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Neighbourhood walkability in high-density apartment complexes in Seoul, South Korea

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Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of ***MSc Urban Design and City Planning*** at University College London:

I declare that this dissertation is entirely my own work and that ideas, data, and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

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Abstract

Walkability has been an important principle of urban design and planning, and research has been identified the complex relationship between spatial attributes and users' perception of walkability. However, limited research focused on which perceived qualities could be affected by specific attributes, and how people react to particular environment. also apartment complexes in South Korea have not been considered enough despite their unique typology and spatial attributes derived from cultural and historical backgrounds, which might affect residents' experience of their neighbourhood. Research in walkability lacks multi-dimensional studies, examining spatial attributes and people's perceptions of walking. The research examines the complex relationship between spatial attributes in high-density apartment complexes and users' perceptions of walkability. The data from GIS, observation and surveys were analysed cross-sectionally to decode how people evaluate their neighbourhood regarding walkability and discover unexpected patterns between spatial attributes and perceived walkability. Findings reveal that the possible implication of high functional mix and permeability combined with the Green network enhancing walking and encouraging people to walk and repeatedly visit their neighbourhood, which explains high sense of walkability. In that the Green network has been developed to overcome segregation of apartment-dominant neighbourhood, the finding provides further area of walkability debate on time and historical background, while corroborating the importance of walkability assessment in different geographical context. In addition, providing key spatial attributes of apartment complexes in Seoul, South Korea, the study suggests empirical evidence of current level of walkability in South Korea, which could support developing the concept of Daily-walking neighbourhood' in Seoul Plan 2040.

1. Introduction

1.1 Background

Walkability has been an essential principle for a sustainable city (Forsyth and Southworth, 2008), and walking is seen as a decisive factor for healthier, environmentally friendly, and sound social settings (Forsyth and Southworth, 2008, Evans, 2009). This led to extensive efforts to assess walkability and examine related factors affecting walkable environments.

In particular, an increased awareness of walkability has placed attention on which factors encourage walking and how spatial attributes affect walkability. Research has found that various spatial attributes affect walkability, from street furniture and human-scale elements at the street level to density or functional mix at the neighbourhood or city level. Many studies have also examined how individuals understand the environment regarding walkability and found that perceived qualities such as safety or usefulness are common in walkable places. A large body of work has subsequently developed to evaluate and assess walkability. GIS analysis or Walk score allows us to measure walkability based on morphological attributes such as density or level of functional mix of neighbourhood (Dovey and Pafka, 2019), while perceived qualities are evaluated by survey or interview to examine how people consider certain places walkable or not.

However, the relationship between built environment and walkability is complex, varying according to the purpose of walking, leading to mixed findings between factors. Also, how people perceive the environment is complicated since people react differently. This relationship is also affected in a more complex way by several factors, from the design elements of the building and the atmosphere of streets at a micro-scale to diverse destinations or quality of service and goods within walking distance. Tuckel and Milczarski(2015) found the inconsistency between Walk Score and perceived neighbourhood walkability, which implies that even if specific spatial attributes is expected to encourage walking, it might not induce people to walk. Therefore, investigating the relationship between spatial attributes and perceived qualities by users is important, enabling a more elaborated understanding of walkability. However, limited research was conducted to examine how diverse spatial attributes affect the decision-making process in multiple and complex ways.

The complexity becomes far more complicated when it is combined with different cultural, social, or personal backgrounds. Importantly, walkability varies in different geographical contexts, and a growing literature developed contextual analysis, particularly in non-US and different morphological areas in countries. For example, traffic, safety, and crime turned out to be the most influential factors in cities in Latin America (Arellana et al., 2019), while those factors have low or no correlation with walkability in

Japan (Koohsari et al., 2021). A few studies in Korea also found that walkability in low-density residential areas may be affected by the physical condition of streets, such as the presence of sidewalks, while various open spaces or vibrant streets with windows are the most influential in the high-density residential area (Choi et al., 2015, Kim et al., 2019).

Seoul metropolitan government has recently announced a new planning policy based on the introduction of 'the concept of Daily-walking neighbourhood' in Seoul Plan 2040(2022) to achieve a walkable environment, addressing the need for a specific strategy for high-rise and high-density apartment complexes districts to improve neighbourhood walkability. However, research so far only covered limited factors such as street connectivity and traffic without a comprehensive understanding of neighbourhood scale attributes. Also, most assessment methods are based on measuring the physical environment without considering user-oriented qualities (Choi et al., 2015).

The Korean apartment complex, in which more than half of the population lives, has been developed in a distinctive way influenced by housing policy, leading to unique spatial attributes (Gu, 2019). 'Danji-hwa', which means exclusion and privatisation of urban structure and facilities in Korean, is one of the keywords that explain the unique characteristics of apartment complexes in South Korea, as well as enlargement and internalisation, which also results in trials and applications of diverse planning methods. No research has investigated spatial attributes underlying those characteristics and how users recognise them and react towards walkability.

This research aims to address these gaps by assessing spatial attributes of high-density apartment complexes and examining the relationship between those spatial attributes of apartment complex areas and perceived qualities. It will also provide comprehensive indicators and guidelines for a walkable environment for planning policy for the walkable neighbourhood in Seoul.

1.2 Research question

How do spatial attributes of high-density apartment complexes in South Korea affect walkability and mediate user's perception of walkability?

Research Objectives

- To investigate current debates on walkability and the relationship between spatial attributes and perceived walkability and develop a framework for evaluating walkability

- To examine and analyse the spatial characteristics of the apartment complex in Seoul critically, South Korea, both at street level and neighbourhood level
- To assess residents' perceived walkability for decoding attributes that hinder or promote walking, and examine the relationship between perceptions and spatial attributes.
- To provide distinctive key attributes in the apartment complex of Seoul, South Korea, for improving policy and practice to promote a walkable environment

The research focuses on the apartment complex dominant area in Seoul. Based on a framework drawn from the literature, the study will use a mix-methods approach to investigate the spatial characteristic of apartments quantitatively at macro-scale qualitatively at micro-scale through GIS and observation. Survey will be used to decode how people evaluate their neighbourhood regarding walkability and investigate consistency and inconsistency with spatial attributes. Drawn from historical background, the study will also compare two representative apartment complex area, which will provide evidence of which spatial attributes strongly affect perception by distinguishing the difference between those two areas. The result of this study will contribute to further understanding the complex relationship between built environment attributes and perceived qualities, and provide a comprehensive framework for assessing apartment complex walkability. It will also provide helpful evidence for political approaches including Seoul Plan 2040.

1.3 Research structure

Figure 1 shows the structure of the research. The literature review will discuss the complexity of walkability definition, spatial attributes and perceived walkability keywords to understand current knowledge about walkability. Also, the relationship between spatial attributes and perceived walkability will be discussed for the framework. In the methodology, framework and analysis method will be provided based on the literature review, and site selection and criteria will be explained. The analysis part is divided into three chapters; ***spatial attributes, perceived walkability and discussion.*** In the first chapter of the analysis, Macro-level attributes will be assessed with GIS data quantitatively, while micro attributes will be analysed qualitatively by observation. Perceived qualities assessed by the survey from residents will be analysed quantitively in the second part of the analysis. In the discussion, consistency and inconsistency between the results of the two previous chapters will be discussed to examine how people react based on different spatial attributes and what implies inconsistent results.

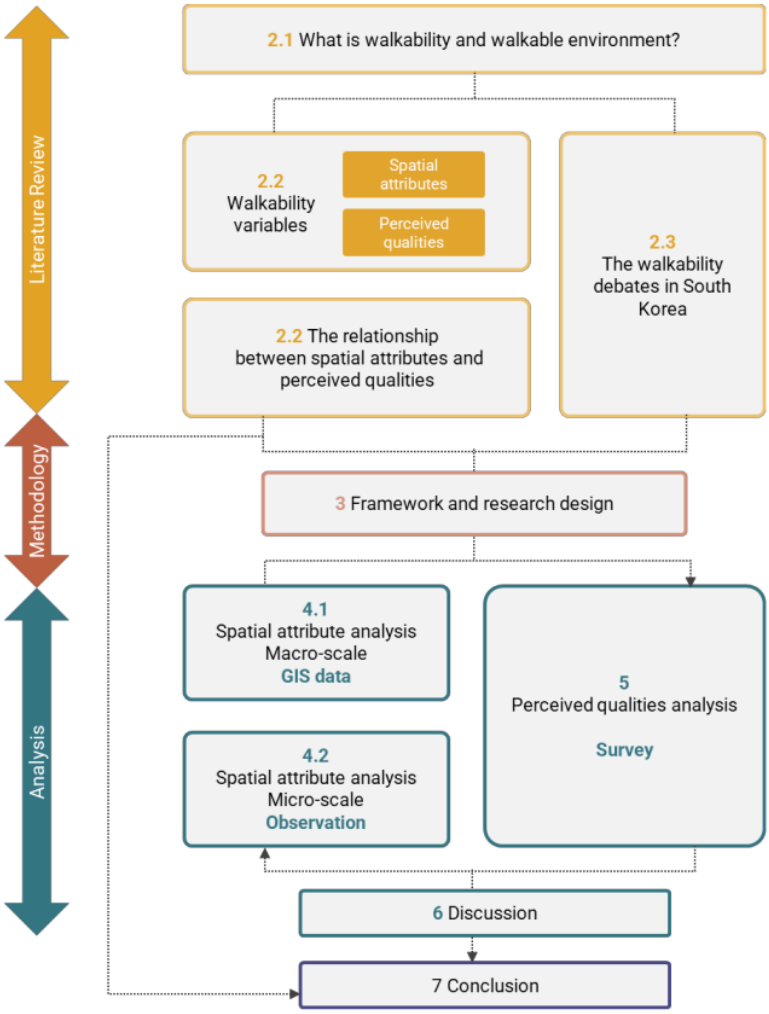


Figure 1 Research structure

2. Literature Review

2.1 What is walkability and walkable environment?

There is no straightforward definition of 'walkability' (Shields et al., 2021, 1). Despite the word 'walkable' has been used since at least the seventeenth century (Oxford English Dictionary, 2014), dictionaries rarely explain it (Forsyth, 2015). As walkability discussions have flourished, the concept of 'walkability' has become a significant role in several multidisciplinary fields, connecting urban design and planning to broader issues towards a healthier, more sustainable environment, city competitiveness and social equity (Dovey and Pafka, 2019). Due to a broad use without a precise definition, walkability tends to refer to diverse phenomena, varying meanings depending on the area of study or practical discussion. Table 1 summarizes the key operational definitions found throughout the literature.

Table 1 various definitions of walkability

Southworth (2005, 247-248)	Walkability is the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network.
Hasan et al., (2021, 2)	Quality of the walking environment and conditions, including safety, comfort, and convenience through measuring the friendliness of built environment.
Ewing and Handy (2008, 67)	Walkability refers to the way that individuals feel about the street as a place to walk.

Conflicting definitions are problematic because they impact how walkability is measured, how to create walkable places in practice, and how to assess the advantages of walkable environments. Practitioners and researchers may speak passionately about improving the walking environment but propose conflicting solutions (Forsyth, 2015). For example, the ideas based on sociable walkable areas might not be suitable when the aim is to support increased exercise. Shields et al. (2021) also argue the possibility of manipulating walkability in planning political and commercial discourses results from the openness of walkability.

Forsyth (2015) unpacked this issue by identifying three walkability dimensions: *1) Environmental conditions or Means, 2) Outcomes, 3) Proxy.* Means indicates the essential requirement of a walkable environment, and outcomes can be seen as the aims of a walkable environment. Finally, walkability also

broadly implies good design or holistic solutions for various human problems (Figure 2).

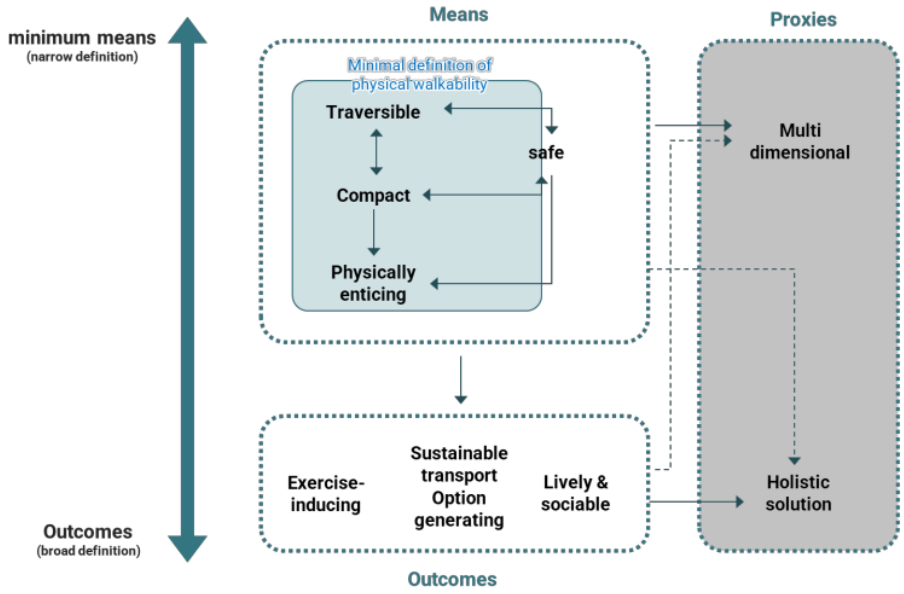


Figure 2 Forsyth's framework of walkability dimensions (2015)

According to Forsyth(2015), walkability is defined multiply, and it is helpful to have clear and shared definitions to promote communication and understanding. This study attempts to show how spatial attributes affect the user's reaction and how people perceived walkable environment. Hence, this study will focus on walkability as a means of a walkable environment, which is the definition of Southworth(2005).

2.2 Walkability variables: spatial attributes and perceived qualities

Based on the above definition, walkability means "characteristic or qualities of the walking environment and conditions, including safety, comfort, and convenience that support to walk". Characteristic is more related to the physical environment, such as street design, density, or pattern of land uses, while safe, comfort, and convenience are more human-oriented qualities focusing on how people evaluate their environment. Researchers in planning has identified physical-environmental variables related to walking, while studies based on Maslow (1954)'s hierarchy of needs have focused on the level of an individual's reactions or physical activity levels according to certain factors (Alfonzo, 2005).

Spatial attributes

For the last two decades, the importance of walkability has led to extensive attempts to measure and evaluate built environments regarding walkability at different scales (Brownson et al., 2009, Girling et al., 2019). Early empirical studies focused on high density, fine-grained multi-functional street patterns based on Jane Jacobs's walkable environment (Shields et al., 2021) and found residential density, high level of FAR, mixed-used and connectivity with high shared intersections as critical components of walkability (Cervero and Kockelman, 1997 Frank et al., 2009).

As walkability measurement methods have been developed, studies are subdivided into two major categories, which Shields et al. (2021) defined as micro and macro approaches. ***Macro-level features*** refer to urban form: density, functional mix, and accessibility.

Density indicates more people and more places within walkable distance (Dovey and Pafka, 2019) and Floor Area Ratio(FAR), dwelling density, job density and open space density are commonly used for measurement. However, results differ depending on subjects such as buildings, populations, open space, scales and intensities (Dovey and Pafka, 2013)which requires considering the relationship between different density indicators.

Functional mix focuses on the extent of diversity of destination and activity to support our diverse needs, which is measured by several approaches: entropy, residential/non-residential index, or single-use categories. Since the fine-grained category blurred the different levels of motivation for walking, it is essential to understand walking motivations between living, working, and visiting (Dovey and Pafka, 2017).

Access means the city network that enables and constrains pedestrian flows. Fine-grained blocks provide good permeability with the multiplicity of route choices, but short block also constrains possibilities for density and active frontages. Access can be considered with two main concepts: how a block is permeable and how private space plugs into public networks (Pafka and Dovey, 2016).

Recent studies mainly utilise GIS, Walk Score™ approach to assess macro attributes. Frank et al. (2009) found that high-level walkability scores, including intersection density, net residential density, entropy(land use mix), and retail FAR, have a positive relationship with walkability. Girling et al. (2019) employ Walk Score™ analysis based on the distance to amenities, population density, and road metrics. Recent studies have started to employ the assemblage approach to investigate the interconnections and synergies among urban morphologies above (Dovey and Pafka, 2019).

Micro-level physical features started to be discussed with growing awareness of the significant influence of individual-level physical environment on walking behaviour (Alfonzo, 2005). Ewing and Handy (2008) attempted to measure subject urban design qualities and verified five design qualities related to walkability; enclosure, human scale, transparency, complexity and imageability, which have been widely used by urban design researchers (Adkins et al., 2012, Singh, 2016).

Enclosure refers to the degree to which buildings, walls, or trees define streets or open spaces (Ewing and Handy, 2008), creating a room-like quality (Adkins et al., 2012) with a comfortable feeling while the proportion of ground, the number of openings or the depth of view work against enclosure.
Transparency indicates the level of interaction closely related to the ground-level floor. Windows, doors, and courtyards' openings allow people to perceive human activity beyond the wall. Also, Trees with high canopies create 'partially transparent tents', providing transparency and enclosure (Ewing and Handy, 2008, 78).
Human scale refers to the size, texture, and physical elements that match the proportions of humans and also the speed at which humans walk.
Complexity refers to the visual richness of a place with the numbers and kinds of buildings and details, people and activities, and street furniture, which provide many interesting things to look at when walking. Imageability is related to a distinctive place and is considered as a net effect of the other four qualities (Ewing and Handy, 2008). Therefore, this study will not consider imageability a primary attribute.
In addition, ***Safety*** is also the physical environment qualities that affect walkability significantly and usually refers to the level of safety from crime and traffic safety (Forsyth, 2015, Choi et al., 2015) . **Table 2** summarise validated spatial attributes and indicators commonly considered.

Table 2 tested spatial attributes and indicators

Scale	Spatial attributes		Indicator	Author
Micro level	Urban design quality	enclosure	Street width to building height ratio Proportion street wall Trees / Small openings	Ewing and Handy (2008) Adkins et al. (2012)
		Transparency	Ground floor façade with door and windows Interesting and engaging storefronts Trees	Ewing and Handy (2008), Mehta (2008), Singh (2016)
		Human scale	Street furniture, Small planters Height of buildings	Ewing and Handy (2008), Mehta (2008)
		Complexity	Number of buildings with identifiers Number of people Number of activity	Ewing and Handy (2008) Girling et al. (2019)
		Safety	Presence of traffic calming design Lighting	Forsyth (2015), Choi et al. (2015)

		Pedestrian-friendly street	
Macro level	Density	Residential density Retail density Job density Open space density	Cervero and Kockelman (1997), Frank et al (2009) (Dovey and Pafka, 2013)
	Mix	Entropy Land use mix (live/work/visit mix) Mixed-use Index (the ratio of residential to non-residential) Functional mix	(Frank et al., 2007), Hoek (2008) Frank et al (2009), (Dovey and Pafka, 2017), Masoumzadeh et al. (2021)
	Access	Network density Intersection density IC (Interface catchment) The area-weighted average perimeter (AwaP)	Frank et al. (2009) Berghauser Pont and Haupt, (2010) (Pafka and Dovey, 2016)

Perceived qualities

As many researchers in the field of public health aimed to identify relations between street environment and a person's physical behaviour, planning research started to broaden academic interest in qualities of perception (Alfonzo, 2005). Those studies are based on the personal side of walking (Buckley et al., 2016), explaining when they prefer walking and how they feel about the environment.

Alfonzo (2005) suggests five qualities of perception- *Feasibility, Accessibility, Safety, Comfort and Pleasurebility* based on Maslow's (1954) theory of motivation. Mehta (2008) attempted to bridge Southworth (2005)'s six criteria of walking environments with Alfonzo (2005)'s framework and provided five perceived qualities; ***Sense of Belonging, Sensory Pleasure, Comfort, Sense of Safety, Usefulness***. "sense of belonging" quality added the significance of destinations for social gathering on walking behaviour, which emphasize social characteristic dimension on walkability. Those qualities were verified with studies focusing on walking motivation and needs by conducting surveys and interviews (Mehta, 2008; Buckley et al., 2016). (for a summary of perceived qualities, see Appendix 1).

Usefulness is the ability of the environment to satisfy the individual's day-to-day needs for shopping, eating, and entertainment, and also affected by the quality of goods and services (Mehta, 2008).
Safety is a broadly affected quality by traffic, street crime and risk of injury (Southworth, 2005). Also, people may be affected by urban forms that allow natural surveillance, particular land uses, and the presence of certain groups (Alfonzo, 2005), and transparency with the presence of first-floor windows (Mehta, 2008).
Comfort refers to a person's level of ease, convenience, and contentment (Alfonzo, 2005, 829) and may be affected by weather, physical settings, perceived safety and distance, the familiarity of the setting and people, or easy terrain (Mehta, 2008, 221).

Sensory pleasure refers to a Visually appealing environment that people feel being provided concerning a person's walking experience (Alfonzo, 2005). The richness of the design elements creates an attractive and enjoyable environment that promotes walking, reflecting aesthetics (Alfonzo, 2005; Buckely et al.,2016). ***Sense of belonging*** is the ability for a person to belong to a group, to be accepted in it and to feel a sense of attachment to it (Mehta, 2008, 222). Mehta (2008) argues that community places play a significant role in encouraging walking, and there is limited research on the relationship between walkability and the presence of community places. It may be affected by opportunities to talk or meet with friends or neighbours and the presence of a community place (Buckely et al., 2016) or the repeated use and visits to build place attachment.

The relationship between spatial attributes and perceived qualities

High-density and mix-uses are usually considered as factors that support walking (Wang and Yang, 2019), but it does not mean people perceive this environment as a 'high-density environment'. People might perceive it as a 'convenient place', 'interesting place' or 'safe place where activities occur until night. People perceive the environment in different ways, and this is mediated by many factors. Ewing and handy (2008)and Mehta (2008) provide a helpful framework for understanding the complicated relationships between attributes and qualities perceptions.

Ewing and Handy (2008) explain the multi-directional and physical environment-oriented process of perception related to walkability (Figure 3). Spatial attributes influence perceived walkability both directly and indirectly, and walking behaviour comes up as an individual reaction. Although urban design qualities are separated from physical features, they are considered as a part of spatial attributes because those qualities such as enclosure, refer to the condition of the environment, not individual experiences about the environment.

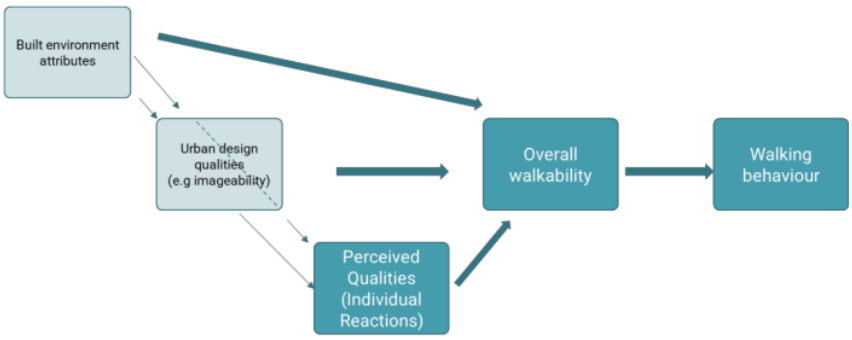


Figure 3 Ewing and Handy(2008)'s physical environment-oriented framework

Mehta (2008) described the relationship between spatial characteristics and perceptions more user-oriented way. He argues that perceived qualities are not connected to the environment straightforward but mediated by not only overall built environment factors but also individual relations (Figure 4).

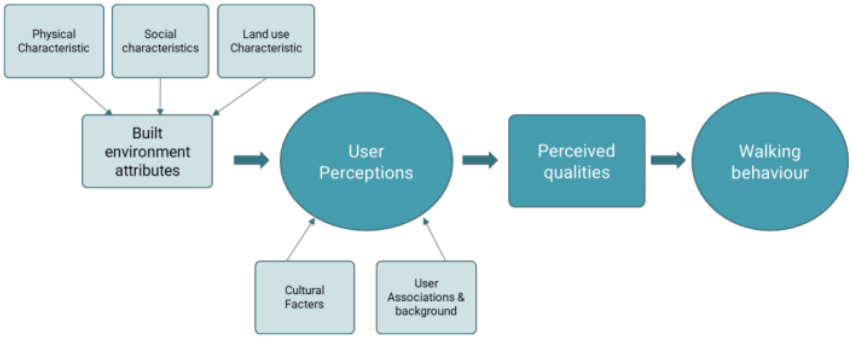


Figure 4 Mehta(2008)'s user perception-oriented framework

Both studies concentrate on street-level walkability, and Mehta(2008) suggested the importance of a macro-scale correlation study, addressing the possibility of a contrasting result. Therefore, built factors were added as a part of the spatial environment. since limited studies attempt to examine those complicated relations, transdisciplinary research is now investigating the relationship between the built environment and walking behaviour, and recent studies have tried cross-sectional mix-method research (Table 3).

Table 3 Recent research on walkability measurement

Authod	location	scale	method
Azmi and Ahmad(2013)	Malaysia	neighbourhood	GIS
Singh(2016)	New Delhi, India	street	observation and survey
Buckley et al(2016)	Vancouver, Canada	street, neighbourhood	observation, survey
Girling et al(2019)	Vancouver, Canada	street, neighbourhood	Walk Score, observation, survey
Masoumzadeh et al(2021)	Ardabil city, Iran	street, neighbourhood	GIS mapping, observation

Studies attempt to examine user's reactions and experiences in certain built environments by cross-analysing the result of spatial attributes from GIS, observation and walk scores and interviews or surveys answered by users. Girling et al. (2019) employ Walk Score® with a questionnaire to assess the walkability and actual usage of the public spaces. While verifying physically walkable status at the neighbourhood level, they also found unexpected findings that the landscape and public realm of the regional park are the strong motivation to walk from the questionnaire. However, the result does not show how people experienced such green space and which feelings made them walk. They might feel a sense of belonging or feel comfortable with the fresh air in the landmark place. More importantly, research so far has limitedly taken the significance of destinations for social gathering into consideration on walking behaviour. This

paper attempts to fill this void by closely examining how people recognise perceived qualities that induce walking and the correlation between the assessed built environment and the level of each perception by conducting a cross-sectional analysis with several methods.

2.3 The walkability debates in South Korea

Understanding walkability becomes more complicated regarding the different contextual backgrounds because different experiences, cultural characters, history, and emotional interpretations of the place also mediate an individual's perception (Mehta, 2008). Many studies have begun measuring walkability while validating developed methods such as Walk score™ in various locations and comparing to early research mainly based in the USA, Europe and Australia (Cerin et al., 2007, Hasan et al., 2021).

Arellana et al.(2019) attempted to identify the most critical walkability factors in the Latin American context while validating the Walkability Index(WI) by the survey. Security and Traffic Safety were notably recognised as the most critical components that affect walkability, which suggests that the presence of police officers, cameras and urban animation and surveillance guaranteed by the presence of other people) should be considered to improve walkability. In contrast, Koohsari et al.(2021) also measured the perceived built environment in ultrahigh-density areas of Japan. By comparing Walk Score with the survey, most of the spatial attributes such as access to shops, transport, recreational place, and density have a meaningful correlation between walk score, and there were no significant correlations between Walk score™ and aesthetics, safety from crime. Those findings suggest that the extent to influencing walkability among built environment attributes is likely to differ according to geographical context.

The walkability debate in south Korea has also been burgeoning. South Korea is a rapidly grown and urbanised nation, and large-scale apartment complexes have efficiently served the nation to cope with such rapid urbanisation, which leads to an apartment complex as a dominant typology in which more than half of the population lives(KOSIS, 2017). Growing awareness focused on inherent problems of apartment complexes such as traffic congestion, high level of car dependency, and losing a sense of community, and the debate on neighbourhood walkability in apartment complexes also started to be increased.

Studies found that influencing walkability factors differ depending on the kind of Residential Zone in South Korea. (Park et al., 2013, Choi et al., 2015). While Residential Zone1 (low-density area) is mainly affected by connectivity, such as the presence of bus stops and sidewalks, Residential Zone 3 (high-rise and high-density area) is significantly affected by the presence of plaza or square, impressive sculptures, and windows with bars (Choi et al., 2015). Also, Kim et al. (2019) found that residents of apartment

complexes near large parks were delighted with their walking experiences, while the Walk score™ appeared low. However, most research primarily focused on the narrow physical environment of streets, such as signals, sidewalks and bicycle lanes. Few studies have measured spatial attributes in apartment complexes, such as the configuration of community centres or landscape furniture, and their impact on walkability assessed by users. Moreover, those attributes were not sufficiently considered in a macro-scale morphological context.

Importantly, an apartment complex In South Korea does not just mean high-rise multi-family housing but implies 'complexed, internalised' high-rise housing with joint property ownership. After the Korean war, the 'Pre-construction sale system' and 'joint property ownership' was introduced to supply housing and infrastructure within a limited time and budget, and apartment complex residents became responsible for the construction of the supportive facilities under this system (Gu, 2019). Therefore, the Apartment complex became an enlarged middle-income housing complex that contains 500~3,000 and occasionally more than 4,000 units of residence with commercial facilities and large community centres for daily activities, developed on a single block with shared property rights. It is also described as 'Danji-hwa', which means exclusion and privatisation of urban structure and daily facilities. (Jung et al., 2018). Since this phenomenon cause debates on social isolation and sense of belonging, planning methods, such as the Neighbourhood street strategy, were discussed and applied, which also leads to distinct spatial attributes in an apartment complex. Seoul metropolitan government has released Seoul Plan 2040(2022), including 'the concept of Daily-walking neighbourhood', articulating apartment complexes area have a few challenges to create a walkable city. However, no research was conducted to examine spatial attributes of apartment complexes that discourage people from walking at multi-dimensional levels, nor investigate unique attributes and planning methods of apartment complexes in depth. As addressed above, those background and contextual differences can affect individual experience about walkability, and those gap needs to be addressed.

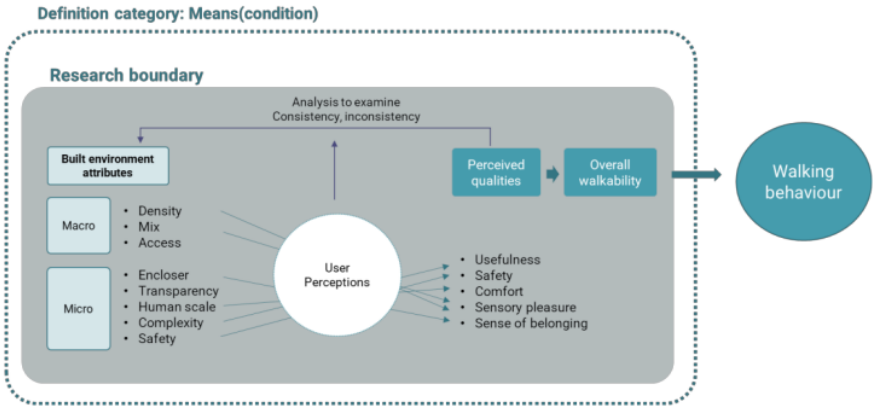
3. Methodology

3.1 Framework

The literature review reveals two significant gaps: one is the link between spatial attributes and user's perception of walkability, and the other one is walkability measurement in high-density apartment complexes area in Seoul, South Korea, leading to the aim of research in examining how spatial attributes of high-density apartment complexes in South Korea affect user's perception of walkability.

This study developed a framework based on the framework of Ewing and Handy (2008) and Mehta (2008) (Figure 5). This framework focuses on how people perceive their environment and the reason for walking in certain spatial attribute conditions. For example, the research focuses on how various destinations along the street influence individual's feelings and walking decisions and decoding the unexpected pattern between high functional mix and usefulness.

Table 4 research framework



First, evaluating spatial attributes focused on variables at both micro and macro level, drawn from the literature review. After analysing spatial attributes, potential walkability and qualities were expected. And then, Five categories drawn from the literature review were used to examine individuals' experiences in the environment. The result of perceived qualities was analysed to discover the most influential spatial attributes in the site by cross-checking with spatial attributes. It also revealed whether the result is consistent with the expectations or unexpected patterns, as well as the distinct attributes of apartment complex areas in Seoul, South Korea.

3.2 Case study: comparative research

As addressed in the literature review of walkability in South Korea, distinctive apartment spatial characteristic is a result of commercialisation, internalisation and enlargement of mixed-uses property

with shared land ownership and the trial to recover from the neighbourhood segregation. Therefore there have been two primary approaches: trial to restructure urban fabric to solve problems by public-led development, and the highly-internalisation and commercialisation apartment to upgrade property value by private-led development (for detailed background, see Appendix 2). Therefore, a Comparative case study is proper to encompass spatial attributes in an apartment complex. For this, two cases that represent public-led with public-led each were selected.

Site selection

Seoul has been developing a robust policy tool to be more walkable since the introduction of the concept of Neighbourhood Street in the early 2000s. Seoul metropolitan government has released Seoul Plan 2040(2022), including 'the concept of Daily-walking neighbourhood'. Therefore, Investigating areas in Seoul contributed to the guideline for the concept of Daily-walking neighbourhood' at the same time while examining different planning methods and effects on walkability. Two distinctive cases in Seoul were selected. Both cases are typical bed towns in Seoul, distancing around 10km from Central Business District in Seoul with geographical context(park, stream, stations) and educational reputation(for detailed site information, see Appendix 3). Site boundaries were defined by the criteria of 'Daily-walking neighbourhood' of Seoul Plan 2040(Seoul Metropolitan Government, 2022) that aims at a 30-minute walking distance as a whole neighbourhood (see Appendix 4).

Site 1 E-Town: Eunpyeong New town (public-led development)

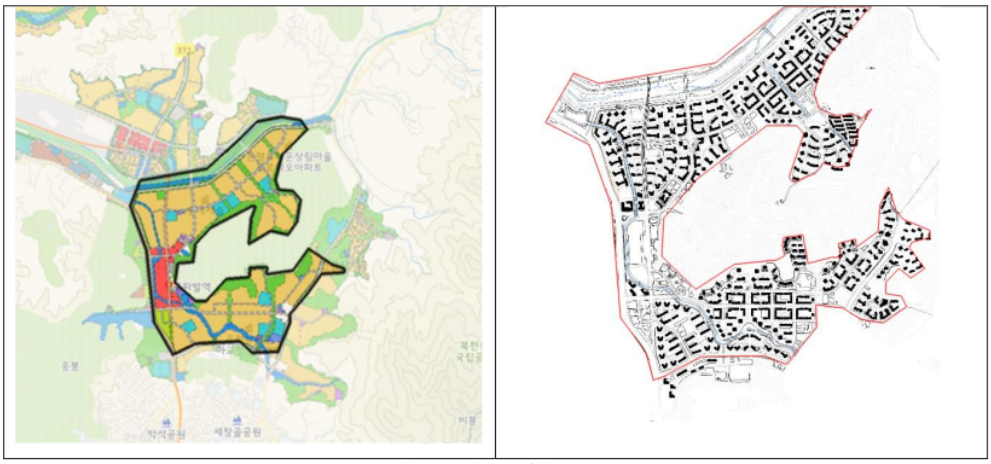


Figure 5 Map of E-town

Site 2 G-Town Gang-ill Complex (private-led development)

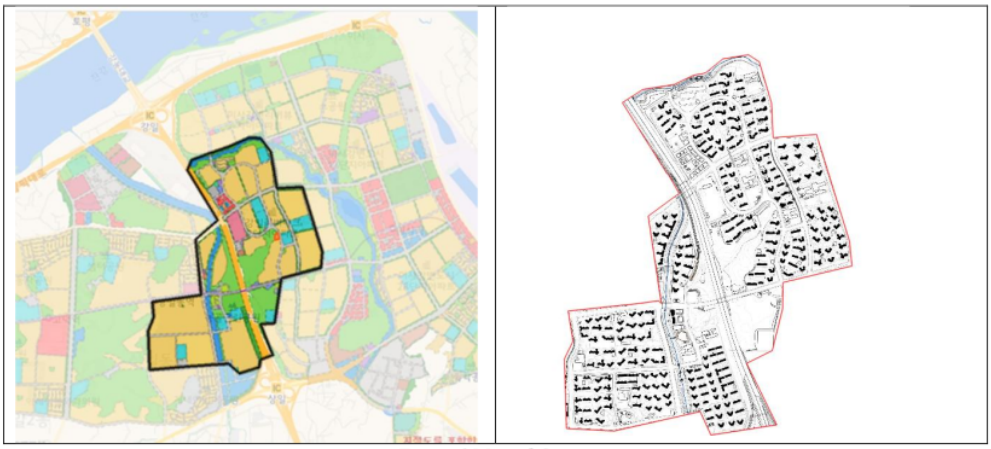


Figure 6 Map of G-town

E-Town was developed in the 2000s by Seoul Housing & Communities Corporation (SH), with the application of the 'Neighbourhood Street[1]', and 'Green network'[2] laid out throughout the neighbourhood. Mid-rise & high density courtyard typology, community and retail shops, specialised balcony and terrace design element are located along the neighbourhood street. G-Town is also supplied by SH, but each block have been developed by private developer and construction companies. Therefore, centralisation of configuration, large community facilities in the centre of the complexes, elaborated landscape design, and central square open space are found. Diverse landscape area and community facilities has been provided. (for detailed spatial characteristic, see Appendix 2).

[1] The Neighbourhood street is one of planning methods of high street developed to improve walkability and vitality in residential-dominant areas in South Korea by providing street-space with day-to-day destination, human-scale specialised design, the application of traffic calming design or open spaces.

[2] The green network refers to a linear pedestrianised open space with greenery connected to regional park and green space. It is usually used in New Town urban planning in South Korea.

Figure 7 The Green network

3.3 Data collection method

3.3.1 GIS data

GIs data were used for assessing macro-level spatial attribute analysis. GIS data has been collected on National Geographic Information Platform (NGIP, http://map.ngii.go.kr/ms/map/NlipMap.do) run by National Geographic Information Institute (NGII) and V-world (http://map .vworld.kr/map/ws3dmap.do) run by Ministry of Land, Infrastructure and Transport(MOLIT). All data are open to the public. 2D information, including building, street width, and terrain, was collected from NGII. V-world is an open API platform that provides 2D, 3D spatial information, including land uses, FAR, the number of housing, transportation, building height, and zoning regulation, which were used for GIS analysis.

3.3.2 observation

Observation contributed to assessing the micro spatial attribute. Apartment complexes usually occupy the whole block, occurring differences between inside and outside of the apartment complex environment due to the exclusivity depending development method. To address that property, two representative spots - an open space in an apartment complex and a street beside an apartment block - were selected in each area. The researcher conducted 3-hour observation periods during fieldwork between 13th, July to 20th, covering both weekdays and weekends and at two different times as a way to collect information throughout the day: afternoon (13:00-16:00), evening(17:00-20:00). Photographs were taken to assess enclosure, transparency, human-scale, and safety, while counting people was to assess complexity.

3.3.3 survey

The purpose of the survey was to obtain information about how residents recognise their walking environment according to perceived qualities and significant spatial attributes that influence their

perception the most. Those data contributed to evaluating the level of correlation between spatial attributes and perceived qualities. In the survey, residents were asked about their walking preference and frequency with a single choice question for evaluating the level of walkability, a series of questions about perceived walkability and sub-questions about spatial attributes that were expected to affect certain perceived qualities with 5 Likert-scale (5=strongly agree, 3=normal, 1=strongly disagree). For example, respondents were asked to 'my neighbourhood is enjoyable to walk. 'And also asked to 'There are various events or activities accessible in the apartment.' as a part of sub-questions. Finally, open-ended questions were asked to obtain residents' walking patterns. (see Appendix 6 for survey question). Answers were collected via digital format, Google form, and the researcher surveyed during the fieldwork between 13th, July to 20th July. Google Form were used to distribute the link.

3.4 Analysis

On completion of the GIS collecting, observation, and spatial data were analysis by both quantitatively and qualitatively. Macro level spatial attributes were analysed by QGIS, and visualised by Auto CAD. Those data were compared quantitatively. Photographs were used to assess urban design qualities for micro-level spatial attributes qualitatively. Survey results were analysed by SPSS. Descriptive statics were used to compare two areas and examine the correlation between walkability and sub-question.

3.5 Research Ethics

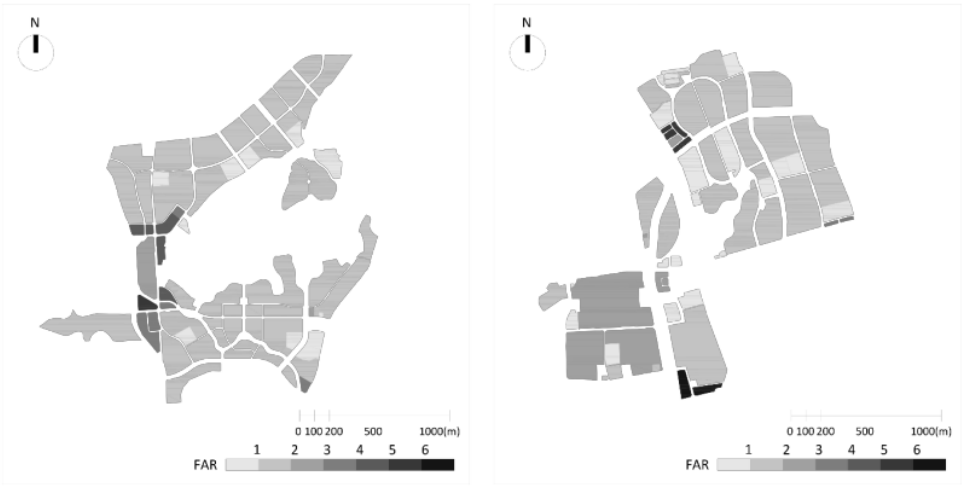
This study employed a survey asking the opinions about walkability and observation for analysing the condition of the area. Since this research include the involvement of human participants and visual record such as photography, ethical issues might arise from it. Nevertheless, the interview questions mostly consist of walking experiences that are not sensitive issues; the ethical risk is low. To minimise ethical risks, participating in the project was voluntary, and informed consent was discussed with all participants beforehand, allowing participants to answer or refuse to answer any question. Also, personal data was not collected to avoid any sensitive data and to secure individual confidentiality. Interviewees were anonymised when data was saved on a computer for analysis. Only photos for recording physical conditions such as streets or open spaces were taken without containing the faces of people.

4. Spatial attributes analysis

4.1 Macro-level spatial attributes

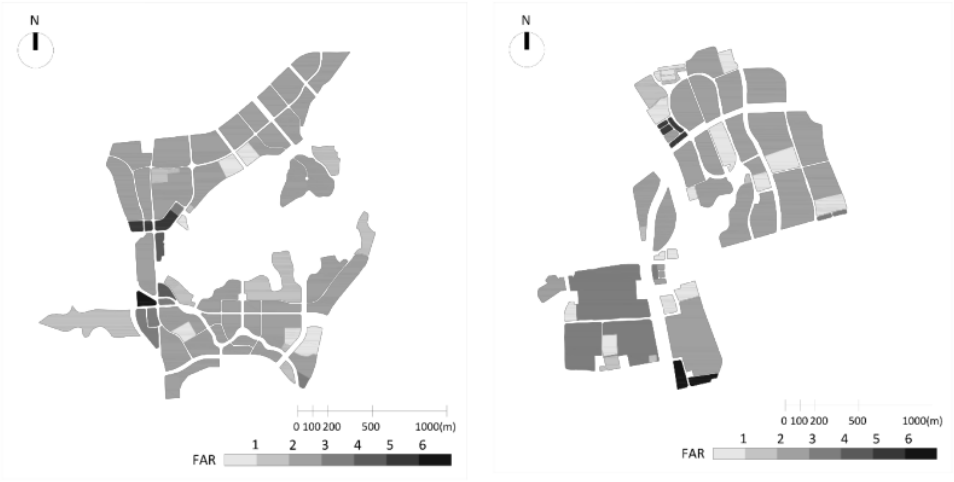
Density

FAR, dwelling density(D/h) and green space ratio were analysed by QGIS and visualised according to the results. Figure 8 provides the intensity of FAR in both E town and G-town, showing a range of FAR from 1.7 to 2.5 and FAR 5 in some commercial areas. FAR seems to be lower than other Asian cities. However, this is because of the 'Extended balcony' rule that allows remodelling for the balcony space, which is not counted as a floor area, as an extended living space in an apartment complex amended in 2005. As a result, balcony spaces have been an additional living space to avoid FAR limit. If the floor area includes balcony areas, FAR typically increases by 0.6~0.7. Therefore, adjusted FAR is estimated to be around 2.3~3.6 (Figure 9).



E-town G-town

Figure 8 FAR

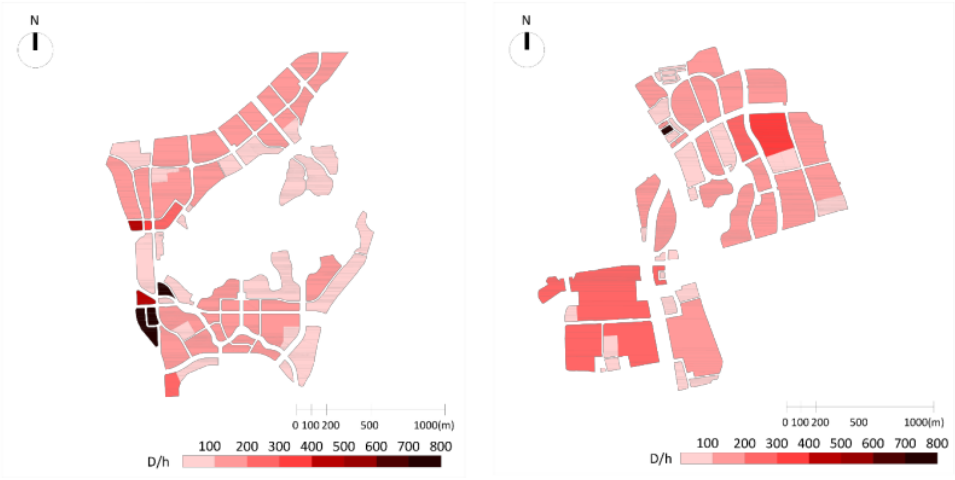


E-town G-town

Figure 9 FAR(adjusted)

Two towns have similar FAR levels, while G-town is slightly higher than E-town. However, the way density distribution throughout the neighbourhoods is different. The floor area is distributed almost evenly excepting the transit centre with commercial area in E-town while G-town shows the uneven distribution. It is because G-town only has Zoning regulations that determine maximum density in each block, while E-town has a dedicated masterplan to optimise overall density over the area.

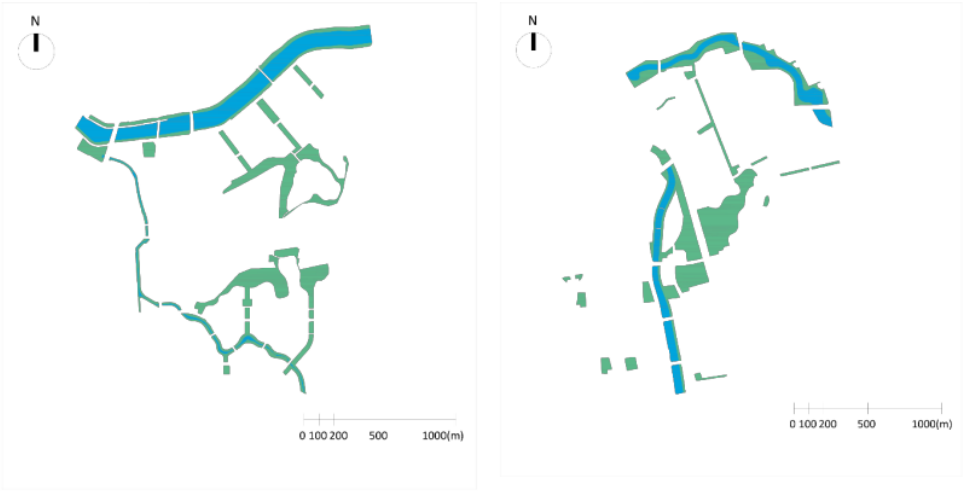
Dwelling density also shows a similar level (Figure 10), but inconsistency is found when overlapping with FAR. Dwelling density in E-town is lower when the block is far from the transit centre, while all those blocks remain high-density in FAR. In contrast, blocks with low dwelling density also have low FAR, regardless of the distance from the transit centre. Lower dwelling density in E town implies more mix-uses, while those in G-town are physically low density. It indicates density in E-town is distributed evenly, and more destinations are within walkable distance since blocks are supported with higher mix-uses even if they are far from the commercial centre. On the other hand, people in G-town are more likely to experience the density gap in certain areas.



E-town G-town

Figure 10 Dwelling density (D/h)

The green space ratio in G-town is also higher than in E-town, with the figure of 00 and 00, respectively (Figure 11). However, while green spaces in E-town are connected throughout the whole neighbourhood and expanded to regional green areas, those in G-town tend to be centralised in a limited part of the neighbourhood or distributed as a small pocket park. It implies not all blocks might have a reachable distance to green space.



E-town G-town

Figure 11 Green space density

Functional mix

Functional mix were analysed through the lens of the triangular framework of live/work/visit developed by Dovey and Pafka (2017) to concentrate on three major walking motivational activities instead of segregating every single use. Red, blue and green indicate living, work, and visit, respectively, and the triangle shows three primary kinds of mix: Yellow is live/work mix that is mostly linked to living, shopping, eating and playing; magenta is live/work mix related to commuting; cyan is work/visit mix that is the ways of shopping, eating and playing in conjunction with work (Dovey and Pafka, 2017). the more mix-used a block is, the brighter colour is mapped.

The proportion of mixed colours is higher in E-town than in G-town, and G-Town generally consists of blocks of single uses with a high proportion of red, green, and blue colours. Also, the configuration of mix-uses is different between the two towns. Mix-uses are linearly laid out in E-town from the high mixed transit centre (Figure 12. above), and yellow and magenta colour appears alternately along the high street. In contrast, single uses of visit(green) and work(blue) tend to be surrounded by single resident use in G-town (Figure 12, below). This difference is derived from different planning delivery methods. Most apartment G-town is private-led properties focused on exclusivity and enlarged community centres. Therefore, most community facilities are located in the centre of the block of an apartment complex, and only a few isolated local stores or daily facilities are at the main entrance of complexes to comply with building regulations in South Korea. This method enables suppliers to provide more large cultural programmes such as theatre, local gym, swimming pool, or indoor golf course, but the access is limited to the apartment complex's residents.

E-town

Figure 12 Functional mix

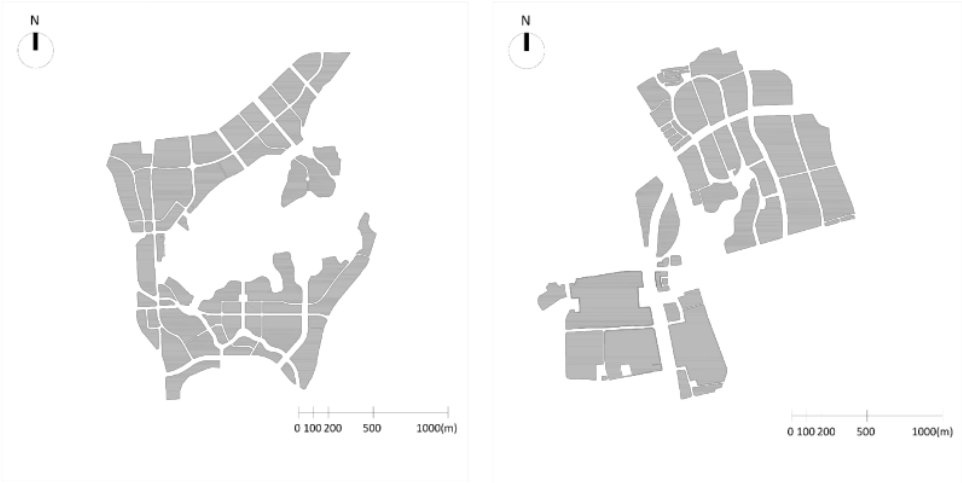
As per the GIS mapping, E-town seems to support diverse functions and activity throughout the neighbourhood, particularly along the high street. In addition, a part of the green network is between those mix-use blocks, and it might support diverse walking needs, including multiple activities such as taking a rest and shopping. On the other hand, G-town seems to provide much more diverse scale of programmes than E-town, considering the floor area of community centres.

Access

Access was assessed through the lens of the area-weighted average perimeter (AwaP) and the interface catchment (IC) developed by Dovey and Pafka (2016). AwaP is the average of the perimeter of each block

multiplied by its area and is suitable for the permeability of urban blocks, particularly heterogeneous mix shapes of blocks with a different types of intersections. Considering that the shape and arrangement of urban blocks in Seoul are greatly affected by the contour due to mountainous terrain, AwaP can be a proper measurement tool. IC is the total of all block perimeters within a walkable catchment, similar to network distance but more focused on the length of public/private interfaces.

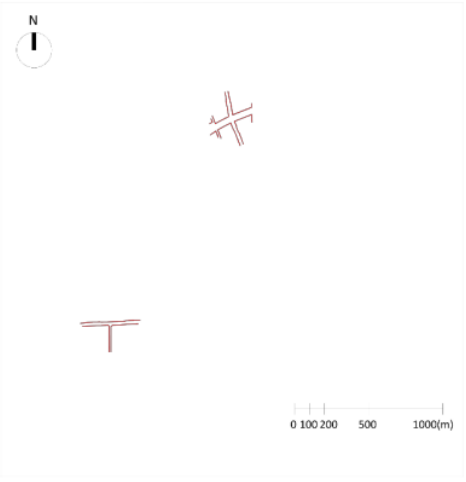
Figure 13 shows the overall morphology for each case, and AwaP in E-town is considerably lower than in G-town, recording 833 and 1130, respectively. Low AwaP scores indicate high permeability, while high scores indicate low permeability (Pafka and Dovey, 2016); therefore, the urban structure of E-town is more permeable than G-town. Since E-town has a 'green network' throughout the neighbourhood, blocks were divided much smaller than in G-town, even though both towns have a similar density of car road intersections.



E-town G-town

Figure 13 AwaP

IC was calculated at a 200-metre interface reach (IC200m) in two spots of towns each. Figure 14 maps The peak is in E-town due to relatively small grain morphologies, while the low in G-town reflects large blocks and T-junctions. However, IC presented a considerable gap between the two spots within the town. That is because both towns have inconsistent block sizes, and IC cannot distinguish a difference between the boulevard and the green network pathway that both have a similar width, while it accounts for the different hierarchy of streets.



E-town (IC200m = 1,502(above), 1,875(below)) G-town (IC200 = 1,127(left), 1,471(right))

Figure 14 IC 200m

The results show that E-town has more permeable blocks and streets, which provide more chances to interact in the neighbourhood. However, referring to Pafka and Dovey's (2016), findings, the figures indicate that both areas are significantly more impermeable than Nagoya, Barcelona or Manhattan. With this, the inconsistency in IC figures implies that the current method might not account for specific characteristics such as the green network in South Korea.

4.2 Micro attributes

As mentioned in the methodology, an open space in an apartment complex and a street beside an apartment block were assessed for micro-scale spatial analysis. <figure> shows selected spots in both towns.

E-town

G-town

As per the observation, **enclosure** in E-town was higher level in both inside of apartment and neighbourhood street compared to G-town. but qualities of enclosure appears differently because of typology and building height. A dominant typology in E-town is Courtyard with mid-height of building while high-rise Tower is the most dominant in G-town. In detail, E-town neighbourhood street has a strong enclosure because of a continuous faced punctuated by store entrances and windows. In contrast, G-town streets in both spots are less defined by buildings since the main typology is tower buildings, which create irregular openings between the buildings and blank walls. However, inside apartment complex provide relatively higher enclosure compared to street, since a number of trees defended each open space instead of apartment buildings.

E-town **G-town**

Figure 15 Enclosure (above-outside, below-inside)

Transparency was assessed similarly with enclosure, which mostly based on typological differences. Streets in E-town provide continuous stores, entries towards to courtyard of apartment complex, and tress while limited stores near the apartment complex's entrance partly occupy the street and fence with trees are more dominant in G-town. However, many stores on the ground floor are real estate brokerages and private academies (Hakwon[3]), which work against transparency.

E-town **G-town**

Figure 16 Transparency (outside)

On the other hand, most of the ground façades of open space in the complex are blank walls or openings towards parking lots with a few building entrances in E-town, while community facilities with expansive windows surround the open space in G-town. Compared to E-town, most apartment complexes are well landscaped with big trees, providing opportunities for partially transparent tents affording awareness of the space beyond while still conferring a sense of enclosure.

[3] A private academy for primary and secondary school student. And many students usually stay late at night in Hakwon due to high-level competition.

E-town **G-town**

Figure 17 Transparency (Inside)

Human scale quality was rated higher in E-town than in G-town <figure >. Due to the application of design coding of E-town, buildings adjacent to the street are lower than those inside the complex with small elements such as balconies, bridges, or diverse materials in E-town, all of which contribute to human-scale qualities. Housing buildings in G-town are higher than in E-town regardless of the location of the building, which works against human scale.

E-town **G-town**

Figure 18 Human scale (outside)

However, G-town's open space in the complex is not overwhelmed by apartment buildings because of landscape elements, street furniture and trees. In E-town, the mid-rise courtyard and trees gives a sense of human scale.

E-town **G-town**

Figure 19 Human scale (inside)

Complexity was assessed by observing distinctive physical elements and the number of people, activities and. The street in E-town shows high complexity because of different design elements, benches, trees and people, while G-town shows low complexity because of the fence and simplified building design.

E-town **G-town**

Figure 20 Complexity (Outside)

In contrast, the open space in the apartment was relatively low in complexity with a lack of street furniture, while G-town has many landscape pavilions, trees and activities.

E-town **G-town**

Figure 21 Complexity (inside)

The number of people and activities shows such opposite situation between the inside and outside apartment complexes (Figure 22). the open space in the G-town complex shows diverse activities, including recreation and activity, while the number of people is high in the street in E-town.

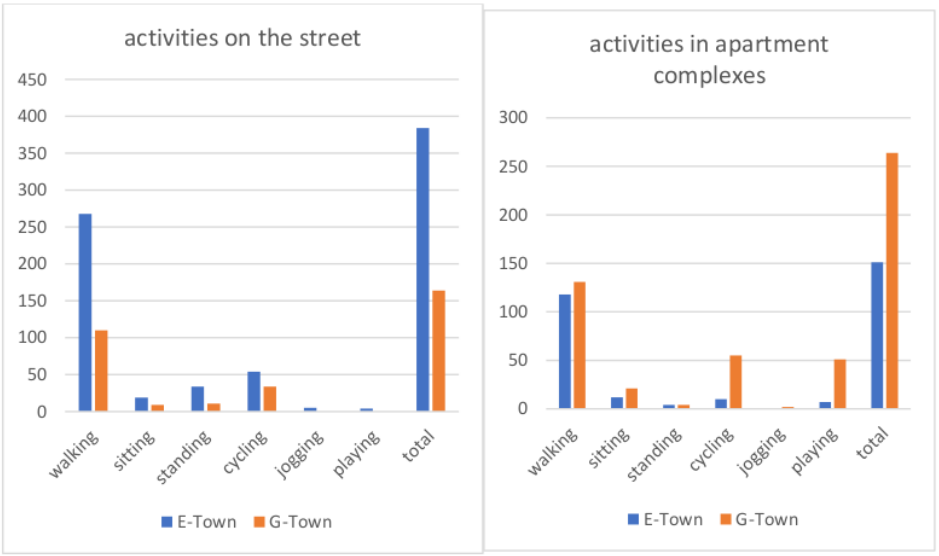


Figure 22 The number of activities and people

Safety is highly applicable in E-town with traffic-calming design such as pedestrian-friendly paving on intersections, curvy road shapes, pocket parking areas, and speed bumps, while G-town is relatively car-oriented, and car speeds are faster than in E-town.

In terms of complexes inside, both towns have footpaths separated with car roads. However, paving and lighting in E-town were not maintained well, which decreased perceived safety.

E-town **G-town**

Figure 23 Safety

Figure 24 and 25 shows summarised urban design qualities. Design qualities of the street(outside the apartment complex) are generally high level in E-town, while the open space(inside the apartment complex)'s design qualities show opposite results. It implies residents might recognise more elements that induce walking outside the apartment complexes in E-town, while G-town residents might feel that more inside the apartment complexes.

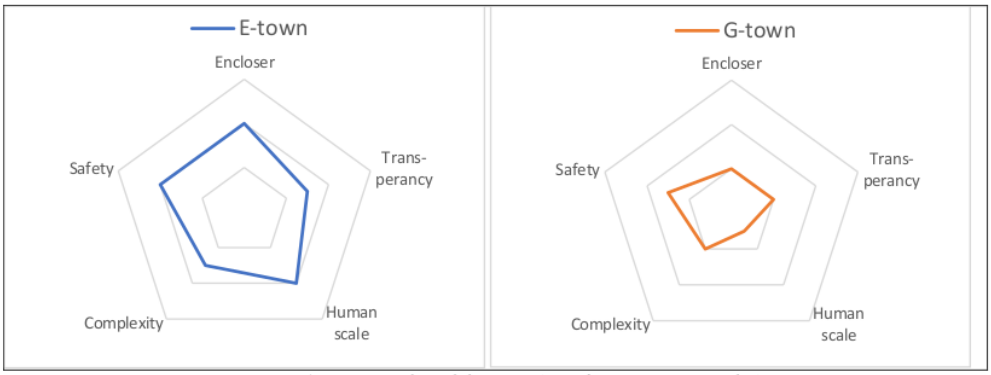


Figure 24 Design quality of the street (outside apartment complex)

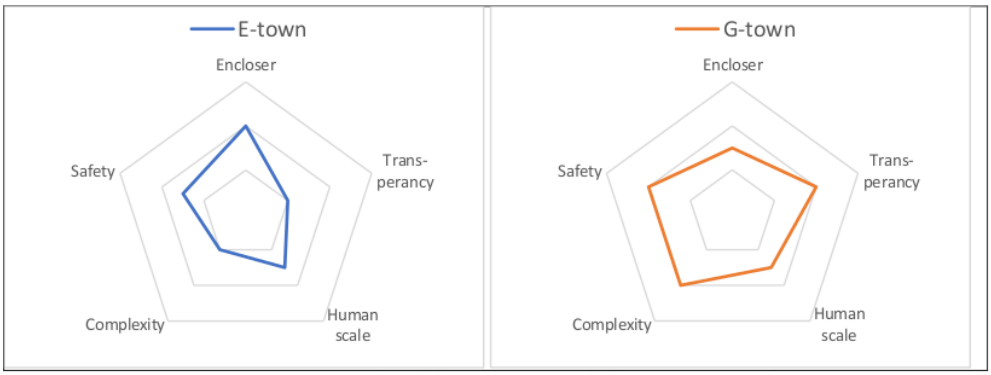


Figure 25 Design quality of the open space (inside the apartment complex)

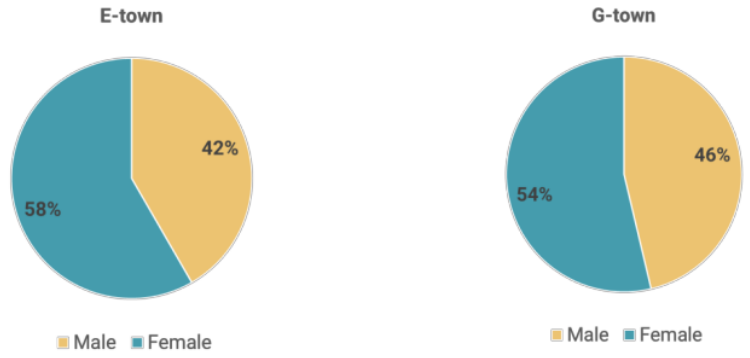
5. Perceived qualities analysis

5.1 demographics and walking patterns

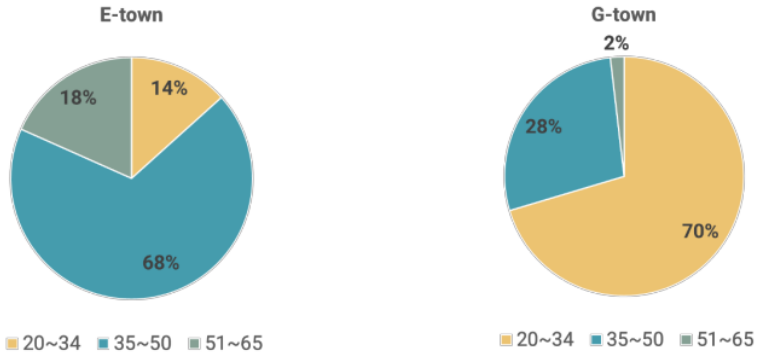
73 and 59 E-town and G-town residents participated in the survey, and 61 of E-town and 53 of G-town were validated for analysis.

Figure 26 shows that the largest age group in E-town is 35-50, while 20~34 is the largest group in G-town, and the period of residence is longer in E-town than in G-town due to different development methods. G-town has been developed by private companies sporadically, and newly built apartments are an opportunity for the young generation to get their first own house via the Special Supply for Newlyweds by the government, which might cause demographical differences between the two towns.

Gender



Age



Period of residence

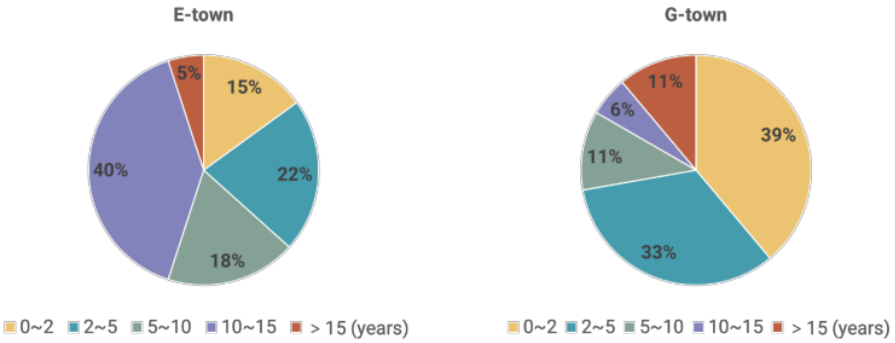
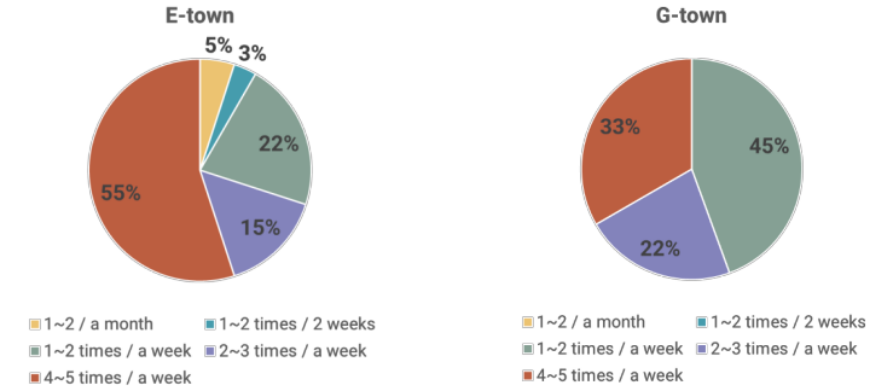


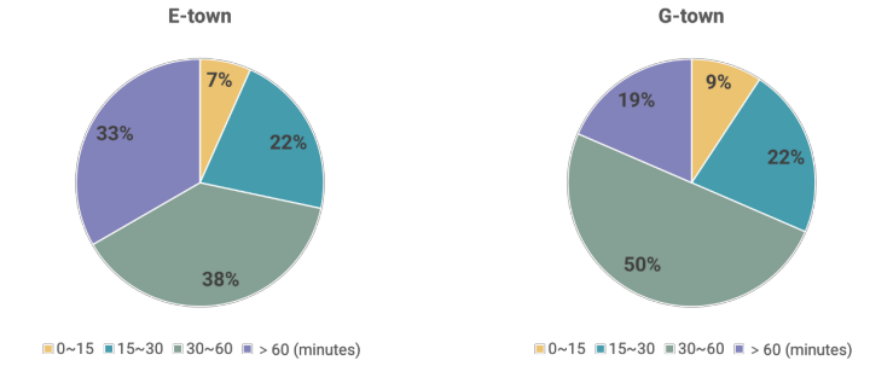
Figure 26 Demographics and residence period

Regular walking patterns clearly show that E-town residents prefer walking more than G-town residents (Figure 27). Walking times in a day, including essential walking needs such as commuting, appears slightly higher in E-town than G-town. However, the frequency of going out and the amount of time walking in the local area is significantly higher in E-town.

Frequency of going out



Regular walking time (including daily routine – e.g. commuting)



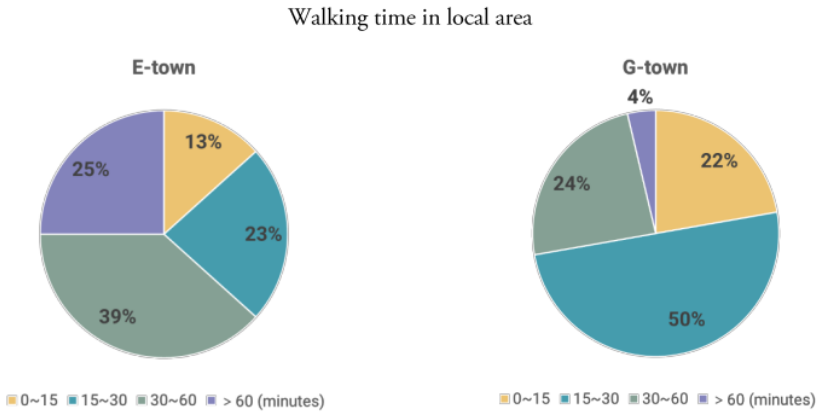


Figure 27 Regular walking patterns of residents

5.2 Perceived walkability assessment

Descriptive statistics show how residents perceive their area related to walking. The average walkability score assessed with the Likert scale was higher in E-town than G-Town, with 4.47 and 4.02, respectively (Figure 28 right). Also, in questions asking about perceived qualities of walkability in their towns (e.g. My neighbourhood is safe to walk.), E-town scored higher in every quality except usefulness than G-town (Figure 28 left).

E-town residents answered sense of belonging and comfort as the best qualities that account for their walking environment, while usefulness and safety reached the highest in G-town. Interestingly, E-town was expected to provide a diverse destination with fine-grained blocks, leading to the convenience of walking in spatial attribute analysis. However, usefulness was the lowest score in E-town. Also, qualities with higher scores - sensory pleasure and sense of belonging - in E-town generally got low scores in G-town. However, usefulness shows the opposite result, implying that significant differences in spatial attributes might be a factor driving walkability.

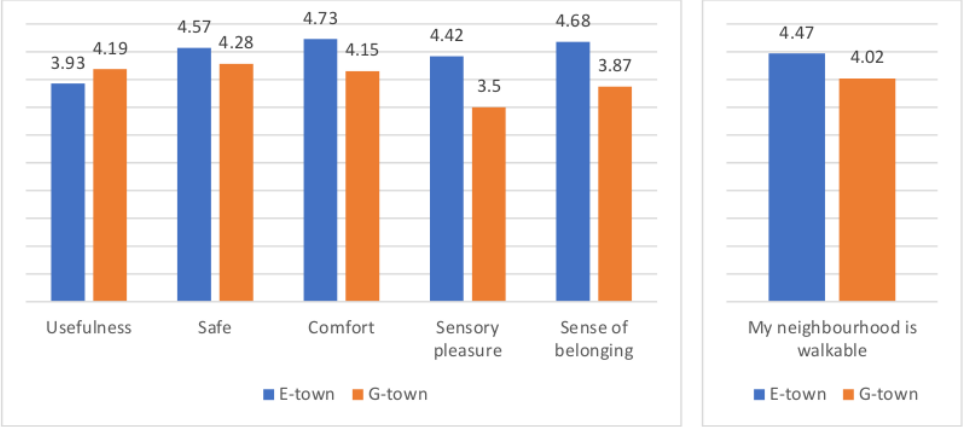


Figure 28 overall perceived walkability

Figure 29 shows the whole scores of sub-questions asking whether each spatial attribute contributes to their walking decision with the 5-Likert scale. Each keyword indicates what the question focuses on, and all questions are grouped according to possible perceived qualities expected to relate to the question. Questions also were divided depending on the area that questions ask - inside apartment complexes or throughout the neighbourhood.

Since respondents in both towns assessed the walking environment positively, key spatial attributes were selected by two criteria; 1) high score with low Std. Deviation(x<1) influencing positive answers, 2) large gap between two areas as critical spatial attributes differentiating the two areas.

Key spatial attributes turn out*: **day-to-day destination, street without obstacles, sidewalk separated from the road, traffic-calming design, security system, fresh air, tidiness, attractive landscape design, stores to meet someone and regional park and landmark as the most influencing attributes***, and ***intersection density, lighting, slow car speed, presence of tree-lined street, regional park and landmark*** as distinctive attributes (for descriptive statics, see Appendix 7).

Importantly, sub-questions that are expected to be related to certain qualities provide a result different from perceived quality assessment. For example, sense of belonging is a key perceived quality of walkability in E-town. However, respondents answered questions related to the quality, such as community places, with a low score, implying other factors might significantly drive sense of belonging for walkability. These features are discussed in detail following the sub-question analysis.

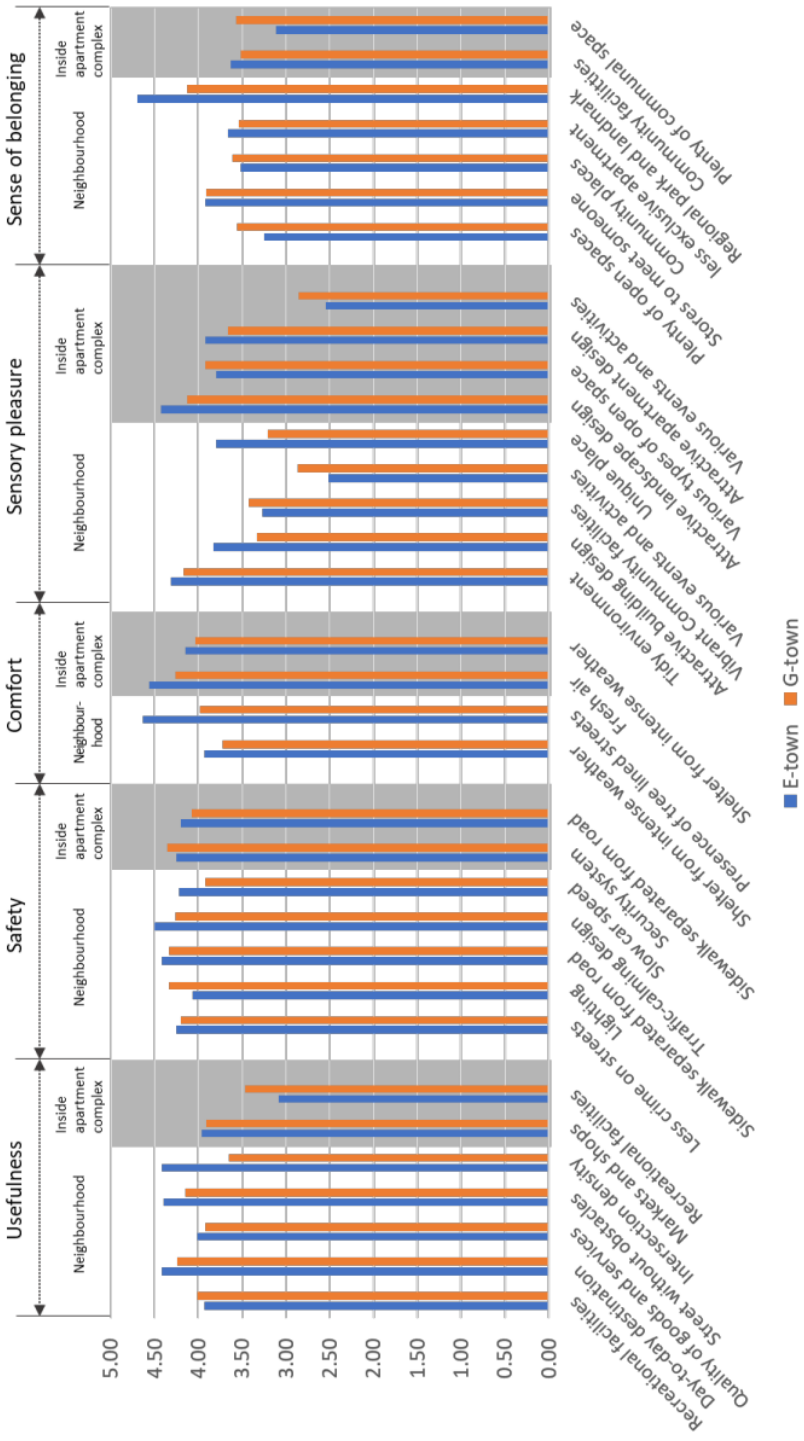


Figure 29 Result of sub-question about spatial attributes

Usefulness

Notably, residents in E-town scored relatively higher than in G-town (figure 30, left), while the results contrast with the assessment of perceived usefulness (figure 30, right). Drawn from macro-scale analysis, E-town seems more convenient to walk with well-distributed destinations and permeable blocks and configurations. Of course, sub-questions related to usefulness reach high scores compared to those related to sensory pleasure and sense of belonging; it is noticeable that usefulness is the lowest perceived quality in E-town, while this is the second highest perceived quality in G-town.

In detail, intersection density creates a considerable gap between the two towns, supporting the result of AwaP and IC but contrasting the result of perceived quality and implying permeability might affect other perceptions more in both towns. Additionally, recreational facilities seem somewhat correlated with usefulness, considering those attributes were assessed high in G-town. However, day-to-day destinations within walking distance and the quality of goods and services show contrasting results, similar to permeability. Those results imply the complex relationship between spatial attributes and perception of walkability.

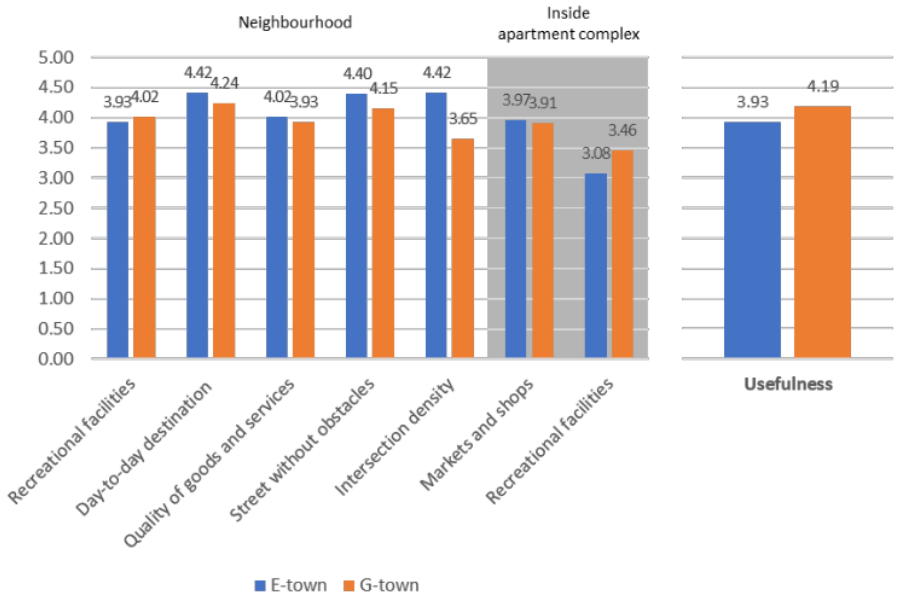


Figure 30 Usefulness

Safety

Safety were generally answered positively in both neighbourhoods. From the author's observation, there were no signs of anti-social activity in any part of the neighbourhood, and the potential danger of car

accidents was significantly low. All respondents evaluated positively about their neighbourhood as expected. However, it is noticeable that traffic-calming design was only applicable in E-town, and respondents answered that attributes as the most significant factors. Regarding safety, it is evident that pedestrian-friendly street design is a powerful attribute that induces people to walk.

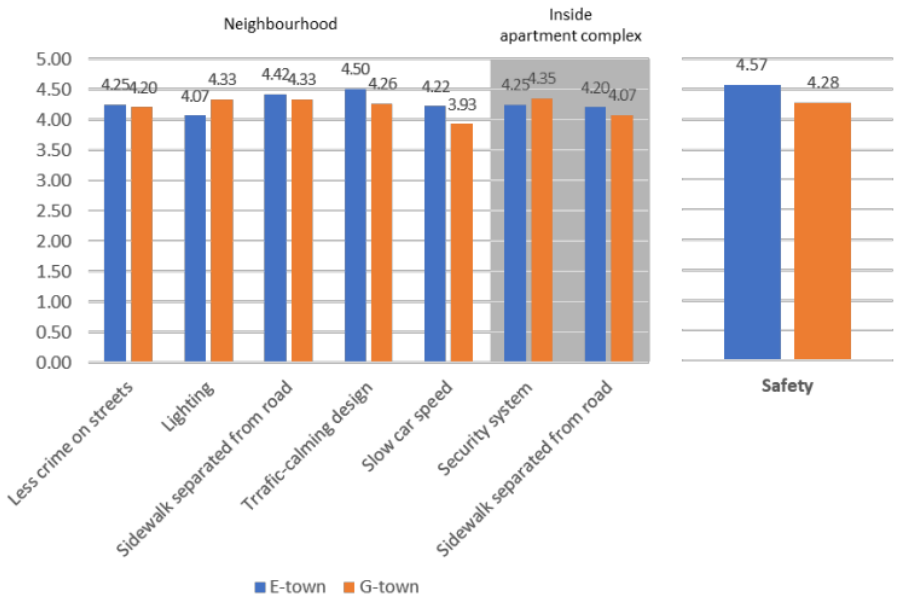


Figure 31Safety

Comfort

Drawn from macro-scale analysis, it was evident that greenery throughout the neighbourhood along the street was one of the main differences between the two areas. Notably, the result implies that laying green spaces out throughout the neighbourhood while connecting each urban space has a more significant role in perceived walkability than other factors. GIS results suggested that G-town has a more expansive green space, and the quality of the landscape, pavilions and well-planted trees were observed in the apartment complex in G-town, which also contributes to high enclosure and transparency. However, E-town was scored higher in all relevant questions, not only perceived quality assessment. It implies Green network connecting local green spaces and other destinations is more influential than the amount of green space, and it is supported further in open-ended questions.

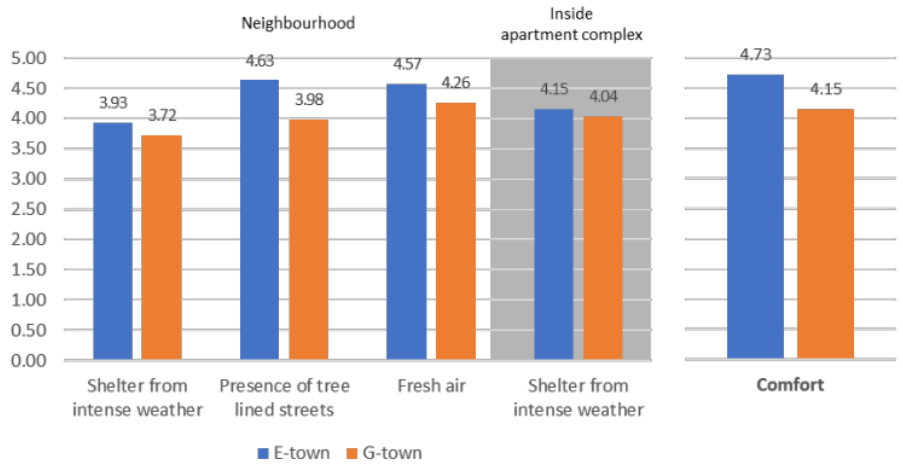


Figure 32 Comfort

Sensory pleasure

It is noticeable that questions related to sensory pleasure, excepting attractive landscape design and tidiness, were rated considerably low compared to other parts of attributes. Also, respondents rated lower scores in sub-questions, even though they positively assessed their environment as attractive and enjoyable to walk (Figure 33 right). According to observation, the two areas have distinctive typologies, and design approaches strongly influence micro-level qualities, such as enclosure, human scale and complexity, and both neighbourhoods of residents also recognise different building types and designs. E-town residents answered more positively about building height, design, and uniqueness of architecture than people in G-town, while vibrant community facilities and open spaces in the apartment complex were evaluated more positively in G-town. Those results imply that design qualities in both areas negatively act against the perception of walking, and although the E-town design approach induces people to walk more and people in E-town recognise distinctiveness, there is a need to improve the urban design. This result is supported further by open-ended questions' answers.

The key attributes influencing walkability perception were landscape, tidy and cleanness, implying that green space and landscape affect the perception of sensory pleasure, not only comfort. These result also

accounts for the complex relationship between walkability and spatial attributes.

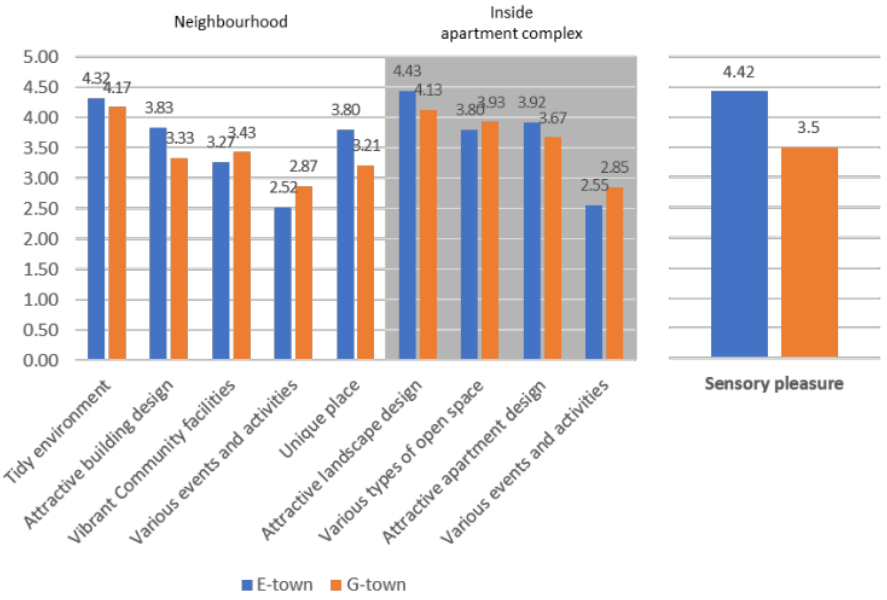
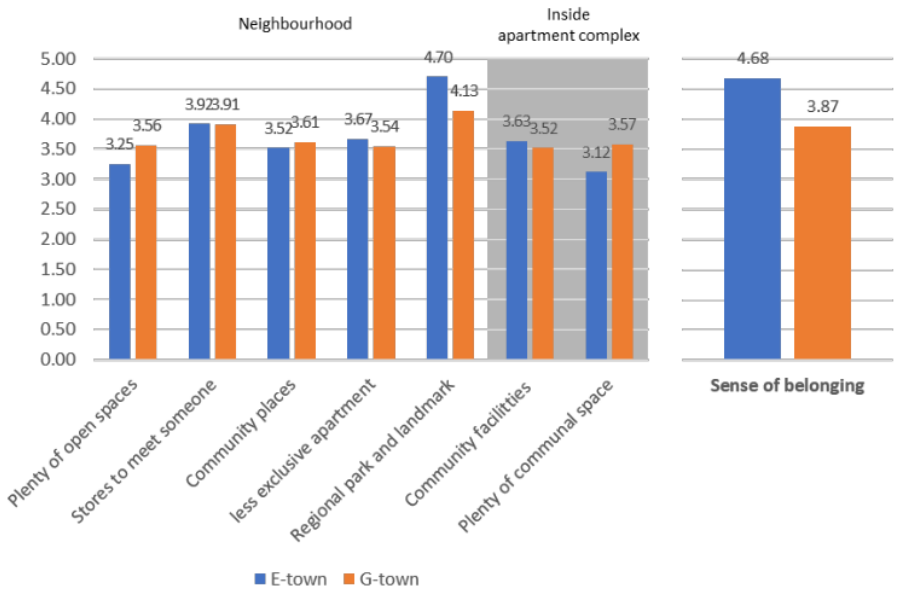


Figure 33 sensory pleasure

Sense of belonging

Similarly to sensory pleasure, E-town residents assessed all questions negatively except for regional parks, and even questions about destinations such as community facilities, open spaces and meeting places were assessed lower in E-town than in G-town. The result contrasts with an overall assessment of perceived sense of belonging (figure 1. 1 right), recalling the result of usefulness. Considering that sense of belonging is the second influential driver of walkability, and there is a considerable gap between the two towns, it supports that the relationship between spatial attributes and perceived qualities is not straightforward. Also, the opportunity for social gatherings seems higher in G-town; however, sense of belonging was the second lowest perceived quality, which suggests there is not a strong correlation between a perceived sense of belonging and the amount of community place. It explains that other

attributes, not only community facilities or opportunities, affect place attachment that induces walking.



Open-ended question

Open-ended questions were also asked to examine potential factors that are not considered in survey questions. Comparing questions to investigate residents' preference of walking in the local area were asked first, and 86% of respondents in E-Town answered their preference of walking in the local area, while 51% of respondents in G-Town answered, which clearly shows E-town is considered a walkable place than G-town (figure 34).

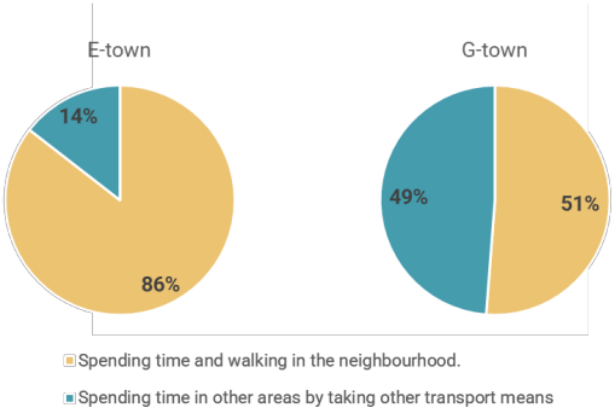


Figure 34 Areas in which residents prefer walking

Participants who prefer walking in the local area answered the following open-ended questions about the reason (Figure 35) and what they usually do during spending time (Figure 36).

Nature-related factors such as stream pathways and good scenery were the most compelling reason in both areas, particularly in E-town. Notably, many E-town residents commented a combination of nature and daily routine, such as "cafes with good scenery", "many shops with pleasure environment", or "daily facilities close to my home with a tidy and comfortable environment."

In the case of G-town, residents also answered park and stream as motivations but tended to recognise green spaces as another destination; participants commented park and other destinations separately; for example, "park and stream", "cafe and shops near my house", or "various facilities within walking distance".

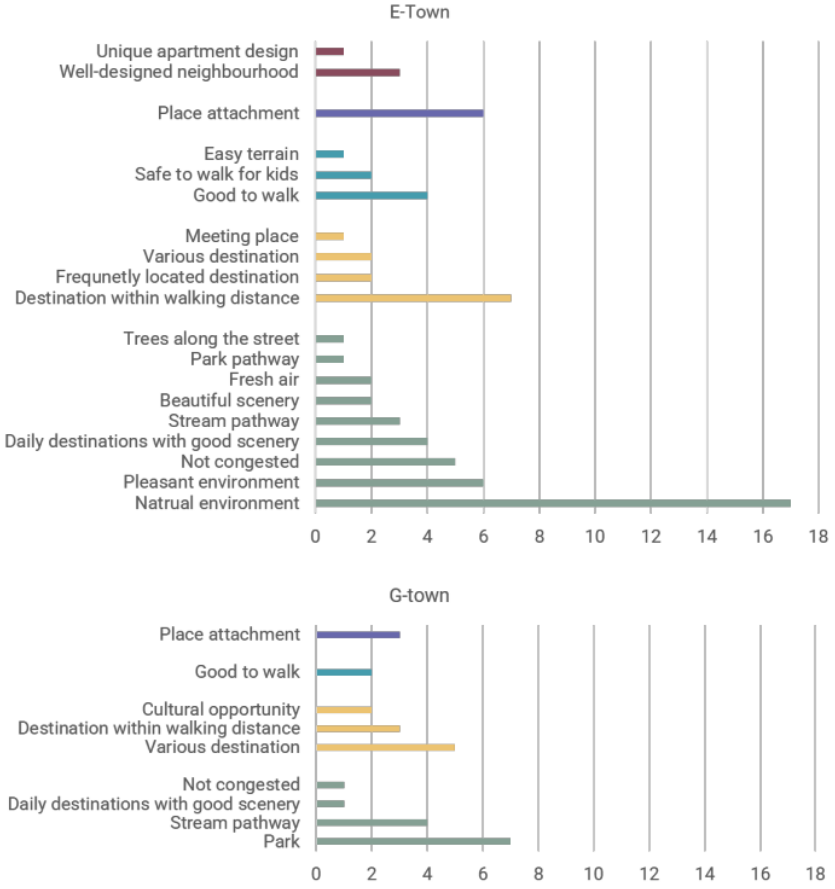


Figure 35 motivations of walking in local areas

Following questions support this tendency (figure 11). Residents in both areas described their multi-purpose walking routines in the local area, such as "visiting a café or library to take a rest after taking a walk" or "taking a walk for a while after dropping by a bank". Those patterns were more pronounced in the case of E-town than G-town, and most walking patterns incorporated strolling. Also, it seems to increase the frequency of visits, which might lead to place attachment. For example, some participants commented:

"I love to take a walk from my apartment complex pathway to the stream. Also, there is a small cafe near the park, and I enjoy having coffee there."
"I love kinds of library tour, there are libraries near the park. Since many of those are close to playground in neighbour apartment, I usually do it with my kids. "

The multiple uses along the green network or near the green space ensured that there was something more not just for single purpose of walking in the neighbourhood. The comments of the participants suggest how each one walked to the neighbourhood for multiple needs and when they are satisfied with walking, leading to an increased frequency of use, might be resulted in place-attachment.

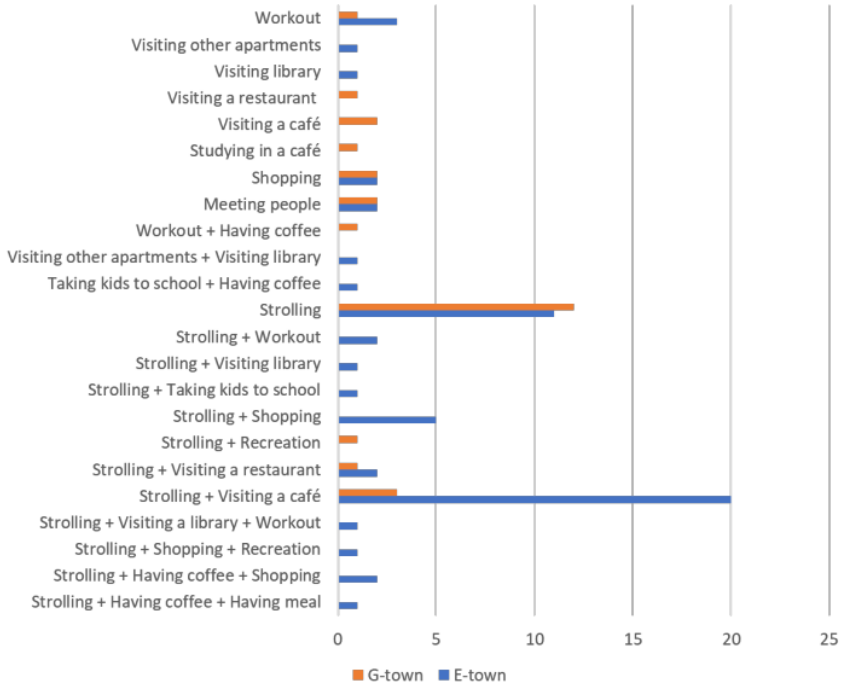


Figure 36 walking routines in the local area

Additionally, the other noticeable difference between the two areas was the presence of answers about their urban design and form of architecture. Some E-town participants said they appreciated unique architectural design or well-planned neighbourhoods, which never answered in G-town. It is explained further in followed question about improvements.

When asked about factors that discourage people from walking, E-town residents mostly answered a lack of destinations, particularly large-scale facilities such as shopping mall centres, museums, and art galleries, while activities and places that provide unique experiences were the most frequent answers in G-town (Figure 37). It provides clues of a low level of usefulness in E-town and a low level of sensory pleasure and sense of belonging in G-town.

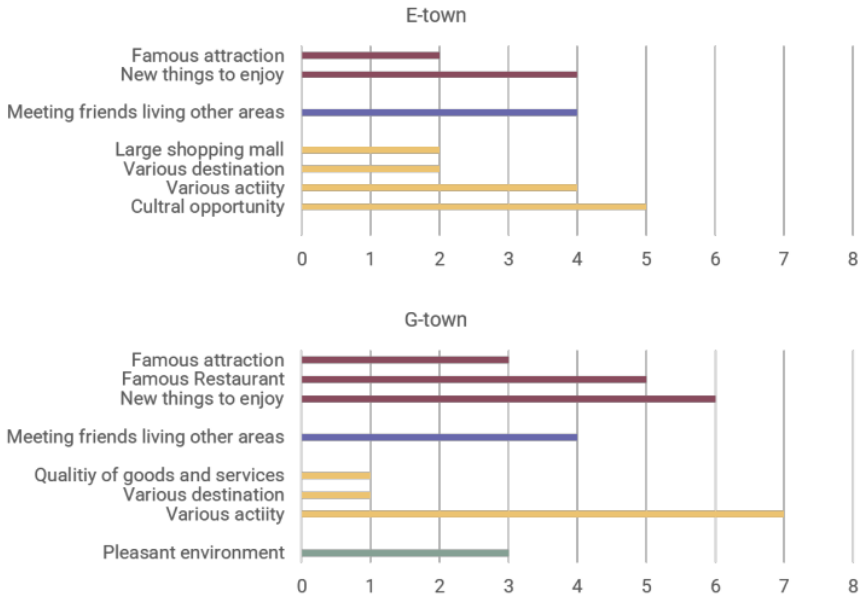


Figure 37 Factors that discouraging walking in local areas

Notably, people in G-town frequently answered about boredom such as "boring", "no special areas", "no uniqueness", and "monotonous street". In the following question about things that need to change, many participants answered unique shops, design improvements, or small shops along the street in G-town. On the other hand, E-town residents mainly focused on the need for maintenance work on old urban spaces and facilities and diversifying shops. Drawn from the micro-scale analysis, transparency in E-town might decrease due to real estate brokerages and private academies, and some residents pointed out the need for various shops instead of specified uses.

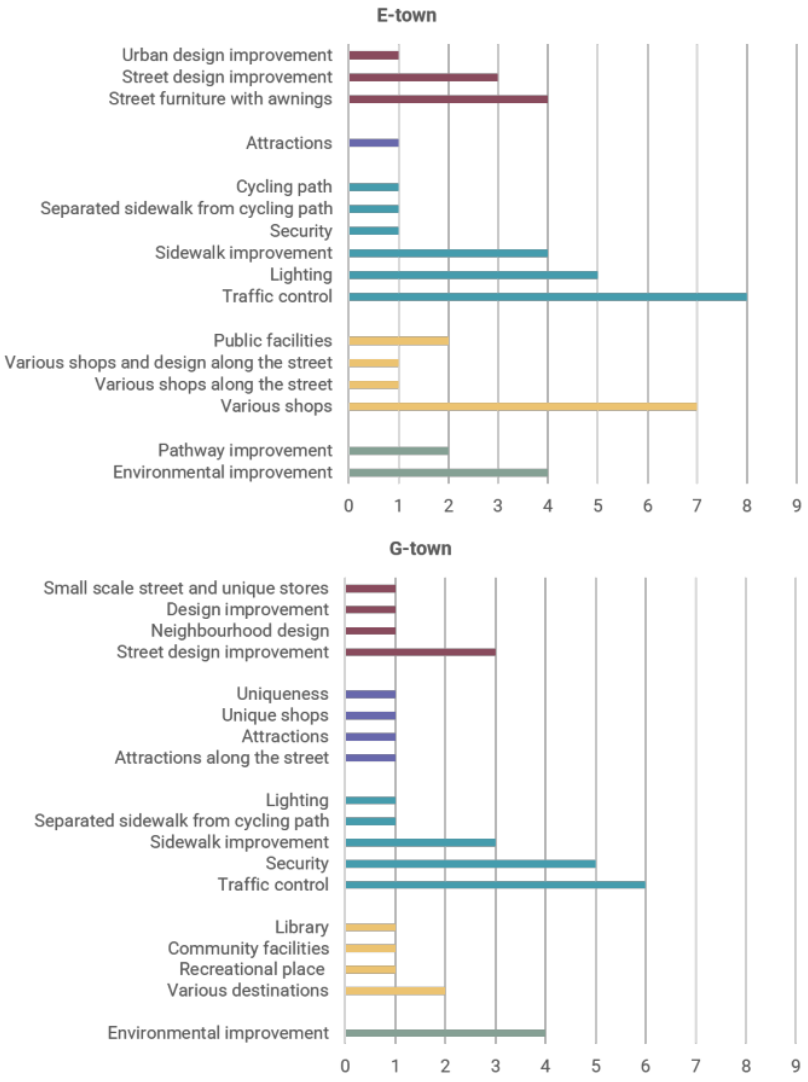


Figure 38 Factors that need to improve

6. discussion

The findings reveal a complex relationship between spatial attributes and people's perception of walkability. Macro-level spatial analysis shows that E-town has a high functional mix and permeability, which are expected to be a driver of usefulness. However, the survey results show that people perceived comfort and a sense of belonging more positively than usefulness in E-town, while usefulness is the highest quality in G-town. This inconsistency was also found in the inconsistent results between perceived quality scores and sub-question results, particularly sub-questions grouped in sensory pleasure and sense of belonging. In open-ended questions, participants suggested their multi-purpose walking needs and their satisfaction with the walking journey, combined with the green network and natural environment, led to repeated visits. Mehta(2007) provides some insight into this discussion, suggesting that an increased frequency of visits translates into a familiarity with the environment and becomes a routine that creates a sense of place and place-attachment for the users (Mehta, 2017, pp). Fine-grained, functionally mixed land use patterns combined with the green network might synergise walking, supporting users' multi-needs, not only functionally but also sensibly, and encourage people to walk and repeatedly visit, which explains E-town's high sense of belonging. However, further research needs to discuss the synergy among three attributes and the relationship between frequency and place attachment.

Also, the survey result provides evidence that the green network with tree-lined streets connecting to regional parks and day-to-day destinations is the critical driver of walkability in a high-density apartment complex context in Seoul, South Korea. Also, the results reveal distinctive attributes- intersection density, car speed, lighting, and presence of tree-lined streets- between two areas developed through different development methods. It provides evidence that residents in apartment complexes assessed as low walkable areas were satisfied with their walking environment in 000(2000) study, suggesting the importance of walkability measurement in different geographical contexts. In line with this contextual importance, macro-scale analysis suggests the importance of walkability measurements adjusted according to different contexts, particularly in South Korea. IC and AwaP figures indicated that those areas have significantly less connected and impermeable urban structures than Venice or Nagoya measured by Pafka and Dovey (2016). South Korea is mountainous, and it is hard to provide well-fine grained, grid urban structure. as a result, many blocks form irregular and are often surrounded by Hills or mountains. Also, the kind of planning method, such as the green space, is one of the main strategies to secure connectivity while accepting the surrounding terrain more naturally. There is a limitation of AwaP and IC to catch such geographic characteristics

Apartment complexes in South Korea usually have a community centre and security system; therefore, there is a lack of emphasis on safety and usefulness. However, the presence of small blocks and the green network reveals distinctive spatial attribute differences between the two main types of development, based on internalised and exclusive private-led apartment planning methods and public-led development more focusing on connectivity at the urban scale.

In addition, survey results about design elements such as building height, street design, or uniqueness show considerable gaps between the two areas, providing evidence that people recognise different micro-design qualities and perceive them differently. Open-ended questions also support different satisfaction and needs regarding design qualities. G-town residents comment that their neighbourhood needs to provide more unique places, improving street design qualities, which might affect their preference for spending more time elsewhere, not in their neighbourhood. Also, traffic design is one of the most influential attributes that affect perceived walkability.

However, micro qualities inside the apartment complex appeared less influential than micro qualities of the street outside the apartment complex. For example, even micro-scale in the apartment complex is positive, people in G-town commented on the neighbourhood's urban qualities outside the apartment. Micro-scale qualities can be different depending on the location. Particularly, the gap between different areas is significant in residential areas of South Korea compared to other countries. Micro-level urban design qualities of urban place that is not privatised within apartment complexes are likely to be abandoned without elaborating planning method depending on the planning delivery method.

7. conclusion

Literature on walkability has suggested that the complex relationship between spatial attributes and users' perception of walkability and different geographical context might also affect how people perceive the walkable environment. However, limited research focused on which perceived qualities could be affected by specific attributes and how people react to a particular environment. Also, apartment complexes in South Korea have not been considered enough despite their unique typology and spatial attributes derived from cultural and historical backgrounds, which might affect residents' experience of their neighbourhood. This study attempted to fill this void by closely examining built environment attributes with GIS and observation and by conducting a survey based on perception qualities. The results corroborated the complex relationship between spatial attributes and perceived qualities of walkability by providing an unexpected perception of walkability; a high level of functional mix and access is not exactly related to usefulness and synergy with the green network encourages people to build place-attachment,

which lead to promoting walking as a daily routine and is likely to sense of belonging. The finding that the green network with tree-lined streets connecting to regional parks and day-to-day destinations is the critical driver of walkability in a high-density apartment complex context in Seoul corroborate the importance of walkability measurement in different geographical context. In that the Green network has been developed to overcome segregation of apartment-dominant neighbourhood, it also provides further area of walkability debate on time and historical background. The need for a multi-dimensional approach is also supported by findings indicating that a lower level of micro-level qualities might affect the decision to walk. Notably, micro-level spatial attributes in apartment complexes seem affecting or less than the streets outside the complex, including high-street in Seoul, and this finding implies an essential role of political guidelines in South Korea.

This study contributes to expanding our understanding of walkability about the complex relationship between environment and perceptions and the synergic effect of environmental attributes, supporting Dovey and Pafka's discussion (2020). Also, by synthesising built environment attributes of high-density apartment complex areas in Seoul, South Korea, the study addressed the importance of apartment complexes in South Korea as a unique typology, as a 'complexed, internalised' high-rise housing with joint property ownership with the importance of the green network connecting to regional parks and day-to-day destinations as an influential walkability factor.

However, there are also limitations to the research boundary, method, and procedure. This study was conducted in apartment complex areas, and hence, the lessons from this study are most likely applicable to similar urban contexts. In the case of micro-scale attributes, limited categories were considered and could not find what residents wanted to improve in terms of urban design in detail, leading to limited findings on urban design qualities. Although the study attempted to eliminate the demographical gap between the two areas as much as possible, age groups were not evenly divided and failed. Personal factors such as willingness to save money by walking more are not considered. More mix-method research approaches are needed to expand our understanding of perceived walkability mediated by cultural or individual background.

The study provides the implication of different project delivery methods to urban morphology and empirical findings about living qualities perceived by residents. The current white paper of Seoul Plan 2040 does not incorporate detailed guidelines and methods to promote a walkable-neighbourhood environment while commented the need to improve the apartment complex's walkability. The recommendation of this study is to recognise different typologies of apartment complexes that have

different implications on a walkable environment and develop detailed guidance addressing the distinct planning method for walkability.

References

ADKINS, A., DILL, J., LUHR, G. & NEAL, M. 2012. Unpacking Walkability: Testing the Influence of Urban Design Features on Perceptions of Walking Environment Attractiveness. *Journal of Urban Design,* 17**,** 499-510.

ALFONZO, M. A. 2005. To Walk or Not to Walk? The Hierarchy of Walking Needs. *Environment and Behavior,* 37**,** 808-836.

ARELLANA, J., SALTARÍN, M., LARRAÑAGA, A. M., ALVAREZ, V. & HENAO, C. A. 2019. Urban walkability considering pedestrians' perceptions of the built environment: a 10-year review and a case study in a medium-sized city in Latin America. *Transport Reviews,* 40**,** 183-203.

AZMI, D. I. & AHMAD, P. 2015. A GIS Approach: Determinant of Neighbourhood Environment Indices in Influencing Walkability between Two Precincts in Putrajaya. *Procedia - Social and Behavioral Sciences,* 170**,** 557-566.

BROWNSON, R. C., HOEHNER, C. M., DAY, K., FORSYTH, A. & SALLIS, J. F. 2009. Measuring the built environment for physical activity: state of the science. *Am J Prev Med,* 36**,** S99-123 e12.

BUCKLEY, P., STANGL, P. & GUINN, J. 2016. Why people walk: modeling foundational and higher order needs based on latent structure. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability,* 10**,** 129-149.

CERIN, E., MACFARLANE, D. J., KO, H.-H. & CHAN, K.-C. A. 2007. Measuring perceived neighbourhood walkability in Hong Kong. *Cities,* 24**,** 209-217.

CHOI, Y., SEO, M. J. & OH, S. H. 2015. Walkability analysis of Busan's urban residential zones. *KSCE Journal of Civil Engineering,* 20**,** 2535-2547.

DOVEY, K. & PAFKA, E. 2013. The urban density assemblage: Modelling multiple measures. *URBAN DESIGN International,* 19**,** 66-76.

DOVEY, K. & PAFKA, E. 2017. What is functional mix? An assemblage approach. *Planning Theory & Practice,* 18**,** 249-267.

DOVEY, K. & PAFKA, E. 2019. What is walkability? The urban DMA. *Urban Studies,* 57**,** 93-108.

EVANS, G. 2009. Accessibility, Urban Design and the Whole Journey Environment. *Built Environment,* 35**,** 366-385.

EWING, R. & HANDY, S. 2009. Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. *Journal of Urban Design,* 14**,** 65-84.

FORSYTH, A. 2015. What is a walkable place? The walkability debate in urban design. *URBAN DESIGN International,* 20**,** 274-292.

FORSYTH, A. N. N. & SOUTHWORTH, M. 2008. Cities Afoot—Pedestrians, Walkability and Urban Design. *Journal of Urban Design,* 13**,** 1-3.

FRANK, L. D., SALLIS, J. F., CONWAY, T. L., CHAPMAN, J. E., SAELENS, B. E. & BACHMAN, W. 2007. Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality. *Journal of the American Planning Association,* 72**,** 75-87.

FRANK, L. D., SALLIS, J. F., SAELENS, B. E., LEARY, L., CAIN, K., CONWAY, T. L. & HESS, P. M. 2010. The development of a walkability index: application to the Neighborhood Quality of Life Study. *Br J Sports Med,* 44**,** 924-33.

GIRLING, C., ZHENG, K., MONTI, A. & EBNESHAHIDI, M. 2019. Walkability vs. walking: assessing outcomes of walkability at Southeast False Creek, Vancouver, Canada. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability,* 12**,** 456-475.

GU, N. 2019. Korean apartment complexes and social relationships of the residents. *Housing Studies,* 35**,** 1362-1389.

HASAN, M. M., OH, J.-S. & KWIGIZILE, V. 2021. Exploring the trend of walkability measures by applying hierarchical clustering technique. *Journal of Transport & Health,* 22.

JUNG, E., LEE, J. & KIM, K. 2018. The Relationship Between Pedestrian Environments and Sense of Community in Apartment Complexes in Seoul, Korea. *Journal of Asian Architecture and Building Engineering,* 14**,** 411-418.

KIM, E. J., WON, J. & KIM, J. 2019. Is Seoul Walkable? Assessing a Walkability Score and Examining Its Relationship with Pedestrian Satisfaction in Seoul, Korea. *Sustainability,* 11.

KOOHSARI, M. J., MCCORMACK, G. R., SHIBATA, A., ISHII, K., YASUNAGA, A., NAKAYA, T. & OKA, K. 2021. The relationship between walk score(R) and perceived walkability in ultrahigh density areas. *Prev Med Rep,* 23**,** 101393.

MASOUMZADEH, S., BOSMAN, C. & OSBORNE, N. 2021. Becoming walkable: relational and contextual effects of enhanced walkability. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability***,** 1-17.

PAFKA, E. & DOVEY, K. 2016. Permeability and interface catchment: measuring and mapping walkable access. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability,* 10**,** 150-162.

PARK, S.-H., KIM, J.-H., CHOI, Y.-M. & SEO, H.-L. 2013. Design elements to improve pleasantness, vitality, safety, and complexity of the pedestrian environment: evidence from a Korean neighbourhood walkability case study. *International Journal of Urban Sciences,* 17**,** 142-160.

RAFIEMANZELAT, R., EMADI, M. I. & KAMALI, A. J. 2017. City sustainability: the influence of walkability on built environments. *Transportation Research Procedia,* 24**,** 97-104.

SINGH, R. 2016. Factors Affecting Walkability of Neighborhoods. *Procedia - Social and Behavioral Sciences,* 216**,** 643-654.

WANG, H. & YANG, Y. 2019. Neighbourhood walkability: A review and bibliometric analysis. *Cities,* 93**,** 43-61.

YIN, L. 2017. Street level urban design qualities for walkability: Combining 2D and 3D GIS measures. *Computers, Environment and Urban Systems,* 64**,** 288-296.

Southworth, M. 2005. "Designing the Walkable City." Journal of Urban Planning and Development 131 (4): 246–257.10.1061/(ASCE)0733-9488(2005)131:4(246)

Hoek, J. v. d. (2008). The MXI (Mixed-use Index) as Tool for Urban Planning and Analysis. Research Paper, Delft University of Technology. Retrieved from: www.corporationsandcities.org

Appendix

Appendix 1 Category of perceived qualities

Category of Perceived qualities	Authors
Usefulness	Alfonzo(2005). (Mehta 2008). Buckley et al(2016)
Safety	Alfonzo(2005), (Mehta 2008). Ewing and handy(2008) Buckley et al(2016). Singh(2016)
Comfort	Alfonzo(2005), (Mehta 2008). Buckley et al(2016) Ewing and handy(2008) Singh(2016)
Sensory pleasure	Alfonzo(2005), (Mehta 2008), Ewing and handy(2008) Buckley et al(2016)
Sense of belonging	Alfonzo(2005), (Mehta 2008), Buckley et al(2016)
Individual relations	(Mehta 2008), Buckley et al(2016)

Appendix 2 Historic and cultural background and characteristic of the apartment complex in South Korea

<table>
<tr><td>1966
~1975</td><td>Introduce of apartment complexs</td><td colspan="2">• Introducing apartment complex development to address housing shortage</td></tr>
<tr><td>1976
~1990</td><td>Quantitative growth of apartment complexes</td><td colspan="2">• The introduction of 'Pre-construction sale system' and 'joint property ownership' and active supply of apartment complex
- the means of satisfying governmental need of supplying housing and infrastructure within short time and limited budget, maximising interest of private sector who want to sell housing with reasonable budget, and customers enthusiasm towards wealth accumulation.
• Advertised as a symbol of middle-class housing</td></tr>
<tr><td>1990s</td><td>The attempt to improve quality of living space : Growing interest in quality of apartment and lifestyle</td><td colspan="2">• Growing debates of a negative effect of unified development method of apartments
• Economic growth and the demand for quality improvement of living space.
• Legislation of 'housing construction standard'
• Growing planning techniques and trials for improvement of apartment complex</td></tr>
<tr><td rowspan="2">2000s</td><td rowspan="2">The prosperity the flourish of diverse planning method & polarising of the way of commodification</td><td>Public-led apartment complex area</td><td>• The attempt to improve quality of neighbourhood and city scape : Problem of segregation, and polarisation
• Introducing MA regulation : Master Architect for housing complex
• Supplying various apartment complex model by Apartment complex compition.
- discussion and applying of "The Neighborhood Street"
- the concept of the Neighbourhood Street : space that contains the daily life of residents. Spaces connected to surrounding complexes and urban spaces. (Housing research, 2002)
- The purpose of Living Street is to revitalize the street through restoration of publicity, to form a community of residents by linking the streetside external space and public facilities, and to create a living environment as a contact space between public and private spaces. (Park, 2011)

<main characteristic of public-led apartment complex>
<table><tr><td>Typology and configuration</td><td>Housing building: ㅁ, street, ㄴ, specialised building type
Other uses : linear configuration along the neighbourhood street</td></tr><tr><td>height</td><td>low-middle height, low-level specialization, human-scale specialised building(Judong)</td></tr><tr><td>element</td><td>human-scale design, terraced or balcony unit
piloti</td></tr><tr><td>facilities</td><td>Community facilities satisfying minimum standard of law</td></tr><tr><td>street environment</td><td>set-back or specilaised façade section. Arcade</td></tr><tr><td>open space</td><td>landscape section, evenly divided and distributed open-space, linear green space section</td></tr></table></td></tr>
<tr><td>Private sector</td><td>• Acceleration of commercialisation and apartment Branding phenomenon
• High competition of developing apartment complex model and supplying housing between construction companies which run apartment brand.</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>
Deepening of commodification, internalisation and enlargement of apartment complex as a part of gentrifying strategy
<main characteristic of public-led apartment complex>
<table>
<tr><td>Typology and configuration</td><td>Housing building : tower
Other uses : Spatial exclusivity : centralised open space and community facilities</td></tr>
<tr><td>height</td><td>Maximising height and storeys</td></tr>
<tr><td>element</td><td>human-scale design, terraced or balcony unit
piloti</td></tr>
<tr><td>facilities</td><td>providing diverse community facilities : include day care centres, libraries, gyms, indoor driving ranges, table tennis rooms, saunas, senior centres, cafes, plazas, playgrounds, outdoor exercise equipments, basketball courts, and soccer fields.</td></tr>
<tr><td>street environment</td><td>Inside : landscape and furniture
Boundary of the complex : buffer space, fence</td></tr>
<tr><td>open space</td><td>luxurious landscape with large open space in the centre of apartment complex</td></tr>
</table>
</td></tr>
<tr><td>2010s</td><td>Increased interest in neighbourhood and city scape :</td><td colspan="2">
Continuous Problem of segregation, polarisation and growing debate on the need of developing Neighbourhood level urban planning method
- Reconsidering the relationship between apartment and neighbourhood, city
</td></tr>
<tr><td>2020~</td><td>vigorous debate on Korean walkable city model</td><td colspan="2">

The need of developing and supplying 3rd Generation New Towns in Korea(to tackle housing price problem)
Global awareness of climate change, pandemic, and competitiveness of city and The emergence of concept of Walkable city and growing interest in walkable neighbourhood
- Vigorous attempt to develop Korean-style neighbourhood, and city planning
- Starting to consider the concept of 15 minute city in South Korea
Seoul Plan(2040) and the concept of ‘Daily-walking neighbourhood’
- a new concept that reflects the changed lifestyle as the spatial and temporal constraints of the work space disappear due to the digital transformation and the COVID-19 pandemic, and the residence emerges as the central space of daily life.
- the spatial division of residence, leisure and work will be blurred by transforming areas based on first-and-last mile locality infrastructure, so that residence, leisure and work will all be interconnected and accessible within a 30-minute walk
- reorganising the daily living space with various functions such as jobs, leisure culture, waterfront green space, commercial facilities, and public transportation hubs within a 30-minute walk within a walking area.

</td></tr>
</table>

Appendix 3 Overview of cases

	E-town: Eunpyeong new town	G-town: Gang-ill Complex
		
Type of development	Public-led, MA(master architect)	Private-led, district plan+ individual development
Controlled Characteristic		
Administrative district	Eunpyeong-gu	Gangdong-gu
Distance from central Seoul	Around 9km from Jong-no gu(northern CBD)	Around 10km from Gangnam-gu(Southern CBD)
Educational reputation	Mid-level	Mid-level
Subway	2 subway (line 3)	2 subway (line 5)
Average housing prices	31,000,000WON/3.3m	35,000,000WON/3.3m
Geographical context	1 mountain park Chang-reung stream Adjacent new town development(Go-yang changryung)	1 large neighbourhood park Goduck stream Adjacent new town development(Hanam Misa)
Comparative characteristic		
Type of housing building	Various type (courtyard, linear, tower) Mid-rise	Uniformed type(tower, slab) High-rise
Overall configuration	Street-oriented	seperated
Green network	Integrated	Separated (centralised openspace of each block)

Appendix 4 The criteria of 'Daily-walking neighbourhood'

physical environment	20,000~30,000 population administive boundary(Dong) : 1~2 30-minute walking distance
central area	station area : 1~2 subways
natural environment	7~8 various type of green space around 1km stream, 0.3km2 waterfront
cultural environment	2~3 exhibition, performance centre around 30 daily service facilities (nursery, GP, gym, library, Public Health centre)

Appendix 5 Consent form

"Neighbourhood walkability in high-density apartment complexes in Seoul, South Korea"

Eunseol Moon Bartlett School of Planning, UCL

Information for participants

Thank you for considering participating in this study which will take place from 13 July 2022 to 20 July 2022. This information sheet outlines the purpose of the study and provides a description of your involvement and rights as a participants, if you agree to take part.

1. **What is the research about?**

The purpose of this study is to evaluate walkability in neighbourhood of apartment-dominant area in Seoul, South Korea, and

2. **Do I have to take part?**

It is up to you to decide whether or not to take part in. you do not have to participate if you do not want to do. If you do decide to take part in, I will ask you to sign a consent form which you can sign and return in advance of the survey

3. **What will my involvement be?**

You will be asked to take part in a survey about your experience of walking around the area. The survey will take approximately 10 minutes, and will be conducted via online format(google).

4. **How do I withdraw from the study?**

You can withdraw at any point of the study, without having to give a reason. If any questions during the survey make you feel uncomfortable, you do not have to answer them. Withdrawing from the study will have no effect on you. If you withdraw from the study, we will not retain the information you have given thus far, unless you are happy for us to do so.

5. **What will my information be used for?**

I will use the collected information for my dissertation on the MSc Urban Design and City Planning(Bartlett School of Planning, UCL)

6. **Will ma taking part and my data be kept confidential? Will it be anonymised?**

The records from this study will be kept as confidential as possible. Only myself and my supervisor will have access to the data files. Your data will be anonymised – Your name will not be collected and used, and other basic information such as gender, income, or education will not identify you. All digital files will be given codes and stored separately.

7. **What if I have a question or complaint?**

If you have any questions regarding this study please contact me, on eunseol.moon.21@ucl.ac.uk. If you have any concerns or complaints regarding this study, please contact the Postgraduate Programmes Administrator via e.fleming@ucl.ac.uk

To request a copy of the data held about you please contact eunseol.moon.21@ucl.ac.uk.

I have read and understood the study information dated 13/7/22, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	Yes/No
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	Yes/No
I agree to the survey conducted via online format and stored.	Yes/No
I understand that the information I provide will be sued for Eunseol Moon's MSc Urban Design and City Planning dissertation and that the information will be anonymised.	Yes/No
I agree that my information can be quoted in (anonymised) research outputs.	Yes/No

Appendix 6 Questionnaire

1. General

1.1 How long are you living in this area?
○ 0~2 years ○2~5 years ○5~10 years ○10~15 years ○more than 15 years

1.2 Please choose your age boundary.
○20~34 ○35~50 ○51~65 ○more than 60

1.3 What is your gender?
○ male ○ female

1.4 How frequently do you usually go out? (excepting commuting or going to school)
○ once or twice per month ○ once or twice in two weeks ○ once or twice a week
○ 2~3 times a week ○ 4~5 times a week

1.5 How long do you usually walk during a day in general? (all types of walking including commuting, going to school, taking a walk, going to shopping, etc.)
○ less than 10 minutes ○ 10~15 minutes ○ 15~30 minutes
○ 30~60 minutes ○ more than an hour

1.6 How long do you usually walk during a day in your neighbourhood? (all types of walking including commuting, going to school, taking a walk, going to shopping, etc.)
○ less than 10 minutes ○ 10~15 minutes ○ 15~30 minutes
○ 30~60 minutes ○ more than an hour

2. motivations to walk in neighbourhood

this section consists of a serious of questions asking your experience about walking in your area, which are asking your opinion about inside of apartment complex and neighbourhood around your apartment.

Please answer on a 5-point scale (5=strongly agree, 3=normal, 1=strongly disagree)

2.1. usefulness

'usefulness' refers convenience of living and moving around because of a lot of or various destination, including daily uses, in walking distance.

<in apartment complexes>

2.1.1. I can do most of my shopping at stores in apartment complex or local stores.

2.1.2. I can do most of recreational activities such as reading a book, listening to music, playing, work out at community facilities in my apartment complex.

<neighbourhood>

2.1.3. I can do most of recreational activities such as reading a book, listening to music, playing, work out at places near my apartment complex.

2.1.4. There are various day-to-day destination such as café, school, hospital or pharmacy in my neighbourhood.

2.1.5. Those facilities provide good qualities goods and services.

2.1.6. I can visit stores or other places in my neighbourhood easily since streets are not blocked by wall or fences, or cut off.

2.1.7. distances between intersections are short enough to move around.

2.1.0. overall, my neighbourhood is convenient and useful because of a lot of or many places in walking distance.

2.2. **Safety**

'Safety' refers to walkable environment without any danger of traffic accident, falling down, or crime.

<in apartment complexes>

2.2.1. My apartment is safe to walk with good security system.

2.2.2. My apartment is safe to walk because sidewalks and roads are clearly separated.

<neighbourhood>

2.2.3. My neighbourhood is safe to walk without worrying about crime.

2.2.4. My neighbourhood is safe to walk at night because of well-installed lightings

2.2.5. My neighbourhood t is safe to walk because sidewalks in my apartment separated from the road used by vehicles.

2.2.6. My neighbourhood's roads are well designed with traffic control facilities such as traffic lights. Speed bump, paving, round-shape streets.

2.2.7 Cars do not disturb pedestrians without speeding

2.2.0. overall, my neighbourhood is safe to walk.

2.3. Comfort

'comfort' means good environment to walk regardless of weather or health level because there are a lot of places to take a rest or shelter in public space.

<apartment>

2.3.1. Landscape in apartment provide fresh air to walk

2.3.2. Landscape facilities such as bench, tea house or pavilions in apartment provide place to avoid sunlight or rain.

<neighbourhood>

2.3.3. Landscape facilities such as bench, awning or pavilions along the street provide place to avoid sunlight or rain.

2.3.4. Trees provide fresh air to walk.

2.3.0. overall, my neighbourhood is comfort to walk.

2.4. **Sensory pleasure**

Sensory pleasure means environmental qualities that provide vibrant atmosphere or attractive looking to walk, which are influenced by design of stores, or street, shape of buildings including height of buildings, various opportunities to take part in events or activities.

<apartment>

2.4.1. Landscape in apartment are well maintained and attractive

2.4.2. Various themes of open spaces in apartment (exercising area, playground, garden, farm) are enjoyable.

2.4.3. Apartment design(Judong- height, colour, entrance, balance among buildings) is enjoyable to walk.

2.4.4. There are various events or activities accessible in apartment.

<neighbourhood>

2.4.5. My neighbourhood is tidy and clean

2.4.6. Building design(height, colour, special design with balcony, garden) along street is enjoyable to walk

2.4.7. Community facilities or stores provide vibrant atmosphere.

2.4.8. There are various events or activities accessible in my neighbourhood.

2.4.9. There are unique and attractive places or attractions in my neighbourhood.

2.4.0. overall, my neighbourhood is enjoyable and attractive to walk.

2.5. **Sense of belonging**

Sense of belonging refers environmental characteristic that encourage people to walk and visit local places and mingling with neighbours more with bonding and affection for the neighbourhood.

2.5.1. There are community facilities such as library, café, meeting room where neighbours meet and mingle with each other in my apartment.

2.5.2. There are places such as piloti, communal lobbies or benches where neighbours meet and mingle with each other in my apartment.

2.5.3. There are plenty of open spaces where neighbours can bump into each other.

2.5.4. There are places such as shops, convenient stores or terraces where people can stay and talk along the street in my neighbourhood.

2.5.5. There are plenty of community places where people can mingle with their neighbours.

2.5.6. It is easy to visit and stay in other apartment complexes without any restrictions.

2.5.7. There are good local landmark or attractions to walk such as regional park, stream, or pathway

2.5.0. overall, my neighbourhood is friendly and good for walking.

3. individual preference of walkable place (open-ended question)
Please answer freely about your preference of walkable place.

3.1 when I have some time

○ I prefer spending time and walking in my neighbourhood. (please answer **3.1.1-a** and **b**)

○ I prefer spending time in other areas by taking other transport means (underground, bus, car). (please answer **3.1.2-a** and **b**)

3.1.1-a What makes you stay and walk in local area? (e.g friendly, many destinations, good environment such as park, shops or restaurants that you know well, convenient, comfort, etc.)

3.1.1-b what do you usually do when spending time in local area? (e.g talking a walk in the park, having coffee in local café.)

3.1.2-a What makes you visit other areas? (e.g friendly, many destinations, good environment such as park, shops or restaurants that you know well, convenient, comfort)

3.1.2-b what makes you are reluctant to spend time in your area? (e.g lack of destinations, lack of activities, not tidy, boring, etc.)

3.2. Please write any improvements needed that you think. (e.g security, traffic control, improving street design, introducing regional essential facilities such as library, etc.)

Appendix 7 apartment complex policy context and comparison of public-oriented and private oriented approach

Perceived qualities	Spatial Attributes		E-town		G-town	
			Mean	Std. Deviation	Mean	Std. Deviation
Usefulness	Whole neighbourhood	Recreational facilities	3.93	1.247	4.02	0.812
		Day-to-day destination	**4.42**	0.829	**4.24**	0.989
		Quality of goods and services	4.02	0.948	3.93	0.908
		Street without obstacles	**4.40**	0.867	**4.15**	0.940
		Intersection density	**4.42**	0.809	3.65	1.012
	Inside apartment complexes	Markets and shops	3.97	1.164	3.91	1.120
		Recreational facilities	3.08	1.476	3.46	1.145
	average		**4.03**		**3.91**	
Safety	Whole neighbourhood	Less crime on streets	4.25	0.914	4.20	0.877
		Lighting	4.07	0.841	**4.33**	0.752
		Sidewalk separated from road	**4.42**	0.720	**4.33**	0.727
		Trrafic-calming design	**4.50**	0.701	**4.26**	0.757
		Slow car speed	**4.22**	0.865	3.93	0.908
	Inside apartment complexes	Security system	**4.25**	0.895	**4.35**	0.828
		Sidewalk separated from car road	4.20	1.086	4.07	1.007
	average		**4.27**		**4.21**	
Comfort	Whole neighbourhood	Shelter from intense weather	3.93	1.056	3.72	1.089
		Presence of tree-lined street	**4.63**	0.637	3.98	1.000
	Inside apartment complexes	Fresh air	**4.57**	0.789	**4.26**	0.851
		Shelter from intense weather	4.15	0.917	4.04	0.931

	average		**4.32**		**4.00**	
Sensory pleasure	Whole neighbourhood	Tidy environment	**4.32**	0.770	**4.17**	0.771
		Attractive design along the street	3.83	1.137	3.33	1.133
		Vibrant Community facilities	3.27	1.056	3.43	1.075
		Various events and activities	2.52	1.066	2.87	1.133
		Unique place	3.80	1.205	3.21	1.133
	Inside apartment complexes	Attractive landscape design	**4.43**	0.810	**4.13**	0.933
		Various types of open space	3.80	1.162	3.93	1.061
		Attractive apartment design	3.92	1.078	3.67	1.149
		Various events and activities	2.55	1.254	2.85	1.188
	average		**3.60**		**3.51**	
Sense of belonging	Whole neighbourhood	Plenty of open spaces	3.25	1.099	3.56	1.003
		Stores to meet someone	**3.92**	0.944	**3.91**	0.957
		Community places	3.52	1.157	3.61	0.998
		less exclusive apartment	3.67	1.188	3.54	1.161
		Regional park and landmark	**4.70**	0.530	**4.13**	0.933
	Inside apartment complexes	Community facilitties	3.63	1.178	3.52	1.128
		Plenty of communal space	3.12	1.223	3.57	1.075
	average		**3.69**		**3.69**	

Appendix 8 E Ethic clearance form

Ethical Clearance Pro Forma

It is important for you to include all relevant information about your research in this form, so that your supervisor can give you the best advice on how to proceed with your research.

You are advised to read though the relevant sections of UCL's Research Integrity guidance to learn more about your ethical obligations.

Submission Details

1. **Name of programme of study:**

MSc Urban Design and City Planning

2. **Please indicate the type of research work you are doing (Delete that which do not apply):**

- Dissertation in Planning (MSc)
- Dissertation in City Planning (MPlan)
- Major Research Project

3. **Please provide the current working title of your research:**

Neighbourhood walkability in high-density apartment complexes in Seoul, South Korea

4. **Please indicate your supervisor's name:**
   Martins, Juliana

Research Details

5. **Please indicate here which data collection methods you expect to use. (Tick all that apply/or delete those which do not apply.)**

- Interviews
- Focus Groups
  - Questionnaires (including oral questions)
-
- Action research
  - Observation / participant observation
- Documentary analysis (including use of personal records)
- Audio-visual recordings (including photographs)
- Collection/use of sensor or locational data
- Controlled trial
- Intervention study (including changing environments)
- Systematic review
  - Secondary data analysis

- Advisory/consultation groups

6. **Please indicate where your research will take place (delete that which does not apply):**
    - UK only
    - Overseas only
    - UK and overseas

7. **Does your project involve the recruitment of participants?**
   'Participants' means human participants and their data (including sensor/locational data and observational notes/images.)

   Yes

Appropriate Safeguard, Data Storage and Security

8. **Will your research involve the collection and/or use of personal data?**

Personal data is data which relates to a living individual who can be identified from that data or from the data and other information that is either currently held, or will be held by the data controller (you, as the researcher).

This includes:

- Any expression of opinion about the individual and any intentions of the data controller or any other person toward the individual.
- Sensor, location or visual data which may reveal information that enables the identification of a face, address etc. (some post codes cover only one property).
- Combinations of data which may reveal identifiable data, such as names, email/postal addresses, date of birth, ethnicity, descriptions of health diagnosis or conditions, computer IP address (of relating to a device with a single user).

No

9. **Is your research using or collecting:**

- special category data as defined by the General Data Protection Regulation*, and/or
- data which might be considered sensitive in some countries, cultures or contexts?

*Examples of special category data are data:

- which reveals racial or ethnic origin, political opinions, religious or philosophical beliefs, trade union membership;
- concerning health (the physical or mental health of a person, including the provision of health care services);
- concerning sex life or sexual orientation;
- genetic or biometric data processed to uniquely identify a natural person.

No

10. Do you confirm that all personal data will be stored and processed in compliance with the Genral Data Protection Regulation (GDPR 2018)? (Choose one only, delete that which does not apply)

- Yes
  - No
  - I will not be working with any personal data

11. I confirm that:

- The information in this form is accurate to the best of my knowledge.
- I will continue to reflect on and update these ethical considerations in consultation with my supervisor.

Yes

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

n **DEPARTMENT/SECTION: BARTLETT SCHOOL OF PLANNING**
LOCATION(S): SEOUL, SOUTH KOREA
PERSONS COVERED BY THE RISK ASSESSMENT: EUNSEOL MOON

BRIEF DESCRIPTION OF FIELDWORK (including geographic location):

This research will employ semi-structured interviews and observation to compare three cases of apartment complexes. All of fieldwork will take place in Seoul, South Korea. Interview venues will be either the public realm of the apartment complexes or indoor spaces such as community cafes if there is unexpected weather condition. Interviews will be finished within 30-minutes, and observation will take place 2 hours per planned day.

COVID-19 RELATED GENERIC RISK ASSESSMENT STATEMENT:

Coronavirus disease (COVID-19) is an infectious disease caused by coronavirus SARS-CoV-2. The virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Droplets fall on people in the vicinity and can be directly inhaled or picked up on the hands and transferred when someone touches their face. This risk assessment documents key risks associated fieldwork during a pandemic, but it is not exhaustive and will not be able to cover all known risks, globally. This assessment outlines principles adopted by UCL at an institutional level and it is necessarily general. Please use the open text box 'Other' to indicate any contingent risk factors and control measures you might encounter during the course of your dissertation research and writing.

Please refer to the Dissertation in Planning Guidance Document (available on Moodle) to help you complete this form.

Hazard 1: Risk of Covid -19 infection during research related travel and research related interactions with others (when face-to-face is possible and/or unavoidable)

Risk Level - Medium /Moderate

Existing Advisable Control Measures: Do not travel if you are unwell, particularly if you have COVID-19 symptoms. Self-isolate in line with NHS (or country-specific) guidance.

Avoid travelling and face-to-face interactions; if you need to travel and meet with others:

- If possible, avoid using public transport and cycle or walk instead.
- If you need to use public transport travel in off-peak times and follow transport provider's and governmental guidelines.
- Maintain (2 metre) social distancing where possible and where 2 metre social distancing is not achievable, wear face covering.
- Wear face covering at all times in enclosed or indoor spaces.
- Use hand sanitiser prior to and after journey.

- Avoid consuming food or drinks, if possible, during journey.
- Avoid, if possible, interchanges when travelling - choose direct route.
- Face away from other persons. If you have to face a person ensure
that the duration is as short as possible.
- Do not share any items i.e. stationary, tablets, laptops etc. If items need to be shared use
disinfectant wipes to disinfect items prior to and after sharing.
- If meeting in a group for research purposes ensure you are following current country specific guidance on face-to-face meetings (i.e rule of 6 etc.)
- If and when possible meet outside and when not possible meet in venues with good ventilation (e.g. open a window)
- If you feel unwell during or after a meeting with others, inform others you have interacted with, self-isolate and get tested for Covid-19
- Avoid high noise areas as this mean the need to shout which increases risk of aerosol transmission
of the virus.
- Follow one way circulation systems, if in place. Make sure to check before you visit a building.
- Always read and follow the visitors policy for the organisation you will be visiting.
- Flush toilets with toilet lid closed.
-'Other' Control Measures you will take (specify):

I will be taking the Covid-19 test on the day before and the day of the the fieldwork and bring hand sanitiser with me during the field trip and use it regularly, about once every hour.

NOTE: The hazards and existing control measures above pertain to Covid-19 infection risks only. More generalised health and safety risk may exist due to remote field work activities and these are outlined in your Dissertation in Planning Guidance document. Please consider these as possible 'risk' factors in completing the remainder of this standard form. For more information also see: Guidance Framework for Fieldwork in Taught and MRes Programmes, 2021-22

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low? The average temperature in Early Summertime in Seoul(from the end of June to the beginning of July) is about 22.8 Celsius, and there is little rain during this season, which is the optimal weather to conduct fieldwork. Also, the safety in

residential areas in Seoul is perceived as safe, so the general environment is expected as low risk.

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	work abroad incorporates Foreign Office advice
	only accredited centres are used for rural field work
•	participants will wear appropriate clothing and footwear for the specified environment
	refuge is available
	work in outside organisations is subject to their having satisfactory H&S procedures in place
•	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: Just in case there is an unexpected accident, I will plan all my schedule and routes to take in advance and share them with my family so that they are always informed and noticed. All Clothing that I am going to wear will be comfortable to move.

EMERGENCIES	Where emergencies may arise use space below to identify and assess any risks
e.g. fire, accidents	Examples of risk: loss of property, loss of life

South Korea has high standards of public safety and very low crime rates, so the public is less likely to be exposed to crime. However, there is a slight risk of exposure to traffic-related accidents if you are not careful. The general level of risks is very low.

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
•	contact numbers for emergency services are known to all participants
•	participants have means of contacting emergency services
	a plan for rescue has been formulated, all parties understand the procedure
	the plan for rescue /emergency has a reciprocal element
•	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Compliance with Korean traffic laws will be the priority.

FIELDWORK **1** May 2010

EQUIPMENT	Is equipment used?	YES	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks

e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?
To record respondents' responses, the smartphone recording function will be used. The function is simple and easy to use, but always keep in mind the low battery situation.	
CONTROL MEASURES	

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Every fieldwork will be conducted in safe areas and intaking any food will be avoided during the fieldwork. I have no allergies and any personal health considerations. However, lack of rest might lead to an unexpected accident or feeling unwell. The general level of risk is very low.
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	all participants have had the necessary inoculations/ carry appropriate prophylactics
	participants have been advised of the physical demands of the research and are deemed to be physically suited
	participants have been adequate advice on harmful plants, animals and substances they may encounter
•	participants who require medication should carry sufficient medication for their needs
•	OTHER CONTROL MEASURES: please specify any other control measures you have implemented: The researcher should always be informed of the location of medication and do not try to do too much in one day while ensuring sufficient rest is taken.

TRANSPORT	Will transport be required	NO		Move to next hazard
		YES	•	Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low? Public transport is needed to travel to the fieldwork sites. The risk level is very low.			
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**			

•	only public transport will be used
	the vehicle will be hired from a reputable supplier
	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
•	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

	Travelling is avoided during peak time (from 7 am to 9 am on weekdays) to avoid any risk of injury.

DEALING WITH THE PUBLIC	**Will people be dealing with public**	**YES**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low? The research will employ interviews and observation to get data. Most of the people in South Korea are usually friendly and welcoming towards others and are not aggressive. However, there are likely to be people who are reluctant to do an interview, and this could create an upsetting situation. Also, there is a risk of unintentionally taking pictures that infringe on the right to portrait. This risk might be medium compared to other categories.		
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**		

●	all participants are trained in interviewing techniques
	advice and support from local groups has been sought
●	participants do not wear clothes that might cause offence or attract unwanted attention
	interviews are conducted at neutral locations or where neither party could be at risk
●	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Taking photos containing faces of people that are identifiable on the street or public realm should be avoided. Only photos for recording physical conditions such as streets or open spaces will be taken.
In terms of the interview, ensuring interviewees know who the speaker is and what I am doing with appropriate interview technique will be the priority and a UCL ID card will be carried to prove my identity.
I will seek training in good interview techniques and try to stay calm and speak gently and slowly during having conversations with respondents.

WORKING ON OR NEAR WATER	**Will people work on or near water?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	lone working on or near water will not be allowed
	coastguard information is understood; all work takes place outside those times when tides could prove a threat
	all participants are competent swimmers
	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
	boat is operated by a competent person
	all boats are equipped with an alternative means of propulsion e.g. oars
	participants have received any appropriate inoculations
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	the departmental written Arrangement for MH is followed
	the supervisor has attended a MH risk assessment course
	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
	all persons performing MH tasks are adequately trained
	equipment components will be assembled on site
	any MH task outside the competence of staff will be done by contractors
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**		

- ☐ the departmental written Arrangements for dealing with hazardous substances and waste are followed
- ☐ all participants are given information, training and protective equipment for hazardous substances they may encounter
- ☐ participants who have allergies have advised the leader of this and carry sufficient medication for their needs
- ☐ waste is disposed of in a responsible manner
- ☐ suitable containers are provided for hazardous waste
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	NO	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		
CONTROL MEASURES	**Give details of control measures in place to control the identified risks**		

Have you identified any risks that are not adequately controlled?			
	NO	•	Move to Declaration
	YES		Use space below to identify the risk and what action was taken

DECLARATION	The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.
	Select the appropriate statement:
•	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
•	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR **Juliana Martins**

FIELDWORK **5** May 2010

BPLN0039_RCWW6

GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

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