uncontrolled urban expansion. Waste collection and transportation costs constitute approximately 70% of the total waste management budget (Mazloomi et al., 2015). Waste collection process is generally carried out through three main methods: door to door collection, curbside containers and street bins (Guerrini et al., 2015). Although curbside collection is more costly, it offers enhanced control and preserves the integrity of the waste

composition until it reaches the recycling facility, largely due to the reduced interference from informal pickers (Reis-Filho et al., 2025). Waste collection costs are influenced by several factors, including the type of collection vehicle, route design, bin distribution, crew size, collection point locations, and the quantity and composition of the generated waste (Bošković et al., 2016). However, the factors that have the most direct and significant impact on costs are the frequency of collection, the capacity of the compactor truck, and the number of workers assigned to each truck. These parameters are therefore critical in assessing and optimizing waste collection systems. The management of waste collection differs from one city to another