FUEL CONSUMPTION RATE IN WASTE COLLECTION SERVICES

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1. INTRODUCTION

Infrastructure Stakeholders

- Users
  - Reliability, quality, cost

- General Public
  - Environment, social equity

- Government
  - Service level, vulnerability, regulatory control

- Owner/Investor
  - Profitability, compliance with demand and regulations
1. INTRODUCTION

**Vital context**: business/activity objectives, policies and market; legal and regulatory requirements; socio-cultural context; performance and risk goals

**Important interface**: motivation; communication; roles and responsibilities; knowledge; experience; competence and capability; leadership; teamwork

**Important interface**: life cycle cost; investment criteria, value of asset performance

**Important interface**: reputation/image; moral and ethics constraints; socio-cultural and environmental impact

**Important interface**: condition; performance level; hazards and opportunities; processes, protocols and activities
1. INTRODUCTION

Organizational strategic goals

Capital investment optimization and sustainability planning

Sustained performance and risk optimization

Optimize life cycle activities

Corporate management

Manage asset portfolio

Manage asset systems

Manage assets

Create acquire

Utilize

Maintain

Renew Dispose

Dispose

Create acquire

Utilize

Maintain

Renew Dispose
2. FUEL CONSUMPTION

Municipal solid waste collection represents the largest share (from 50% to 70%) of waste management costs and fuel is a substantial expense in waste collection and transportation (Sonesson 2000; Sousa et al. 2018).

Previous studies of rear- and side-loader garbage trucks reported fuel consumptions from 53 L/100 km up to 235 L/100 km (Agar et al., 2007; Ivanič, 2007; Thiruvengadam et al., 2010; Sandhu et al. 2015).

Bender et al. (2014) measured a fuel consumption of 79 L/100 km, from which nearly 60% was due to the compactor operation / idling.

In Portugal, Teixeira et al. (2014) estimated an average fuel consumption of 3.96 L/Tonne for mixed waste collection in the city of Porto, Portugal.
3. CASE STUDY

Area: 100 km²
Population: 212,000 inhabitants
Waste production: 136,000 tonnes per year
4. RESULTS AND DISCUSSION

![Graph showing the amount of waste collected over years from 2002 to 2018. The x-axis represents the years, and the y-axis represents the amount of waste collected in tons. The graph shows a decline in waste collection from 2002 to 2012, followed by an increase from 2012 to 2018.](image-url)
4. RESULTS AND DISCUSSION

![Bar chart showing frequency of consumption in l/tonne]

**Consumption [l/tonne]**

- [1.9, 3.5]
- (3.5, 5.1]
- (5.1, 6.7]
- (6.7, 8.3]
- (8.3, 9.9]
- (9.9, 11.5]
- (11.5, 13.1]
- (13.1, 14.7]
- (14.7, 16.3]
- (16.3, 17.9]
- (17.9, 19.5]
- (19.5, 21.1]
- (21.1, 22.7]
- (22.7, 24.3]
- (24.3, 25.9]
- (25.9, 27.5]
- (27.5, 29.1]
- (29.1, 30.7]
- (30.7, 32.0]
- >32.0

**Frequency [ ]**

- 0
- 50
- 100
- 150
- 200
- 250
- 300

**Paper**
4. RESULTS AND DISCUSSION

[Bar chart with box plots showing consumption per tonne across different circuits. Each circuit is represented by a box plot with median, quartiles, and outliers marked.]
4. RESULTS AND DISCUSSION

Plastic
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Plastic
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Glass
4. RESULTS AND DISCUSSION

Glass
5. FINAL REMARKS

The fuel consumption rate per distance was estimated in 83 L/100 km, which is within the range of values published in the literature.

The fuel consumption rate per amount of waste ranged from 0.63 L/tonne to 53.59 L/tonne, with an average of 4.95 L/tonne, a median of 4.66 L/tonne and a standard deviation of 1.90 L/tonne

Considering an average of 90 000 tonnes of mixed municipal solid waste collected yearly, this corresponds to an average of 2.1 l/inhabitant per year.