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A QUALITATIVE STUDY ON THE EVALUATION OF WALKABILITY CRITERIA

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Abstract. As 20th-century motorised-vehicle planning took hold, it became clear that cities should be organised with pedestrian priority. Accordingly, the issue of walkability has grown in importance in urban design and planning. Numerous studies have identified criteria for making urban corridors walkable. In this research, a 'suitable criteria setting' study was conducted with nine experts through a focus group method to incorporate walkability criteria into local urban-corridor planning with a participatory approach. Participants were architects, landscape architects and urban planners who are familiar with Trabzon and conduct academic research on the city. Conducted in the urban core of Trabzon and analysed using descriptive analysis, the study identified eight main criteria and 45 sub-themes. The most important output is that, if units, facilities, services or infrastructure elements that cannot be associated with each other are not properly integrated, they generate a 'cut-off point' a rupture where walking trips typically end. To prevent such breakpoints, we propose placing a linkage sub-theme under each main criterion, emphasising that walkability depends on the continuous and integrated application of these criteria.

Keywords: *Walkability, suitable criteria setting, locally walkability criteria, focus group interview, linkage.*

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1. Introduction

According to the latest data from the World Bank, the global urban population has already surpassed half of the world's population (Ritchie *et al*., 2024). By 2050, two-thirds of the world's population is expected to live in urban areas, bringing with it a series of unforeseen challenges such as food, water, sanitation, housing, waste and governance. Transportation occupies a critical place among these challenges (Kenworthy, 2018). The increasing pressure of migration to urban areas is driving demand for additional transport infrastructure (Aysan Buldurur, 2018). Indeed, it is estimated that global road infrastructure will expand by 25 million kilometres of asphalt lanes between 2010 and 2050, with the 2050 level being 60% higher than the 2010 level (Dulac, 2013). While transport is indispensable for the continuity of daily life, it is also one of the main causes of climate change. Air, sea and land transport modes, which remain dependent on internal combustion engines, accounted for 16% of total greenhouse gas emissions in 2023,

making them the second largest source of global emissions (Statista Research Department, 2024). At the regional level, 71.1% of transport-related CO_2 emissions in European Union countries in 2019 came from road transport, with 61% of this coming from passenger cars (European Parliament, 2023). In 2022, emissions from cars and vans alone reached 10% of global CO_2 emissions (Tiseo, 2024). These figures show only part of the picture that emerges when transport is managed solely through capacity expansion.

In fact, the finding that increasing capacity can worsen traffic congestion is not new; towards the end of the twentieth century, it became apparent that the car-oriented approach to urban planning that began at the start of the century (Freund & Martin, 1996) had produced precisely this result. As road capacity expanded, cities experienced brief relief; however, the increase in additional car usage, proportional to the capacity increase, reintroduced traffic congestion in the same corridors, this time with higher traffic volumes (Newman & Kenworthy, 2007). Thus, urban designers and planners realised that increases in motor vehicle capacity did not alleviate traffic (Litman, 2014; Speck, 2013).

Plans that increase motor vehicle volume and individual vehicle use have become responsible for problems such as climate change, greenhouse gases, smog, respiratory diseases linked to air pollution, extreme weather events, disruptions in food supply, increased forest fires and changes in species survival and migration (Nunez, 2019). They have also raised concerns about declining quality of life and impaired social cohesion (Alfonzo, 2005). Consequently, it has been initiated efforts to increase pedestrian use in urban areas. In this context, the organisation and benefits of walkable environments have been the subject of multidisciplinary research and have been evaluated from different perspectives by different professional disciplines. While public health researchers have focused on promoting walking as a physical activity, urban planners or transport engineers have focused on reducing traffic density and noise as well as improving air quality (Reyer *et al*., 2014).

Walkability refers to the level of pedestrian friendliness of the built environment (Abley, 2005). It can be defined more comprehensively as the degree to which the built environment encourages people to walk with reasonable effort between places while also offering visual appeal, comfort and safety (Southworth, 2005). The issue of walkability needs to be considered sophisticatedly. Because the type, duration, distance and/or amount of travel, pedestrian's abilities and preferences have an impact on walkability. In addition, physical and social characteristics such as urban density, mixed land use, street connectivity, traffic volume and distance to destinations all influence walkability. Pavement continuity, block size, slope, perceived safety and aesthetics are also important environmental factors that shape how walkable an area is (Pivo & Fisher, 2011).

Various qualities of roads, which can be improved by design methods, influence the walking probability (Council, 1998; Southworth, 2005). Pedestrian-oriented design includes advanced urban design and planning principles that provide increased choice, mobility and social identity to users (SANDAG, 2002). Many studies analysing the factors affecting the amount of physical activity have shown that environmental variables, personal, social and regional characteristics affect walking (Alfonzo, 2005). Therefore, the built environment has the effect of restricting or facilitating walking and this effect is recognised by researchers. Therefore, researchers need to understand how built environment features influence walking. In particular, the safety, comfort and attractiveness of public spaces strongly affect whether people are encouraged to walk (Saelens & Handy, 2008).

Researchers working on walkable cities have long used a wide variety of indicators to ensure spatial walkability or to assess how walkable a place is. This parameter-based approach has evolved in recent years towards data-driven and multi-layered models. In recent studies, objective and subjective components are combined by integrating criteria based on street appearance, behavioural/social variables and environmental perception (Dragović *et al*., 2023; Lam *et al*., 2022; Venerandi *et al*., 2024). Thus, it can be said that there is a trend towards moving beyond static inventories towards adaptable indices that work across multiple spatial scales (Liu *et al*., 2023; Qiao & Yeh, 2023; Wu *et al*., 2022).

Researchers have tried different approaches to develop walkability criteria. Some researchers have developed walkability assessments by compiling the most frequently cited indicators in the literature, focusing on widely accepted criteria such as density, land use mix and connectivity (Dragović *et al*., 2023; Lam *et al*., 2022; Shields *et al*., 2021; Venerandi *et al*., 2024). Erturan and Aksel (2023) adopted a similar approach by integrating commonly used indicators into a localised framework. Others have established a hierarchical structure by prioritising and/or ranking walkability criteria according to their relative importance in various contexts (Alfonzo, 2005; Jamei *et al*., 2021; Mehta, 2008; Venerandi *et al*., 2024; Yazıcıoğlu Halu, 2010). More recently, Al-Dawoodi and Al-Moqaram (2023), Lam et al. (2022), Liu et al. (2023), Nared (2020), Qiao and Yeh (2023), Rodrigue et al. (2022), Yıldırım et al. (2023), Yurtcan and Kurdoğlu (2023) have attempted to determine spatially meaningful walkability criteria using both qualitative and quantitative methods.

Researchers often group various sub-criteria or indicators to make walkability criteria more functional. For example, while Southworth presents criteria such as connections to other modes of transport, mixed land use, safety and road quality, each one addresses street- and network-level characteristics in detail. Mehta (2008) categorises indicators at the street level into physical (wide/continuous pavements, shade-providing trees, attractive shopfronts, signage, street furniture, etc.), land use (commercial diversity, uniqueness of goods/services, events, etc.) and social (gathering places, presence of people/activities, perceived safety, etc.) dimensions. The contemporary index study (Lam *et al*., 2022) groups measurable variables under components aligned with the '6D' framework. It addresses components such as Design (intersection density, green space, pavement density), Density (population, retail/service density), Diversity (land use mix) and Transit Proximity (transit density). Recent local studies (Yıldırım *et al*., 2023) group indicators under Infrastructure, Built Environment and Environment & Activities, linking elements such as permeability, greenness, pedestrian density and pavement quality.

Despite the extensive literature on walkability, very few studies directly examine the continuity between sub-criteria and its effects on overall walkability. In practice, most studies operationalise connectivity using morphological network metrics, particularly intersection density and links to nodes (Litman, 2022). Dobesova and Krivka (2012) operationalise connectivity as an intersection-based feature of the pedestrian-related network. In this context, it excludes non-walkable connections (motorways/access-restricted expressways and lines over water surfaces without pedestrian crossings, etc.) from the network and prevents artificial intersection proliferation by connecting nodes that are closer than 15 metres to each other. Reyer et al. (2014) report positive but modest associations between intersection-based connectivity and walking for transport in Stuttgart. Lam et al. (2022) compute street connectivity as the point density of actual intersections on pedestrian-accessible segments, evaluated across multiple spatial buffers (e.g., 100-800 m) to capture local and neighbourhood-scale network structure. Akkar

Ercan and Belge (2016) proposed a comprehensive connectivity measure that includes network continuity, pedestrian comfort, continuity of accessibility and the positioning of social spaces on the network under the criterion of 'connections between open space systems', in addition to 'network connectivity capacity'. However, the linkage that provides continuity among indicators such as physical, functional and perceptual integration is often under-specified.

Many frameworks rely on scoring and aggregating indicators such as intersection density and mixed use within a specific area (e.g., 400-800 m). The buffer approach is practical. However, it often represents morphology in crude terms and may overlook continuity at the micro-scale (e.g., pavement discontinuities, unsafe crossing points) (Shields *et al*., 2021; Venerandi *et al*., 2024). However, case studies demonstrate the sensitivity of network measures to micro-scale disruptions. When junctions deemed unsafe by parents are removed from the pedestrian network, the overall connectivity level drops significantly and local disruptions undermine network integrity and spatial consistency (Schlossberg *et al*., 2015).

Table 1. Criteria encouraging walking in urban corridors

Criteria	Subcriteria
Attractive walking	1. The effect of mountain/sea view on walking preference, 2. The effect of historical/touristic/cultural heritage richness on walking preference, 3. The effect of open and green spaces on walking preference, 4. The effect of the tree-lined route on the walking preference.
Presence of facility and urban furniture in walking	5. The effect of cafe/buffet/restaurant on walking preference, 6. The effect of the bank/municipal/health center on walking preference, 7. The effect of the presence of urban furniture on walking preference, 8. The effect of school/museum/library on walking preference, 9. The effect of shopping mall/market/bazaar on walking preference.
Traffic density in walking	10. The effect of heavy vehicle traffic on walking preference, 11. The effect of heavy pedestrian traffic on walking preference
Safe walking	12. The effect of safety against crime on walking preference, 13. The effect of pedestrian safety against traffic on walking preference.
Walking for everyone	14. The preference of barrier-free spaces, 15. The preference of the places with mixed transportation planning
Walking duration	16. The effect of walking distance of an average of 10 minutes on walking preference, 17. The effect of walking distance of more than 10 minutes on walking preference
Walking in every condition and time	18. Walking preference in rainy/windy weather, 19. Walking preference in evening time
Slope in walking	20. The effect of uphill on walking preference, 21. The effect of downhill on walking preference.

Source: Yurtcan and Kurdoğlu (2023)

In this study, the concept of walkability is discussed and it is aimed to carry out a local criteria study. The city of Trabzon, which is considered as the study area, has a narrow hinterland. As a result of the accelerated urban growth since 1960, it has been subjected to automobile-oriented regulations in order to eliminate traffic congestion. Based on the idea that a different transportation plan is possible for the city center, a 'suitable criteria setting' study was conducted with expert participants based on 'criteria encouraging walking in urban corridors' (Table 1). The most important contribution of

the research to the literature is importance of the idea of evaluating the sub-criteria of 'linkage' under each theme.

2. Material and method

Within the scope of this research, the analysis focuses on the urban corridors situated in the city centre of Trabzon, specifically within the administrative boundaries of Ortahisar District. Trabzon, located in the eastern part of Türkiye's Black Sea Region, is a historic harbour city whose urban core lies along the Black Sea coast. Its mountainous topography not only shapes the city's spatial organisation but also restricts its hinterland to a narrow strip of land. According to data from Trabzon Metropolitan Municipality (2022) and the General Directorate of Meteorology (2025), Ortahisar experiences a humid and rainy climate throughout the year, with mild winters. The city's monthly average temperatures range from 7.3°C in February to 23.5°C in August, with an average annual precipitation of 828.9 mm. Prevailing wind directions are southerly in the inland areas and north-westerly along the coast.

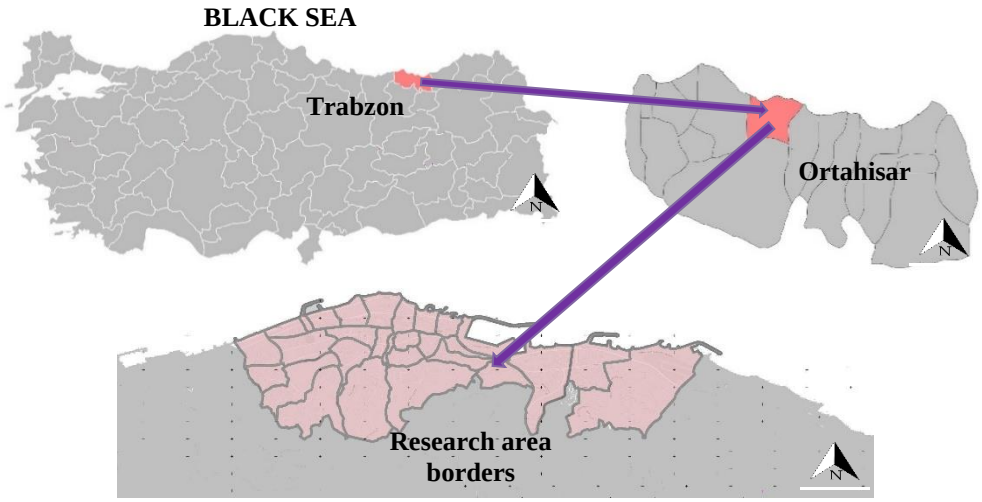

Figure 1. Research area

Focus group interviews were used as the method in this study. Group interviews are a form of qualitative research conducted with multiple participants at the same time instead of interviewing one participant (Punch, 2005). The ideal number of participants for a focus group interview is between 6 and 8. However, variables such as the purpose of the study and the number of questions can change the number of participants from 4 to 15 people (Yıldırım & Şimşek, 2016).

In this research, a 'suitable criteria setting' process was conducted with expert participants based on criteria encouraging walking in urban corridors. During the 'suitable criteria setting' process, experts were asked questions aimed at determining additional criteria to be evaluated alongside criteria encouraging walking in Trabzon. Participants were asked to evaluate each criterion encouraging walking separately.

The focus group interview was conducted with a total of 9 expert participants, consisting of 2 architects, 2 urban and regional planners and 5 landscape architects, who know Trabzon and have included it in their research. The richness of focus group data depends more on the qualitative diversity of participants' expertise and perspectives than

on their sheer number (Krueger & Casey, 2014; Morgan, 1998). Therefore, the expert group consisted of representatives of professional chambers, municipality employees, private sector employees and academicians. In addition, during the session, it was concluded that thematic saturation was achieved as participants' contributions began to merge around common ideas. The focus group interview process was conducted online and recorded. The consent of all participants was obtained before recording. The interview form within the scope of the research was approved at the ethics committee meeting dated 06/04/2022, numbered 23. Each expert participant was briefly expressed as EP-1, EP-2, ..., EP-9.

The data obtained in the focus group interview were analysed through descriptive analysis. The analysis consisted of four stages;

1. Creating a framework according to predetermined categories (The framework was created by the criteria encouraging walking in urban corridors),
2. Organise data according to the framework,
3. Not defining the data clearly and supporting them with important quotations and
4. The processes of interpreting the findings were followed (Yıldırım & Şimşek, 2016).

During data analysis, the content of the responses provided by expert participants was evaluated and coded. For example, when sub-criteria were examined for the top criterion of attractive walking, EP-5: '...We need to influence walking behaviour, because the opportunity to encounter or the popularity of the space is so important...' was coded as popularity.

3. Results

In the 'suitable criteria setting' process based on criteria encouraging walking in urban corridors, participants were asked to evaluate each criterion encouraging walking separately. Therefore, the results for each main criterion are presented under separate subheadings.

Attractive walking

EP-2: "... when you look at the titles you created, the first group is attractive walking. ... ... it seems to me like expressions about the quality of the area here instead of attractive walking. I mean, the fact that the route is planted... I mean, the presence of landscape elements on it. In other words, it sounds like statements about quality. ... I think the presence of urban images, the presence of urban furniture, the presence of social foci, the quality of the destination, the variety of activities, attractiveness can be added to these statements under the title of quality".

"Sub-parameters related to enjoyment on that route, the presence of ... clean air, noise level on the route can be added..."

EP-3: "...if we are going to say attractive walking, other sub-concepts should be added. Or maybe the concepts of comfort and quality might be more meaningful as a subheading on the concepts here…"

"... I think that legibility and connectivity can perhaps be defined with the concept of quality and the title called attractive walking, it may be more meaningful to organise it there".

EP-4: "In attractive walking, accessibility or the accessibility you mentioned below, which is in the walking for everyone, that is a corridor may be very comfortable, cosy, safe in itself. But does has it access from every point? I think accessibility should be

examined under this heading and pedestrian density should also be examined here ... identity being included in a place, that is, how do we walk and why do we walk? ... where will this corridor lead to".

EP-5: "... I think these things should also be included a little bit. First of all, what are the social dimensions? For example, it is really important for me that corridor offers the opportunity to meet. ... the opportunity to participate in informal activities there, ... in a street, a boulevard, a corridor, even if there are historical, functional ecological dimensions, recreation dimensions in your design, we need to attract the user to that space. We need to influence walking behaviour, because the opportunity to encounter or the popularity of the space is so important..."

EP-7: "... actually all the criteria are related to attractiveness somewhere.

... Legibility will definitely increase attractiveness...

... Linkage is very important, there is a lot of fragmentation in Trabzon, places should be associated to each other, green areas, historical areas should be connected to each other".

EP-9: "... In attractive walking, sub-criteria of historical, touristic and cultural buildings should be expanded? Because ... it is one thing to preserve a historical building frozen in a conservation area, it is another thing to preserve it as a museum, it is one thing for a historical building to have a museum function, it is another thing to visit a place designed as an archaeological museum or any museum..."

Table 2. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		**Suitable Criteria Setting Process**	
Attractive walking	+The route is planted + Open and green areas (Parks, squares, etc.) +Natural landscapes (Mountain, sea, valley, forest, etc.) +Historical, touristic and cultural buildings	**Attractive walking**	+ The route is planted + Presence of open and green areas on the route (parks, squares, etc.) + Presence of natural landscapes and areas that have not lost their natural qualities along the route (mountain, sea, valley, forest, etc.) + Presence of historical, touristic, cultural and symbolic structures along the route + Pollution Control (noise, smell, image, air etc.) + Comfortable walking + Variety of events + Variety of facades + Popularity + Legibility +Linkage (Associating attractive route elements with each other)

Before the focus group process, the 'attractive walking' criterion primarily emphasised the physical and visual qualities of the walking environment, such as the presence of planting, green areas, natural landscapes and historical buildings. However, during the 'suitable criteria setting' process, experts proposed to expand this scope by incorporating experiential, perceptual and social dimensions. They highlighted that attractiveness should not only reflect the visual quality of the route but also the diversity of activities, comfort, legibility, linkage and popularity, all of which contribute to pedestrians' sense of place and motivation to walk. Accordingly, the criterion evolved

from describing what exists along the route to explaining how these elements interact and how they influence walking behaviour and continuity. The key changes identified through this process are summarised in Table 2.

Presence of facilities and urban furniture as well as ground floor uses

EP-1: "... the impact of the presence of restrictive elements on walking, especially those that limit vehicle passage and indirectly pedestrian passage, can be assessed.

... physical arrangements, pavement heights, especially road arrangements such as different pavements can be evaluated".

EP-2: "... wouldn't it be better if the ground floor utilisation of the buildings (functional structure), architectural style etc. were considered as structural elements?"

EP-3: "Would it be more accurate to express the lighting elements under the sub-heading "presence and adequacy of equipment such as bench, WC, waste bin" under the heading "presence of facility and urban furniture in walking" or should the lighting itself be emphasised? I think we can discuss this. The other sub-criteria are actually meaningful in that sense in relation to their functional distribution".

Table 3. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		**Suitable Criteria Setting Process**	
Presence of facility and urban furniture in walking	+Presence of facilities such as bank, municipality, health centre +Presence and adequacy of equipment such as benches, WC, waste bin… + Presence and adequacy of facilities such as cafes, buffets and restaurants +Existence and adequacy of facilities such as schools, museums and libraries + Existence and adequacy of facilities such as markets, bazaars, shopping centres	**Presence of facilities and urban furniture as well as ground floor uses**	+ Presence of facilities such as bank, municipality, health centre, + Presence and adequacy of equipment such as benches, WC, waste bins, + Presence and adequacy of facilities such as cafes, buffets and restaurants, + Existence and adequacy of facilities such as schools, museums and libraries, + Existence and adequacy of facilities such as markets, bazaars, shopping centres, + Presence and adequacy of lighting elements, + Limiting elements and limitation solutions, + Digital, internet-based and non-digital information systems (signage, signboard, counselling, etc.), + Presence of facilities and equipment suitable for socio-cultural and current conditions, + Linkage (associating service units with each other).

EP-5: "...service facilities may come here".

EP-6: "...things such as the presence of facilities and equipment suitable for sociocultural and current conditions can be added. For example, an encounter area may be sometimes preferred only because of a digital equipment in there…"

Prior to the focus group discussions, this criterion primarily focused on the presence and adequacy of public facilities and urban amenities such as benches, toilets, litter bins, schools and cafés. However, spatial distribution or experiential impact was not taken into account. In the process of 'suitable criteria setting', expert participants emphasised the need to broaden the criterion to include ground floor uses, lighting elements, boundary structures, digital information systems and service units, reflecting a shift towards a more functional, integrated and user-centred understanding of facility provision.

Consequently, the criterion was renamed 'Presence of facilities and urban furniture as well as ground floor uses' and gained a more inclusive wording that considers not only what is present but also how these elements interact, connect and contribute to walkability. The identified key improvements are presented in Table 3.

Traffic density in walking

EP-1: "... examination of other traffic generating factors; logistics, traffic movement in the procurement process, traffic attracting and generating uses, ... distribution of parking and stopping areas, traffic flows to car parking areas can be evaluated".

"...the movement and density of other means of transport (bicycles, motorised bicycles and other electric vehicles) within the area-corridor can be thougt..."

EP-2: "... instead of the main criteria of traffic density, transport, proximity to public transport stops, noise created by traffic can be added".

EP-3: "... When we look at the traffic density in walking, it is meaningful to generalise under two headings as vehicular traffic density and pedestrian traffic density, but it would be more meaningful to consider both stationary and moving traffic in vehicular traffic and to consider service-delivery vehicles; I would like to make a suggestion that it would be more meaningful to define different movements such as minibus stops.

... if you want, considering vehicle traffic as the density of stationary and moving traffic can be an impressive definition in terms of walkability".

EP-4: "... traffic flow speed can be analysed under the heading of traffic density in walking. ... noisy places, places where traffic speed is very intense and air pollution is intense are of course more disadvantageous. In terms of walkability, the role of noise pollution in walkability criteria can be analysed".

Table 4. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		**Suitable Criteria Setting Process**	
Traffic density in walking	+ Vehicular traffic density + Pedestrian traffic density	**Traffic density in walking**	+ Idealising vehicular traffic density + Idealising pedestrian traffic density + Balancing mixed-use traffic density + Linkage (Associating idealized vehicular-pedestrian and balanced mixed-use traffic)

In the initial framework, traffic density was treated as a quantitative condition measured separately for vehicles and pedestrians. However, during the process of 'suitable criteria setting', expert participants emphasised the need to move from measurement to optimisation, redefining the criterion as idealising vehicle and pedestrian traffic density. Furthermore, the importance of balancing mixed-use traffic (including bicycles, delivery vehicles and micro-mobility vehicles) and linking them together to ensure continuity was highlighted. Accordingly, the revised criterion reflects a more qualitative, integrative and user-centred approach, focusing not only on the densities of different traffic components but also on how they coexist. The key improvements identified are presented in Table 4.

Safe walking

EP-3: "When I look at safe walking ... actually, the concepts of safety and security are not exactly the same, but when we look at the concept of safe walking, it was right to address these two in that sense. I don't think there is a need for further clarification, the title is sufficient and defined".

EP-5: "... the opportunity to participate in activities and most importantly, apart from physical security, we need to somehow attract the feeling of being safe there so that we use that route. This is not only about physical safety in terms of pavements, width, etc., but also the social dimension, liveliness, night use and the feeling of being safe should be added".

EP-6: "We are talking about physical concrete things related to security, but sometimes you don't enter a street just because of its ideological image. ... it is safe, it has equipment etc..., it is OK, but you don't feel safe for sociological and psychological reasons or perceptual reasons, ... underneath the feeling of being safe lies the feeling of belonging".

In the first framework, 'safe walking' focused primarily on physical measures, which were defined by the sub-criteria of 'security against crime' and 'traffic related pedestrian safety'. During the process of 'suitable criteria setting', expert participants recommended expanding this scope to include a sense of security and connection, reflecting the continuity between physical and perceived security. They emphasised that safety should not be based solely on visible measures and driver behaviour, but should also include social, psychological and sensory dimensions such as liveliness, night-time usability and a sense of belonging (EP-5, EP-6). Accordingly, the revised criterion combines physical, behavioural and perceptual factors, emphasising safety both as a measurable condition and as an experienced feeling. Key improvements are summarised in Table 5.

Table 5. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		**Suitable Criteria setting Process**	
Safe walking	+ Security against crime + Traffic related pedestrian safety	**Safe walking**	+ Taking physical security precautions against crime + Physical precautions and driver behaviors that ensure pedestrian safety + Feeling safe + Linkage (Continuity of physical and sensory safety and security)

Walking for everyone

EP-2: "I think connectivity is important. Besides this, maybe there should be perceptibility. ... the presence of panoramas, vistas, viewpoints on the route. These are also important".

EP-3: "I think the concept of walking for everyone is a title that comes from design for everyone and I think it is actually an accurate definition…"

… the concept of walking for everyone, which is what we call universal design and design for everyone. So, it seems meaningful with the subtitle and those other two things below.

EP-4: "… in walking for everyone, linkage seems to be related to accessibility. ...If a walk of over 10 minutes is targeted, linkage have to be explained. Because I can deviate from one place to another while walking, so walkability-based planning seems to be a bit broken here. Because walking is constantly interrupted".

EP-6: "...linking is very important beyond material and structural things. For example, uninterrupted circulation floor in a commercial corridor. ... I think these are very important; the spatial setup, for example, transit transitions, waiting areas in front of a shop or the circulation flow between a public, semi-public or private, that is, how many channels are there that feed that connected live corridor? I think it is important for me".

EP-8: "…linkage should be considered multi-dimensional and explained well."

EP-9: "...from a public perspective, I think it would be important to have an activity for children".

Initially, the 'walking for everyone' criterion emphasised accessibility and inclusivity, focusing on providing suitable routes for disabled persons, children and individuals with limited mobility and on mixed traffic use. During the process of determining appropriate criteria, expert participants emphasised that walkability must also ensure continuity and integration, highlighting the importance of 'linkage (uninterrupted walking)' (EP-4, EP-6, EP-8). Therefore, it was emphasised that walkability-based planning should prevent physical and functional interruptions through appropriate spatial arrangement, uninterrupted transitions and multidimensional connections. Additionally, the mixed-use traffic arrangements included in the revised criteria will be meaningful when aligned with the sustainable transport hierarchy. The identified key improvements are presented in Table 6.

Table 6. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		**Suitable Criteria setting Process**	
Walking for everyone	+ Suitable arrangement for disabled people, children and individuals with limited mobility (Accessibility) + Roads that can be used by vehicles, pedestrians and bicycles (mixed-use traffic)	**Walking for everyone**	+ Suitable arrangement for disabled people, children and individuals with limited mobility (Accessibility) + Roads that can be used by pedestrians, bicycles and cars (mixed-use traffic) + Linkage (Uninterrupted walking)

Walking duration

EP-2: "Walking time over 10 minutes can be limited… Such as 10-60 minutes walking time and over 1 hour walking time…"

EP-7: "... for walkability, the use of public transport should be emphasised and its preferability should be increased. In cases where transfers are required, I think the walking distance between stops is very important, such as a walking distance of maximum 10 minutes ... or for example, when you leave one place to go to another place, if the walking time is too long, the walking preference may be negative. Here again, the walking time between stops should be considered".

In the first framework, 'walking time' is defined by fixed time thresholds, with average walking time (10 minutes) and longer walks (over 10 minutes) separated. During the process of determining appropriate criteria, expert participants emphasised that walking time should not only be measured but also contextualised through connection and integration. They highlighted the need for 'linkage' to ensure functional integration between units and transport modes within a maximum 10-minute walking time, stressing that walkability decreases when distances between destinations or transfer points exceed acceptable walking times (EP-2, EP-7). Accordingly, the revised criteria shift from a time-based measurement to a network-focused perspective.

Table 7. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		Suitable Criteria setting Process	
Walking duration	+ Average walking time of 10 minutes + Walking time over 10 minutes	**Walking duration**	+ Average walking time of 10 minutes + Walking time over 10 minutes + Linkage (Integration between units and transportation modes providing a maximum walking time of 10 minutes)

Walking in every condition and time

EP-1: "... Trabzon residents generally use the streets during the day. They are usually at home at night. Social life usually continues at home. Places that are very crowded during the day are completely empty at night. I think this should be taken into consideration".

Table 8. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		Suitable Criteria setting Process	
Walking in every condition and time	+ Having suitable spatial features for walking in rainy/windy weather + Having suitable spatial features for walking in the evening time	**Walking in every condition and time**	+ Having suitable spatial features for walking in rainy/windy weather + Having spatial features suitable for walking in the evening time + Having suitable spatial features for walking in sunny/humid weather + Having spatial features suitable for walking during daytime + Linkage (Continuity of spatial features that allow walking under all conditions and times)

EP-7: "... under walking in every condition and time, precautions for evening hours and rainy/windy weather are considered, but humidity is also important, conditions for walking during daylight hours can also be sought".

Prior to the process of 'suitable criteria setting', the concept of 'walking in every condition and time' addressed physical suitability for adverse weather conditions and night-time conditions by focusing on features that support walking in rain, wind and evening hours. During the process of defining appropriate criteria, expert participants proposed expanding this scope to include daytime conditions, sunny and humid weather and most importantly, the 'linkage' dimension that ensures the continuity of spatial features enabling walking in all conditions and at all times (EP-1, EP-7). This change reflects an expansion of the understanding of environmental adaptability, integrating temporal and climatic variability with spatial continuity. Accordingly, the revised criteria emphasise not only protective design features but also the seamless integration of walkable environments throughout changing conditions and daily cycles. The key improvements identified are presented in Table 8.

Effect of topography on walking

EP-2: "... the slope in walking is actually about the comfort of the user on that route, isn't it? It is about the perceived comfort. Slope can be a sub-criterion under the comfort heading. Or instead of evaluating it as uphill and downhill, it can be evaluated as a morphological structure and things like street texture, length, width of the route, level of closure... can be added..."

EP-6: "We go up and down a lot of slopes, there are too many vertical circulation solutions at the moment. So, when it is considered for downhill and uphill, solving one may actually mean solving the other".

EP-9: "... in the concept of slope in walking, should I walk either uphill or downhill? For example, isn't flatness decisive? Do I not have the chance to walk straight besides downhill and uphill or do I have to walk with a little slope or something like that..."

Initially, the criterion titled 'walking on slopes' addressed slope as two separate conditions: 'walking uphill' and 'walking downhill'. During the process of 'suitable criteria setting', the name of this criterion was changed to 'effect of topography on walking' to reflect a broader and more holistic understanding of terrain and movement, based on the responses of experts. The focus shifted from slope measurement to facilitating movement and the sub-criteria were changed to 'facilitating walking uphill' and 'facilitating walking downhill'. Additionally, 'walking on flat and nearly flat slopes' was added as a new item (EP-2, EP-9).

Table 9. Comparison of before and after the focus group interview process

Criteria Encouraging Walking		Suitable Criteria setting Process	
Slope in walking	+ Walking uphill + Walking downhill	**Effect of topography on walking**	+ Facilitating uphill walking + Facilitating downhill walking + Walking on flat and nearly flat slopes + Linkage (Associating vertical circulation solutions suitable for topography)

Emphasising the impact of morphological and experiential factors such as route length, width, degree of enclosure and street texture on walking on slopes revealed the necessity of facilitating walking regardless of the topographical structure's characteristics (EP-2). Furthermore, a ‘linkage’ component has been added to link vertical circulation solutions along the urban corridor, emphasising seamless and understandable pedestrian corridors despite terrain changes (EP-6). Significant improvements are presented in Table 9.

4. Discussions

This study aimed to conduct a process of developing ‘suitable criteria setting’ adapted to local conditions for the walkability of urban corridors in Trabzon by integrating ‘criteria encouraging walking in urban corridors’ with expert opinions (n=9). The results confirm many well-known relationships (e.g., density, mixture and intersection-based connectivity) while adding a more detailed understanding of micro-scale continuity along actual walking routes. Across the criteria, experts have focused on the importance of keeping elements connected. Thus, 'linkage' has been considered not only as a network feature but also as a physical-functional-perceptual continuity alongside other positive features that encourage walking (greenery, facades, amenities).

Walkability is not merely the sum of the physical environment. It is an experience that varies not only with age, gender, socio-demographic characteristics, time of day, weather conditions and topography, but also on a perceptual level. For example, Alfonzo's (2005) ‘walking needs hierarchy’ model treats the decision to walk as a system of intermediate variables shaped by layers such as accessibility, safety, comfort and pleasure, as well as the individual's life stage and contextual conditions. As an example of the local adaptation of this framework, Yazıcıoğlu Halu (2010) took Alfonzo's hierarchical scheme as a basis but interpreted the ‘safety’ layer with higher priority, taking into account the socio-cultural patterns and time-space usage of the study area. Studies have reported that women's perception of safety is relatively more negative in the evening/night hours; micro-scale characteristics such as lighting and street activity particularly affect night-time walking (Cui *et al*., 2023; Su *et al*., 2024). Weather conditions (rain, wind, extreme heat/cold) have systematic effects on daily mode choice and walking intention (Böcker *et al*., 2013). Topography is also a significant dimension of localisation. Walking can become less appealing as the slope increases (Meeder *et al*., 2017; Xiong *et al*., 2024). On the other hand, it has also been shown that the effects of the built environment vary spatially for certain groups, such as the elderly population (Xiong *et al*., 2024). Therefore, in cities with different morphologies and social patterns, such as Paris-Trabzon-Hakkâri, the sets of indicators and/or priority rankings that encourage walking must inevitably vary according to the local context. In this regard, as also noted by Huang et al. (2024), context-sensitive and localised approaches gain importance.

According to experts, the main factors weakening walkability in Trabzon are fragmentation between focal points, disruption of the ground floor façade rhythm, speed/service movements in mixed traffic, imbalance between night and day use, high rainfall/humidity and topographical slope. These factors disrupt the route's connectivity, creating cut-off points. Therefore, the aim is to identify these weak points and establish a sequential walking sequence through ‘linkage’-focused interventions (continuity of

lighting, safe pedestrian crossings, connecting vertical links to the main route, directional guidance and speed management).

This study demonstrates that walkability in the context of Trabzon is not solely dependent on the presence of individual positive attributes, but rather on the sequential and uninterrupted connection of these attributes along the corridor. Although 'connectivity' is mostly measured in the literature using network-based morphological metrics such as intersection density Dobesova and Krivka (2012), Lam et al. (2022), Litman (2022), Reyer et al. (2014), it aligns with findings that walking frequently ends at cut-off points when micro-scale continuity (pavement integrity, safe crossings, lighting transitions, living facades) is lacking (Schlossberg *et al*., 2015). Southworth (2005) treats the 'connectivity' of the walkable network (intersection density, block length, minimisation of obstacles, etc.) and its ''linkages to other modes' (integration within a reasonable walking distance to buses/trams/metro) as separate criteria. This distinction is consistent with our positioning of 'linkage' in our study not merely as a network metric, but as an integrative principle that ensures continuity. Therefore, the indicator/sub-criterion we present as 'linkage' complements and extends the index/framework approach (Shields *et al*., 2021; Venerandi *et al*., 2024) that aggregates components separately, in that it treats linkage not merely as a numerical property of the network but as a condition of physical, functional and perceptual continuity.

The appeal of corridors is not limited to visual appeal based solely on greenery, façade diversity, historical focal points or the presence of events. These elements are motivating in terms of sustaining the route and ensuring continuity between segments (Appleyard, 1978; Gehl, 2020; Southworth, 2005; Speck, 2018). Even a short segment that is dirty/noisy or poorly lit can reduce the appeal of the entire route (Rodrigue *et al*., 2022) and create a 'cut-off point' effect. According to focus group findings, in Trabzon specifically, although the coastal strip, historic core and green focal points are close to each other, the fragmented structure should be transformed into a continuous one by connecting the gaps between them, according to the 'attractive walking' criterion.

Facade continuity, active edges and courtyards/niches enhance street life and pedestrian flow (Jacobs, 2011; Mehta, 2008). The impact of components emphasised by experts in this study, such as lighting continuity, wayfinding (digital/analogue), socio-cultural opportunities and the management of restrictive elements (kerb/pavement differences, barriers), on supporting walking is consistent with the findings of Alexander et al. (2021) and Metro (2019). Micro-level arrangements have been shown to increase the preference for public transport as an alternative to private cars (Alexander *et al*., 2021), highlighting the need to ensure the continuity of facilities and establish links between service units and facilities to increase walkability between facilities or between modes of transport. Therefore, the spatial configuration and continuity of facilities along routes are considered necessary to ensure the continuity of walkability along routes.

The volume and composition of motor vehicles are among the factors that influence pedestrians' perception of comfort and safety (Landis *et al*., 2001). The fact that perceived safety is directly related to environmental conditions, diversity of use and the presence of people on the street has shown that traffic-related noise, speed and pollution weaken both actual and perceived safety and negatively affect pedestrian behaviour (Mehta, 2008). Study of Rodrigue et al. (2022), also quantitatively confirms this link: it reports that every 10 km/h increase in the speed limit significantly reduces both 'travel' and 'leisure' walking scores and that high speeds are accompanied by increased air and noise pollution, which reduce perceived safety. Therefore, the movement patterns of vehicles,

rather than their numerical density, also have an impact on walking. Another perspective is that the intersection of low-density pedestrian corridors with controlled corridors or junctions open to vehicular traffic may increase perceived safety (Robertson, 1993). While Gehl (2020) and Jacobs (2011) point to situations where pedestrians attract other pedestrians, Fruin (1971) and Still (2000) show that as the distance between pedestrians decreases, walking speed decreases, directional conflicts increase and perceived stress rises. Therefore, as experts also emphasise, the fundamental goal in walkability is not to eliminate traffic entirely, but to optimise both comfort and safety by balancing pedestrian-vehicle-micromobility interactions. Indeed, excessively crowded or excessively empty corridors disrupt continuity in both cases, while balanced density and behavioural harmony become prerequisites for safe walking. According to Jacobs (2011), social sharing, awareness and communication increase in spaces where density is balanced and various activities are carried out simultaneously. This creates conditions where security is provided through social presence and familiarity. This situation creates a natural surveillance mechanism by enabling individuals to observe and be aware of each other, thereby indirectly contributing to physical security. Similarly, Mehta (2008) states that lively street life not only enhances social interaction but also strengthens the sense of security. Therefore, safe walking should be supported not only by physical measures but also through social vibrancy and continuous use. In this context, the concept of 'safe walking' is evolving into an inclusive approach that considers the safety and healthy mobility of all users, regardless of age, gender, disability status and socio-economic diversity, rather than a single type of pedestrian profile.

The purposes of journeys planned to be undertaken on foot can be decisive in terms of walking time. Walking times of 5-10 minutes, accepted as the local access threshold, are consistent with common planning practice (North Shore City Council, 2009; Southworth, 2005). Walking for recreational or tourism purposes can be undertaken over longer periods. However, continuity may be weakened when transitions between different modes of transport are not provided. Continuity is seen to weaken when (recreational/tourism) modes are not supported by easy transitions between them. Studies by Lam et al. (2022) and Huang et al. (2024) have similar findings. Furthermore, the interaction between walking purpose and perceptual/climatic conditions can affect walking under different conditions and at different times (An *et al*., 2023; Böcker *et al*., 2013; Eom & Nishihori, 2022). Therefore, the holistic relationship between micro-measures taken against climatic factors (continuous lighting, shelter/shading) that make the night more walkable supports the idea of walkability in all conditions. Topography can also impose another constraint. As the gradient increases, the comfortable walking time is effectively reduced (Meeder *et al*., 2017; Yıldırım *et al*., 2023). However, there are also studies showing the desirable/beneficial effects of walking uphill, such as increased energy expenditure and cardiovascular stimulation (Philippe *et al*., 2017). Therefore, for daily walking for access/transport purposes, vertical circulation solutions (ramps, stairs, lifts, funiculars, etc.) should be designed contextually and holistically to reduce the deterrent effect of inclines. while for recreational/health-related walking, incorporating moderate slopes safely into the route offers an approach that maintains continuity and reduces ‘cut-off” risks in both situations.

5. Conclusion

Studies evaluating walkability are as diverse as the researchers who examine it. This is because the methods and data used by researchers have different capabilities and sensitivities. The diversity of results and methods can be attributed to the many walking environments offered by cities, as well as various urban morphologies and specific problems and challenges (Fonseca *et al*., 2021). Although walkability is a global issue, it involves problems that need to be solved locally. In this study, the 'suitable criteria setting' process was managed using the focus group discussion method conducted with experts. In the process, which was based on criteria encouraging walking in urban corridors, a total of 45 sub-criteria/indicators were identified under 8 main criteria specific to Trabzon. The most significant contribution of the research is the concept of the 'cut-off point' and the emphasis placed on the 'linkage' sub-criterion under each main criterion. 'Linkage' stands out in terms of designing a corridor, the corridors it connects to and the routes reaching the destinations from a walkability perspective and ensuring that walkability is maintained without interruption. In this study, the linkage has been interpreted by experts who are familiar with Trabzon and work on the city, taking local conditions into account. This contribution can be considered a contribution to the local context. However, the requirement to relate the criteria in every walkability study results in a global contribution.

This research argues that when the corridor transport infrastructure established according to walkability criteria cannot be interconnected, full walkability cannot be achieved. Units/facilities/services/infrastructure elements that cannot be interconnected locally or globally and cannot be properly integrated may create a cut-off point in walkability planning and walkability may end at the location of the cut-off point. Therefore, it is necessary to establish connections by interlinking the sub-criteria of each walkability criterion. As a new criterion that ensures the coexistence of related criteria, linkage criteria should be placed separately under each main criterion. The reason for the linkage criterion appearing repeatedly as a sub-criterion of each main criterion is that each main criterion has a different characteristic.

Local authorities and urban designers can base walkability decisions not only on network morphology but also on standards based on the principle of 'linkage'. Systems for determining cut-off points can be integrated into walkability studies. Strategies can be developed to identify and resolve issues at unwalkable points/areas/corridors. Thus, walkability, which is dynamic (needs may change according to time, culture and/or technological developments), can be continuously updated. Furthermore, in this study, the concept of 'linkage' as a sub-criterion to each main criterion allows for separate feasibility studies on determining and linking 'cut-off points' at the micro level.

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