Measuring the perceptual impact of urban waste placement: Bridging operational metrics and citizen-centric liveability

MSc Thesis Project – Transport & Logistics

1. Problem description

Urban waste placed beside collection points (*bijplaatsing*) is a persistent challenge for Dutch municipalities. Bags, cardboard, and bulky items left next to underground containers degrade public space and generate operational costs in collection logistics. To manage this, municipalities rely on the **CROW condition scoring system** (CROW, 2023), which classifies streetscape conditions on an A–B–C–D scale by counting objects and measuring waste volumes. These standardised metrics are effective tools for monitoring physical asset quality and scheduling collection routes.

Yet the impact of *bijplaatsing* on residents extends beyond object counts. Experimental evidence shows that visible disorder in public space triggers further norm violations and erodes neighbourhood satisfaction (Keizer et al., 2008). Two scenes assigned the same CROW score can produce markedly different reactions among residents: a neatly stacked row of boxes and a scattered pile of household waste may share an identical object count, yet residents experience them differently. This divergence between operational measurement and subjective experience is well documented in urban evaluation research, where expert-driven metrics and citizen perception often follow different logics (Nasar, 1998). Integrating citizen feedback into municipal service delivery can improve both operational responsiveness and policy legitimacy (Bovaird, 2007), yet current assessment frameworks lack a systematic, empirical layer that captures how residents perceive and evaluate *bijplaatsing*.

This project addresses that gap. Using a large-scale paired-comparison survey, residents will choose which of two *bijplaatsing* images they would find more acceptable near their home. The resulting preference data will be analysed with **Computer Vision-enriched Discrete Choice Models (CVDCM)** (van Cranenburgh and Garrido-Valenzuela, 2025), a method that integrates visual features extracted directly from images into a random utility framework. By estimating citizen utility as a function of visual scene attributes, the project enables a direct comparison between the quantity-based CROW classification and a perception-based measure of liveability, providing municipalities with a complementary, citizen-centric evaluation layer for public space management.

2. Assignment

A labelled image dataset of bijplaatsing scenes will be provided by UrbanVue B.V. at the start of the project. The images originate from systematic street-level collection in Dutch municipalities and are classified according to CROW condition classes (A, B, C and D). All imagery is anonymised, i.e. persons and vehicles are blurred. The dataset covers variation in spatial arrangement, object type, season and urban context.

Building on this dataset, the student will carry out the following tasks:

- **Survey design.** Design a paired-comparison choice experiment in which respondents select which of two *bijplaatsing* scenes they would find more acceptable near their home. Optimise the experimental design for information gain and minimal respondent burden (Louviere et al., 2000).
- **Data collection.** Deploy the survey targeting a large, representative sample of Dutch residents, yielding sufficient pairwise comparisons for robust statistical estimation.
- **CVDCM estimation.** Estimate Computer Vision-enriched Discrete Choice Models (van Cranenburgh and Garrido-Valenzuela, 2025) that link visual image features to citizen preferences within a random utility framework.
- **Operational comparison.** Compare the perception-based utility scores against formal CROW condition classes to quantify intra-class perceptual dispersion and identify which visual attributes drive citizen acceptability (Ewing and Handy, 2009).

- **Policy synthesis.** Translate findings into actionable recommendations for municipal waste logistics and public space design guidelines.

3. Candidate

We are looking for a motivated MSc student with the following profile:

- Enrolled in an MSc programme at TU Delft (e.g., EPA, CoSEM, MOT, Transport, Infrastructure & Logistics, or Civil Engineering).
- Solid computational skills in **Python** for data analysis and statistical modelling.
- Interest in discrete choice modelling, computer vision, or quantitative survey design.

4. Research group & contact

This project is hosted by the **Transport and Logistics (T&L)** section within the **Faculty of Technology, Policy and Management (TPM)** at Delft University of Technology.

Supervision:

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References

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