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A Hybrid AHP–MCDM Model for Prioritising Accessibility Interventions in Urban Mobility Nodes: Application to Segovia (Spain)

Juan L. Elorduy *  and Yesica Pino 

Escuela de Ingenierías Industriales, Universidad de Valladolid, Paseo Prado de la Magdalena 3-5, 47011 Valladolid, Spain; yesica.pino@uva.es

* Correspondence: juanluis.elorduy@uva.es

Abstract

Universal accessibility remains a critical challenge for effective public transport and urban equity. This study addresses the need for operational prioritisation tools by proposing a robust hybrid methodology to rank interventions at urban mobility nodes. The approach combines the Analytic Hierarchy Process (AHP) for integrating expert and participatory criteria weighting with four Multi-Criteria Decision-Making (MCDM) techniques (TOPSIS, VIKOR, COPRAS, and ARAS) to ensure solution reliability. Empirical validation, conducted on 30 bus stops in Segovia, Spain, confirmed the methodological soundness, evidenced by near-perfect correlations ($Q = 0.99$) among the compromise and additive ratio models (TOPSIS–VIKOR and COPRAS–ARAS) and stability across over 85% of sensitivity simulations. The findings validate that the methodology effectively guides resource allocation towards interventions yielding maximum social impact and demonstrate its transferability to complex urban supply chain contexts, such as logistics microhubs. Ultimately, this replicable and adaptable model supports the transition towards more equitable, resilient urban systems, aligning directly with Sustainable Development Goal 11 (Sustainable Cities and Communities).

Keywords: AHP; MCDM; risk management; universal accessibility; urban mobility; urban resilience

1. Introduction

While cities occupy a mere 3% of the global land area, they concentrate the vast majority of economic activity and population [1,2], a figure projected to reach 80% by 2050 [3]. This demographic density, coupled with the fact that urban centres account for over 70% of global CO₂ emissions [4], positions them as critical focal points for climate mitigation and the transition toward sustainable development paradigms [5,6]. Central to this challenge is urban transport, a primary contributor to both environmental degradation and the decline in public health [7–9]. Consequently, transforming this sector has become a prerequisite for achieving international climate objectives [10–12]. This transformation requires a holistic view, as urban mobility entails a complex interplay between passenger movement and last-mile freight distribution. Since both processes share critical infrastructure—such as streets and intermodal nodes—they generate transversal effects on congestion and efficiency [13,14]. Accordingly, current literature increasingly advocates for moving beyond traditional transport silos, promoting integrated models that leverage synergies to enhance logistical efficiency and mitigate environmental impacts [15–17].



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Cities are beginning to explore synergies between urban passenger mobility and freight distribution. Specifically, integrating freight and passengers within the same system, particularly through the shared utilisation of buses, trams, and metros, has emerged in recent years as a potential solution to urban logistics challenges, thereby fostering reduced emissions and a more efficient use of existing infrastructure [15,18–20].

In this context, beyond environmental and logistical efficiency, the sustainability of urban transport systems must be multidimensional. It must not only optimise the utilisation of existing infrastructure via the integration of passengers and freight, but it must also ensure universal accessibility. The incorporation of universal design ensures that this same infrastructure meets the needs of all citizens, particularly those with reduced mobility.

Public transport plays a fundamental role in many aspects of daily life, facilitating access to employment [21], education [22], healthcare [23], leisure [24], and participation in social life [25]. The inability to access public transport is one of the primary situations that prevents individuals from engaging in daily activities despite their desire to do so, disproportionately impacting people with disabilities or reduced mobility [26–30].

Accessibility in urban public transport has been extensively analysed in the academic literature. The lack of accessibility at stops, stations, or within vehicles constitutes one of the primary barriers to mobility for people with disabilities and reduced mobility, thereby limiting their participation in the social, economic, and cultural life of cities [31–36]. Therefore, it is necessary to incorporate universal design as a guiding principle in the planning of transport infrastructure, with the aim of ensuring equitable access for all users [26,37,38].

The existing literature has primarily relied upon qualitative studies, conducted through interviews or focus groups with small sample sizes, whereas research employing direct observation to assess the actual status of accessibility remains scarce [39]. Furthermore, most of the work has focused on describing the barriers experienced by people with disabilities rather than on proposing solutions for their elimination [35,36,38,39].

Nevertheless, public administrations and transport operators require support instruments that facilitate the efficient allocation of resources and maximise the social impact of accessibility interventions. Although the integration of accessibility into urban transport planning is a widely recognised need in the literature [32,40–42], the lack of tools that enable the prioritisation of these improvements constitutes a critical gap in the research. This gap becomes even more relevant within the context of the increasing convergence between passenger mobility and urban logistics, where the prioritisation of interventions could be applied to dual-function mobility nodes, which simultaneously act as connection points for users and as logistical hubs.

Some studies have developed and validated a tool to assess the accessibility of public transport for people with physical disabilities and/or reduced mobility across various Spanish cities [32,43]. This methodology established critical and non-critical requirements from the perspective of user autonomy and safety in the use of public transport. Crucially, one of its main contributions was the integration of accessibility experts and people with physical disabilities in the definition, verification, and validation processes.

The literature has demonstrated that the participation of people with disabilities in the design of transport systems is essential to ensure that their mobility needs are met, to improve service quality, and to detect barriers that are invisible to traditional planners [32,38,41,42]. Consequently, the methodology integrated both compliance with the parameters established in the current regulations and legislation and the perspective provided by the users with physical disabilities themselves.

To complement traditional approaches, analytical tools that allow for the integration of multiple dimensions of analysis are required. In this regard, MCDM methodologies, such as the Analytic Hierarchy Process (AHP) or the Technique for Order Preference by

Similarity to Ideal Solution (TOPSIS) constitute valuable resources for supporting complex decisions in urban planning. Various studies have demonstrated their utility in infrastructure projects [44], in the planning and resource allocation for public services [45–47], and in the analysis and design of transport systems [48,49], by allowing the integration of social, environmental, technical, and economic criteria into more robust and transparent planning processes.

Similarly, methods such as *VlseKriterijumska Optimizacija I Kompromisno Resenje* (VIKOR), the Complex Proportional Assessment (COPRAS), or the Additive Ratio Assessment (ARAS) have become established as effective approaches for solving problems with multiple conflicting objectives, such as the prioritisation of sustainable mobility measures in European cities [50], the evaluation of transport options in contexts of urban congestion to determine the most sustainable alternatives [51], the identification of key indicators in public transport systems [52], and the optimisation of mobility infrastructure, such as the development of a park-and-ride system [53].

The literature also highlights the utility of the AHP [54,55] and its fuzzy variants for prioritising criteria linked to accessibility in urban environments [56,57]. This is complemented by the value of hybrid approaches, which allow for a comprehensive evaluation of accessibility across spatial, economic, and social dimensions. These approaches have been applied in urban planning with multiple sustainability criteria [56,58], in the evaluation of accessibility to urban services, in the assessment of the impact of design on mobility [54,55,57,58], and in the identification of urban vulnerabilities linked to safety and social cohesion [59].

The objective of this work is to design and validate a methodology for the prioritisation of interventions at bus stops. The purpose is to develop a practical tool that assists administrations and transport operators in optimising resource allocation and maximising the social impact of accessibility improvements.

The proposed methodology is based on a multi-criteria approach that integrates objective data with the active participation of a working group comprising researchers, architects, people with physical disabilities, and accessibility experts. This collaborative approach, applied from the design phase, ensures that the evaluation criteria respond comprehensively to the real needs of the users.

For empirical validation, the methodology was implemented in the city of Segovia (Spain). Building upon a preliminary study which evaluated 149 bus stops [43], a sample of 30 stops was selected by an expert panel to facilitate the application and comparative analysis of prioritization results, utilising a combination of four MCDM methodologies: AHP-TOPSIS, AHP-VIKOR, AHP-COPRAS, and AHP-ARAS. This comparison enabled the authors not only to test the effectiveness of the methodology in a real urban context but also to analyse the differences between the approaches in order to assess their utility as a decision-support instrument.

Finally, the paper explores the possibility of extrapolating the methodology to other urban mobility nodes, such as intermodal stations or logistical micro-hubs. In this way, it contributes to the development of more inclusive, safe, and sustainable cities, fostering the implementation of accessible transport systems and the integration of accessibility into urban mobility policies. The proposal aligns directly with Sustainable Development Goal (SDG) 11, particularly Target 11.2 (Affordable and sustainable transport systems), by ensuring that interventions address the accessibility needs of vulnerable groups. This includes persons with disabilities, the elderly, expectant mothers, and individuals with temporary mobility impairments (e.g., those with injuries or recovering from medical procedures), as well as families with young children. By adopting this inclusive scope, the study ensures that the prioritisation model responds to the diverse functional requirements

of the entire population throughout different life stages, while simultaneously addressing the environmental dimension of sustainability by fostering a modal shift away from private vehicle reliance toward more efficient public transport networks.

2. Study Area and Methodology

2.1. Study Area: City of Segovia

This case study was conducted in the city of Segovia (Spain), a medium-sized municipality with 51,525 inhabitants [60], designated as a UNESCO World Heritage Site. Segovia features an urban configuration that combines a historic centre, peripheral residential areas, and recently developed expansion zones, covering a surface area of 163.6 km², of which almost 50% lies within the old town. The city is located in the central area of the Iberian Peninsula, between Valladolid (the regional capital) and Madrid, the national capital, and enjoys easy access (approximately 90 km) to the Adolfo Suárez Madrid–Barajas International Airport (Figure 1). Segovia's topography is characterised by steep inclines and irregular slopes, which pose additional challenges for people with physical disabilities in terms of mobility and accessibility [43]. This morphological and functional diversity makes Segovia a particularly suitable environment for analysing accessibility conditions and their spatial variability within the urban public transport system.



Figure 1. Location of Segovia on the map of Spain [43] (With permission from ASCE).

Previous research [43] analysed 149 bus stops, two train stations, and ten taxi ranks in the city through structured field observation, based on the assessment of critical and non-critical accessibility requirements. Although the results showed that progress had been made, they revealed significant deficiencies, particularly the absence of tactile paving, the lack of protective elements at the beginning and end of bus stops to prevent other vehicles from encroaching on the designated bus area, insufficient shelter equipment (such as ischiatic supports and armrests), and limited accessible information systems. These findings highlighted the need for a prioritisation tool to guide the planning of accessibility improvements. Building upon these findings, the present study develops and validates a multi-criteria prioritisation methodology for accessibility interventions at bus stops, integrating objective data with expert evaluation to optimise resource allocation.

2.2. Methodological Framework

A mixed expert panel was established for the development of the methodology, comprising the members of the research team—including an architect specialising in urban design and accessibility—people with physical disabilities, and technical staff from the Confederation of People with Physical and Organic Disabilities (COCEMFE). This multidisciplinary panel allowed for the incorporation of different perspectives—technical,

social, and user-based—ensuring an inclusive and participatory approach in defining the evaluation criteria and prioritising interventions.

The working process was structured into three participatory sessions:

- **First Session (February 2025):** The conceptual framework of the methodology was presented and validated, including a review of the results from the previous accessibility study in Segovia. In this session, the application of a MCDM approach was agreed upon, and the scope of the study was defined, establishing that the empirical validation would be performed on a sample of 30 bus stops out of the total 149 existing within the municipal network. The 30 stops (alternatives) selected by municipal technicians and policymakers ensure spatial representativeness across all city sectors. The sample covers the 7 municipal districts, including the pedestrianised historic centre, the central area, residential neighbourhoods, satellite settlements within the municipality, and peripheral industrial zones.
- **Second Session (March 2025):** The evaluation criteria were defined and validated through a participatory process involving a multidisciplinary expert panel. This panel built upon the established composition described in [43], comprising 17 participants (two researchers from the University of Valladolid, five technical staff members from COCEMFE, and ten people with physical disabilities). For the present study, the panel was specifically expanded to include municipal technical staff to ensure the robustness of the technical feasibility and economic viability assessments.

The selection followed a structured workflow:

- **Preliminary Identification:** Criteria were initially proposed based on the accessibility dimensions identified in previous research [32,43].
- **Consensus and Adaptation (March 2025):** The panel refined these into four final criteria (AC1–AC4, detailed in Section 2.3), deemed necessary and sufficient to align social needs with municipal operational constraints.
- **Data Collection and Analysis (April–June 2025):** Following the consensus, the research team collected and analysed the necessary data, calculating potential usage values based on demographic data and evaluating the technical and economic feasibility of the interventions.

This timeline ensures that the evaluation is based on recent, validated data that reflects the current urban and budgetary reality of the city.

- **Third Session (July 2025):** The resulting data were reviewed and validated by the expert panel based on the information corresponding to each stop. Finally, the criteria were weighted using the Analytic Hierarchy Process (AHP) method through a consensus-building process, resulting in a single collective pairwise comparison matrix. All meetings were documented by means of minutes and AHP templates, with the consistency of judgements ($CR < 0.10$) being verified in each case, in accordance with Saaty's recommendations [61].

2.3. Criteria Definition

Based on the participatory process described in Section 2.2, four different criteria, combining social, technical, economic, and environmental dimensions, were defined and validated. These criteria are:

1. **Infrastructure Usage (AC1—Quantitative):** This criterion serves as a proxy for potential demand by assessing the resident population per census section and district within the stop's catchment area. Data were sourced from the municipal register. This indicator addresses the social dimension and service efficiency, as interventions at high-density stops yield greater collective impact. It is acknowledged that this metric

is limited as the data neither distinguish between people with and without physical disabilities nor reflect actual infrastructure utilisation. The measurement unit is the number of residents within the catchment area.

2. **Proximity to Essential Services (AC2—Qualitative):** This criterion evaluates the presence and relative significance of essential services located within an accessible distance (defined as ≤ 250 metres) of the stop. The threshold distance and the service categorisation were defined by the expert panel. The upper level encompasses services considered critical, such as healthcare centres, public transport stations and disability support facilities, while the lower level includes services of lower strategic relevance, such as urban parks and recreational areas. Measurement was conducted using Geographic Information Systems (GIS) tools and subsequently verified through direct observation. The objective of this criterion is to prioritise investments at stops that enhance the social participation and autonomous mobility of people with disabilities. This is assessed on a 1–9 scale based on the strategic importance and number of services located within the 250 m threshold.
3. **Technical Feasibility (AC3—Qualitative):** This encompasses the expert assessment of the technical complexity of the works required to achieve full compliance with accessibility requirements. Evaluation was conducted through structured field observation and scoring by the expert panel. It is expressed on a 1–9 scale, where higher values indicate greater technical ease for the intervention.
4. **Economic Viability (AC4—Quantitative):** This criterion assesses the economic cost of the interventions required for accessibility compliance. Valuation was performed by the expert panel, drawing on typical unit costs and expert judgement rather than detailed project budgets. By incorporating economic viability, this criterion facilitates the optimal allocation of public resources and ensures an appropriate balance between social impact and implementation expenditure. Values are expressed in Euros (EUR), though a conversion factor has been applied to ensure the confidentiality of sensitive municipal budgetary data.

This structured timeline and the involvement of both users and municipal technicians ensure that the evaluation is based on recent, validated data that reflects the current urban and budgetary reality of the city.

2.4. Bus Stop Data

The specific data collected for the 149 stops—based on the four criteria defined in Section 2.3—are synthesized in Table 1 (which displays a representative sample of 30 stops). These values constitute the decision matrix used in the multi-criteria assessment, where the four evaluation criteria—Infrastructure Usage (AC1), Proximity to Essential Services (AC2), Technical Feasibility (AC3), and Economic Viability (AC4)—demonstrate significant heterogeneity across the sample.

AC1 was defined as a quantitative measure of the potential resident demand associated with each bus stop. Segovia is administratively structured into seven census districts, each of which is subdivided into a set of census sections. These sections constitute the smallest territorial unit for which official demographic statistics are available. Each bus stop was therefore linked to its corresponding district and census section, consequently enabling a direct and unambiguous population value to be attributed to each alternative. Population figures were retrieved from the Official Population Register of Spain [60]. Consequently, the AC1 value for each stop represents the resident population recorded in the administrative unit where the stop is located. These values—which range from 830 to 1954 inhabitants—capture the demographic variability across the city and thus highlight

those locations where accessibility interventions have the potential to generate the greatest collective social impact.

Table 1. Collected data.

	Infrastructure Usage	Proximity to Essential Services	Technical Feasibility	Economic Viability
	(AC1)	(AC2)	(AC3)	(AC4)
Bus Stops	(Inhabitants)	(Scale 1–9)	(Scale 1–9)	(Converted EUR)
1	876	9	5	100
2	1400	7	3	120
3	1361	5	5	125
4	1849	1	3	123
5	1160	3	7	99
6	934	5	3	97
7	1020	7	5	94
8	1549	1	9	90
9	1905	3	3	130
10	953	1	5	132
11	1792	7	3	101
12	1505	5	9	125
13	1223	1	7	106
14	941	3	1	113
15	1043	9	3	103
16	1650	5	7	122
17	1221	7	1	131
18	1551	3	5	133
19	830	1	9	135
20	1954	5	5	91
21	1247	9	3	96
22	1017	5	7	106
23	1920	9	9	111
24	980	7	7	122
25	1288	3	9	127
26	1499	9	5	129
27	1595	3	3	131
28	1158	5	1	96
29	1287	9	7	92
30	1883	7	5	91

The AC2 values shown in Table 1 reflect the spatial proximity of each bus stop to essential urban services, based on a 250-metre accessible distance defined by the expert panel. Services were initially identified using publicly available open-data sources and subsequently verified through direct on-site observation to ensure accuracy, particularly in areas where informal or unlisted facilities are common. A five-level classification system was established by the expert panel to distinguish services according to their strategic relevance for users with reduced mobility. The highest level (score 9) includes healthcare centres, public transport stations, and disability support facilities, reflecting their critical role in enabling autonomous mobility. Intermediate levels (scores 3–7) comprise educational institutions, large commercial areas (e.g., shopping centres and municipal markets), major administrative buildings, and cultural or public venues. The lowest level (score 1) encompasses urban parks and recreational areas, which—while beneficial—present lower strategic relevance for daily mobility needs. Across the stops analysed, AC2 values display

substantial variation, indicating significant differences in the availability and functional importance of essential services within 250 m of each stop.

The AC3 values capture the technical complexity of achieving full accessibility compliance at each bus stop. The assessment was conducted through structured on-site inspections using a standardised checklist based on the methodology described in [55], incorporating both critical and non-critical accessibility requirements. Following the field assessment, a panel of experts evaluated the technical difficulty of the interventions required for each stop to meet all accessibility standards. A single AC3 value was assigned by consensus using a 1–9 scale: a score of 9 indicates that the required adaptations are straightforward and do not entail major structural modifications, whereas a score of 1 reflects situations requiring extensive works or significant alterations to the physical configuration of the stop. The variation observed across AC3 values mirrors the diverse physical, structural, and heritage-related constraints identified in the field.

The AC4 values represent the estimated economic cost of achieving full accessibility compliance at each bus stop. Cost estimation was primarily informed by the technical experts' professional experience, utilising typical unit costs and expert judgement rather than detailed project budgets. The estimated cost reflects the interventions required for each stop to meet 100% of the accessibility requirements, including, for example, enlargement or adaptation of the boarding area, shelter replacement, pavement regularisation, kerb adjustments, removal of physical barriers, or tactile paving installation, and, where necessary, more extensive works affecting the surrounding urban space. A single AC4 value was assigned to each stop by consensus of the expert panel, with higher scores indicating a greater expected expenditure. Due to confidentiality constraints, the original monetary figures could not be disclosed in their absolute form and were therefore transformed while preserving their relative differences. Across the stops analysed, AC4 values exhibit significant variation, reflecting differences in the scope and structural complexity of the works required to achieve full compliance.

These four criteria constitute the variables of the decision matrix. AC1, AC2, and AC3 were defined as benefit criteria, whereas AC4 was treated as a cost criterion, since higher values indicate greater expected expenditure and therefore represent less desirable alternatives. All criteria were subsequently expressed on a comparable scale prior to weighting and ranking.

3. Multi-Criteria Decision-Making Methods

Following the definition of the four evaluation criteria and their associated data, their relative importance was determined using the Analytic Hierarchy Process (AHP), developed by Saaty [61]. This method structures complex decision problems into hierarchical levels and assigns weights to the criteria based on pairwise comparisons conducted by the expert panel.

During the third session, each expert compared the relative importance of the criteria using Saaty's fundamental scale (1–9), where a value of 1 indicates equal importance and 9 expresses an extreme preference of one criterion over another. The individual comparison matrices were aggregated by means of the geometric mean, obtaining a group consensus matrix. Based on this matrix, the normalised weights of each criterion were calculated, and the Consistency Ratio (CR) was verified to ensure the coherence of the judgements issued. Only matrices with $CR < 0.10$ were accepted, in accordance with the recommendations of Saaty [61].

In complex decision processes, Multi-Criteria Decision-Making (MCDM) methods constitute essential tools for evaluating alternatives under multiple criteria—both qualitative and quantitative—and allow for the integration of technical and social information within

a common analytical framework [62]. In the present study, four representative methods of this approach were applied with the purpose of analysing the robustness and consistency of the results obtained in the prioritisation of interventions aimed at improving accessibility at bus stops.

The following outlines the mathematical formulation employed to derive the weights of the different criteria.

1. Pairwise Comparison Matrix

$$P = [P_{jk}]_{n \times n}, \text{ where } P_{jk} = \begin{cases} \text{scale value (ej. Saaty) Reflecting the importance of } c_j \text{ over } c_k, j \neq k \\ 1, & j = k \end{cases} \quad (1)$$

$$\text{Y } P_{kj} = \frac{1}{P_{jk}}$$

The pairwise weighting matrix for calculating the overall global weights of the assessment criteria and the priority weights is presented in Table 2.

Table 2. Pairwise comparisons of assessment criteria.

	AC1	AC2	AC3	AC4	Priority Weight
AC1	1	1/5	2	5	0.20275
AC2	5	1	5	9	0.63142
AC3	1/2	1/5	1	2	0.11057
AC4	1/5	1/9	1/2	1	0.05526

2. Normalise the matrix by dividing each entry by the corresponding sum of the column to which it belongs.
3. Calculation of the eigenvector (priorities): the principal eigenvector associated with the maximum eigenvalue is obtained $\lambda_{\max}$ (4.1918):

$$P_W = \lambda_{\max} W \quad (2)$$

Subsequently

$$w_j = \frac{\hat{w}_j}{\sum_{k=1}^m \hat{w}_k} \text{ when } \hat{w} \text{ is the eigenvector corresponding to } \lambda_{\max} \quad (3)$$

4. Consistency Check: Consistency Index (CI) and Consistency Ratio (CR):

$$CI = \frac{\lambda_{\max} - n}{n - 1}, \quad CR = \frac{CI}{RI} \quad (4)$$

The consistency analysis shows that the matrix is acceptable, as the calculated Consistency Index ($CI = 0.063933$) combined with the Random Index for $n = 4$ ($RI = 0.90$) results in a Consistency Ratio of $CR = 0.071037$, which is below the recommended threshold of 0.10.

The final weights derived from AHP were employed in the application of four AHP–MCDM methodologies, selected for representing distinct approaches to decision making:

- AHP–TOPSIS (Technique for Order Preference by Similarity to Ideal Solution): A method that identifies the best option by assessing the distance of each alternative from an ideal and an anti-ideal solution. Therefore, ensuring the best balance between positive and negative criteria [63].

- AHP–VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje): A method focused on finding compromise solutions by simultaneously considering the maximum collective utility and the minimum individual dissatisfaction [64].
- AHP–COPRAS (Complex Proportional Assessment): This method evaluates alternatives based on their proportional contribution to the overall set, explicitly weighting both benefits and costs [65].
- AHP–ARAS (Additive Ratio Assessment): Calculates an additive ratio between each alternative and the best possible option, taking into account both the magnitude and the required direction of improvement [66].

For each method, a decision matrix was constructed with 30 alternatives (stops) and the four weighted criteria. Quantitative criteria values underwent linear min-max normalization, unless the specific method for instance, vector normalization was strictly applied within the TOPSIS framework to maintain consistency with its mathematical formulation. For qualitative criteria, ordinal scales ranging from 1 to 9 were employed, following the consensus of the expert panel.

Subsequently, an independent ranking of the 30 stops was obtained for each MCDM method. The results were compared to analyse the robustness and stability of the priority order by calculating the Spearman correlation coefficient between the different rankings. This analysis enabled the authors not only to assess the consistency among the methods but also the reliability of the proposed model as a decision-support tool in complex urban settings.

The foundations of each of the applied methods are described in detail in the following sections.

3.1. AHP-TOPSIS

The Analytic Hierarchy Process (AHP) coupled with the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was employed to evaluate and prioritise alternatives. The integration of AHP weights into TOPSIS facilitates the simultaneous assessment of each alternative's proximity to the positive ideal solution (A+) and its distance from the negative ideal solution (A−), thereby accommodating both increasing and decreasing criteria.

This combined approach provides an objective and quantitatively precise evaluation, capitalising on the hierarchical rigour of AHP and the strong discriminatory capacity of TOPSIS. This integrated approach proves particularly suitable for problems requiring the comparison of technical solutions under multiple criteria related to performance, efficiency, and sustainability [67,68].

Starting from the performance matrix, $X = [X_{ij}]_{n \times m}$.

Step 1. Normalisation (Vector Normalisation—Euclidean): Starting from the original evaluation matrix, a normalised decision matrix is constructed. This step is essential to convert all alternative values, with respect to the individual assessment criteria, to a common dimensionless base, thus enabling the necessary comparisons between them. The normalised rating r_{ij} is calculated as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^n x_{ij}^2}}, R = [r_{ij}] \quad (5)$$

Step 2. Weighted Matrix: The normalised decision matrix is multiplied by the relative weight of the corresponding criterion (column), which is calculated using a separate criterion weighting calculation method (for example, AHP).

$$v_{ij} = w_j r_{ij}, \quad V = [v_{ij}] \quad (6)$$

Step 3. Ideal Solutions: Two hypothetical variables, A^+ and A^- , are defined, which, respectively, capture the maximum and minimum possible weighted performance values for each assessment criterion. The distinction between benefit criteria and cost criteria determines the values assigned to the positive ideal solution A^+ and the negative ideal solution A^- . The components of these ideal solutions are formally defined for each criterion as:

$$\begin{aligned} v_j^+ &= \begin{cases} \max_i v_{ij}, & \text{if } c_j \text{ is a benefit criterion,} \\ \min_i v_{ij}, & \text{if } c_j \text{ is a cost criterion.} \end{cases} \\ v_j^- &= \begin{cases} \min_i v_{ij}, & \text{if } c_j \text{ is a benefit criterion,} \\ \max_i v_{ij}, & \text{if } c_j \text{ is a cost criterion.} \end{cases} \end{aligned} \quad (7)$$

Step 4. Euclidean Distances to the Ideal Solutions: The Euclidean distance of each alternative from the Positive Ideal Solution and the Negative Ideal Solution is calculated using the Euclidean metric, establishing the proximity of each option to these respective reference points. The corresponding distances are determined as follows:

$$d_i^+ = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^+)^2}, \quad d_i^- = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^-)^2} \quad (8)$$

Step 5. Closeness Coefficient: The Closeness Coefficient for each alternative, which determines its proximity relative to the Positive Ideal Solution and the Negative Ideal Solution, is calculated as follows:

$$C_i = \frac{d_i^-}{d_i^+ + d_i^-}, \quad 0 \leq C_i \leq 1 \quad (9)$$

Step 6. Final Ranking: The calculated Closeness Coefficient yields the final ranking of alternatives: a higher value indicates the preferred alternative. Consequently, the alternatives are classified in descending order of their values, with those receiving the highest proximity measure ranked in the top positions.

3.2. AHP-VIKOR

The combined Analytic Hierarchy Process (AHP) and VIKOR (VIšeKriterijumska Optimizacija I Kompromisno Rešenje) approach integrates two complementary multi-criteria methods. The VIKOR method [69] is designed to identify a compromise solution that represents the closest balance to the ideal, based on the weighted criteria derived from AHP [70].

The methodology commences with a set of m alternatives, A_i ($i = 1, 2, \dots, m$), and n criteria, C_j ($j = 1, 2, \dots, n$). The performance values are organised in a decision matrix $X = [X_{ij}]_{n \times m}$.

Step 1. Determination of the ideal and anti-ideal solutions: For each criterion C_j , the best (ideal) and worst (anti-ideal) performance values are defined as follows:

$$\begin{aligned} f_j^* &= \begin{cases} \max_i x_{ij}, & \text{if } C_j \text{ is increasing,} \\ \min_i x_{ij}, & \text{if } C_j \text{ is decreasing,} \end{cases} \\ f_j^- &= \begin{cases} \min_i x_{ij}, & \text{if } C_j \text{ is increasing,} \\ \max_i x_{ij}, & \text{if } C_j \text{ is decreasing,} \end{cases} \end{aligned} \quad (10)$$

Step 2. Calculation of utility and regret measures: The utility index (S_i) and the regret index (R_i) for each alternative are calculated as:

$$S_i = \sum_{j=1}^n w_j \frac{f_j^* - x_{ij}}{f_j^* - f_j^-}, \quad R_i = \max_j \left[w_j \frac{f_j^* - x_{ij}}{f_j^* - f_j^-} \right] \quad (11)$$

where w_j are the criterion weights obtained through AHP.

- S_i : Represents the weighted aggregated distance to the ideal (utility criterion).
- R_i : Reflects the worst relative performance (maximum regret criterion).

Step 3. Calculation of the compromise index (Q_i): The compromise index (Q_i) for each alternative is subsequently defined as:

$$Q_i = v \frac{S_i - S^*}{S^- - S^*} + (1 - v) \frac{R_i - R^*}{R^- - R^*} \quad (12)$$

where

- $S^* = \min_i S_i, S^- = \max_i S_i$
- $R^* = \min_i R_i, R^- = \max_i R_i$
- $v \in [0, 1]$ is the strategy weight parameter, which reflects the importance of the majority group. In this study, following standard practice for an equitable compromise, the parameter value was set to $v = 0.5$, granting equal weight to the group utility and the individual regret.

Step 4. Ranking and Compromise Conditions: Alternatives are ranked according to their Q_i values in ascending order. The alternative with the lowest Q_i value is considered the compromise solution, provided that the following two conditions are met:

- Acceptable Advantage Condition (A_1 must be sufficiently better than A_2):

$$Q(A_2) - Q(A_1) \geq \frac{1}{m - 1}, \quad (13)$$

where A_1 is the best-ranked alternative and A_2 is the second-best.

- Acceptable Stability Condition: A_1 must be the best-ranked alternative by both S_i and R_i measures.

If either condition is not satisfied, the compromise set comprises the alternatives with proximate Q_i values.

3.3. AHP-COPRAS

The COMplex PROportional ASsessment (COPRAS) method, introduced by Zavadskas in 1994 [71,72], provides a robust methodology for MCDM problems, effectively accommodating both increasing (benefit) and decreasing (cost) criteria. The integration of AHP weights ensures coherent criterion weights for the ranking of alternatives.

The COPRAS methodology employs the following stages, commencing with the definition of the decision matrix:

$$X = [X_{ij}]_{n \times m} \quad (14)$$

This matrix comprises m alternatives, A_i ($i = 1, \dots, m$), and n criteria, C_j ($j = 1, \dots, n$). Crucially, each criterion is classified as either a benefit (to be maximised) or a cost (to be minimised) criterion.

Step 1. Normalisation of the Decision Matrix: Each element x_{ij} of the decision matrix is normalised by the sum of all elements within the respective criterion j :

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}}, \quad i = 1, \dots, m, \quad j = 1, \dots, n. \quad (15)$$

Step 2. Weighting of the Normalised Entries: The normalised matrix entries are weighted using the criterion weights (w_j) obtained, for instance, via AHP:

$$q_{ij} = w_j r_{ij} \quad (16)$$

Step 3. Calculation of Weighted Sums for Benefit and Cost Criteria: The weighted normalised values are summed separately for the two criterion types:

- Weighted sum for benefit criteria:

$$S_i^+ = \sum_{j \in J^+} q_{ij} \quad (17)$$

- Weighted sum for cost criteria:

$$S_i^- = \sum_{j \in J^-} q_{ij} \quad (18)$$

where J^+ and J^- denote the sets of indices for benefit and cost criteria, respectively.

Step 4. Calculation of the Relative Utility Index (Q_i): The Relative Utility Index is calculated using the following formula:

$$Q_i = S_i^+ + \frac{\sum_{i=1}^m S_i^-}{S_i^- \sum_{i=1}^m \frac{1}{S_i^-}} \quad (19)$$

Step 5. Final Ranking: Alternatives are ranked in descending order based on their Q_i values; the alternative with the highest Q_i score is designated as the most desirable.

3.4. AHP-ARAS

The AHP-ARAS approach combines the hierarchical weighting capability of AHP with the Additive Ratio Assessment (ARAS) methodology, proposed by Zavadskas and Turskis [66,73]. The ARAS method is distinguished by its incorporation of an ideal (optimal) alternative (A_0) and its calculation of relative utility indices. This feature makes the method particularly suitable for decision problems where the performance of each option must be expressed in proportion to the best possible alternative.

The methodology begins by defining the decision matrix:

$$X = \{x_{ij}\}, \quad i = 0, 1, 2, \dots, m; \quad j = 1, 2, \dots, n \quad (20)$$

where A_0 represents the optimal (ideal) alternative, and the remaining A_i are the actual alternatives.

Step 1. Normalisation of the Decision Matrix: The decision matrix is normalised using different formulas based on the nature of the criterion:

- For maximisation (benefit) criteria:

$$x_{ij}^* = \frac{x_{ij}}{\sum_{i=0}^m x_{ij}} \quad (21)$$

- For minimisation (cost) criteria:

$$x_{ij}^* = \frac{1/x_{ij}}{\sum_{i=0}^m (1/x_{ij})} \quad (22)$$

Step 2. Weighting of the Normalised Entries: The normalised values are subsequently weighted using the criterion weights (w_j) obtained from the AHP:

$$x_{ij}^{**} = w_j \cdot x_{ij}^* \quad (23)$$

Step 3. Calculation of the Aggregate Score: For each alternative A_i , the additive weighted aggregate score (S_i) is calculated as the sum of its weighted normalised values:

$$S_i = \sum_{j=1}^n x_{ij}^{**} \quad (24)$$

The value S_0 corresponds to the optimal or ideal alternative.

Step 4. Determination of the Relative Utility Degree: The relative utility degree (K_i) for each alternative is determined as a function of the ideal alternative score (S_0):

$$K_i = \frac{S_i}{S_0}, \quad 0 < K_i \leq 1 \quad (25)$$

Step 5. Final Ranking: Alternatives are ranked in descending order based on their K_i values. The alternative with $K_i = 1$ represents the ideal solution, and all other values are interpreted as a percentage of utility relative to the best possible option.

4. Application of the Methodology and Results

4.1. Results of MCDM Method Application

In this study, four different MCDM methods were used to highlight the characteristics of each one and to demonstrate the advantages of applying them together.

The four MCDM methods generated distinct prioritisation rankings for the bus stop alternatives. In all models, the alternatives were first normalised and subsequently evaluated based on the criterion weights consensually derived by the expert panel, thereby ensuring methodological coherence across all comparative models. The resulting rankings for the sample of 30 bus stops, obtained through the independent application of each AHP–MCDM approach, are presented in Table 3, while the comprehensive indices calculated for each method are detailed in Appendix A.

Table 3. Prioritisation rankings for bus stop Alternatives across four MCDM methods.

RANKING	TOPSIS	VIKOR	COPRAS	ARAS
1	A23	A23	A23	A23
2	A26	A26	A29	A29
3	A29	A29	A26	A26
4	A21	A21	A21	A21
5	A1	A30	A1	A1
6	A15	A15	A15	A15
7	A30	A11	A30	A30
8	A11	A1	A11	A11
9	A2	A2	A24	A24
10	A24	A7	A7	A2

Table 3. *Cont.*

RANKING	TOPSIS	VIKOR	COPRAS	ARAS
11	A7	A24	A2	A7
12	A17	A17	A17	A17
13	A12	A20	A12	A20
14	A20	A16	A20	A12
15	A16	A12	A16	A16
16	A3	A3	A22	A3
17	A22	A22	A3	A22
18	A6	A28	A6	A6
19	A28	A6	A28	A28
20	A25	A9	A25	A25
21	A9	A25	A9	A9
22	A18	A18	A5	A18
23	A5	A5	A18	A5
24	A27	A27	A27	A27
25	A14	A14	A8	A8
26	A8	A8	A14	A14
27	A19	A4	A13	A4
28	A4	A13	A4	A13
29	A13	A19	A19	A19
30	A10	A10	A10	A10

4.2. General Performance of the Methods

The comparative application of the four AHP–MCDM methods revealed consistent prioritisation patterns that reflect the structural inequalities of accessibility within the Segovia transport network. As illustrated in Figure 2, the trajectories of the alternatives exhibit a high degree of convergence in the upper section of the ranking, where the lines corresponding to the most prioritised stops remain practically parallel across all four approaches. The top rank (i.e., the highest-scoring stop) remained stable across all models, confirming unanimous agreement on the most strategic location for intervention.

Discrepancies were primarily concentrated in the intermediate positions of the rankings, where subtle differences in criterion performance produced moderate changes in rank order. This behaviour is visually captured in Figure 2 by the intersection of lines representing alternatives with comparable quantitative and qualitative values, consistent with the expected methodological sensitivity of multicriteria frameworks when alternatives present similar attribute levels. Importantly, these variations do not alter the general prioritisation pattern: in all methods, the highest-ranked stops were located in densely populated districts with limited access to essential services, thus confirming that demographic concentration and spatial accessibility exerted the strongest influence on the decision-making process.

Both compromise-based (TOPSIS, VIKOR) and additive-ratio-based (COPRAS, ARAS) methods demonstrated a strong alignment in identifying priority bus stops, despite relying on distinct mathematical formulations. The persistence of this convergence across independent procedures underscores the methodological robustness of the proposed hybrid approach and mitigates concerns regarding potential bias arising from the selection of a single decision-making technique.

Overall, the results indicate that the proposed methodology effectively discriminates between areas where accessibility interventions would yield the highest social impact and those where technical or financial constraints reduce feasibility. This finding highlights the practical relevance of the model as a decision-support tool for municipalities operating under constrained budgets, enabling transparent and evidence-based prioritisation of accessibility improvements.

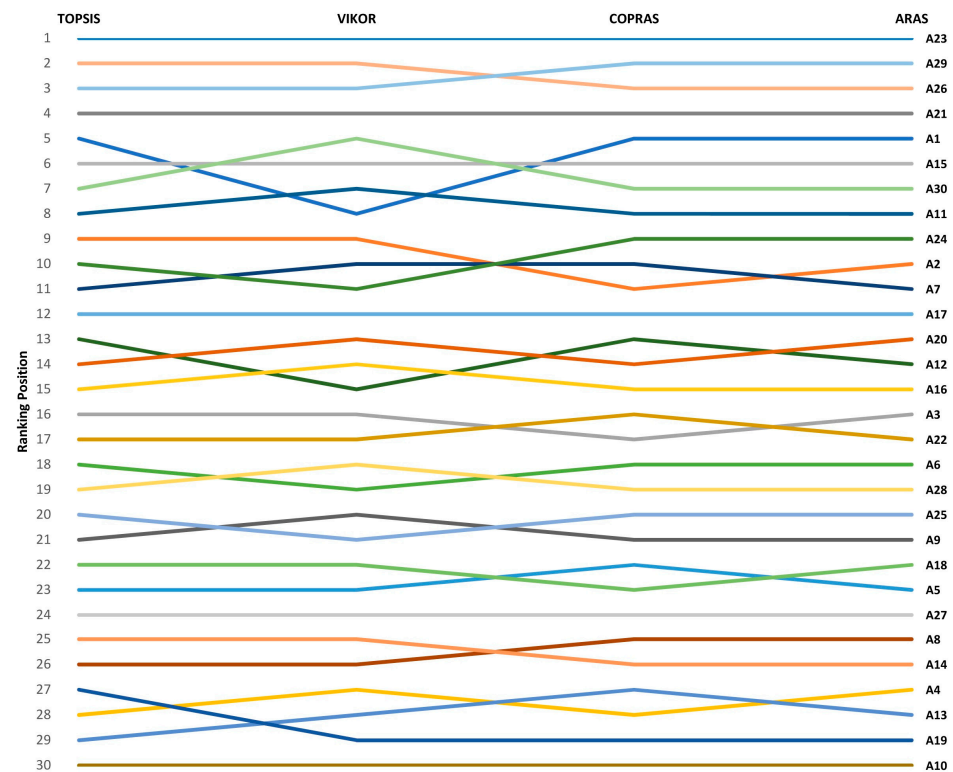


Figure 2. Comparative trajectories of bus stop rankings across the four AHP-MCDM methods.

4.3. Analysis of Ranking Concordance

To assess the robustness and stability of the prioritisation results, Spearman's rank correlation coefficient (ρ) was calculated to measure the degree of concordance among the rankings generated by the four AHP-MCDM methods. The correlation values ranged from 0.980 to 0.997, indicating a generally high level of agreement across most approaches.

As shown in Table 4, the strongest correlations were observed between COPRAS and ARAS ($\rho = 0.9978$) and between TOPSIS and ARAS ($\rho = 0.9969$) and TOPSIS and COPRAS ($\rho = 0.9951$), reflecting the close mathematical relationship between additive ratio and compromise-based models.

Table 4. Spearman's rank correlation coefficient between MCDM method rankings.

	TOPSIS	VIKOR	COPRAS	ARAS
TOPSIS	1	0.9929	0.9951	0.9969
VIKOR	0.9929	1	0.9907	0.9933
COPRAS	0.9951	0.9907	1	0.9978
ARAS	0.9969	0.9933	0.9978	1

4.4. Sensitivity and Robustness of the Final Ranking

A sensitivity analysis was conducted by varying the criterion weights by $\pm 10\%$ to test the stability of the prioritisation outcomes. The analysis confirmed that the highest-ranked bus stops retained their relative positions in more than 85% of the simulations, indicating that the proposed methodology is robust against moderate fluctuations in the weighting scheme.

Variations were mainly observed among alternatives with similar aggregate scores for technical feasibility and economic viability, suggesting that the social and spatial criteria exert a dominant influence on the final prioritisation. Overall, these results strengthen confidence in the reliability of the model as a decision-support tool, even when expert judgements or contextual conditions introduce minor inconsistencies in criterion weighting.

4.5. Integrated Ranking

An integrated ranking was developed by aggregating the individual outcomes of the four AHP–MCDM methods through a normalised average of the positions. This combined ranking provides a coherent synthesis of the information derived from each model and was considered the most representative basis for final decision making. The ten highest-priority bus stops exhibited an 80% concordance across all methods, consistently corresponding to areas with high population density and favourable technical and economic feasibility. These results empirically confirm the internal consistency of the proposed prioritisation framework and demonstrate its capacity to identify interventions with the greatest potential social return under real urban conditions.

5. Discussion

The high consistency of the generated rankings (Section 4.3), evidenced by the near-perfect correlations between COPRAS and ARAS ($\rho = 0.9978$) and between TOPSIS and ARAS ($\rho = 0.9969$) and TOPSIS and COPRAS ($\rho = 0.9951$), confirms the methodological robustness of the results. This strong convergence is primarily attributable to the methods' distinct mathematical underpinnings: TOPSIS and VIKOR are compromise-based approaches that prioritise distance from the ideal solution, whereas COPRAS and ARAS rely on additive ratio models. Furthermore, the robust stability of the core ranking across over 85% of the sensitivity simulations (Section 4.4) effectively mitigates the inherent subjectivity often associated with AHP weighting.

Figure 3 reinforces this analytical finding by displaying the Maximum Position Deviation (MPD) between the highest and lowest rank obtained by each alternative across the four methods. The results indicate that more than 75% of the alternatives either remained unchanged or varied by only one position in the ranking, whereas only one alternative exhibited a deviation of three positions. This limited dispersion indicates that the observed consistency is not a mere statistical artefact of high correlation coefficients but rather reflects a structural stability of the prioritisation order. In other words, the methods converge not only in relative direction but also in absolute positional agreement, even under different computational assumptions.

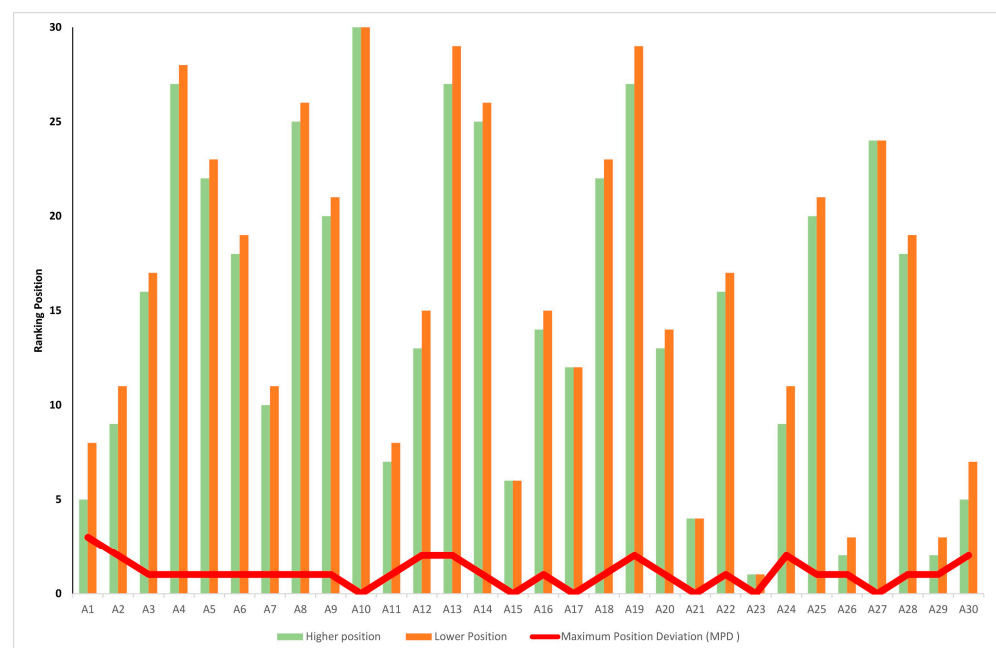


Figure 3. Ranking consistency and Maximum Position Deviation (MPD) for the 30 alternatives across the four AHP–MCDM methods.

Taken together, these results confirm that the proposed prioritisation framework is both methodologically coherent and operationally resilient, providing a reliable basis for informed decision making in urban accessibility planning.

5.1. Practical Implications and Value Added

The results obtained validate that the developed methodology enables the precise identification of the most strategic bus stops for intervention, thereby facilitating decision making in resource-constrained contexts. This finding represents a significant advance over traditional approaches, which focused exclusively on diagnosing barriers without providing operational prioritisation tools [35,36,38,39].

The added value of the model resides in its capacity to integrate objective criteria—specifically, potential stop usage and the level of accessibility deficit—with participatory consultation of users and experts via AHP. This integration not only reinforces the model's technical soundness but also enhances its social legitimacy. In practical terms, this combination provides a rigorous framework for municipal planning, directing the allocation of resources towards interventions that generate the maximum social impact.

5.2. Extrapolation, Resilience, and Global Relevance

In a broader sense, the proposed methodology extends beyond passenger public transport, as it may be extrapolated to other urban mobility nodes, such as intermodal stations or last-mile logistics microhubs. This potential transferability relies on the structural similarity of the decision-making processes involved, which require the joint consideration of social, technical, economic, and environmental criteria. In such contexts, the same AHP–MCDM framework can be adapted by redefining the criterion weights and incorporating additional indicators (e.g., freight flows or transfer times) without altering the underlying logic of prioritisation.

Although this extrapolation has not yet been empirically validated, its conceptual coherence suggests that the proposed model may serve as a general decision-support tool for integrated passenger–freight planning, fostering the convergence of accessibility and efficiency within sustainable logistics systems. This represents a promising avenue for future research aimed at verifying the operational robustness of the model across different urban nodes.

Beyond its empirical application, the study constitutes a significant methodological contribution to the field of urban accessibility. The proposal introduces a straightforward and replicable model that can be readily adapted to diverse urban contexts and varying levels of data availability. Furthermore, the global relevance of the model is reinforced by its direct alignment with Sustainable Development Goal (SDG) 11, specifically Target 11.2 (Affordable and sustainable transport systems).

5.3. Limitations and Directions for Future Research

Nonetheless, certain limitations should be noted. Firstly, the empirical validation was conducted exclusively in a single city (Segovia), which restricts the immediate generalisation of the findings. Secondly, the approach was applied solely to bus stops; hence, further work is required to confirm its effectiveness in intermodal stations or other, more complex, multimodal nodes.

Future work primarily involves extending the methodology to various urban mobility nodes, such as railway stations, interchanges, and logistics microhubs, where efficient accessibility management can decisively impact sustainable mobility and freight distribution. A second line of research focuses on incorporating dynamic data via digital tools, which would allow for the continuous updating of intervention priorities based on evolving demand and changing urban conditions.

Finally, a third line of research focuses on evaluating the robustness of the model against variations in the input data values for the selected criteria. Since MCDM results can change materially depending on the specific performance values assigned to each alternative (bus stops), future studies should explore how potential fluctuations in these measurements—due to data collection timing or environmental changes—might influence the final rankings. This would further validate the stability of the prioritisation model under varying empirical conditions.

6. Conclusions

This study successfully developed and validated a robust AHP–MCDM methodology for prioritising universal accessibility interventions at urban mobility nodes. The model’s reliability and its applicability in resource-constrained contexts are affirmed by the high consistency observed across the majority of the derived rankings and the stability confirmed in the sensitivity analysis. The comparative analysis shows that the four MCDM methods used (TOPSIS, VIKOR, COPRAS, and ARAS) provide highly similar rankings for the bus stops. This convergence of results ensures that municipal authorities can prioritise accessibility interventions objectively, as the final prioritisation remains consistent regardless of the specific mathematical method applied. By demonstrating that different evaluation perspectives lead to nearly identical outcomes, the framework provides a reliable and transparent basis for decision making, ensuring that public investments are directed toward the most critical nodes with high technical and social consensus.

Crucially, the model offers an innovative hybrid approach by combining objective criteria (e.g., stop usage and accessibility deficit) with participatory validation via AHP, thereby integrating the perspectives of disabled individuals and accessibility experts. This hybridisation ensures both the technical rigour and the social legitimacy of the resulting prioritisation decisions. On a practical level, the methodology contributes to optimising the allocation of municipal resources by focusing efforts on interventions that yield the greatest social impact, enabling a transition towards more equitable and efficient transport systems. However, it must be acknowledged that the final prioritisation is inherently linked to the specific values recorded for each criterion across the 149 bus stops. Recognising that results in MCDM can change materially depending on the chosen criteria set and the values assigned to each alternative, further research is required to assess the model’s robustness against fluctuations in these input data.

The findings demonstrate the methodology’s transferability and potential for extension to other complex urban mobility nodes, such as intermodal stations and logistics microhubs, thereby reinforcing its relevance to urban supply chains and the construction of more resilient and sustainable cities. Ultimately, the model is a replicable and adaptable tool that directly supports the global agenda through alignment with SDG 11 (Sustainable Cities and Communities), specifically Target 11.2 (Affordable and sustainable transport systems). While the framework focuses on social and technical accessibility criteria, it integrates the environmental dimension transversally; by optimising public transport nodes, the model promotes a reduction in urban emissions and supports the transition to more sustainable and low-carbon urban mobility patterns.

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Abbreviations

The following abbreviations are used in this manuscript:

AHP	Analytic Hierarchy Process
ARAS	Additive Ratio Assessment
CI	Consistency Index
COPRAS	Complex Proportional Assessment
CR	Consistency Ratio
GIS	Geographic Information Systems
MCDM	Multi-Criteria Decision-Making
MPD	Maximum Position Deviation
RI	Random Index
SDG	Sustainable Development Goal
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
VIKOR	VlseKriterijumska Optimizacija I Kompromisno Resenje

Appendix A

Appendix A.1

Appendix A.1 presents the distance values to the positive and negative ideal solutions (S_i^+ and S_i^-), together with the C_i coefficients, which indicate the relative closeness of each alternative to the optimal and negative ideal solutions obtained through the AHP–TOPSIS method.

Table A1. d_i^+ , d_i^- , and C_i values.

Alternatives	d_i^+	d_i^-	C_i
A1	0.031911288	0.159298335	0.833108359
A2	0.047407082	0.120145950	0.717062226
A3	0.082150153	0.081797119	0.498923331
A4	0.160100529	0.027948261	0.148622392
A5	0.121031566	0.045949968	0.275179939
A6	0.086454785	0.079751005	0.479832893
A7	0.048854806	0.119975928	0.710628482
A8	0.158994426	0.034389747	0.177831237
A9	0.120917052	0.049348998	0.289834631
A10	0.161502145	0.014544126	0.082615361
A11	0.045210741	0.121919965	0.729488721
A12	0.080264353	0.086112152	0.517573994
A13	0.159974160	0.023813105	0.129568851
A14	0.125233421	0.039815023	0.241232345
A15	0.032194211	0.158915532	0.831540713
A16	0.080088998	0.084951453	0.514731101

Table A1. Cont.

Alternatives	d_i+	d_i-	C_i
A17	0.052601958	0.119424845	0.694222313
A18	0.120350831	0.046248783	0.277604385
A19	0.161455487	0.028342741	0.149330905
A20	0.080571853	0.085994386	0.516277410
A21	0.028345027	0.159211818	0.848872339
A22	0.083428149	0.082304807	0.496610990
A23	0.002074159	0.163727870	0.987490146
A24	0.047935220	0.120928637	0.716130966
A25	0.120321595	0.050239290	0.294553408
A26	0.018930414	0.160248585	0.894349148
A27	0.121286703	0.045104056	0.271073085
A28	0.086832529	0.079866348	0.479105494
A29	0.019050093	0.160552869	0.893932190
A30	0.042155965	0.123085904	0.744883270

Appendix A.2

Appendix A.2 identifies the site with the lowest Q_i value, which represents the most favorable option according to the VIKOR approach. The corresponding S_i , R_i , and Q_i values are reported in Table A2.

Table A2. S_i , R_i , and Q_i values.

Alternatives	S_i	R_i	Q_i
A1	0.262020353	0.194456823	0.268969395
A2	0.377553468	0.157855026	0.303882917
A3	0.520941099	0.315710053	0.515039291
A4	0.773808722	0.631420105	0.918236756
A5	0.655485571	0.473565079	0.721210373
A6	0.591226313	0.315710053	0.554662277
A7	0.386532126	0.168481143	0.317717324
A8	0.704476704	0.631420105	0.879151130
A9	0.614447546	0.473565079	0.698075364
A10	0.918844413	0.631420105	1
A11	0.283511245	0.157855026	0.250867020
A12	0.439681179	0.315710053	0.469229363
A13	0.810571740	0.631420105	0.938961748
A14	0.795107616	0.473565079	0.799921698
A15	0.263221688	0.164332250	0.244776347
A16	0.437483446	0.315710053	0.467990400
A17	0.450992020	0.157855026	0.345283583
A18	0.654346091	0.473565079	0.720567997
A19	0.889431519	0.631420105	0.983418608
A20	0.372222222	0.315710053	0.431199667
A21	0.217827306	0.127533371	0.188804980
A22	0.532021340	0.315710053	0.521285729
A23	0.031919655	0.025786509	0
A24	0.400487484	0.175696610	0.331541554
A25	0.639135969	0.473565079	0.711993356
A26	0.185249403	0.082075932	0.132910499
A27	0.671595340	0.473565079	0.730292186
A28	0.577233892	0.315710053	0.546774110
A29	0.150415883	0.120317904	0.144845124
A30	0.227174649	0.157855026	0.219107507

Appendix A.3

Appendix A.3 reports the Relative Utility Index (Q_i), used in the COPRAS approach to identify the most advantageous alternative.

Table A3. Q_i values.

Alternatives	Q_i
A1	0.046897332
A2	0.039540097
A3	0.032513296
A4	0.017140825
A5	0.025171612
A6	0.029413371
A7	0.039545973
A8	0.020555496
A9	0.025531915
A10	0.013988642
A11	0.041816490
A12	0.036104494
A13	0.017150590
A14	0.019515711
A15	0.046236410
A16	0.035432770
A17	0.037067937
A18	0.025164384
A19	0.016211973
A20	0.036082316
A21	0.047399155
A22	0.032522129
A23	0.054782857
A24	0.040286339
A25	0.026794722
A26	0.049552766
A27	0.023971522
A28	0.029118117
A29	0.050562831
A30	0.043927928

Appendix A.4

Appendix A.4 presents the Aggregate Score (S_i) and the Relative Utility Degree (K_i) obtained through the ARAS method. Based on the K_i values, the alternatives are ordered from highest to lowest utility.

Table A4. S_i and K_i values.

Alternatives	S_i	K_i
A1	0.044381005	0.846182795
A2	0.037448895	0.714012920
A3	0.030807186	0.587379915
A4	0.016306561	0.310906244
A5	0.023868366	0.455082105
A6	0.027866110	0.531304399
A7	0.037444300	0.713925313
A8	0.019528451	0.372335861
A9	0.024235517	0.462082313

Table A4. Cont.

Alternatives	S _i	K _i
A10	0.013285061	0.253297342
A11	0.039622870	0.755462640
A12	0.034206777	0.652197627
A13	0.016290980	0.310609163
A14	0.018510533	0.352927895
A15	0.043763376	0.834406893
A16	0.033579507	0.640237890
A17	0.035102659	0.669278817
A18	0.023871294	0.455137923
A19	0.015379379	0.293228294
A20	0.034216354	0.652380230
A21	0.044873681	0.855576336
A22	0.030804227	0.587323509
A23	0.051876345	0.989091412
A24	0.038134006	0.727075481
A25	0.025400566	0.484295520
A26	0.046911422	0.894428571
A27	0.022746709	0.433696219
A28	0.027597898	0.526190582
A29	0.047866002	0.912628903
A30	0.041625479	0.793645034

References

1. Ruggieri, R.; Ruggieri, M.; Vinci, G.; Poponi, S. Electric mobility in a smart city: European overview. *Energies* **2021**, *14*, 315. [CrossRef]
2. Telega, A.; Telega, I.; Bieda, A. Measuring walkability with GIS—Methods overview and new approach proposal. *Sustainability* **2021**, *13*, 1883. [CrossRef]
3. UN-Habitat. World Cities Report 2022: Envisaging the Future of Cities. Available online: https://unhabitat.org/sites/default/files/2022/06/wcr_2022.pdf (accessed on 2 September 2025).
4. Liu, H.; Hu, C.; Xiao, Q.; Zhang, J.; Sun, F.; Shi, X.; Chen, X.; Yang, Y.; Xiao, W. Analysis of anthropogenic CO₂ emission uncertainty and influencing factors at city scale in Yangtze River Delta region: One of the world's largest emission hotspots. *Atmos. Pollut. Res.* **2024**, *1*, 102281. [CrossRef]
5. Mondal, R.; Bresciani, S.; Rizzo, F. What cities want to measure: Bottom-up selection of indicators for systemic change toward climate neutrality aligned with sustainable development goals (SDGs) in 40 European cities. *Climate* **2024**, *12*, 41. [CrossRef]
6. Litt, G.; Ferraioli, E.; Magni, F.; Lucertini, G.; Musco, F. Intermunicipal methodology for climate transition strategies: The first case in Italy. *Sustainability* **2022**, *14*, 2529. [CrossRef]
7. Perdikopoulos, M.; Karageorgiou, T.; Ntziachristos, L.; Deville Cavellin, L.; Joly, F.; Vigneron, J.; Arfire, A.; Debert, C.; Sanchez, O.; Gaie-Levrel, F.; et al. Developing emission factors from real-world emissions of Euro VI urban diesel, diesel-hybrid, and compressed natural gas buses. *Atmosphere* **2025**, *16*, 293. [CrossRef]
8. Yang, L.; Wang, Y.; Lian, Y.; Dong, X.; Liu, J.; Liu, Y.; Wu, Z. Rational planning strategies of urban structure, metro, and car use for reducing transport carbon dioxide emissions in developing cities. *Environ. Dev. Sustain.* **2023**, *25*, 6987–7010. [CrossRef]
9. Yuan, M.; Song, Y.; Hong, S.; Huang, Y. Evaluating the effects of compact growth on air quality in already-high-density cities with an integrated land use-transport-emission model: A case study of Xiamen, China. *Habitat Int.* **2017**, *69*, 37–47. [CrossRef]
10. Mahadevia, D.; Mukhopadhyay, C.; Lathia, S.; Gounder, K. The role of urban transport in delivering Sustainable Development Goal 11: Learning from two Indian cities. *Heliyon* **2023**, *9*, e19453. [CrossRef]
11. Lättman, K.; Otsuka, N. Sustainable development of urban mobility through active travel and public transport. *Sustainability* **2024**, *16*, 534. [CrossRef]
12. Monteiro, J.; Sousa, N.; Coutinho-Rodrigues, J.; Natividade-Jesus, E. Challenges ahead for sustainable cities: An urban form and transport system review. *Energies* **2024**, *17*, 409. [CrossRef]
13. Teixeira, L.; Ramos, A.L.; Costa, C.; Pedrosa, D.; Faria, C.; Pimentel, C. SOLFI: An integrated platform for sustainable urban last-mile logistics' operations—Study, design and development. *Sustainability* **2023**, *15*, 2613. [CrossRef]
14. Maxner, T.; Dalla Chiara, G.; Goodchild, A. The state of sustainable urban last-mile freight planning in the United States. *J. Am. Plann. Assoc.* **2025**, *91*, 88–101. [CrossRef]

15. Rześny-Cieplińska, J. Overview of the practices in the integration of passenger mobility and freight deliveries in urban areas. *Case Stud. Transp. Policy* **2023**, *11*, 101106. [\[CrossRef\]](#)
16. Ghaderi, H.; Tsai, P.; Zhang, L.; Moayedikia, A. An integrated crowdshipping framework for green last mile delivery. *Sustain. Cities Soc.* **2022**, *76*, 103552. [\[CrossRef\]](#)
17. Golińska-Dawson, P.; Sethanan, K. Sustainable urban freight for energy-efficient smart cities—Systematic literature review. *Energies* **2023**, *16*, 2617. [\[CrossRef\]](#)
18. Li, S.; Zhu, X.; Shang, P.; Wang, L.; Li, T. Scheduling shared passenger and freight transport for an underground logistics system. *Transp. Res. Part B Methodol.* **2024**, *179*, 102907. [\[CrossRef\]](#)
19. Amrani, A.; Fri, M.; Benmoussa, O.; Rouky, N. The integration of urban freight in public transportation: A systematic literature review. *Sustainability* **2024**, *16*, 5286. [\[CrossRef\]](#)
20. Chicaiza-Vaca, J.; Barán, B.; Sandoya, F.; Barán, M. Taxonomy for integrated passenger—Freight transportation models as an alternative for urban logistics. In Proceedings of the Intelligent Transport Systems. INTSYS 2023, Molde, Norway, 6–7 September 2023; Martins, A.L., Ferreira, J.C., Kocian, A., Tokkozhina, U., Helgheim, B.I., Bråthen, S., Eds.; Springer: Cham, Switzerland, 2024; pp. 185–200. [\[CrossRef\]](#)
21. Tessier, A.; Clément, M.; Gélinas, I.; Boucher, N.; Croteau, C.; Morin, D.; Turcotte, M.; Archambault, P. The impact of transportation on the employment of people with disabilities: A scoping review. *Transp. Rev.* **2023**, *44*, 85–111. [\[CrossRef\]](#)
22. Appleyard, B. Opportunity access as a design framework for guiding transportation and land use integration: An evaluation of U.S. transit-oriented developments (TOD). *Local Environ.* **2023**, *28*, 1231–1242. [\[CrossRef\]](#)
23. Patil, D.; Bailey, A.; George, S.; Hyde, M.; Ashok, L. Unpacking the role of transport inequalities among older adults for accessing healthcare in Bengaluru, India. *Glob. Public Health* **2023**, *18*, e2274438. [\[CrossRef\]](#)
24. Jeghers, M.; Winter, S.; Classen, S. Exploring transportation challenges and opportunities for mobility-vulnerable populations through the social-ecological model. *Occup. Ther. J. Res.* **2024**, *45*, 475–484. [\[CrossRef\]](#)
25. Bezyak, J.L.; Sabella, S.; Hammel, J.; McDonald, K.; Jones, R.A.; Barton, D. Community participation and public transportation barriers experienced by people with disabilities. *Disabil. Rehabil.* **2020**, *42*, 3275–3283. [\[CrossRef\]](#) [\[PubMed\]](#)
26. Aarhaug, J.; Elvebakk, B. The impact of universally accessible public transport—A before and after study. *Transp. Policy* **2015**, *44*, 143–150. [\[CrossRef\]](#)
27. Neven, A.; Ectors, W. I am dependent on others to get there: Mobility barriers and solutions for societal participation by persons with disabilities. *Travel Behav. Soc.* **2023**, *30*, 100751. [\[CrossRef\]](#)
28. Desai, R.; Hollingsworth, H.; Stark, S.; Putnam, M.; Eyler, A.; Wehmeier, A.; Morgan, K. Social participation of adults aging with long-term physical disabilities: A cross-sectional study investigating the role of transportation mode and urban vs rural living. *Disabil. Health J.* **2023**, *16*, 101503. [\[CrossRef\]](#)
29. Stafford, L.; Tye, I. I have mentally cancelled a lot of trips: Trips not made by disabled people due to public transport inequity in lutruwita/Tasmania. *J. Transp. Geogr.* **2023**, *110*, 103668. [\[CrossRef\]](#)
30. Almoshaogeh, M.; Jamal, A.; Ahmed, T.; Alharbi, F.; Iqbal, M.; Haider, H.; Alinizzi, M. A review on disability-inclusive public transportation: Current barriers and prospects. *IEEE Access* **2025**, *13*, 75769–75786. [\[CrossRef\]](#)
31. Bęczkowska, S.A.; Zysk, Z. Safety of people with special needs in public transport. *Sustainability* **2021**, *13*, 10733. [\[CrossRef\]](#)
32. Elorduy, J.; Pino, Y.; Gento, Á. Assessing public transport accessibility for people with physical disabilities in Burgos, Spain: A user-centered approach to inclusive urban mobility. *PLoS ONE* **2025**, *20*, e0322068. [\[CrossRef\]](#)
33. Duri, B.; Luke, R. The structural barriers to universally accessible transport: The Tshwane (ZAF) metropolitan area study case. *Int. J. Transp. Dev. Integr.* **2022**, *6*, 428–442. [\[CrossRef\]](#)
34. Hidalgo, D.; Urbano, C.; Olivares, C.; Tinjacá, N.; Pérez, J.M.; Pardo, C.F.; Rodríguez, M.; Granada, I.; Navas, C.; Glen, C.; et al. Mapping universal access experiences for public transport in Latin America. *Transp. Res. Rec.* **2020**, *2674*, 79–90. [\[CrossRef\]](#)
35. Bezyak, J.; Sabella, S.; Gattis, R. Public transportation: An investigation of barriers for people with disabilities. *J. Disabil. Policy Stud.* **2017**, *28*, 52–60. [\[CrossRef\]](#)
36. Park, J.; Chowdhury, S. Investigating the barriers in a typical journey by public transport users with disabilities. *J. Transp. Health* **2018**, *10*, 361–370. [\[CrossRef\]](#)
37. Duri, B.; Luke, R. Assessing accessibility of transport and universal access in the city of Tshwane using expert opinion. *Soc. Sci.* **2024**, *13*, 690. [\[CrossRef\]](#)
38. Cerdan Chiscano, M. Improving the design of urban transport experience with people with disabilities. *Res. Transp. Bus. Manag.* **2021**, *41*, 100596. [\[CrossRef\]](#)
39. Elorduy, J.L.; Gento, A.M. Accessibility of public transport for people with disabilities: A systematic literature review. *Transport* **2025**, *40*, 74–93. [\[CrossRef\]](#)
40. Ferreira, A.; Leite, A.; Neves, L.; De Jesus, J.; De Oliveira, M.; Chang, S. Wheelchair accessibility of urban rail systems: Some preliminary findings of a global overview. *IATSS Res.* **2021**, *45*, 147–153. [\[CrossRef\]](#)

41. Flemmer, C.; McIntosh, A. Perceptions of people with disabilities on the accessibility of New Zealand's built environment. *Disabilities* **2025**, *5*, 75. [\[CrossRef\]](#)
42. Kumar, Y.; Singh, R.; Kataria, C. Understanding and exploring barriers of assistive technology for individuals with mobility disabilities. *Assist. Technol.* **2025**, 1–9. [\[CrossRef\]](#)
43. Elorduy, J.L.; Gento, A.M. Public transport and accessible tourism: Analysis in a Spanish UNESCO World Heritage city. *J. Urban Plann. Dev.* **2024**, *150*, 05023049. [\[CrossRef\]](#)
44. Broniewicz, E.; Ogrodnik, K. Multi-criteria analysis of transport infrastructure projects. *Transp. Res. D Transp. Environ.* **2020**, *83*, 102351. [\[CrossRef\]](#)
45. Tscheikner-Gratl, F.; Egger, P.; Rauch, W.; Kleidorfer, M. Comparison of multi-criteria decision support methods for integrated rehabilitation prioritization. *Water* **2017**, *9*, 68. [\[CrossRef\]](#)
46. Jaiswal, A.; Sinha, T.; Pandey, K.; Kumar, P.; Saran, S. Geospatial multi-criteria decision based site suitability analysis for solid waste disposal using TOPSIS algorithm. *ISPRS Ann. Photogramm. Remote Sens. Spat. Inf. Sci.* **2018**, *IV-5*, 431–438. [\[CrossRef\]](#)
47. Saleem, J.; Ahmad, S.S.; Shabbir, R. Evaluating land suitability analysis for urban services planning in coal clusters of Punjab using AHP, WOM, and TOPSIS method. *Arab. J. Geosci.* **2022**, *15*, 324. [\[CrossRef\]](#)
48. Ogrodnik, K. Application of MCDM/MCDA methods in city rankings—Review and comparative analysis. *Econ. Environ.* **2023**, *86*, 132–151. [\[CrossRef\]](#)
49. Farooq, U.; Abbas, W.; Chaudhry, F. Multi-criteria decision making and graph theory-based optimization of the Lahore metro system: A metric dimension, VIKOR, and PROMETHEE approach. *J. Math. Res.* **2025**, *17*, 1–51. [\[CrossRef\]](#)
50. Curiel-Esparza, J.; Mazario-Diez, J.L.; Canto-Perello, J.; Martin-Utrillas, M. Prioritization by consensus of enhancements for sustainable mobility in urban areas. *Environ. Sci. Policy* **2016**, *55*, 248–257. [\[CrossRef\]](#)
51. Raza, A.; Ali, M.U.; Ullah, U.; Fayaz, M.; Alvi, M.J.; Kallu, K.D.; Zafar, A.; Nengroo, S.H. Evaluation of a Sustainable Urban Transportation System in Terms of Traffic Congestion—A Case Study in Taxila, Pakistan. *Sustainability* **2022**, *14*, 12325. [\[CrossRef\]](#)
52. Solanki, V.S.; Agarwal, P.K. Identification of key performance indicators using hybrid COPRAS-TOPSIS for urban public transit systems by evaluating with AHP and FAHP. *Multimed. Tools Appl.* **2024**, *83*, 82439–82469. [\[CrossRef\]](#)
53. Muñoz-Medina, B.; Ordoñez, J.; Romana, M.G.; Alcaraz Carrillo de Albornoz, V. Achieving sustainable urban mobility with a modified VIKOR method to improve the selection of a park and ride system. *J. Civ. Eng. Manag.* **2025**, *31*, 153–170. [\[CrossRef\]](#)
54. Hoang Thuy, L.; Nguyen Thi Hong, H.; Phan Thi Thu, H.; Nguyen Hoang, T. Accessibility to public transport from the perspective of the aged people in developing countries: A case study in Hanoi, Vietnam. *Tạp Chí Khoa Học Giao Thông Vận Tải* **2022**, *73*, 344–358. [\[CrossRef\]](#)
55. Olsson, L.E.; Friman, M.; Lättman, K. Accessibility Barriers and Perceived Accessibility: Implications for Public Transport. *Urban Sci.* **2021**, *5*, 63. [\[CrossRef\]](#)
56. Lima, J.P.; Abitante, J.D.C.; Pons, N.A.D.; Senne, C.M. A spatial fuzzy multicriteria analysis of accessibility: A case study in Brazil. *Sustainability* **2019**, *11*, 3407. [\[CrossRef\]](#)
57. Hanani, F.; Soulhi, A. Fuzzy Logic Framework for Local Accessibility Assessment based on Built Environment Characteristics. In Proceedings of the 2nd International Conference on Big Data, Modelling and Machine Learning (BML 2021), Kenitra, Morocco, 5–6 June 2021; pp. 187–195. [\[CrossRef\]](#)
58. Anastasiadou, K.; Gavanis, N. Enhancing urban public space through appropriate sustainable mobility policies. A multi-criteria analysis approach. *Land Use Policy* **2023**, *132*, 106765. [\[CrossRef\]](#)
59. Rosa, A.G.F.; de Miranda Mota, C.M.; de Figueiredo, C.J.J. A spatial multi-criteria decision analysis framework to reveal vulnerabilities of areas to incidences of street robberies. *Appl. Geogr.* **2023**, *151*, 102840. [\[CrossRef\]](#)
60. Official Population Figures for Spanish Municipalities. Available online: <https://www.ine.es/jaxiT3/Tabla.htm?t=2894&L=0> (accessed on 4 November 2025).
61. Saaty, T.L. *The Analytic Hierarchy Process*; McGraw-Hill: New York, NY, USA, 1980.
62. Velasquez, M.; Hester, P.T. An analysis of multi-criteria decision-making methods. *Int. J. Oper. Res.* **2013**, *10*, 56–66.
63. Zarrad, A.; Bahsoon, R.; Manimaran, P. Optimizing regression testing with AHP-TOPSIS metric system for effective technical debt evaluation. *Autom. Softw. Eng.* **2024**, *31*, 58. [\[CrossRef\]](#)
64. Dang, P.; Gao, H.; Niu, Z.; Geng, L.; Hui, F.K.P.; Sun, C. The supplier selection of prefabricated component production line: A lean-based AHP-improved VIKOR framework. *Buildings* **2024**, *14*, 4018. [\[CrossRef\]](#)
65. Güner, E.; Aldemir, B.; Aydoğdu, E.; Aygün, H. Novel Hamacher aggregation operators with applications to the AHP–COPRAS method for spherical fuzzy environment. *Neural Comput. Appl.* **2025**, *37*, 12941–12990. [\[CrossRef\]](#)
66. Zavadskas, E.K.; Turskis, Z. A new additive ratio assessment (ARAS) method in multicriteria decision-making. *Ūkio Technol. Econ. Vystym.* **2010**, *16*, 159–172. [\[CrossRef\]](#)
67. Wang, S.; Zuo, Z.; Liu, Y. Study on location of bus stop in subway service area based on residents' travel accessibility. *Sustainability* **2023**, *15*, 4517. [\[CrossRef\]](#)

68. Madhu, K.A.; Rajakumara, H.N.; Kangda, M.Z.; Girija, S.P.; Reddy, G.R.; Wodajo, A.W. Evaluation of optimal route selection for public transport network routes on urban roads using Fuzzy-TOPSIS method. *Eng. Rep.* **2024**, *6*, e12794. [[CrossRef](#)]
69. Papathanasiou, J.; Ploskas, N. *Multiple Criteria Decision Aid: Methods, Examples and Python Implementations*; Springer International Publishing: Cham, Switzerland, 2018.
70. Opricovic, S.; Tzeng, G.H. Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *Eur. J. Oper. Res.* **2004**, *156*, 445–455. [[CrossRef](#)]
71. Zavadskas, E.K.; Kaklauskas, A.; Peldschus, F.; Turskis, Z. Multi-attribute assessment of road design solutions by using the COPRAS method. *Balt. J. Road Bridge Eng.* **2007**, *2*, 195–203.
72. Viteikiene, M.; Zavadskas, E.K. Evaluating the sustainability of Vilnius city residential areas. *J. Civ. Eng. Manag.* **2007**, *13*, 149–155. [[CrossRef](#)]
73. Kutut, V.; Zavadskas, E.K.; Lazauskas, M. Assessment of priority options for preservation of historic city centre buildings using MCDM (ARAS). *Procedia Eng.* **2013**, *57*, 657–661. [[CrossRef](#)]

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