MOHAMAD DARWICH
EXAMINING WALKABILITY OF STREETS: COMPARISON OF ISMET INONU AND OSMAN PASA STREETS IN NORTH CYPRUS
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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
MOHAMAD DARWICH

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Architecture

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Approval of Director of School of Graduate School of Applied Sciences

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To the **Graduate School of Applied Sciences**

The research project titled "Examining Walkability of Streets: Comparison of Ismet Inonu And Osman Pasa Streets in North Cyprus" has been evaluated. Since the researchers will not collect any data from humans, animals, plants or earth, this project does not need through the ethics committee.

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Signature:

Role in the Research Project: Supervisor

Title:

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Signature:

Role in the Research Project: Co-Supervisor

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that as required by these rule and conduct, I have fully cited and referenced all material and results that are not original to this work.

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Signature:
Date:

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I extend my deepest gratitude to my parents for their great support. Their true love has been my strongest inspiration for success.

To my parents...

ABSTRACT

Walkability of a street is determined by many factors. Some of this factors are well-understood by the experts in the domain and accordingly pedestrian environment assessment tools are developed to evaluate walkability of the streets through observation. These tools provide a manner for qualitatively explain the walkability. On the other hand, perceived walkability which is a construct related more to the pedestrians rather than experts has been extensively studied in the literature to uncover dimensions of walkability and provide a quantitative assessment of these dimensions.

The aim of this thesis is to conduct a comparative study on walkability using both streamlines. Two popular streets in North Cyprus namely, Ismet Inonu Boulevard in Famagusta and Osman Pasa Street in Nicosia are selected for this study. To fulfill the aim of the study, a mix method approach is used. In qualitative phase of the study, Pedestrian Environment Data Scan (PEDS) is exploited. This tool directs the observation through several items. The quantitative phase is performed by proposing a model of walkability considering different dimensions suggested in the literature. The questionnaire survey is conducted in both streets separately and the model is evaluated. All constructs of the proposed model are confirmed and then used to statistically compare walkability dimensions in the case studies. Comparative study of these streets in terms of walkability helped in understanding the weaknesses and strengths of the designs and led to guidelines for intervention and modification in order to improve the walkability and encourage people to walk more.

***Keywords*:** Urban design; Public open spaces; Walkability; Pedestrian-friendly; PEDS audit tool; Mixed method; Confirmatory factor analysis

ÖZET

Bir sokağın yürünebilirliği birçok faktör tarafından belirlenir. Bu faktörlerin bazıları, alandaki uzmanlar tarafından iyi anlaşılmakta ve buna göre, caddelerin gözlemlenebilirliğini değerlendirmek için yaya ortamı değerlendirme araçları geliştirilmiştir. Bu araçlar, yürünebilirliği niteliksel olarak açıklamak için bir yol sağlar. Öte yandan, uzmanlardan ziyade yayalarla ilgili bir yapı olan algılanabilir yürünebilirlik, literatürde yürünebilirliğin boyutlarını ortaya çıkarmak ve bu boyutların nicel bir değerlendirmesini sağlamak için yoğun bir şekilde incelenmiştir.

Bu tezin amacı, her iki düzeneği kullanarak yürünebilirlik üzerine karşılaştırmalı bir çalışma yapmaktır. Kuzey Kıbrıs'taki iki popüler cadde, Gazimağusa'daki İsmet İnönü Bulvarı ve Lefkoşa'daki Osman Pasa Caddesi bu çalışma için seçildi. Çalışmanın amacını yerine getirmek için karma yöntem yaklaşımı kullanılmıştır. Çalışmanın nitel aşamasında, Yaya Çevresi Veri Taraması (PEDS) kullanılmaktadır. Bu araç, gözlemi birkaç madde üzerinden yönlendirir. Kantitatif faz, literatürde önerilen farklı boyutlar göz önünde bulundurularak bir yürünebilirlik modeli önerilerek gerçekleştirilir. Anket anketi her iki sokakta da ayrı ayrı yürütülmekte ve model değerlendirilmektedir. Önerilen modelin tüm yapıları onaylanır ve daha sonra vaka çalışmalarında yürünebilirlik boyutlarını istatistiksel olarak karşılaştırmak için kullanılır. Bu caddelerin yürünebilirlik açısından karşılaştırmalı olarak incelenmesi, tasarımların zayıf yönlerini ve güçlü yönlerini anlamada yardımcı olmuş ve yürünebilirliği iyileştirmek ve insanları daha fazla yürümeye teşvik etmek için müdahale ve değişiklik için kılavuzlara yol açmıştır.

Anahtar Kelimeler: Kentsel tasarım; Kamusal açık alanlar; Yürünebilirlik; Yaya dostu; PEDS denetim aracı; Karışık yöntem; Doğrulayıcı faktör analizi

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CHAPTER 1
INTRODUCTION

1.1 Background

In the procedure of decision making for urban design, public open spaces play a crucial role. For the planners who initiate the creation of public spaces or regulate, develop and evolve them, the key design elements and their management have always been a matter of concern to fulfill the needs of the community. Public open spaces not only are known as valuable urban design elements but also contribute to economic, social, and environmental conditions of today's contemporary cities. As the modern urban planning features condense architecture restricted by strict rules, space limitations and financial considerations, identifying the flaws and strengths provides a clear image to the experts for manipulation.

In fact, the concept of public open space has a broad definition including squares, parks, streets, and plazas where people rest, shop, hang out or take a walk. It should be noted that regardless of the type, all public open spaces share a discriminative physical form. More precisely, the sense of enclosure distinguishes public open spaces from surrounding area. For the case of streets known as one of the most important urban design elements, the surrounding area infuses severe land-use restrictions with negative effects on favorable neighborhood design. Streets are meant to provide convenient paths for traffic flow, to connect different sectors, to offer parking spaces, and most importantly a walking environment. Therefore, streets play key roles in the cities by contributing to economical assets, health issues and environmental problems.

Walkability is one of the main characteristics of public spaces in general which has been highlighted in a wealth of studies related to service industry, urban design and general health. More specifically, walkability of shopping streets has been the subject matter of

several researches in recent years because of its definite impact on community's health, perceived quality of service and financial condition. As a matter of fact, the urban designers have always had a fundamental objective to plan the streets more walkable much before the health sector put prominence on walkability as a contributing factor to public health. Urban designers consider walking not only as a physical activity but also as an interaction with design elements to experience comfort, sensory pleasure and social life. From this point of view, the walkability-related attributes comprise a comprehensive set of physical and architectural characteristics which make the streets pedestrian-friendly.

1.2 Problem Definition

A properly designed modern city essentially provides the residents with pleasant walkable public spaces. Although the quantity and the quality of walking in a community is dynamically subjective to many factors other than design elements such as culture, financial state, and the infrastructures, the level of comfort the pedestrians feel when walking in a street is closely related to design characteristics. In today's crowded cities, inadequate space is a serious issue for walkability. In order to conduct consistent theoretical research that leads to feasible and efficient interventions for improved walkability, a dynamic model should be considered. However, previous studies have partially addressed the problem by either qualitative approach or quantitative approach (Nakazawa, 2011; Radisya Pratiwi, Zhao, & Mi, 2015; Singh, 2016; Vural Arslan, Durak, Dizdar Gebesce, & Balcik, 2018).

The main issue with qualitative methods is that they work based on physical dimensions and availability of elements. Qualitative methods mainly ignore the perceived walkability which identifies how comfortable and pleased the pedestrians are when walking in the streets. Qualitative methods on the other hand are based on the pedestrians' perceptions and the level of satisfaction based on different dimensions of walkability. Qualitative methods lack the precision when it comes to physical design measures. More specifically, for comparing the walkability of two different streets, relying only on either survey or measurement tools can lead to confusion and inaccurate result. On the other hand, mixed-

methods properly address the problem by allowing for evaluating the pedestrians' perspectives as well as scanning the design elements.

The lack of a comparative study to assess the walkability of the streets is the main motivation of this study. In fact, making comparison between two of the main shopping streets in North Cyprus reveals the urban design flaws. A proper study scheme should estimate the relative importance of a comprehensive set of dimensions related to walkability. Similarly, physical design elements are to be measured by a quantitative tool to spot possible inconsistencies between measured walkability and perceived walkability. To the best of our knowledge, this is the first time that walkability of two shopping streets in the same district is comprehensively studied by a mix-method for making comparative conclusions. This is also the first analytical investigation of walkability in urban design in North Cyprus.

1.3 Objectives

The main objectives of this thesis are as follows. In this thesis, we aim at examining the walkability of shopping streets in North Cyprus by studying and comparing two of the main shopping streets namely Ismet Inonu Street located in Famagusta and Osman Pasa Street located in North Nicosia.

1. To examine important factors influencing walkability of the shopping streets.
2. To measure walkability from the point of view of a designer observation.
3. To evaluate perceived walkability from the point of view of pedestrians and visitors.
4. To make comparisons which lead to guidelines for designing more pedestrian-friendly urban environments.

The methodology is mixed-method approach including quantitative and qualitative methods. The qualitative part is performed using Pedestrian Environment Data Scan (PEDS) audit tool developed to specially address pedestrian concerns is used for the quantitative assessment (Clifton, Livi Smith, & Rodriguez, 2007). The quantitative part is

conducted via the pedestrian survey to examine the walkability by measuring the attributes related to walking.

1.4 Overview

The steps taken to fulfill the objectives are as follows.

1. Related literature about pedestrian-friendly streets and the attributes of walkability of streets are reviewed.
2. On-site observation is conducted by assessing a pedestrian environment tool as well as photography. This phase provides the qualitative results.
3. Qualitative results are represented in terms of tables to compare walkability of Ismet Inonu and Osman Pasa Streets.
4. A framework for examining dimensions of walkability is constructed.
5. A questionnaire for surveying perceived walkability among pedestrians is designed to examine the proposed framework.
6. The survey is conducted and statistical information about the subjects for each street is obtained.
7. Reliability of the scales designed to measure walkability is evaluated using Cronbach's alpha.
8. Reliable scales are further analyzed by factor analysis to examine the proposed model of perceived walkability.
9. The survey and analysis phase provide the quantitative results for comparing walkability of Ismet Inonu and Osman Pasa Streets.
10. Bar-charts and graphs are plotted to visualize the results for better comparisons.
11. Qualitative and quantitative results are used for recommending guidelines to improve walkability of the case studies and make them more pedestrian-friendly.

After surveying and filling out the PEDS, the collected data is analyzed for both streets. The results of both quantitative and qualitative parts are used to examine the level of walkability as well as the weaknesses and strengths. These findings are then utilized to make comparison between the two streets and to recommend possible regulations for

improvement. The rest of the thesis is organized as follows. In this chapter, the problem is defined and the main objectives of the study are described. Chapter 2 reviews the literature and introduces the concepts. In Chapter 3, methodology of the study is explained. Chapter 4 represents the results and analysis. Finally, in Chapter 5 the results are discussed and concluded.

CHAPTER 2
LITERATURE REVIEW

2.1 Public Spaces in Urban Design

The public spaces are important elements of urban design contributing into social life, economy, environment and public health of the community. There are a wide range of public spaces different in form, size, usage and design (Carmona, 2015). The concept of public space is not a strictly-framed subject for the users and planners. More precisely, the variation in urban elements called as 'public spaces' is beyond the conventional perception and definitions. In recent decade, the patterns of public spaces have been remarkably changed (Cybriwsky, 1999). Referring to the literature, public spaces can be generally categorized as formal/informal, public/private and open/close. From this point of view, a small corner of a side street used by local residents for an evening chat can be assumes as an informal open space. Alternatively, parks, plazas, streets, grand bazars and festival arenas specifically planned urban elements are forms of formal public spaces.

On the other hand, evolution of communities from industrial to post-industrial and transformation of the cities from modern to post-modern, have resulted in significant changes in decision-making for public space development. As stated by Cybriwsky (1999) "The end of the twentieth century is seeing a selective return to the age of *private public spaces*" (Cybriwsky, 1999). While the term 'private public space' may sound interdictory, according to Carmona (2019), a public space with free entry which requires advanced booking and/or passing the security check is a private public space (Carmona, 2015). Figure 2.1 shows an example of this category of public space in London, UK. When the private sector setts rules on the usage of small sidewalks, parks and even streets, the public space turns into private public space. It should be noted that urban public spaces are mainly known as 'public' in their nature since they provide the community with their daily life needs including social, commercial, transport, etc. Another perspective for grouping public spaces is related to the covering: open and close public spaces. Streets, traditional squares

and parks are three of the well-known open public spaces. Activity centers and plazas are examples of close open spaces.

Figure 2.1: Sky Garden, London, UK – a public space identified as ‘private’ (Carmona, 2019)

Regardless of the type, public open spaces, specifically the formal ones are of the interest of urban designers. Generation, regeneration and regulation of public spaces to better serve the public life are essential components of modern urbanism. These urban elements provide space for the community to shop, move, rest, relax, hang out, take a walk, and play. In urban development schemes, public spaces are also recognized for the comfort and visual pleasure they offer in the flow of the busy streets (refer to Figure 2.2 as an example located in London, UK).

Among all public spaces, streets have attracted the interest of many researchers not only in urban design and planning but also in service industry, health sector, social science and economy. Streets are public open spaces hosting pedestrians, shoppers and vehicles. Consequently, they are meant to provide convenient flow of transportation and at the same time ease of movement for the pedestrians and the cars. It is not exaggeration to refer the

streets as the key elements of urban design since they connect all the other elements in the neighborhood.

Figure 2.2: Passey Place, London, UK- a public open space for pedestrian shoppers at the end of a side street connected to a busy highway (Carmona, 2019)

2.2 Streets

The post-modern urbanism is meaningless without the streets, the paths linking buildings and other public spaces. Well-designed streets are the very first requirement of sustainable urban development. According to Khder (2016), streets are not just components helping pedestrian movement, but "the street is recognized as the most prominent public spaces found in a city" (Khder, Mousavi, & Khan, 2016). The design element "street" is denoted as the path way, the sidewalk and the and neighboring building (Kostof & Castillo, 1999). Streets deliver comfort, safety, sensory pleasure, access and connection for the pedestrian (Litman, 2007). Moreover, in addition to being equipped with amenities to ease the traffic for automobiles, streets function as architectural elements. Each street plays the role of an architectural identity in its urban neighborhood. This identity is holistically related to

specific design and functional characteristics. For instance, the sidewalks in historical sections of cities convey the sense of aesthetic and belonging (Mehta, 2008). The highway roads connecting urban sectors in mega cities with well-managed traffic, create comfort and service satisfaction (Landis, Vattikuti, Ottenberg, McLeod, & Guttenplan, 2007). Streets located in touristic regions remarkably contribute to the economy of the cities (Vural Arslan et al., 2018). However, shopping streets are more frequently highlighted in the studies because of the effective role they play in social life, economy and public health.

From this perspective, urban designers deal with a holistic challenge when regulating the streets as open spaces expected to be safe, comfortable, efficient, pleasant, inviting and accessible (Laplante & Mccann, 2008). The contradictions inevitably arise as the planners try to fulfill all these requirements as the same time. Widening the sidewalk in the favor of pedestrians for example, results in narrowing the pathway road for the cars slowing down the flow of their movements. Another example is the limited space of the sidewalk for installment of pleasant urban furniture to enhance aesthetic value and comfort (See Figure 2.3).

Although attractive design is an essential factor, the items added to the sidewalk to address one requisite can impose as an obstacle for the pedestrians. In fact, planning of shopping streets is even more challenging for designers since a long list of requirements should be met relying on limited space. Keeping the balance between the needs of the population who take advantage of the streets guarantees an optimized design (Adkins, Dill, Luhr, & Neal, 2012). Note that the street and the sidewalks are shared among pedestrians of different ages as well as cars, public transportation, cyclists and even emergency transportation. Among all these users, the pedestrians have attracted the interest of many researchers not only in urban design studies (Adkins et al., 2012; Bahari, Arshad, & Yahya, 2013; Zakaria & Ujang, 2015) but also in public health (Singh, 2016) and sustainability (Talen & Koschinsky, 2013). The common concept broadly investigated, evaluated and analyzed by almost all these experts is “walkability of the streets”.

Figure 2.3: Granville Street, Vancouver, Canada – Urban furniture design in sidewalk with multiple seating options (Nakazawa, 2011)

2.3 Walkability

For urban designers, the term walkability is defined as an overall measure of the quality of walking environment (Litman, 2007). In general, the conditions associated to pedestrian-friendly design such as comfort, safety, accessibility, connectivity and pleasurability identify the level of walking in an urban area (Saelens & Handy, 2008). Walkability can be encouraged by natural or planned aesthetically pleasing features, visual comfort, safe pathways, sidewalk amenities, road conditions, and sense of orientation and land-use diversity (Brown, Werner, Amburgey, & Szalay, 2007), (Southworth, 2005). Although planners are actively engaged in designing more pedestrian-friendly envirnemnts, availability of alternative transportation facilities is the reason of declined level of physical activity in modern communities (Azmi & Karim, 2012).

In recent decade, the level of physical activity of a community is a matter of concern for the experts in medicine, public health, urban design and transportation sector. Although the researchers in different disciplines have been investigating the influencing factors on

physical activity levels, the point of views of public health scholars is dissimilar to that of urban planners. More precisely, health specialists focus more on individual's characteristics such as health socioeconomic conditions, age, occupation, daily life habits, access to fitness centers etc. (Litman, 2007), (Giles-Corti, Kelty, Zubrick, & Villanueva, 2009). On the other hand, urban designers emphasize the quality of the walking environment, design variables and elements affecting the walkability of the community (Adkins et al., 2012; Rahimiashtiani & Ujang, 2013; Southworth, 2005).

In recent years, however, the health experts have started to highlight the relation of urban environment to the levels of walking and pedestrians' decision making (De Bourdeaudhuij, Sallis, & Saelens, 2003). These studies advocate the prominence of design variables on the pedestrian-friendliness of public open spaces specially the streets. Moreover, urban planners have noticed that walkability estimated based on physical measures and quality of design variables does not necessarily represent the perceived walkability which encourages the community to walk more (Alfonzo, 2005). The truth is walkability is a multiple term with several complicated dimensions.

Walkability is not an isolated conception in urban design. It is not even a simple outcome of multiple oversimplified predictors. Essentially, walkability is a notion linked with urban architectural, social, demographic, and economic variables as well as their interrelations. It can be regarded as a dynamic interdisciplinary concept. Dynamic modeling of walkability leads to reliable understanding of the weaknesses and strengths of the design. Therefore, the consequent interventions taken by planners based on theoretical investigations would operate in practice. Novel and intelligent design ideas that adjust the streets into pedestrian-friendly urban items are the upshot of identifying the capacities. In Figure 2.4, a successful example of a pedestrian-friendly street planned using shared space concept is shown.

Principally, the main drawback of the previous works exploring the predictors of walkability is that a comprehensive scheme has not been applied. This makes the related studies less comparable and coming up into a conclusion about the regulation guidelines

for planners is not possible. Taking either of quantitative or qualitative methodologies to evaluate walkability is not a wise approach. In most cases, a vibrant decision-making strategy that turns a street into a pedestrian-friendly urban component cannot be attained. The very first stage to address these issues is to identify the consistent interactive attributes which perform as the predictors of walkability. These predictors are assumed as "walking needs". An elaborated review of the related literature not only in urban design but also in the field of public health opens a new horizon towards the requirements of walkability.

Figure 2.4: Exhibition Road, London, UK – a distinct pedestrian-friendly public open space implemented using the shared space idea (Carmona, 2019)

2.4 The Needs of Walkable Streets

Basically, we can argue that what the urban designers call "walkability" is a broad concept beyond the physical design elements. Narrowing down the notion into a crisp physically quantifiable outcome or assuming it as an outcome of a limited number of predictors may lead to uncertain opinions. As stated in previous section, there is a wealth of factors contributing to a community's level of activity. Alfonzo (2005) has claimed that the experts involved in both public health and urban design should consider individual and

environment variables at the same time to capture the walkability needs. In his article titled as “To walk or not to walk? The hierarchy of walking needs” he has introduced the pyramid of walking requirements. This architecture has been inspired by Maslow’s theory of motivation (1954) which explains that there are a variety of needs which motivate an individual human being (A. H. Maslow & Frager, 1987). Maslow explains that a person’s needs are organized by a prepotency into a hierarchical fashion. In fact, as long as some fundamental needs are not satisfied, the needs at the higher levels of hierarchy would not be prominent (A. Maslow, 1954) . Figure 2.5 illustrates the hierarchy of walking needs proposed by Alfonzo (2005). Since this pyramid was introduced, it has been the foundation of many studies on walkability for researchers in several fields. There are five needs for walking namely feasibility, accessibility, safety, comfort, and pleasurability. Alfonzo (2015) argues that the saliency levels of the factors contributing to walkability and their interactions in identifying the willingness to walk are not clearly pictured.

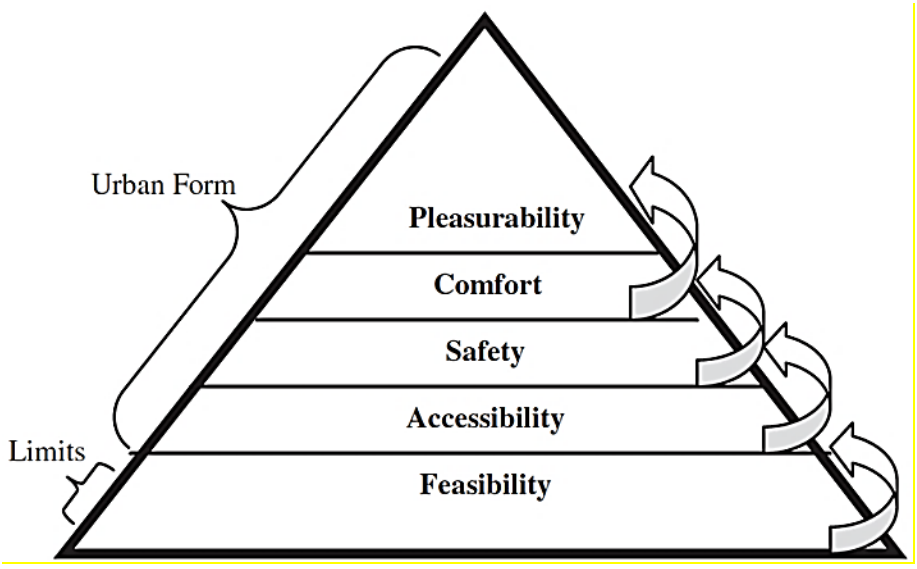


Figure 2.5: The hierarchy of walking needs (Alfonzo, 2005)

In Alfomzo’s hierarchy of walking needs, the impacts of attributes on a person’s decision to walk are not equal. In fact, feasibility is the most basic need contributing to walkability more than other predictors. This need is actually assumed as the limits which hinder walking for individuals in the community. It should be noted that the other four needs for

walking are design-related and they are grouped as the needs of urban form. Thus the definition and evaluation of these four urban form needs are almost distinct in the literature. Feasibility on the other hand is an ambiguous concept for planners since this most elementary need of walking relates to individual's limits. Referring to Alfonzo (2005), feasibility is presumed at individual level. For instance, a person's age, health condition, occupation, daily routine and life style posits feasibility of walking. Therefore, urban designers have nothing to do about feasibility.

On the other hand, the urban form needs are directly related to design elements and intervention plans. These needs progress from the highest order need, accessibility to the lowest order need, pleasurability. Maslow's (1954) theory of human needs is applied in ordering these needs in the hierarchy assuming that the higher needs are not assumed as a requirement until the more basic needs are satisfied. For example, when the street is not safe, proving comfort would not encourage walking. Or in an uncomfortable walking environment, adding design items to create sensory pleasure is not a sensible intervention because comfort as the higher priority need is not met.

It should be noted that Alfonzo's hierarchy of walking needs has been the basis of most of the studies on walkability. In recent urban design studies, researches have highlighted the design form-related dimensions of walkability including accessibility, safety, comfort, sensory pleasure (pleasurability), connectivity, and usefulness (Khder et al., 2016; Mehta, 2008; Saelens & Handy, 2008; Vural Arslan et al., 2018). In this following, this attributes and their relationship with walkability of streets are described in brief. Note that these items are appeared in the text in no specific order unlike. The prominence of the four main needs i.e. accessibility, safety, comfort and sensory pleasure is assumed as the order of walking needs in the hierarchy. For the other two attributes, no presumption regarding their relative priority is made before obtaining the final results.

2.4.1 Accessibility

Accessibility is a context related to the capability of an urban environment to be used by all the individuals in the community regardless of their ages, mobility conditions, and socioeconomic levels. An accessible street offers ease of access to a variety of transportation modes, public spaces for social activities and links to other side streets (Jacobs, 1993). Availability of facilities for car park, ease of access to the street in emergency situations for police car, ambulance and fire truck are also considered as the features related to accessibility (Southworth, 2005). Furthermore, pedestrians are more likely to walk to their destinations within a well-planned compact design which posits quicker paths to their favorite destinations (Handy, Boarnet, Ewing, & Killingsworth, 2002).

In fact, the most significant factor to enhance walkability of a street by improving accessibility is the proximity of potential hot spots for pedestrians such as fairs, markets, retail shops, restaurants, and cafes. People also demand for quick access to parking zones and public transportation stops as characteristics promoting walking. The surrounding area of a shopping street encircles main streets and side streets. Short routing path to link these streets is another highlighted facet of accessibility. There are evidences in the literature that distance to aforementioned facilities and urban components is the most contributing design characteristics in accessibility (Handy et al., 2002). It should be noted that in Alfonzo's hierarchy of walking needs, the quality and quantity of a number of design features, activities and facilities are assumed as the items identifying accessibility. More precisely, accessibility is to be reflected by the higher order needs of walkability and the lower priorities can be defined as separate distinct dimensions for walkability.

In this study, we ponder two other dimensions of walkability namely, connectivity and usefulness as needs with the lowest priorities compared to the other four needs in Alfonzo's model. It has been proved that connectivity and usefulness differ from accessibility when pedestrians' perceptions and attitudes are examined (Mehta, 2008).

Consequently, accessibility is measured by the items directly related to the ease of access and not the linkage or convenience.

2.4.2 Safety

The use of a design element is profoundly affected by the sense of endangerment. Previous studies have shown that perceived walkability of the streets is affected by variety of factors including the physical characteristics of a street, the architectural components, the type of land-use, the existence of surveillance, the quality and quantity of traffic facilities on the roadways for pedestrians' safety, the excellence of maintenance and even the lighting condition at night [2], (Mehta, 2008), [29], [30]. However, the key contributing safety factor which is linked to level of walking in the environment is safety from traffic road and vehicles. The presence or absence of pedestrian safety objects such as traffic signs, car slowing devices, cross sections, barriers between pedestrians and fast-moving vehicles, and the space between sidewalks and roads are to be examined. Their quantity and quality in terms of organization and design management influences the sense of safety in the streets (Craig, Brownson, Cragg, & Dunn, 2002).

One imperative aspect of perceived sense of safety is safety from crime. This feature has been proved to be connected with design environment (Perkins, Meeks, & Taylor, 1992), (Oldenburg, 1999). The streets with loads of "third-places", the notion used by Oldenburg (1999) to mention shops, cafes, hair salons, restaurants etc. met the safety needs better than residential streets (Oldenburg, 1999). The other studies have also advocated the role of non-residential buildings in perceived safety of the streets (Perkins et al., 1992). These arguments provide enough evidence that crime-related safety issues addressed in several studies of walkability if not entirely but are mostly design-related scales.

2.4.3 Comfort

In a comfortable walkable neighborhood, walking is not a burden. The level of comfort plays a crucial role on a person's willingness to walk. This attribute have been more highlighted in the studies conducted in developed countries where other primary needs for

walking are already satisfied (De Bourdeaudhuij et al., 2003), (Leow, 2002). There are several design components and arrangements believed to be related to the sense of comfort in urban areas. The list comprises a wide range of elements ranging from man-made design objects added to provide protection from climate conditions to generous sidewalk dimensions for busy shopping streets. For an individual to be more likely to walk, the perceived sense of comfort matters which means the level of convenience a pedestrian feels while completing the task of walking (Mehta, 2008).

Existing literature suggest that cultural and anthropometric characteristics of local community should be taken into account in planning a walkable neighborhood. In fact, in order to create the sense of comfort for pedestrians, the factors of walkability should also match the cultural context and social behavior of the neighborhood. For instance, narrow overloaded sidewalks may be well-accepted in busy capitals but not in small towns with conservative populations who feel uncomfortable walking in a tight space very close to other people. In general, a comfortable walking street is an environment that meets the walking needs in terms of width of sidewalks, street furniture, service elements such as W.C., shading stuff, and facilities for elderly and people with disabilities (Jacobs, 1993). Both measurement and survey are needed however to estimate accurate levels of comfort in a walking environment.

2.4.4 Sensory Pleasure

Urban designers not only have concerns about the physical form of an urban environment but also emphasize the sensorial pleasure the visitors experience in the context (Carmona, 2015), (Carmona, 2019), (Khder et al., 2016). Sensory pleasure is derived by various aesthetic stimuli in an urban environment such as colors, forms, shapes, natural features, trees and planting lighting, and textures (Mehta, 2008). In shopping streets, decoration of the shop windows, blinds, covers, and awnings also generate sensorial pleasure. The other contributing factors are the orders of the architectural components, cleanness of the pathway and sidewalks, and graffiti-free facades.

Planners and urban designers need to contemplate cultural values of the community when designing sensory stimuli items since over-stimulated patterns can create chaos (Mehta, 2008). As a matter of fact, it has been argued that for the pedestrians a moderate level of complexity in the design elements with touches of novelty is more desired to complex and very unique designs (Nasar, 1990). The perceived pleasurability of a street is also enhanced by removing artifacts, non-matching items and unaesthetic objects replacing them with landscape features, urban furniture and other design ideas. The surrounding view in the shopping streets is a mutual outcome of all these factors. Pedestrians experience a pleasant walk provided that the whole walking environment is planned with coherence, order and attractiveness.

2.4.5 Connectivity

In an urban district, no matter considering it locally or globally in the larger setting, there key urban items such as public open spaces, buildings, streets and pathways. Ease of movement and willingness to walk is the result of competent connections between these elements (Khder et al., 2016). The term connectivity is a feature of urban design that refer to continuity of route network, directness and availability of routing options (Farkic, Peric, Lesjak, & Petelin, 2015). Connectivity of a street is related to the characteristics of the physical network and alternative paths. A connected street offers a diverse range of routing pathways, services and places, orientation signs, linked pedestrian paths. Referring Saelens and S. L. Handy (2008), “Connectivity comprehensively refers to straight paths and also shorter distances in order to reach the desired destinations” (Saelens & Handy, 2008).

A pedestrian-friendly street features continuity of sidewalks free of obstacles and gaps. It also provides a convenient continuous roadway for traffic flow and public transportation. The overall measure of walkability in fact, is influenced by pathway conditions (such as width, obstructions, gaps), road conditions (such as pedestrian crossing, universal design principals in linking roads and sidewalks, intersections) and design facilities (such as orientation signs for pedestrians) (Gallin. N., 2001).

2.4.6 Usefulness

Usefulness has been mainly considered as a notion related to accessibility or comfort (Vural Arslan et al., 2018), (Zakaria & Ujang, 2015), (Abdulla et al., 2017). However, Mehta (2008) has stated that usefulness is not an aspect of other walkability dimensions but a predictor itself (Mehta, 2008). Mehta explains usefulness as the quality of the urban environment to fulfill the user's and visitors daily needs including shopping, entertainment, eating and hanging out. The frequency of visits and consequently the level of walking are then enhanced by usefulness of a shopping street. In service industry literature, outcomes the sense of place-attachment as the pedestrians get familiar with the environment, its elements and facilities (Talavera-Garcia & Soria-Lara, 2015). Usefulness of a street is strongly correlated with pedestrian level of service (Baltes & Chu, 2007; Talavera-Garcia & Soria-Lara, 2015).

Researchers suggest that a community is more likely to walk in an urban environment with variety of shops, presence of eating and drinking facilities, and retail establishments (Radisya Pratiwi et al., 2015; Saelens & Handy, 2008; Vural Arslan et al., 2018). It should be noted that both quality and quantity of these servicing elements contributes to walking decisions of the individuals. The pedestrians in shopping streets translate the diversity of land-use, retail environment and services as 'their needs have been considered'. From this perspective, usefulness of a shopping street that influences walkability can be measured by evaluating the shoppers' perceptions about satisfaction with their daily shopping needs, ease of finding quality restaurants and cafes and comfortable shopping within walking distance.

2.5 Related Work

The level of physical activity is directly associated with public health. Walking is known as the most accessible, comfortable and desired type of physical activity in modern life. However, statistics show that the level of physical activity both in developing countries and developed countries undergoes. Walkability of the neighborhood has been extensively

outlined in several studies in recent years. The problem is examined from different perspectives using analytic, qualitative, and quantitative methods. In this section, some of the most recent studies addressing pedestrian-friendly design and walkability needs are reviewed. It should be noted that the dimensions of walkability considered in both health-related and urban design-related literature provide the motivation for the proposed framework.

One of the most influential works on walkability of the urban environment is the Alfonzo's work (Alfonzo, 2005). Although this work is not a recent study, the hierarchy of walking needs adapted in Alfonzo's study has been the foundation of majority of the ongoing research. It is not overstating if we label this work as the thesaurus of walking needs. In this study, the relationship between walking behavior of the community and a comprehensive set of factors is deeply explained through a multidisciplinary scheme. Alfonzo has tried to fill the gap between socioeconomics, behavioral scientists and urban designers by suggesting a dynamic model of walking. A person's decision making process to walk is analyzed by ordering walking needs from the highest order needs to the lowest order ones. Personal limits are taken as the prominent barriers for walking and then the urban form needs are organized based on priorities. Feasibility, accessibility, safety, comfort and pleasurability are the antecedences of walking (Alfonzo, 2005).

Walkability can also be viewed as a factor in estimating the level of service (LOS) of pedestrian mobility in urban areas. The quality of pedestrian level of service (Q-PLOS) is an index adapted in (Talavera-Garcia & Soria-Lara, 2015) as a novel measure for pedestrian mobility. This study argues that in service sector, the public transport infrastructures and the road attributes for convenient traffic are well notified while the level of service delivered to pedestrians is largely ignored. Q-PLOS measures urban design factors which either provide ease of movement for pedestrians or work as an obstacle of walking. Figure 2.6 shows how this proposed index measures the Q-PLOS for public transport stops in a street.

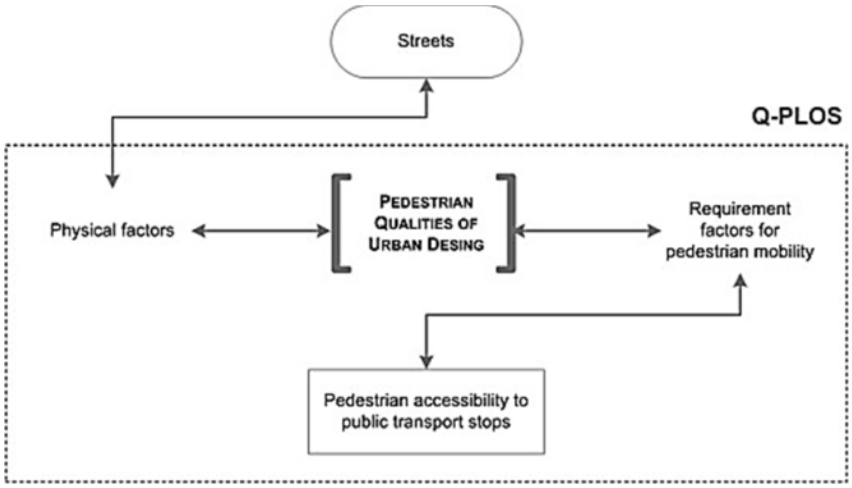


Figure 2.6: The method for examining Q-PLOS of bus stops (Talavera-Garcia & Soria-Lara, 2015)

Khder et al. (2016), have studies the physical elements engaging in walkability of the streets by conducting a research on a well-known commercial street named Mawlawi Street in Sulaymaniyah Province, Iraq (Khder et al., 2016). They have evaluated both sufficiency and quality of the urban components which increase the level walking as well as the quality of the walking experience. Site observation is performed using Pedestrian Environment Data Scan (PEDS) audit tool as well as photography of the physical elements and obstacles in the street. They also interviewed a sample population of the frequent visitors of the street and conducted a survey among the pedestrians. The proposed conceptual model of Khder et al.'s study is illustrated in Figure 2.7. It can be observed from the figure that as set of barriers for walking namely, demographic, comfort, safety, accessibility and connectivity issues are assumed as the dimensions of walkability.

The survey questionnaire, interviews and PEDS tool measure the level of satisfaction related to pedestrian facilities, road characteristics, personal preferences and limitations, and the walking environment. The findings of the proposed model in combination to subjective assessments and the result of PEDS tool have shown that Mawlawi shopping street is not a pedestrian-friendly street. The authors claim that the street suffers from lack of safety and comfort for pedestrians. The levels of connectivity and accessibility are also verified to be unsatisfactory (Khder et al., 2016).

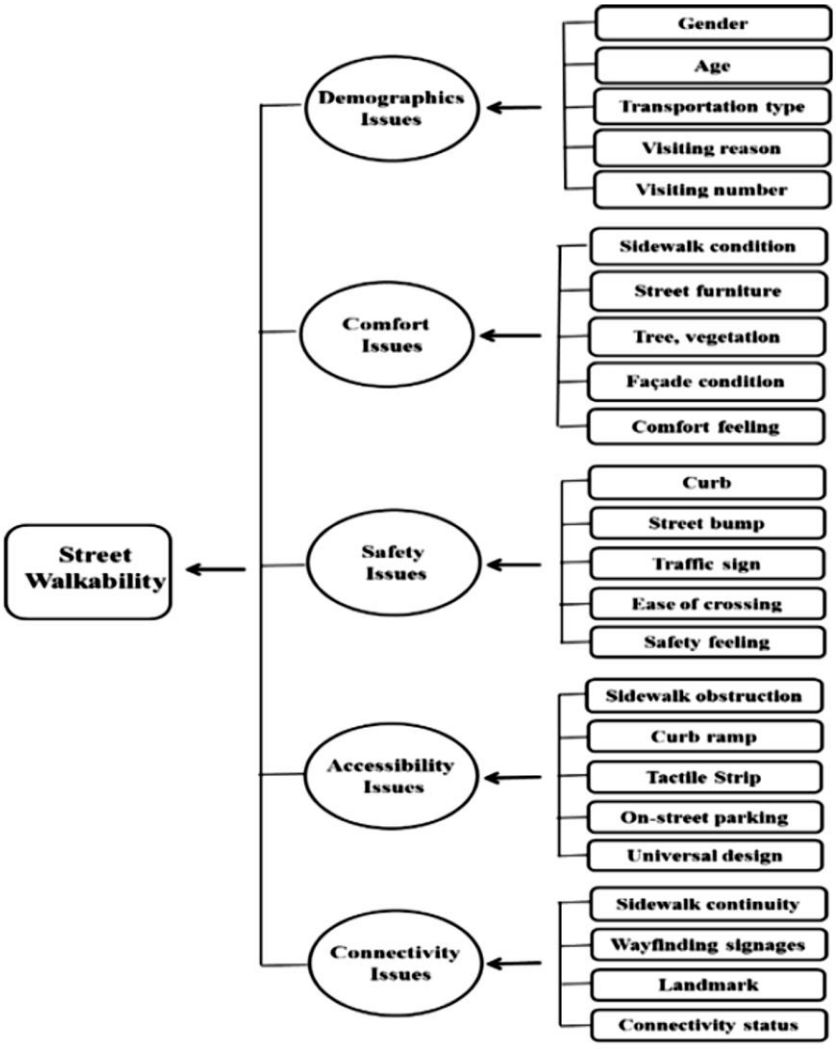


Figure 2.7: Conceptual Framework Proposed by Khder et al. (2016)

The principal attributes of walkability in Bursa City, Turkey is studied in (Vural Arslan et al., 2018). The aim of the study is described as evaluating the consistency between the established factors believed to affect walkability in the literature and the inhabitants' perceptions about the walkability dimensions. Three basic factors including social, economic and spatial features are examined. Firstly, the well-known walkability attributes including accessibility, comfort, safety, aesthetics and connectivity are considered and measured by a qualitative site observation. Then, 200 pedestrians at three main streets are

surveyed to figure out what attributes contribute the most to the people's decision-making about walking. In Figure 2.8 the conceptual model used in (Vural Arslan et al., 2018) is shown. Based on the findings of the study, the authors argue that the impact of environmental aesthetics is overrated in urban design studies as a factor influencing walkability. The other attributes on the other hand, are proved to have significant impact on walkability.

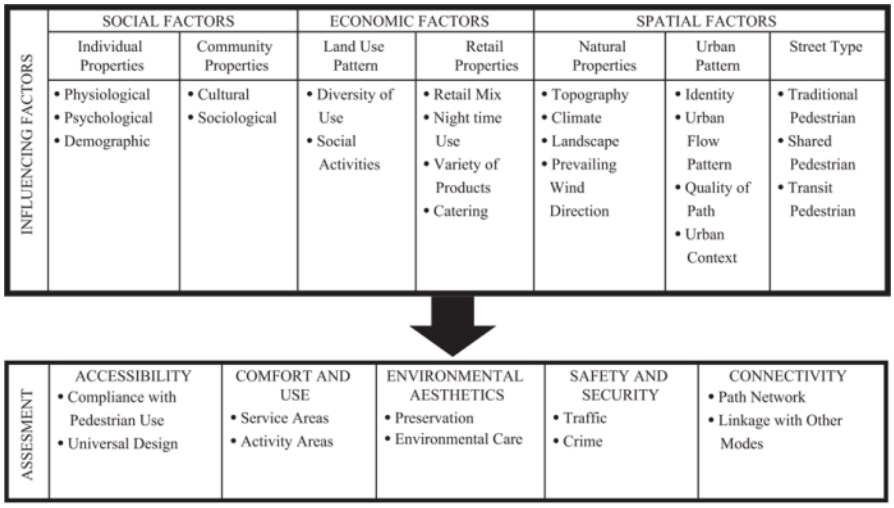


Figure 2.8: Conceptual model proposed by Arslan et al. (2018)

Radisya et al. (2015) have studied the walkability of pedestrian spaces during Hakata Dontaku festival, in Fukuoka, Japan (Radisya Pratiwi et al., 2015). During special events and festivals in urban areas, pedestrians encounter accessibility issues since the walking spaces are packed with visitors. The main objective of the work is to measure the level of satisfaction among pedestrians about accessing the sidewalks in festival days. Safety, mobility and urban design amenities are the three attributes included in the conceptual model proposed in (Radisya Pratiwi et al., 2015). The indicators in the model are extracted from the related literature and organized by analytical hierarchy to determine the level of satisfaction about the accessibility. Perceived accessibility to pedestrian spaces is then identified by these scales. The scales are used to estimate the level of satisfaction with amenities, safety and mobility. The conceptual mode proposed by Radisya et al. (2015) is illustrated in Figure 2.9.

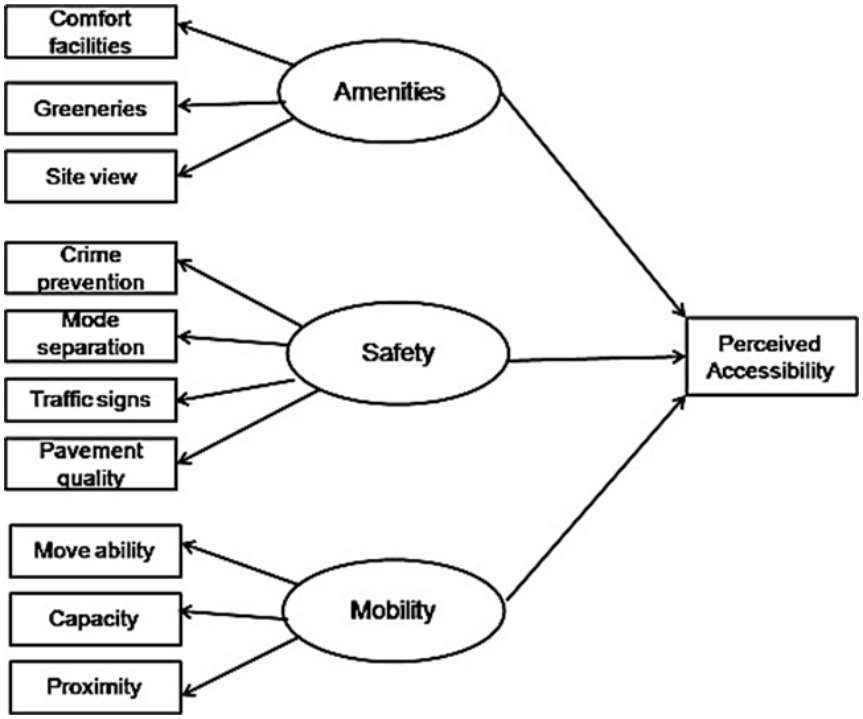


Figure 2.9: The conceptual model proposed by Radysia et al. (2015)

The proposed model was advocated by conducting a survey among the pedestrains during Hakata Dontaku festival. The normality of the data was confirmed firstly. Then, structural equation modeling has been exploited to identify the goodness of fit of the model as well as the significance of the indicators. It has been proved that the constructs proposed in the significantly load values to their presumed constructs. Based on the statistical significance tests, pedestrians' perceived satisfaction with amenities is the most contributing factor of accessibility of the sidewalks during festival days (Radisya Pratiwi et al., 2015). This study provides evidence of the prominence of comfort facilities, and sensory pleasure for the urban designers.

A more elaborative approach toward the walkability of the neighborhood has been used by Zuniga et al. (2017) (Zuniga-Teran et al., 2017). The authors have assumed that there two purposes for physical activity in urban environment namely, transportation and recreation. They have applied a framework to recognize the design characteristics favoring physical

activity in the form of walking in the urban area. Referring to the previous studies, Zuniga et al. (2017) have proposed a conceptual model to explore the interactions between nine design constructs and the level of walking. These constructs are connectivity, land-use, density, traffic safety, surveillance, parking, experience, green space, and community (Figure 2.10). The survey conducted in Tucson, Arizona, U.S. have shown that not only all the design features are significantly correlated with walkability but they with the transportation and recreation as motivators for walking.

Mehta (2008) has explored the pedestrian perceptions, attitudes and consequent behavior in walkable streets (Mehta, 2008). The qualitative approach fills the gap in urban design studies about the microscale evaluation of environment characteristics that influence people's perceptions, satisfaction of walking needs and the stimuli to walk. The comprehensive empirical framework is represented in Figure 2.11. Physical, social and land-use characteristics were assumed as the main features determining the features of a street. The street characteristics are then affects the users' perceptions in combination with personal attitude and cultural background. Walking needs are the next level constructs of the model. Mehta (2008) has considered the sense of safety, usefulness, comfort, belonging, sensory pleasure, accessibility and feasibility as the walking needs. User perception is believed to contribute to these attributes. Finally, the walking behavior in the streets is an outcome of all these factors.

Figure 2.10: Neighborhood design characteristics related to walkability (Zuniga-Teran et al., 2017)

The data collected from the surveys and interviews has advocated the setting suggested for walkability of the main streets. More precisely, Mehta (2008) concludes that the hierarchy of walking needs is shaped not only by a set of well-understood physical design elements but also by subjective impressions. The findings state that safety and comfort are the first priority needs to be met. Provided that these two needs are satisfied, pedestrians seek usefulness, sense of belonging, and sensory pleasure. This framework supports the Alfonzo's hierarchy of walking needs.

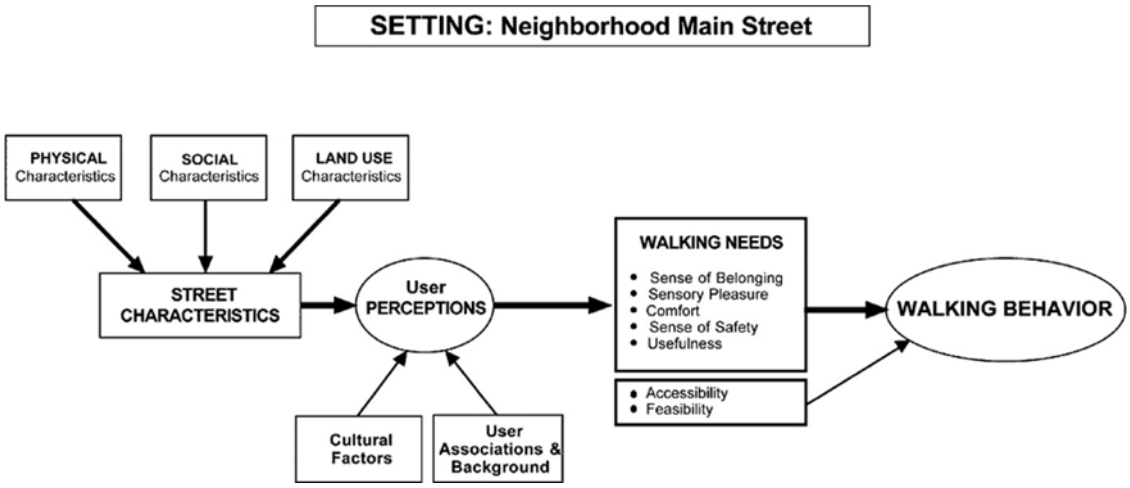


Figure 2.11: Conceptual framework proposed by Mehta (2008)

Reviewing literature on walkability, its dimensions and related factors reveals that there are some common features influencing walkability of a street. These features have already explained in the first section of the chapter and referring to previous studies proves that those factors are the most widely studied constructs of walkability. In addition, two different perspectives are observed in the literature examining walkability: observation and survey. In the proposed framework of this thesis both perspectives are considered and walkability is examined both by observation and questionniare.

CHAPTER 3
METHODOLOGY

3.1 Introduction

The level of physical activity is a major public health concern in modern communities. Walking is known as the most popular form of physical activity whether taken for transportation or recreation (Zuniga-Teran et al., 2017). As explained in the previous chapter, health walkability has been addressed by a numerous researchers in social science, economics, behavioral studies and urban design literature. For the urban designers and planners who wish to intervene, regulate and regenerate urban environment in the favor of walkability, understanding the design-related flaws and strengths is valuable. Design characteristics that put burden on the pedestrians can be modified to turn a street into a pedestrian-friendly environment. It should be noted however, the socioeconomic factors and cultural features are not considered in this study. More precisely, we focus only on design characteristics, elements and concepts that determine walkability of the commercial streets.

The rest of this chapter is organized as follows. In Section 3.2 the mix-method terminology of the study is explained. Proposed framework is introduced in Section 3.2.1. The qualitative method and the qualitative method are described in details in two distinct sections. Finally, the chapter is concluded.

3.2 Mix-Method Approach

The walkability problem is studied in this work using a comparative comprehensive scheme by taking into account several constructs of walkability. The methodology is the mix-method approach comprising qualitative and quantitative methods. In qualitative part, the two streets are compared based on the PEDS audit tool results and on-site photography. The main objective of the qualitative section is to reveal the technical design issues about

the streets and compare their weaknesses and strengths as walkable environments. On the quantitative phase on the other hand, the antecedents of walkability are measured as perceived levels of accessibility, safety, comfort, sensory pleasure, connectivity and usefulness among the frequent visitors of the two shopping streets.

This study fills the gap in the literature related to comparative analysis of walkability from both qualitative and quantitative perspective. More precisely, the result of this study explains how design elements and physical characteristics affect walkability in two different walking neighborhoods with the same usage for the local community. Figure 3.1 represents the general outline of the thesis which will be completed by recommendations and guidelines for planners who wish to intervene and regulate the urban design in the favor of pedestrians.

3.2.1 Proposed Framework

The proposed framework adapted for this study is shown in Figure 3.2. Cross-sectional field survey is used for collecting required information. For each individual street i.e. Osman Pasa and Ismet Inonu, a separate field survey is conducted. Environmental characteristics of the walking neighborhood is estimated by PEDS audit tool which measures walking environments features, road attributes, pedestrian facilities and sidewalks' specifications. In addition, a subjective assessment is performed by on-site photography targeting the items in PEDS tool. Perceived walkability of each street is evaluated by conducting a survey questionnaire among people who frequently walk in the street. Each of the six attributes of walkability is measured by several scales in order to make an inclusive comparison between Salamis and Osman Pasa commercial streets.

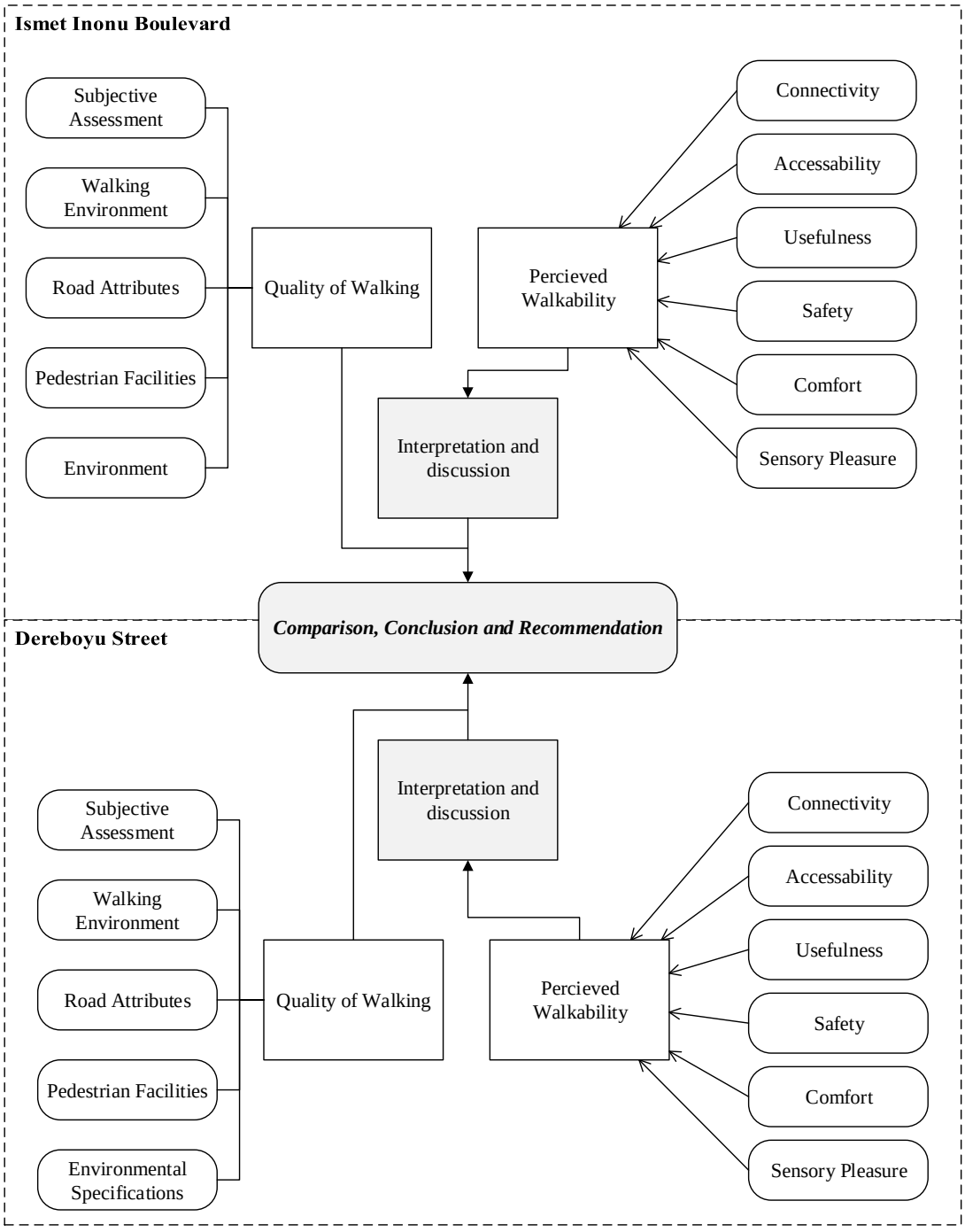


Figure 3.1: The general outline of the comparative study (Clifton et al., 2007; Khder et al., 2016; Radisya Pratiwi et al., 2015; Talavera-Garcia & Soria-Lara, 2015; Vural Arslan et al., 2018)

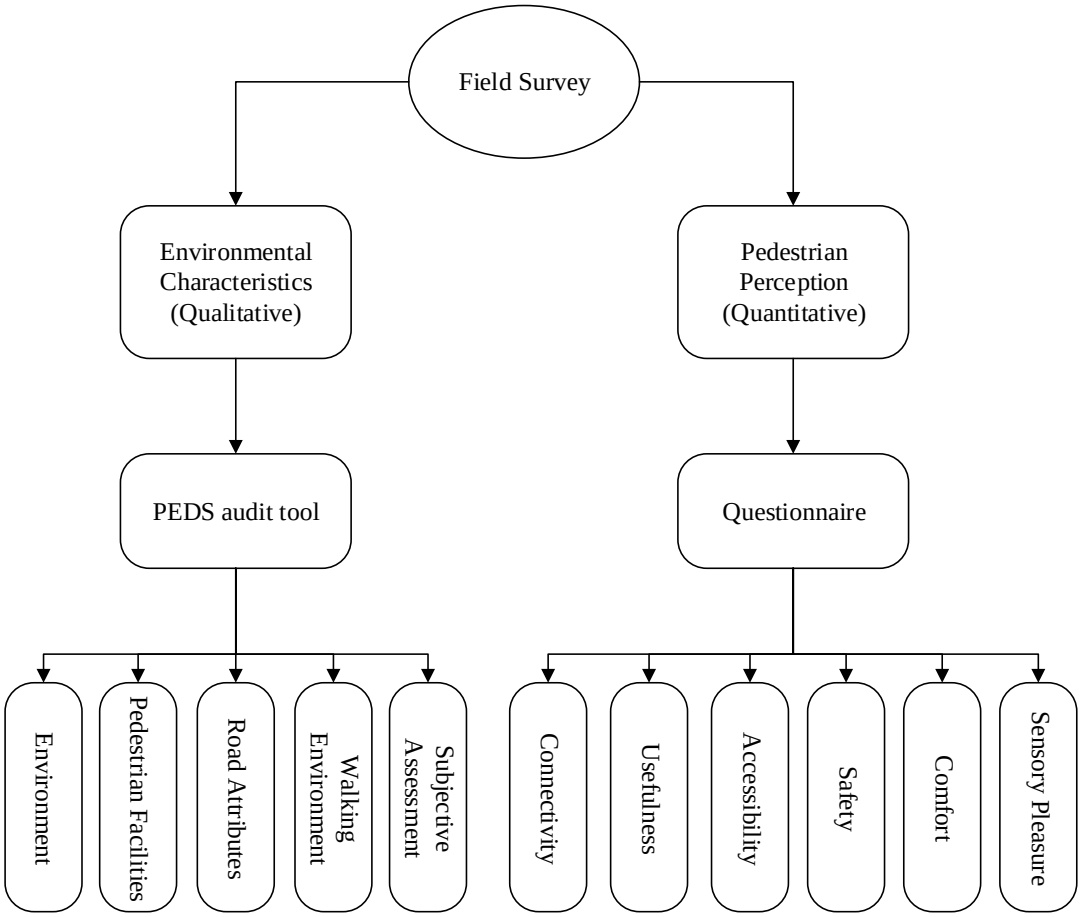


Figure 3.2: Proposed framework for examining walkability (Clifton et al., 2007; Khder et al., 2016; Radisya Pratiwi et al., 2015; Talavera-Garcia & Soria-Lara, 2015; Vural Arslan et al., 2018)

3.2.2 Qualitative Approach

Qualitative research methods are mainly based on direct observation to collect descriptive data about the subject of matter. Interviews, on-site photography and audit tools are some of the well-known qualitative approaches. Generally, audit tools can be applied in a variety of domains to gather information about perceived quality of urban areas as well as community's walking behavior. There are academic and practical versions of audit tools adapted either for research purpose or community commitment (Nakazawa, 2011). The emerging concern among the scholars in urban design and public health about the levels of physical activity has motivated the researchers to generate audit tools for qualitative evaluation of walkability-related factors in urban elements, physical features and

streetscape environment. The pedestrian environment data scan (PEDS) (Nakazawa, 2011), the Irvine Minnesota inventory (Boarnet, Day, Alfonzo, Forsyth, & Oakes, 2006) and the neighborhood environment walkability scale (NEWS) (Cerin, Saelens, Sallis, & Frank, 2006) are the examples of popular tools for walkability assessment.

It should be noted that the main issue for qualitative evaluation of walkability is that this concept is a challenging one to be measured since several qualitative factors including road attribute, traffic management, quality of sidewalks, safety from vehicles, ease of movement, access to amenities, pedestrian facilities, cleanness, greenery and land-use patterns affect it. In this study, the task is even more demanding because the evaluations are to be compared for the two streets. In other words, direct observations on the streets should be structured in a specific arrangement to make the comparisons meaningful and interpretable. The PEDS audit tool is the appropriate tool for the purpose of this study. It is purely qualitative unlike Irvine Minnesota inventory and NEWS which both contain a quantitative component. This tool provides an effective framework to compare different pedestrian environments. The main features of PEDS audit tool and its components are introduced in the following section. One may refer to Appendix A for the complete PEDS tool version 2 (PEDSInstrument.v.2).

PEDS Audit Tool

The pedestrian environment data scan (PEDS) is a tool developed by Kelly J. Clifton (2007) to describe special factors related to walkability based on a straight-forward approach (Clifton et al., 2007). PEDS audit tool provides a descriptive and structured framework for evaluation of street's physical environment. The results reflect the presence and the quality of streetscape characteristics on each street and they are easily comparable and interpretable. PEDS audit tool comprises four major sections and totally 36 questions. The sections are to evaluate environment (3 questions), pedestrian facility (10 questions), road attributes (11 questions) and walking/cycling environment (11 questions). The last question estimates the subjective assessment of walkability by the expert. Each question describes the presence and/or the quality of the related factors using a numeric score (Likert scale) or a check box. There are also a number of open-ended queries to incorporate

the opinions of the expert. The five sections of PEDS tool are explained in brief in the following.

i. ***Environment:*** This section explores streetscape's characteristics which are not very concrete but they knowingly affect the walkability. Environment section is PEDS Audit tool deals with elements such as land use, steepness, and intersections. For the pedestrians, variety in land use means the walking environment offers diversity in activities at different time segments during the day. A lively street attracts more pedestrians and doubtfully contributes in creating a quality walking environment (Nakazawa, 2011).

   Slope is another important factor influencing walkability of a street. Sharp slope makes walking more difficult and in extreme weather conditions, dramatic traffic and walking issues can arise when it rains or snows (Jacobs, 1993). Frozen sidewalks and slippery roads are the disadvantage of a street with a steep slope. However, a fine slope creates a pleasant visual environment as shown in Figure 3.3. This photo shows one of the streets in San Francisco, the U.S. where the gentle slope results in an nice streetscape view (Nakazawa, 2011).

Figure 3.3: The gentle slope of a street in San Francisco and pleasant streetscape (Nakazawa, 2011)

Intersections with other roads and streets also influence the walkability of a street. The more the intersections exist, the more likely pedestrians walk because intersections allow for access to other blocks and let the transportation flow. On the other hand, streets without access to other parts of the city or the deadend streets discourage walking. In the lack of intersections, pedestrians have to take longer distances or return all the way back to access different sections (Landis et al., 2007).

ii. ***Pedestrian Facility:*** Streets and walkways are known as the focal public open spaces in the cities. Competent mobility, high levels of comfort and safety are to be offered to the pedestrians. While in natural open spaces such as parks or green recreational facilities, inherent environmental features satisfy the needs of informal walking, sidewalks in the streets are assumed as the formal walking environment. Sidewalks should allow for efficient mobility in dense pedestrian traffics. Proper design of these pathways which are usually parallel to the roadways not only promotes walking but also contributes to higher levels of public interactions (Nakazawa, 2011).

Activities that are held within an environment yield in pedestrian facilities available in that environment. In common words, trails and other types of dirt found are not in alignment with the built streets but rather are from natural formations such as, parks or greenways or within recreational or residential zones. In places with higher traffic rate regarding pedestrians, pavements are designed in a parallel manner taking road into account. Similarly, walkways are also among the crucial elements of having a friendly street for pedestrians through provision of safety and comfort. This is to be expanded with an efficient accessibility for movement (Asadi-Shekari, Moeinaddini, Muhammad, Shah, & Zaly, 2013). It has also been stated that sidewalks play an even more major role as they the top prominent space for public usage (Jacobs, 1993).

Proper implementation of pedestrian facilities results in positive interactions within the society and further enhances mobility. The extent of which pedestrians feel comfort regarding walking on facilities is also dependent on the materials used for the said facility (Kelly, Tight, Hodgson and Page, 2011). There are several factors in this regard

that not having a slippery surface is among them. This further encourages and fosters walkability and access for any and all age ranges within the society. Additionally, durability of materials used for building/constructing pedestrian material is a fundamental element, which cannot be neglected. Moreover, visual element is another vital factor in this context as aesthetic characteristics can facilitate appeal.

With regard to what was mentioned above, width of these facilities carry significance in terms of increasing quality and provision of a better experience regarding walking. Thus, it is important to note the proper width of sidewalks for adequate space. This allows pedestrians to use the facility without the feeling of being pushed off or perhaps a degree of being in danger. This can be seen in various locations, which is the fruit of pedestrian facility being the second priority after merely construction of road (Kelly, et al., 2011). In addition, the distance between road and the pedestrian facility must be considered with traffic of the area taken into account (Moughtin, 2003).

It is also important to highlight the obstacles (i.e. street hardware for traffic and road control/surveillance) that pedestrians face by using pedestrian-specific-facilities regardless of the fact that these facilities are for their usage (Fruin, 1971). This particular element of inconvenience has a significant impact on the quality of pedestrian spaces (see Figure 3.4). Joy and comfort are vital factors that need to be fostered and encouraged for pedestrians in terms of using facilities without obstacles and/or other inconveniences. Street lamps, traffic signs, parking lots, bus stations are considered as a part of pedestrian facilities despite their opposing nature to this context (Gehl, 2010). For objects and other items to have a space on sidewalks or other facilities, a prior thought process must be implied for proper and comprehensive consideration. Traffic flow of pedestrians can be altered and interrupted by improper installation of amenities such as payphones or newsstands (Gehl, 2010). This can particularly be seen in crowded areas.

Figure 3.4: An example of sidewalk obstacle, Vancouver, (Nakazawa, 2011)

It is crucial to note that considering public amenities and similar services for the society, accessibility and ease of use are key elements, which allow any range of age to have un-discriminated access. Curbs are an example of a proper feature for linking road and sidewalk surface. Curbs can be seen on intersections and can greatly impact the ease of access and extent of usage for pedestrians positively (Nakazawa, 2011). For crossing streets as well as walking on sidewalks, safety and comfort are two key factors that are to be provided for pedestrians. Usage and accessibility can be enhances and facilitated through proper completion of pedestrian facilities. Those streets and areas, where multiple connections are required for pedestrians to provide minimum travel time as well as easiest directions to follow (Moughtin, 2003).

iii. ***Road Attributes*****:** in addition to what was mentioned above, there are other elements that can increase or negatively impact the quality of environments dedicated for pedestrians (e.g. features, size and condition). Furthermore, speed of mobility as well

as its volume can impact the safety degree perceived by the pedestrians using the facility.

For pedestrians to have a sense of safety, the distance that is given between the area for vehicles and pedestrians is a major issue, which required focus and emphasis (Whyte, 1988). Referring to figure 3.5 of this study, parking on the side of street is a common matter that can be seen in a considerable amount of spaces. Often, the function of these spaces is to provide a sufficient amount of space between pedestrian and vehicle dedicated zones. Parked cars can be an element of safety for walking space as they provide a barrier, which can slow the speed. Both commercial and residential streets possess features for residents to have access to the main road from an entrance (e.g. driveway), which can be a negative factor as they may cause accidents or lower mobility (Fruin, 1971).

Nowadays most roads have traffic surveillance or control devices implemented for reduction of speed in roads. Speed bumps, chokers and circles are commonly used to control the speed. This can lead to enhanced quality and safety for pedestrians. Moreover, chokers are used to expand curbs, which can widen the sidewalk leading to reduced distance for pedestrians to cross as well as provision of sight to both vehicles and pedestrians simultaneously (Shaaban, 2019).

Figure 3.5: On-street parking as buffer between pedestrians and vehicles, Kingston, Ontario (Nakazawa, 2011)

The aforementioned devices can significantly decrease consumption of time and exposure of pedestrians to traffic through proper and sufficient space design. Within the same context, crosswalks function as a dedicated area for pedestrians to cross the street. Degree of walkability for pedestrians can be enhanced through provision and designation of sidewalks as well as crosswalks for linking roads and other facilities. Moreover, there are other aiding facilities that pedestrians can use to cross streets that can be namely, signs and signals, over or underpass, lights, and warning sign/lights. Despite the aforementioned notions, it has been stated that some facilities or features designated to pedestrians' use can yield in being more beneficial for cars (Whyte, 1988). For instance, overpasses, although designed for usage of pedestrians, are in fact having cars into consideration as a priority. Pedestrians are directed and forced into consuming more energy to climb overpasses to cross roads as car traffic was

emphasized not to be interrupted in initial design of the environment. Another example can be warning lights that merely provide a low-level attention for drivers of potential pedestrians in the environment. However, such devices do not necessarily force drivers to cease mobility (Khder et al., 2016).

With regard to what was mentioned earlier, bicycle facilities and its implication and installation within street system can be regarded as a significant factor influencing pedestrians' environment and its overall quality. Through promotion of bicycles, and provision of proper space for its usage, activity and sustainability is encouraged and fostered within the city, which has a vital role in fighting climate change and global warming (Gehl, 2010). This is even more crucial and imperative in nowadays as global challenge is to reduce emissions as well as increasing sustainable initiatives and activities on an international scale. Such facilities can be seen on a more explicit manner in EU zone. Hence, it is vital to consider space for people to be able to use bicycle through provision of designated routes throughout the city and alongside roads within the street structure (Laplante & Mccann, 2008). Bicycle designated areas can differ from lanes, curbs, paved shoulders and to separated or striped lanes.

iv. ***Walking/Cycling Spaces*****:** The environment designated for bicyclists or pedestrians can have a positive impact on the extent of quality of these spaces. Through proper design and establishment of city structure and street systems, community can have a better sense for pedestrians as well as bicyclists. Furthermore, through such initiatives, the level of activity can be increased within the society (Giles-Corti et al., 2009).

Following what was mentioned above, it is also important to note that the facilities for walking/cycling have to be made regarding their usage during day or nighttime. Hence, it requires proper lighting, which can aid both pedestrians and cyclists as well as vehicles for safety measures and increased quality (Khder et al., 2016; Shaaban, 2019). In this regard, streets and pedestrian facilities are to be designed with adequate and balanced lighting to provide sight for road as well as sidewalk (Nakazawa, 2011). Nevertheless, amenities and their efficiency in terms of installation and design have an

extreme role in provision of safety and increasing the quality for environments and spaces that are designed for pedestrians or cyclists. That being said, it is key to note that such amenities have to be in adequate amount and not be overly used or have an unnecessary function. This can further be of aid to facing global warming through proper usage of resources. However, scarcity of amenities is also not recommended and thus, the number has to be strategized and properly implemented based on traffic and other influential elements. Appropriateness of location for amenities is to be emphasized in this regard (Craig et al., 2002).

Visual appearance for appeal, safety and accessibility alongside ease of use are key elements in designing pedestrian facilities. On their nature, such facilities are to encourage meeting the needs of society as well as reduction of using vehicles (Cerin et al., 2006). Benches, seats, or similar facilities are also to be designed and located in proper places with respect to the degree of which, in that area activities are being conducted. Commonly, streets or areas, where photography can be encouraged consist of seats or benches to shine light upon architectural aspect (Shaaban, 2019). Furthermore, benches and seats are designed in a manner that there is space among them on a measure (Zakaria & Ujang, 2015).

Following the context of pedestrian amenities, public bins can be designed on a more sustainable manner (e.g. concrete or permanent steel). In addition, their location is important similar to the case of benches that was mentioned earlier in this section. It is often observed that regardless of the amount of trash being loaded in the neighborhoods, the distribution of trash bins is constant regarding space and location. Size, and capacity of containers are significant elements regarding how efficient these bins function for the society (Shaaban, 2019). Litter and trash may remain on the street or sidewalk if containers are improperly designed (too small) or badly located. Lids are also important as they restrict entry of water or animals as well as the scent. It has been noted in the work of Nakazawa (2011) that such factors can lead to lower usage of such facilities.

From a different aspect, maps and signs are commonly used to aid people or visitors to a new area for assistance and ease. Wayfinding aids is the term used for such data, which their effectiveness and efficiency is dependent on the extent of which the needs of pedestrians and/or cyclists have been met (Farkic et al., 2015; Khder et al., 2016). Landmarks and distances can be a fit aid for people in need of navigational assistance that is more complicated than mere directions. In this regard, pedestrians, who are relatively less familiar with their environment, can have a greater sense of confidence and safety as they are able to find important information regarding their surroundings (Shaaban, 2019). The size of these signs has to be in scale that is visible and is not covered or cluttered in any manner.

Trees planted alongside the street and walkways are the most significant part of visual element for pedestrians. This is regardless of their vital significance in terms of sustainability and fighting against global warming. Spatial lines and boundaries are also provided through plantation of trees and proper structuring the texture and scale of greeneryn (Leslie et al., 2005). It is also important to note that planting trees is relatively cheap and has a much higher value added economic-wise. Furthermore, trees can provide shade, which provides additional comfort for pedestrians (Nakazawa, 2011). Placement, types and proper maintenance and care for the planted trees is imperative in this context (Jacobs, 1993).

Building structure and formation surrounding pedestrian areas is also a factor that is highly regarded. Cohesiveness in design can increase openness and appeal level of streets (horizontal and vertical) (Rahimiashtiani & Ujang, 2013). Distinctiveness of buildings affects perception regarding distance that has to be carried. Narrow and short facades can affect perception in terms of seeming shorter and vice versa (Gehl, 2010; Mehta, 2008).

Visual appeal can be influenced on a great level by strong first (ground) floor design of buildings. This can give a perception of positivity to the place from pedestrian perspective. This can further stimuli activity and foster joy in pedestrian environment.

Perception of safety can greatly decrease in areas, where building articulation is weak or none (Asadi-Shekari et al., 2013). Apartment heights and design can be predictors of the street and its design as well as frame (Nakazawa, 2011). For pedestrian environment to be effective visual balance is to be acquired with both buildings and their diversity in terms of façade, and style (Moughtin, 2003). Furthermore, streets and their effectiveness in terms of success is under the influence of transportation systems established. Commonly, bus stops are regarded as generic part of streets and can provide shelter if designed properly, which can result in higher quality for pedestrian spaces. The type of bus stops are dependent on climate and weather conditions of the area they are installed in. It is important that bus stops are made with adequate consideration to their location to further encourage usage as well as providing comfort for waiting time (Talavera-Garcia & Soria-Lara, 2015).

Conducting PEDS Audit Tool

In order to conduct PEDS audit tool, the street map is considered as the reference for the on-site observations. It is strongly recommended to the experts to pace the entire segment carefully before recording the observations to perceive the general context of physical environment and the design elements (Nakazawa, 2011). In the second walk, the scales on the form are marked based on observations. The researchers are advised by the PEDS protocol to pave the street several times to assure the recorded observations are precise. In addition, both sides of a street segment should be evaluated when the audit instrument is applied.

PEDS environmental audit tool is a wise choice for qualitative comparisons between different streets as the process is principally repeatable. Since this instrument was introduced, numerous researchers have exploited it for qualitative estimation of walkability (Chin, Van Niel, Giles-Corti, & Knuiman, 2008; Khder et al., 2016; Nakazawa, 2011). A successful application of PEDS for a qualitative comparison of streets is represented in (Nakazawa, 2011). The walkability of three popular streets located in downtown Vancouver, Canada is evaluated and compared. The city of Vancouver has been admired for its accomplishments in urban planning and quality of life. The main objective of the

study is to discover design regulations to make the streets more pedestrian-friendly. Nakazawa's study offers a framework for the qualitative research approach of this thesis.

This research conducts natural experimentation (observation) on a direct manner to collect the data deemed appropriate for the purposes of this particular case. PEDS audit tool and photographs were used as the means for data collection, which allowed the researcher to have direct information regarding pedestrian environments as well as streetscape features and segmentation. This enhanced the assessment of gathered data.

3.2.3 Quantitative Approach

Quantitative analysis of walkability of the streets is conducted using a survey which assesses pedestrian perceptions about different dimensions of walkability. As described in Chapter 2, dimensions of walkability have been extensively studied in urban design and architecture research. According to these studies, these dimensions include sensory pleasure, comfort, safety, accessibility, usefulness and connectivity (Cerin, Leslie, Owen, & Bauman, 2008; Cerin et al., 2006; Chiang et al., 2017; Khder et al., 2016; Mehta, 2008; Radisya Pratiwi et al., 2015; Shaaban, 2019; Talavera-Garcia & Soria-Lara, 2015; Vural Arslan et al., 2018). Prposed framework is tested by firstly examining reliability of the scales for each street and then confirmatory factor analysis. Correlation coefficients among scales are also obtained to uncover interrelations.

Survey Questionnaire

The survey questionnaire is designed by reviewing the related studies and consists of 35 items for measuring the already mentioned dimensions of walkability. These items are taken from the recent literature on walkability of streets. Table 3.1 shows the considered scales and their corresponding items in the questionnaire. Each item is measured using a 5 point Likert scale (Khder et al., 2016). These scales are defined as 5: very good, 4: good, 3: average, 2: poor and 1: very poor. Consequently, the higher corresponds to better condition. For the items which need different quality measures, similar grade-points are used with different literals. The item "you can do most of your shopping in this street" as a

scale for usefulness is measured as 5: strongly agree, 4: agree, 3: neutral, 2: disagree strongly, 1:disagree. The other item “how adequate is the width for sidewalks?” to assess comfort is measured as 5: quite sufficient, 4: sufficient, 3: tolerable, 2: insufficient, 1: quite insufficient.

The order of items is randomized in the questionnaire. The argument for randomizing the order of the questions is due to the fact that the answers to later questions can be biased by the presentation of earlier questions. Randomizing the question order means that the influence is no longer subject to this ordering bias. Questionnaire is prepared both in English and Turkish to remove the language barrier problem. The subjects decide whether to fill the English questionnaire or the Turkish one.

Chronbach’s Alpha

For measuring construct reliability and internal consistency of the gathered data Cronbach’s alpha was used (Khder et al., 2016; Vural Arslan et al., 2018). This method is commonly used by scholars and experts in the field. Scales defined in this research are tested based on their consistency through this measurement (Tavakol & Dennick, 2011). It is common to test internal consistency of the data and parameters prior to main analysis as construct validity can be measured. Table 3.2 illustrates different values of alpha and related internal consistency.

Table 3.1: Scales used for walkability survey questionnaire and their related items (Khder et al., 2016; Talavera-Garcia & Soria-Lara, 2015; Vural Arslan et al., 2018)

Construct	Item
Accessibility	Ease of accessibility to streets by ambulance, fire truck and police car in emergency
	Ease of access to other main streets from side streets
	Convenient access to public transport
	Availability of car parking zones
Safety	Traffic signs
	Traffic slowing devices in local area
	Ease of Crossing
	Enough space between sidewalks and traffic roads
	Adequate lighting for night use on the pedestrian paths
	Accessibility of security facilities in emergency
	Safety feeling
Comfort	Adequate width for sidewalks
	Adequate number of street furniture
	Adequate number of services (WC, baby care, etc.)
	Adequate number of shading elements providing comfort conditions
	Proper arrangements for people with disabilities (ramps, lift, tactile paving)
	General comfort feeling
Sensory Pleasure (Pleasurability)	Shop window decoration
	Pleasant design features in the area
	Adequate number of bins
	Beautiful views in the surroundings
	Roadside trees/bushes/gardens
	Free from signs of vandalism (graffiti, etc.)
	Cleanliness of the street and sidewalks
Connectivity	Intersections
	Alternative paths
	Adequate number of orientation signs for pedestrians
	Consideration of universal design principles in the connections of traffic roads with sidewalks and pedestrian crossings
	Uninterrupted linkage of pedestrian paths
	Connectivity Status
Usefulness	Can do most of the shopping in the area
	Quality restaurants and cafes in the area
	Many shops within easy walking distance
	Availability of social activity areas
Walkability	The degree of walkability of the street

Table 3.2 Cronbach's alpha value and strength of internal consistency (Mahlangu & Kruger, 2015)

Cronbach's Alpha	Internal Consistency Strength
larger than 0.9	Excellent
Between 0.8 and 0.9	Very Good
Between 0.7 and 0.8	Good
Between 0.6 and 0.7	Moderate
Smaller than 0.6	Poor

Internal consistency and reliability analysis exhibit the degree of effectiveness of parameters in terms of error as reliability has an inverse relationship with error margin. Standard error of measurements are required to be calculated depending on the definition of sample collection procedure (Tavakol and Dennick, 2011).

Calculated-alpha value can increase if items are correlated. As alpha and its degree are influenced by other factors such as test length, merely a high value does not resemble corresponding high internal consistency. This value can be decreased if the test is relatively short. Hence, the inclusion of items that are involved in the model. This notion in turn results in the calculation of alpha on each proposed model and not considering prior values (Tavakol and Dennick, 2011).

Factor Analysis

Factor analysis is a widely-used method for evaluating conceptual models for studying walkability of streets (Carnegie et al., 2002; Cerin et al., 2008, 2006; Khder et al., 2016; Ozer & Kubat, 2013; Vural Arslan et al., 2018). Variables that are observed and are correlated can be described in terms of variation through factor analysis. It can be said that variations of observed variables can reflect variations of underlying variables to a certain extent. Such variations with regard to latent variables is the emphasis of factor analysis. Linear mixture of variables that are under observation is defined in a model with

consideration of error interval. Through conduction of factor analysis independent latent variables can be found (Child, 2006). Number of variables consisting within a model or database can be reduced based on the results of factor analysis as interdependencies are shown among variables that are observed. This is a common method, when handling datasets with relatively large number of variables that are reflective in regard to latent variables that are lower in number compared to observed ones (Child, 2006).

Furthermore, exploratory factor analysis (EFA) is another statistical method (multivariate) of analyzing variables in a large set. EFA is commonly conducted within the context of factor analysis to further recognize and exhibit the relationships that exist among variables under measurement (Norris & Lecavalier, 2010). For questionnaire surveys in quantitative measures, EFA is a common test as surveys are being developed. Through this measurement underlying latent constructs can be recognized and shown (Norris & Lecavalier, 2010). In a study conducted by Vural Arslan et al. (2018) it was noted that, when priori hypothesis do not exist, researchers may conduct EFA to measure variables in terms of patterns. Any trait under observation or measurement can be termed as variable in this context. As number of variables being measured is commonly large, and are under the presumption of having linkage with latent variables, EFA can increase accuracy through multiple measurement of variables (Cerin et al., 2008).

Statistics of Items and Scales for Comparing Walkability

After testing reliability of items in the questionnaire using Cronbach's alpha and testing the proposed framework by means of EFA, reliable constructs of walkability confirmed in the model are considered. In other words, some items might be discarded as unreliable or unrelated to walkability. The remaining constructs of walkability are used to obtain average scores for each of the dimensions of walkability in the model. These procedures are performed for each street separately. Finally, the statistics of the valid items and related dimensions are used to graphically represent the score of each walkability construct and compare the case studies in terms of six dimensions including sensory pleasure , comfort, safety, accessibility, usefulness and connectivity. The total walkability level is also computed as the average score given by respondents for each case study.

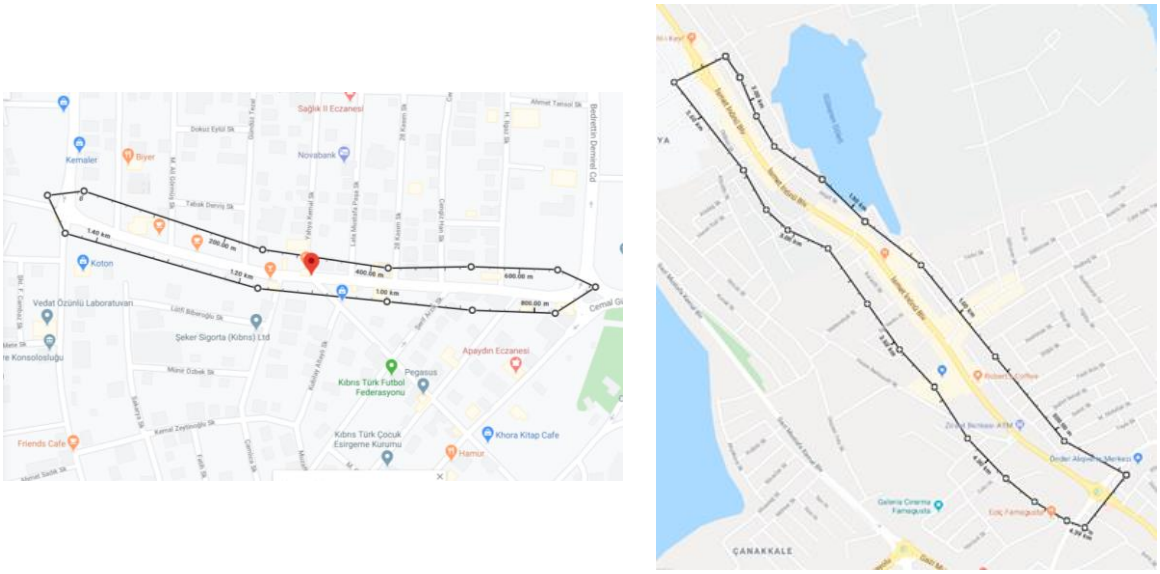
3.3 Summary

The methodology used in this thesis is mixed-research method designed in two phases: qualitative phase and quantitative phase. In the qualitative phase, observation on site is conducted to assess walkability in terms of PEDS audit tool and photography. In the quantitative phase, survey questionnaire is conducted. Reliability of the items in the questionnaire is evaluated using Cronbach's alpha and the proposed framework for examining perceived walkability walkability is tested by EFA. Reliable and confirmed factors are then utilized to compare the case studies in terms of walkability perceived by the pedestrians.

CHAPTER 4
CASE STUDIES

4.1 Introduction

The case studies considered for this thesis are two shopping streets in North Cyprus: Osman Pasa Street in Nicosia (Lefkosa) and Salamis Street officially known as Ismet Inonu Boulevard in Famagusta (Gazimagusa). These cases are selected because they are the most popular streets in these cities. Figure 4.1 shows these street sections on the map.



(a) (b)

Figure 4.1: Osman Pasa Street (a) in Nicosia and Salamis Street in Famagusta on Google Maps.

4.2 Qualitative Results: On-site Observations

The first phase of the study is conducted by on-site photography and observations to assess the items related to walkability. This phase is directed mainly by the scales in PEDS audit tool. Both case study streets are visited at several times and by taking walks through the whole segment of the street, assessment is conducted. This phase relies mainly on the expert skills to recognize the existing items and evaluate their efficiency. The street and its

pedestrian environment are observed by taking walks along the whole segment for several times. According to the PEDS Audit tool, the environment, facilities and quality of the walking are determined and assessed for every single item in the form.

4.2.1 Ismet Inonu Boulevard

Salamis Road is a road of length about 8 kilometers connecting Bogazici district to Famagusta city. This road is then linked to Ismet Inonu Boulevard which is located at the heart of Famagusta city. Ismet Inonu Boulevard is officially used to name the street between Eastern Mediterranean University and Victory Monument (Zafer Aniti) in Namik Kemal distrcit. However, the segment of the boulevard which starts from Eastern Mediterranean University's main gate and ends at Masque Square (Cami Cemberi) is the most popular part of it. In this study, this segment of Ismet Inonu Boulevard is considered for conducting research. The completed PEDS audit tool form for this street is given in Appendix C.

i. Environment: For this section of PEDS tool, uses in segment, slop and intersections are the main concern. In Ismet Inono Boulevard, the buildings are of different types. Figure 4.2 illustrate the uses of the segment for cafe and residential apartments. This segment include residential buildings, shops, supermarkets, entertainment and recreation facilities, drug stores, several restaurants, coffee shops, offices, etc. Hence, the environment condition for walking is quiet suitable as people are able to find almost everything they need in this street. This feature is one of the main reasons the segment is very popular bearing in mind that it is close to the university attracting many students. The slope of the street is very little as it can be assumed as a flat street. The intersections of the segment with other main streets are three-ways although there are several four-way intersections with neighboring avenues. In Figure 4.3 the three-way intersection with Gulseren Street is shown. One the popular sections in this street is the newly build complex close to Eastern Mediterranean University's main gate. Novel Center Point is a dormitory complex with many bars, pubs and restaurants (Figure 4.4)

Figure 4.2: Uses in Ismet Inonu Boulevard for Housing-Multi-Family and for Restaurant/Café/Commercial

Figure 4.3: Three-way intersection in Ismet Inonu Boulevard

Figure 4.4: Novel Center Point, a popular section of Ismet Inonu Boulvard

ii. *Pedestrian Facility*: According to PEDS, pedestrian facilities mainly include the conditions related to sidewalks, material, obstruction, buffer, curb and curb cuts, width, continuity and connection to other sidewalks. Observations and assessment of these items revealed that pedestrian facilities in Ismet Inonu Boulevard are relatively unsatisfactory. The road has sidewalks covers with asphalt or bricks depending on the section, but as shown in Figure 4.5, the condition of sidewalks are poor and there is a need for better maintenance and repairmen. There are also several obstructions such as cars parked on the sidewalk and garbage cans. Figure 4.6 illustrates the condition of obstructions on sidewalks which degrade the walkability of the street. In most of the sections of the selected segment, there are curbs as buffers between sidewalk and the road although in some parts there are missing or broken. The width of the sidewalks is around 6 to 8 feet which is a comfortable width with respect to the sidewalk volume if there were no obstruction. Sidewalk is buffered by hedges from the road and there are several curb cuts exist in the segment as shown in Figure 4.7.

Figure 4.5: The condition of sidewalks in Ismet Inonu Boulevard

Figure 4.6: Obstructions on sidewalks in Ismet Inonu Boulevard

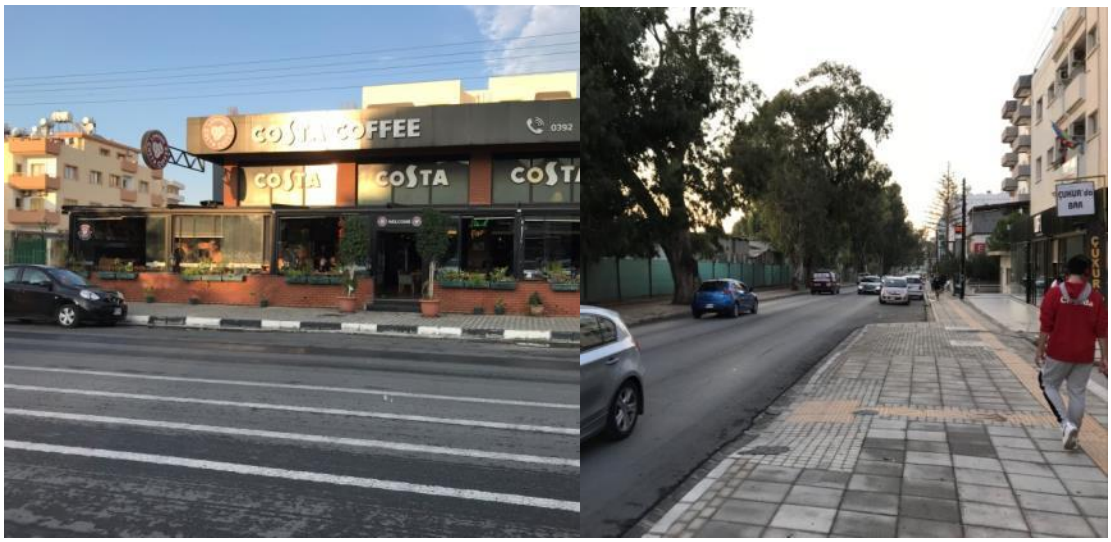


Figure 4.7: Buffer between sidewalk and road and curb cuts in Ismet Inonu Boulevard

iii. ***Road Attributes:*** Road attributes in PEDS audit tool include condition of the road, number of lanes, speed limit, car parks, volume of the driveways, crosswalks, signs, traffic control devices, cross aids and bicycle facilities. In Ismet Inonu Boulevard, the condition of the road is poor in many sections (see Figure 4.8) specifically when it rains. There are two lanes in the road and in some parts the width of the road is narrowed down by the cars parked on the street. As the parking lot spaces are not enough in the segment, some cars are parked in the sidewalk.

Traffic volume is high specifically during the rush hours such as Friday and Saturday evenings. There is a lack of speed limiting devices such as speed bumps. In addition, The number of crosswalks is not satisfactory and it is left to pedestrians to cross safely with caution. There are literally no traffic lights and the signs are very limited as shown in Figure 4.9. In general, road attributes of the segment are not considered as good. Water drains are not designed properly and when there is a heavy precipitation, rain water causes problem for the pedestrians walking beside the cars splashing mud on the sidewalk.

Figure 4.8: Road condition in Ismet Inonu Boulevard

Figure 4.9: Insufficient traffic signs in Ismet Inonu Boulevard

iv. ***Walking/Cycling Environment:*** This section of PEDS tool assesses the quality of the street environment for walkers and cyclers. In Ismet Inonu segment of study, presence of incomplete buildings, construction waste and visually unpleasant items degrades the quality of walking environment although there are some building articulations and planting in front of cafes and restaurants may consider as visually pleasant elements. Some

examples of these contradictory views are represented in Figure 4.10. Moreover, the lack of way finding signals, poor lighting condition and absence of bicycle lanes are the weaknesses of this walking environment. On the other hand, some sections of the the street features old trees providing shade for sidewalks (Figure 4.11). There are also a number of bus stops with shelter and bench as shown in Figure 4.12. Considering all the items in PEDS tool, this segment lacks some of the important features of a high quality pedestrian-friendly street. However, some items contributing to walking environment, add value to Ismet Inonu walakbility. In general, the condition of walking environment in Ismet Inonu Boulevard is assumed as almost good.

Figure 4.10: Pleasant and unpleasant visual elements in Ismet Inonu Boulevard

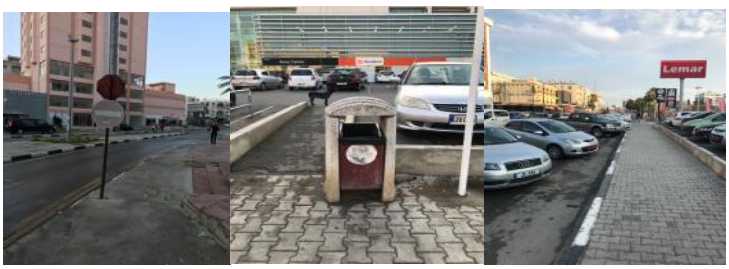
Figure 4.11: Trees in Ismet Inonu Boulevard

Figure 4.12: Bus station with shelter and bench in Ismet Inonu Boulevard

v. ***Summary of PEDS in Ismet Inonu Bouleevrad:*** The result of observation based on PEDS audit tool is summarized in Table 4.1. The completed form of PEDS for Ismet Inonu

is given in Appendix 3. The following table presents an overall overview of the quality of walkability of this street.

Table 4.1: Qualitative overview of walkability constructs in Ismet Inonu Boulevard according to observations guided by PEDS audit tool

PEDS construct	Observations	Quality
Environment		Good
Pedestrian Facility		Fair
Road Attributes		Fair
Walking/Cycling Environment		Fair

4.2.2 Osman Pasa Street

Osman Pasa street officially known as Mehmet Akif Avenue is located in the Nicosia (Lefkosa), the capital city of North Cyprus. The name of the street and the neighboring

area is taken from the Kanli River as the street goes alongside the river. Osman Pasa segment is located between Ali Riza Efendi Road and Osman Pasa Road. It should be noted that unlike Ismet Inonu Boulevard in Famagusta which plays a role in connecting neighboring districts to Famagusta, this street is mainly a local street between Gelibolu and Koskluciftlik urban sections in the city. Thus the length and the width of Osman Pasa is shorter than Ismet However, this street is the busiest street in Nicosia as a shopping and entertainment center.

i. ***Environment:*** Most of the buildings in this segment are restaurants, cafes, shops, and offices. There are also some residential apartments although traffic issues discourage people to live in the area. The slop of the street is very negligible and the street is assumed as flat. The main intersection of the street is with Osman Orek road and there are some intersections with local avenues (Figure 4.13).

Figure 4.13: Intersection with local avenue in Osman Pasa Street

ii. ***Pedestrian Facility:*** The material used in Osman Pasa Street for sidewalk is mainly asphalt and in some parts paving bricks. However, as shown in Figure 4.14, the condition

is not satisfactory and maintenance is poor. There are cracks on asphalt in most of the sections of the path requiring repair. There are also several obstructions on the path including restaurants and buildings abuse the space, car parked on the sidewalk as a result of lack of parking lot spaces and in some cases garbage cans. Some of these cases are captured during the observation and illustrated in Figure 4.15. The sidewalk is buffered from road using hedges but in many parts the buffer destroyed as a result of low maintenance. Moreover, the width of sidewalk is very small as the path is narrowed down by restaurants and cafes extended into the walking path. Figure 4.16 shows a narrow section of the sidewalk in this street. Number of curb cuts is very limited which makes it difficult for people with pushchairs and even for pedestrians when they crossing the road. The sidewalk is connected to the intersecting alleys and street's pathways. Still the path is not completely connected since there are several intersections with neighboring avenues. In Figure 4.17, an intersection is captured where the sidewalk is disconnected into short sections making it difficult for walkers as they have to cross through.

Figure 4.14: Sidewalk Condition in Osman Pasa Street

Figure 4.15: Obstructions on sidewalk in Osman Pasa Street

Figure 4.16: A narrow section in Osman Pasa Street

Figure 4.17: A disconnected sidewalk segment in Osman Pasa Street

iii. *Road Attributes*: Osman Pasa Street has two lanes for drivers. Road condition in general is not very good in this street (Figure 4.18) and the asphalt requires more efficient maintenance. Parking lot spaces are not sufficient and in a very poor condition. One of these areas is illustrated in Figure 4.19. On street parking is very common without considering the issues raised for pedestrians. Traffic control devices such as traffic signs, lights and speed limiting bumps are installed in critical points although there is no crossing aid facility for walkers (Figure 4.20). For cyclers, this street provides almost no facility and they have to share the road with cars or drive in the sidewalk which is too narrow, disconnected and uncomfortable. This also causes issues for pedestrians. In summary, road attributes of Osman Pasa Street is described as unsatisfactory.

Figure 4.18: Road condition in Osman Pasa Street

Figure 4.19: A poor conditioned parking lot space in Osman Pasa Street

iv. ***Walking/Cycling Environment:*** The walking environment in Osman Pasa Street is not a very pedestrian-friendly one. The elements of environment such as lighting condition at night and road-oriented lighting are poor or missing. Amenities include only few numbers of garbage cans, not visually pleasant as depicted in Figure 4.21. There is no other urban

furniture or design element. Building articulations are not very highlighted. Most of the buildings are multistory but not high rise. The number of trees is limited even though efforts have been made to preserve old trees while constructing buildings in the area (Figure 4.22). Building setbacks from street is completely a chaos letting some buildings extend to the half width of the sidewalk. There is no bus stop in the area.

Figure 4.20: Speed limiting and traffic signal facility in Osman Pasa Street

Figure 4.21: Walking environment amenities in Osman Pasa Street

Figure 4.22: Old trees preserved in Osman Pasa Street

v. ***Summary of PEDS in Osman Pasa Street:*** The result of observation based on PEDS audit tool is summarized in Table 4.2. The completed form of PEDS for Osman Pasa is given in Appendix 4. The following table presents an overall overview of the quality of walkability of this street.

Table 4.2: Qualitative overview of walkability constructs in Osman Pasa Street according to observations guided by PEDS audit tool

PEDS construct	Observations	Quality
Environment		Not Good
Pedestrian Facility		Fair
Road Attributes		Fair
Walking/Cycling Environment		Not Good

4.2.3 Qualitative Comparison

The result of qualitative assessment of walkability in case studies is used to compare Ismet Inonu Boulevard and Osman Pasa Street in terms of the strengths and weaknesses. In fact, since the observations were guided by PEDS audit tool, the comparison is framed into four different sections: Environment, Pedestrian Facility, Road Attributes and Walking/Cycling Environment. Conditions, presence and sufficiency of the elements for each section are used to provide this comparative perspective. It should be noted that the result of the qualitative phase relies totally on the observer judgment (the Author). Table 4.3 represents

the qualitative comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of walkability. In the Author's point of view, Ismet Inonu Boulevard is principally more pedestrian-friendly than Ismet Inonu Street. The only feature in Osman Pasa Street which is superior to Ismet Inonu Boulevard is the road attribute. In other words, road condition and maintenance in the former case is slightly better than the latter one.

Table 4.3: Qualitative comparison of walkability in Ismet Inonu Boulevard and Osman Pasa Street in terms of strengths and weaknesses

PEDS section		Ismet Inonu Boulevard	Osman Pasa Street
i. Environment	Strengths	• flat • multiple Intersections • not dead-end	• flat • multiple Intersections • not dead-end
	Weaknesses	• lack of intersection with main roads	• intersection with main roads
ii. Pedestrian Facility	Strengths	-	• width is almost sufficient • multiple curb cuts • buffer exists in most parts
	Weaknesses	• sidewalk material condition is poor • several obstructions in most parts • very narrow in some sections • lack of buffer • sidewalk is not connected	• sidewalk material condition is very poor • obstructions in some sections • sidewalk is not connected
iii. Road Attributes	Strengths	• speed limiting bump • presence of traffic signs	• some off-street parking lot spaces
	Weaknesses	• road condition is poor • no crossing aid • several cars parked on sideway	• road condition is very poor no speed limiting • limited traffic signs • limited crossing aid
iv. Walking/Cycling Environment	Strengths	• overall cleanness is satisfactory	• building articulations • trees and plantation • bus station • garbage can • most buildings set back from sidewalk
	Weaknesses	• lighting is poor • unsatisfactory building articulation • a few garbage cans • buildings extend to sidewalk	• lighting is poor • unpleasant visual elements • overall cleanness is unsatisfactory

4.3 Quantitative Results: Survey and Proposed Framework

In quantitative phase of the study, the model is firstly evaluated on each case study separately. The survey questionnaire is conducted aiming at collecting 100 valid respondents. It should be noted that the comparison is made by evaluating mean value of each walkability construct in the model. Nonetheless, this comparison would be only reliable when the model is evaluated and tested for validity. Therefore, the data collected for each case study is analyzed by an expert to test the reliability of the items in the questionnaire and the constructs of walkability. The survey data is collected by visiting each street several times during weekdays and weekend to ensure an unbiased population of visitors are surveyed. Before asking the subjects to fill the form two screening questions are asked. The first one is about the language as questionnaires are prepared both in Turkish and English. The second screening question is about the number of visits per weeks. The subjects who visit the street less than once a week are not considered for the survey.

4.3.1 Ismet Inonu Boulevard

The survey on this case is conducted by visiting restaurants, cafes, shops and recreation centers at different sections of the street. The section close to Eastern Mediterranean University is mostly visited by the students. The part far from the university on the other hand, has more local visitors. In order to reduce the bias in the surveyed population, maximum ten subjects are surveyed at each spot. The demographic information of the surveyed subjects revealed that the collected information has a fair distribution among locals and students at different ages. However, the percentage of student respondents is higher than non-student subjects. But this distribution is rational for Ismet Inonu Boulevard since most of the visitors are students and the perceived walkability is reliable and consistent with the pedestrian community in the area. Table 4.4 presents the demographic information about the candidates surveyed in Ismet Inonu Boulevard. The ratio of male to female respondents is 52/48. Among all of the subjects, 73% aged between 18-35, 12% aged below 18, 10% aged between 36-50 and only 5% aged over 50. 63% of subjects are

students, 21% are the shop keepers in the streets and, 7% are unemployed and 9% marked "other". More than 60% of the subjects visit the street once or twice a week and the rest visit it more regularly. The ones who visit the street less than one a week are already discarded from the survey.

Table 4.4: Demographic information of the surveyed subjects in Ismet Inonu Boulevard

Respondent's Information	**Percentage**			
Gender	male: 52%		female: 48%	
Age (year)	below 18: 12%	18-35: 73%	35-50: 10%	over 50: 5%
Occupation	student: 63%	shop keeper: 21%	unemployed: 7%	other: 9%
Frequency of visits per week	less than 1: 0%	1-2: 61%	3-5: 17%	more than 5: 22%

In order to test the validity of the model and the designed questionnaire, the collected data is analyzed by computing Cronbach's alpha value and then the model is validated by EFA. These tests are conducted by a statistical expert and only the results are reported in the thesis. Cronbach's alpha value for the survey conducted on Ismet Inonu Boulevard is estimated as 0.774 which considered "Good" according to Table 3.2. This value suggests that the questionnaire is reliable. Further analysis of items statistics and inter-item correlation matrix confirms the reliability of all items in the questionnaire. These findings are compatible with previous studies on walkability as the proposed framework and the questionnaire are designed according to the literature. The next step of reliability analysis is to assess the model and its constructs. Figure 4.23 shows the walakbility model and the results of EFA. The values larger than 0.5 are considered as significantly related to the dependent variable, walkability. All constructs are proved to be positively related to walkability.

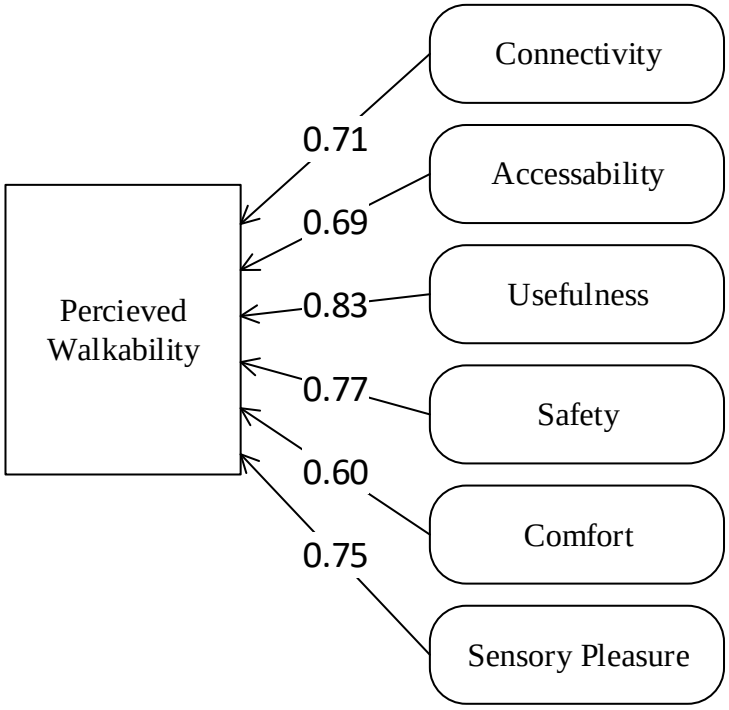


Figure 4.23: Walkability model and result of EFA for Ismet Inonu Boulevard

4.3.2 Osman Pasa Street

For this case study the survey is again conducted by visiting restaurants, cafes, shops and recreation centers at different sections of the street. The segment of Osman Pasa Street is shorter than Ismet Inonu Boulevard but because it is a very busy street during the week and weekend, it is surveyed multiple times to ensure that an unbiased distribution of subjects are selected. Demographic information of the respondents surveys in this segment is slightly different from Ismet Inonu Boulevard. In fact, the number of students visiting this segment are lower than the visitors in the previously explained street. Table 4.5 presents the demographic information about the subjects participated in the survey in Ismet Inonu Boulevard. The ratio of male to female respondents is 54/46. Among all of the subjects, 76% aged between 18-35, 8% aged below 18, 9% aged between 36-50 and 7% aged over 50. Percentage of student participants is 55% and for the rest of subjects 30% are the shop keepers (or business owners), 4% are unemployed and the rest (11%) marked “other” as

occupation. Similar to Ismet Inonu Boulevard, we made sure that the number of visits per week is more than once. More than 60% of the subjects visit the street once or twice a week and the rest visit it more regularly. The ones who visit the street less than one a week are already discarded from the survey.

Table 4.5: Demographic information of the surveyed subjects in Osman Pasa Street

Respondent's Information	**Percentage**			
Gender	male: 54%		female: 46%	
Age (year)	below 18: 8%	18-35: 76%	35-50: 9%	over 50: 7%
Occupation	student: 55%	shop keeper: 30%	unemployed: 4%	other: 11%
Frequency of visits per week	less than 1: 0%	1-2: 66%	3-5: 15%	more than 5: 19%

In order to test the validity of the model and the designed questionnaire, the collected data is analyzed by computing Cronbach's alpha value and then the model is validated by EFA. These tests are conducted by a statistical expert and only the results are reported in the thesis. Cronbach's alpha value for the survey conducted on Osman Pasa Street is estimated as 0.790 which considered "Good" according to Table 3.2. Accordingly, the whole questionnaire is reliable. To confirm reliability of items, further analysis statistics and inter-item correlation matrix performed by expert and it is confirmed that all items in the questionnaire are reliable. These findings are consistent with literature on walkability as the walkability model and the questionnaire are designed based on previous work. The next step of reliability analysis is to assess the proposed walkability model and its constructs. The result of EFA is shown in Figure 4.24. As stated before, the values larger than 0.5 are considered as significantly related to walkability. Therefore, all constructs are proved to be positively related to walkability.

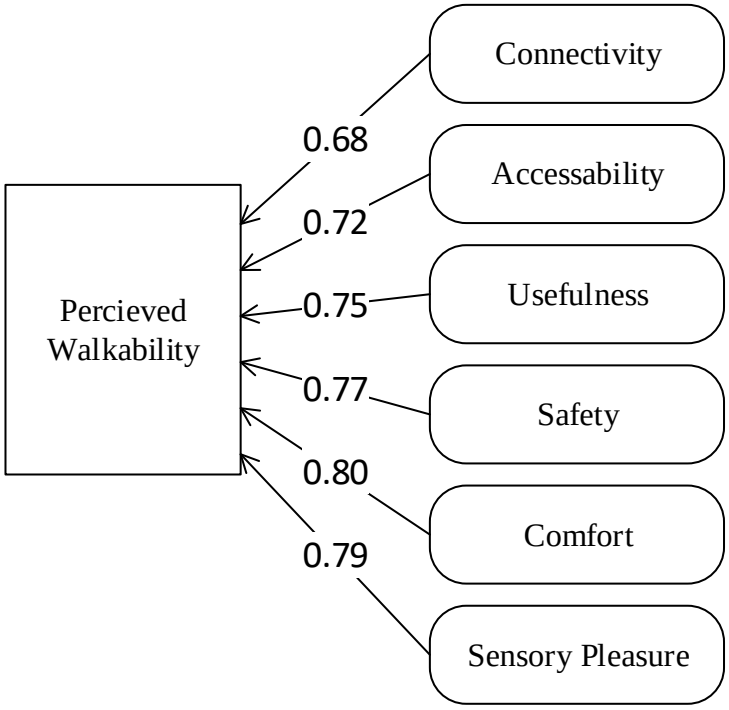


Figure 4.24: Walkability model and result of EFA for Osman Pasa Street

4.3.3 Quantitative Comparison

After proving reliability of the items in the questionnaire and validity of the walkability model, the items in the questionnaire and the constructs in the model can be averaged over respondents to compare the streets. For each of the constructs of the model, there are multiple questions. Responses to those questions range from 1 to 5, where 1 means unsatisfactory and 5 means completely satisfactory. Thus by computing the average of these answers a value is obtained for each question. In this section, barplots are used to compare walkability constructs in two case studies. The height of the bars represents the average of each item and the horizontal axis shows the item numbers in the questionnaire. It should be noted that as mentioned earlier, items in the questionnaire are randomized to avoid bias. In the first step, all items of each construct are compared.

Comparison in Terms of Accessibility

The first construct of model is accessibility measured by 4 items. These items are "Ease of accessibility to streets by ambulance, fire truck and police car in emergency", "Ease of access to other main streets from side streets", "Convenient access to public transport" and "Availability of car parking zones". Figure 4.25 compares this construct in the case studies. Accessibility of Osman Pasa Street is higher than Ismet Inonu Street according to this figure.

Comparison in Terms of Safety

Another construct in the model is safety. Safety of the segment is assessed by seven items including "Traffic signs", "Traffic slowing devices in local area", "Ease of Crossing", "Enough space between sidewalks and traffic roads", "Adequate lighting for night use on the pedestrian paths", "Accessibility of security facilities in emergency" and "Safety feeling. According to Figure 4.26, except for ease of crossing, the rest of the items are higher in Osman Pasa Street when compared to Ismet Inonu Boulevard. However, it should be noted that Ismet Inonu is a longer segment and is considered as the main street connecting the city to neighboring districts. Hence, it is expected to be less safe because of heavy traffic and high speed.

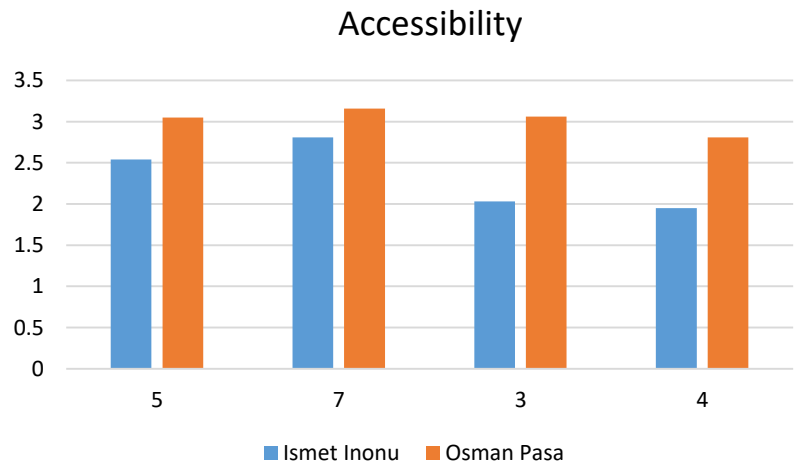


Figure 4.25: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of accessibility

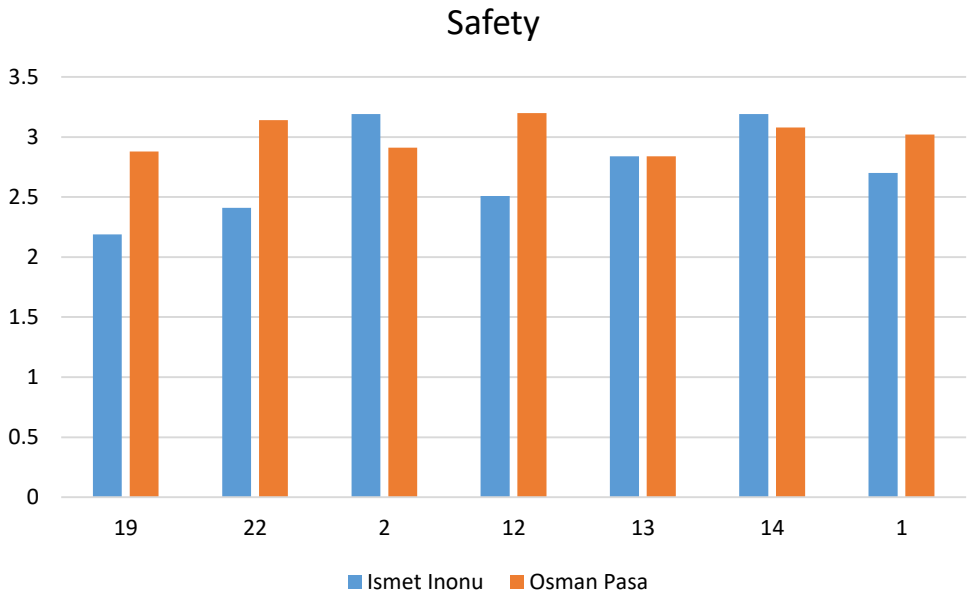


Figure 4.26: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of safety

Comparison in Terms of Comfort

Comfort is measured by six items namely, "Width for sidewalks", "Number of street furniture", "Number of services", "Number of shading elements providing comfort conditions", "Proper arrangements for people with disabilities", and "General comfort feeling". Figure 4.27 shows the comparison plot for these items. It can be argued that Ismet Inonu Boulevard is more comfortable for pedestrians when compared to Osman Pasa Street.

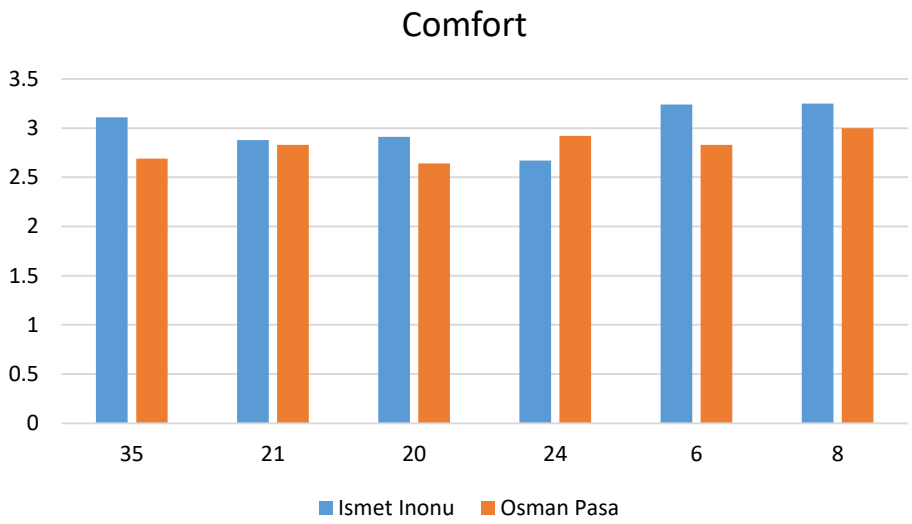


Figure 4.27: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of comfort

Comparison in Terms of Sensory Pleasure

In terms of sensory pleasure evaluated by items: "Shop window decoration", "Pleasant design features in the area", "Adequate number of bins", "Beautiful views in the surroundings", "Roadside trees/bushes/gardens", "Free from signs of vandalism", and "Cleanliness of the street and sidewalks", Ismet Inonu Boulevard is slightly better than Osman Pasa Street. Nonetheless, considering that the former is a much longer segment than the latter, sensory pleasure can be assumed as a prominent feature of Ismet Inonu Boulevard. Specifically, for the students who are the regular visitors of the street, this construct can be encouraging for taking more walks.

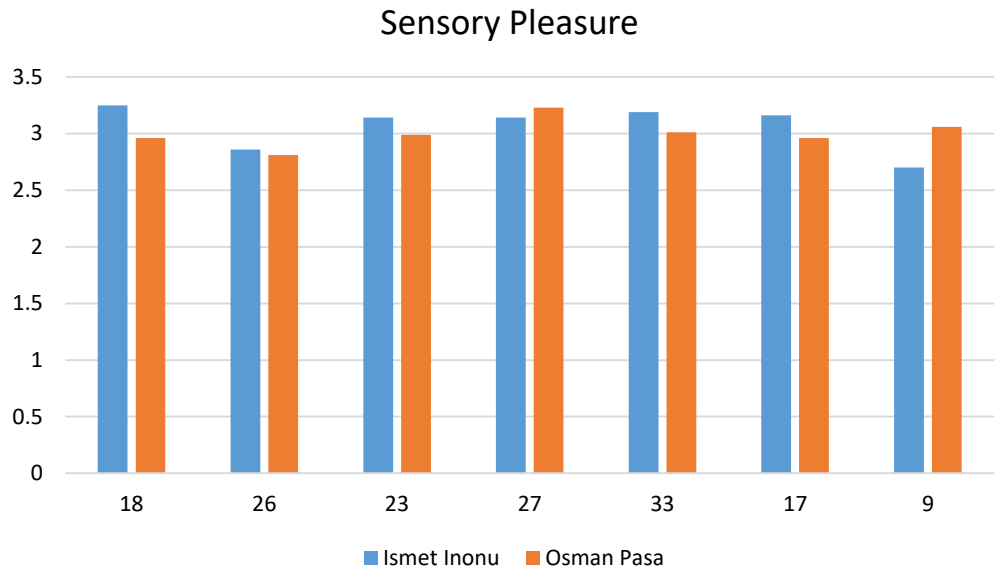


Figure 4.28: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of sensory pleasure

Comparison in Terms of Connectivity

Connectivity, also termed as feasibility in some literature is a construct of walkability related to road and path status. Connectivity is measured by six items including "Intersections", "Alternative paths", "Adequate number of orientation signs for pedestrians", "Consideration of universal design principles in the connections of traffic roads with sidewalks and pedestrian crossings", "Uninterrupted linkage of pedestrian paths" and "Connectivity status". As shown in Figure 4.29, the first item is higher in Dreboyu Street which can be explained by multiple intersections by neighboring avenues as well as the short length of the segment. Ismet Inonu is a longer section and requires more intersection. On the other hand, sidewalks are more connected in Ismet Inonu when compared with Osman Pasa. In general, perceived connectivity of Ismet Inonu Boulevard by pedestrians is better than that of Osman Pasa Street.

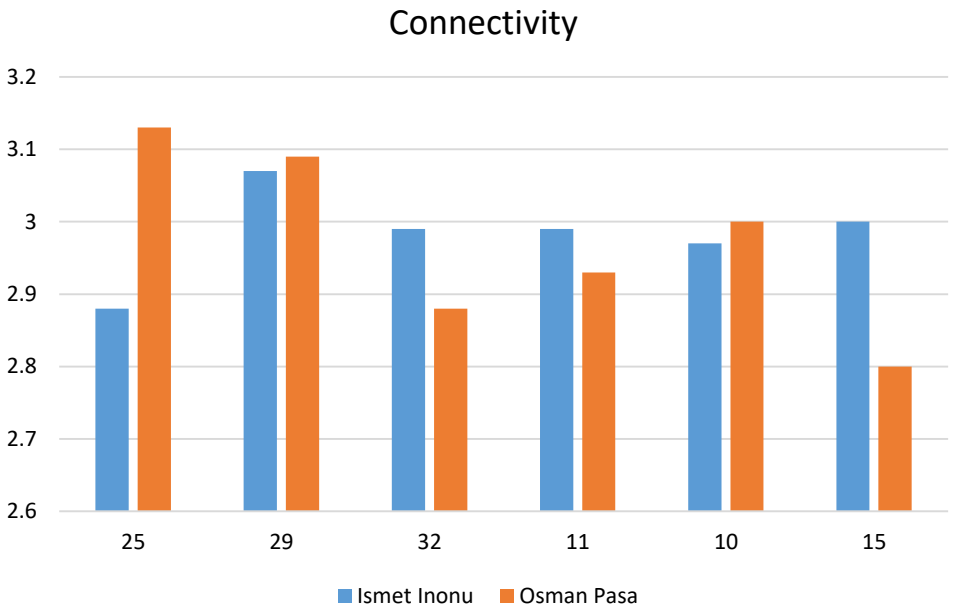


Figure 4.29: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of Connectivity

Comparison in Terms of Usefulness

Usefulness is the last construct of walkability in the model. The four items used for measuring usefulness are "Can do most of the shopping in the area", "Quality restaurants and cafes in the area", "Many shops within easy walking distance", and "Availability of social activity areas". As sown in Figure 4.30, usefulness of Ismet Inonu Boulevard is remarkably higher than Osman Pasa Street.

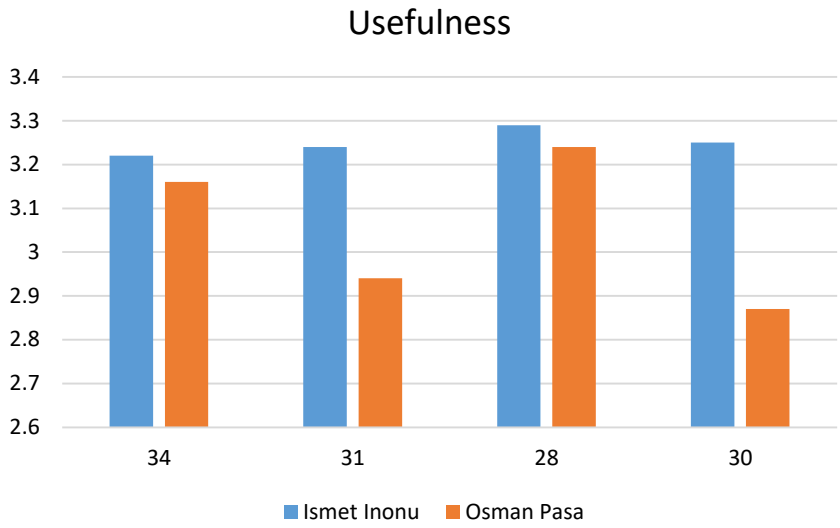


Figure 4.30: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of Usefulness

Comparison in Terms of All Walkability Constructs

In order to have a general perspective of all the items measured and the constructs of walkability in the model, the previously discussed items for each construct are averaged to represent an overall measure. In Figure 4.31, the constructs of the model are compared. It can be argued that Osman Pasa Street is more accessible and safer for pedestrians when compared Ismet Inonu Boulevard. On the other hand, Ismet Inonu Boulevard provides higher comfort levels, sensory pleasure, connectivity and usefulness.

It is worth mentioning that in the questionnaire, there is also an item asking about the walkability score of the street (item 16). This item portrays the general thoughts of respondents about walkability and can be used to roughly score each segment's walkability. The item asks the respondent: "How do you evaluate the degree of walkability of the street"? Mean value of this item is 3.17and 2.63 for Ismet Inonu and Osman Pasa respectively suggesting that Ismet Inonu Boulevard is more pedestrian-friendly and walkable than Osman Pasa Street.

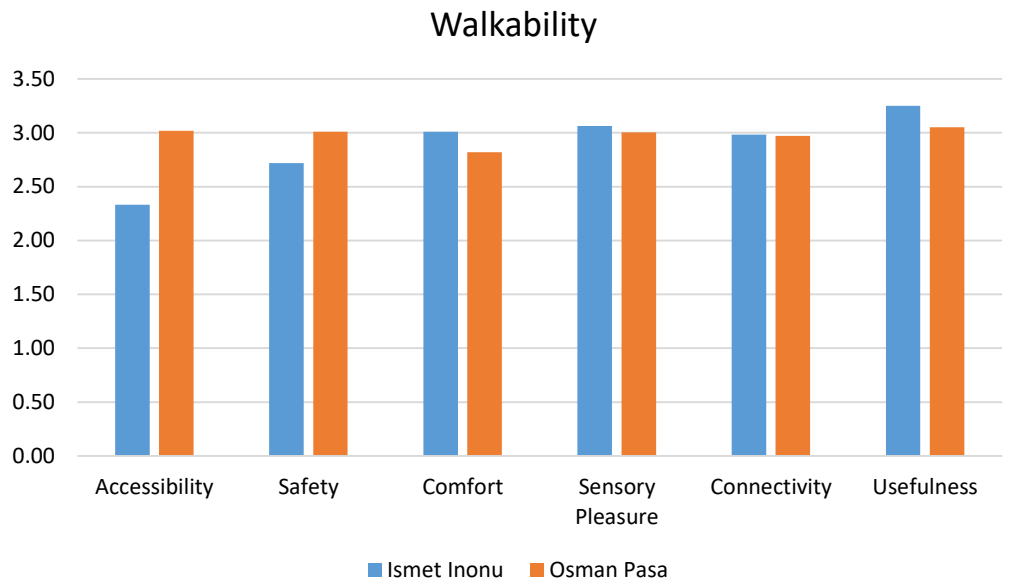


Figure 4.31: Comparison of Ismet Inonu Boulevard and Osman Pasa Street in terms of walkability

4.4 Summary of Comparisons

In order to examine the walkability of the case studies and making comparison, a mixed-method approach is pursued. The qualitative phase is conducted by on-site observation (assessment by PEDS Audit Tool and photography). The result of this part suggests that Ismet Inonu Boulevard features higher walkability than Osman Pasa Street. The strengths and weaknesses of each case study are spotted to compare the segments. This information would be utilized to recommend intervention and modifications for each segment for improving walkability.

The quantitative phase of the study is conducted by a survey questionnaire, evaluating a model and comparing each construct of the model. Totally, 100 subjects are survey in each case study and the result is evaluated by an expert for reliability of the items and validity of the proposed model. After confirming the items and the model, items related to each scale are compared. Finally, each construct is measured by averaging its related items. The result of the comparison revealed how pedestrians who visit the street perceive different scales of walkability. Compatible with the result of observation, Ismet Inonu Boulevard is

characterized by higher walkability index than Osman Pasa although Osman Pasa is better in terms of accessibility and safety for pedestrians.

CHAPTER 5
DISCUSSION AND CONCLUSION

5.1 Discussion

In this thesis, walkability of the streets as public open spaces is studied. The aim of the study was to conduct a comparative research on the scales of walkability and measure them both in terms of observations and survey. In the first phase of the study, related literature is reviewed to describe the related concepts. The needs for walkability are explained and then related work in examining walkability of popular streets is presented. Literature review phase guided the thesis to a comprehensive methodology for examining walkability of two popular streets in North Cyprus: Ismet Inonu Boulevard in Famagusta and Osman Pasa Street in Lefkosa. These two segments are known as the busiest streets in the districts they are located and at the same time these segments are the subject of many concerns by local people, municipality and regional authorities. The main reason of the concerns is the weaknesses in the design, maintenance and management of urban areas.

The key motivation for this study was to evaluate different constructs related to walkability in order to answer the question: “why these segments are so popular regardless of all the issues related to pedestrians, walking, traffic, etc. In order to fulfill that aim, the segments are studied firstly by direct observation and subjective assessment as an expert. Then, a survey is conducted to evaluate how pedestrians perceive walkability of these streets. In order to be able to compare the streets quantitatively according to the survey result, a model is proposed based on previous studies. The questionnaire is also designed by referring to the literature. Although the items in the survey questionnaire and the scales in the model are chosen based on recent studies, still there is a need to test reliability of the items and validity of the model before using the result for comparison. This analysis is performed by a statistician expert for both segments separately. After reliability and validity conformation, the comparisons are made revealing imperative facts about the case studies and walkability. In fact, Ismet Inonu Boulevard in Famagusta is perceived by the

pedestrians as a more walkable street than Osman Pasa Street in Lefkosa. The strengths and weaknesses studies in the observation phase are compatible with the results of the survey. These sources of comparative information are used to recommend potential interventions for converting the case studies into more pedestrian-friendly streets.

5.2 Conclusion and Recommendations

Comparative study of the streets in terms of walkability helped in understanding the weaknesses and strengths of the designs and led to guidelines for intervention and modification in order to improve the walkability and encourage people to walk more. One of the main weaknesses of both streets is the sidewalk and road maintenance. The bricks and asphalt need regular repair. In Ismet Inonu Boulevard, the municipality project for renovating the boulevard improved the walkability of the street in recent year although the work is still incomplete. In addition, cafes, restaurants, shops, entertainment spaces and recreation spaces in Ismet Inonu feature sensory pleasure. The reason is the economy of the city depends on this boulevard to some extent and thus shop keepers and local businesses contribute to the visual pleasurability of the street. Cleanness is kind of an issue for this segment and both municipality and local businesses should cooperate for creating a cleaner walking environment. Traffic signs, speed limiting devices, and crosswalks are inefficient and should be improved. In addition, better control for prohibiting obstruction by cars parked in the sidewalk is required. The number of parking spaces is not enough specifically during busy hours and there is a need for more off-street parking lot spaces.

In Osman Pasa Street, condition of sidewalk and roads is not satisfactory and should be better maintained and is in need for repair in some sections. Obstruction on sidewalk by illegal extension of shops and cafes in the sidewalk is another issue. Local authorities and municipality should be stricter about this problem. There are multiple intersection with neighboring avenues and streets and the connectivity of sidewalk is not acceptable at these intersections. Sensory pleasure features can be improved by planting and adding urban design elements and furniture to the street. Parking lot space is a serious issue and more spaces should be provided for off-street car park.

In summary, the result of this study shows that although very busy, Ismet Inonu and Osman Pasa are not very pedestrian-friendly. Observation revealed so many drawbacks and survey proved that people are not satisfied. One reason for the popularity of these streets regardless of the pitfalls in walkability is the lack of alternative options. Hence, expectations of the respondents in the survey are in general below the ones reported in the studies conducted in developed countries. This means that by slightly improving some of the features of the streets simple interventions, more people would walk in these two streets. This not only contributes to the public health of the community by increasing level of physical activity, but also helps the local economy and business in the region. Improved walkability attracts more visitors, creates a live and cheerful environment and enhances social activities.

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APPENDICES

Appendix 1

PEDS Audit Tool

Name: _____ **Date:** _____ **Study Area:** _____ PEDS

Segment Number: _____ **Time:** _____ **Weather:** _____

0. Segment type
- Low volume road [ ] 1
- High volume road [ ] 2
- Bike or Ped path - skip section C [ ] 3

A. Environment

1. Uses in Segment *(all that apply)*
- Housing - Single Family Detached [ ] 1
- Housing - Multi-Family [ ] 2
- Housing - Mobile Homes [ ] 3
- Office/Institutional [ ] 4
- Restaurant/Café/Commercial [ ] 5
- Industrial [ ] 6
- Vacant/Undeveloped [ ] 7
- Recreation [ ] 8

2. Slope
- Flat [ ] 1
- Slight hill [ ] 2
- Steep hill [ ] 3

3. Segment Intersections
- Segment has 3 way intersection [ ] 1
- Segment has 4 way intersection [ ] 2
- Segment has other intersection [ ] 3
- Segment deadends but path continues [ ] 4
- Segment deadends [ ] 5
- Segment has no intersections [ ] 6

B. Pedestrian Facility *(skip if none present)*

4. Type(s) of pedestrian facility *(all that apply)*
- Footpath (worn dirt path) [ ] 1
- Paved Trail [ ] 2
- Sidewalk [ ] 3
- Pedestrian Street (closed to cars) [ ] 4

The rest of the questions in section B refer to the best pedestrian facility selected above.

5. Path material *(all that apply)*
- Asphalt [ ] 1
- Concrete [ ] 2
- Paving Bricks or Flat Stone [ ] 3
- Gravel [ ] 4
- Dirt or Sand [ ] 5

6. Path condition/maintenance
- Poor (many bumps/cracks/holes) [ ] 1
- Fair (some bumps/cracks/holes) [ ] 2
- Good (very few bumps/cracks/holes) [ ] 3
- Under Repair [ ] 4

7. Path obstructions *(all that apply)*
- Poles or Signs [ ] 1
- Parked Cars [ ] 2
- Greenery [ ] 3
- Garbage Cans [ ] 4
- Other [ ] 5
- None [ ] 6

8. Buffers between road and path *(all that apply)*
- Fence [ ] 1
- Tress [ ] 2
- Hedges [ ] 3
- Landscape [ ] 4
- Grass [ ] 5
- None [ ] 6

9. Path Distance from Curb
- At edge [ ] 1
- < 5 feet [ ] 2
- > 5 feel [ ] 3

10. Sidewalk Width
- < 4 feet [ ] 1
- Between 4 and 8 feet [ ] 2
- > 8 feet [ ] 3

If no sidewalk,skip now to section C.

11. Curb cuts
- None [ ] 1
- 1 to 4 [ ] 2
- > 4 [ ] 3

12. Sidewalk completeness/continuity
- Sidewalk is complete [ ] 1
- Sidewalk is incomplete [ ] 2

13. Sidewalk connectivity to other sidewalks/crosswalks
- number of connections _____ 1

C. Road Attributes *(skip if path only)*

14. Condition of road
- Poor (many bumps/cracks/holes) [ ] 1
- Fair (some bumps/cracks/holes) [ ] 2
- Good (very few bumps/cracks/holes) [ ] 3
- Under Repair [ ] 4

15. Number of lanes
- Minimum # of lanes to cross _____ 1
- Maximum # of lanes to cross _____ 1

16. Posted speed limit
- None posted [ ] 1
- (mph): _____ 1

17. On-Street parking *(if pavement is unmarked, check only if cars parked)*
- Parallel or Diagonal [ ] 1
- None [ ] 2

18. Off-street parking lot spaces

0-5	6-25	26+
1	2	3

19. Must you walk through a parking lot to get to most buildings?
- Yes [ ] 1
- No [ ] 2

20. Presence of med-hi volume driveways
- < 2 [ ] 1
- 2 to 4 [ ] 2
- > 4 [ ] 3

21. Traffic control devices *(all that apply)*
- Traffic light [ ] 1
- Stop sign [ ] 2
- Traffic circle [ ] 3
- Speed bumps [ ] 4
- Chicanes or chokers [ ] 5
- None [ ] 6

22. Crosswalks
- None [ ] 1
- 1 to 2 [ ] 2
- 3 to 4 [ ] 3
- > 4 [ ] 4

23. Crossing Aids *(all that apply)*
- Yield to Ped Paddles [ ] 1
- Pedestrian Signal [ ] 2
- Median/Traffic Island [ ] 3
- Curb Extension [ ] 4
- Overpass/Underpass [ ] 5
- Pedestrian Crossing Warning Sign [ ] 6
- Flashing Warning Light [ ] 7
- Share the Road Warnign Sign [ ] 8
- None [ ] 9

24. Bicycle facilities *(all that apply)*
- Bicycle route signs [ ] 1
- Striped bicycle lane designation [ ] 2
- Visible bicycle parking facilities [ ] 3
- Bicycle crossing warning [ ] 4
- No bicycle facilities [ ] 5

D. Walking/Cycling Environment

25. Roadway/path lighting
- Road-oriented lighting [ ] 1
- Pedestrian-scale lighting [ ] 2
- Other lighting [ ] 3
- No lighting [ ] 4

26. Amenities *(all that apply)*
- Public garbage cans [ ] 1
- Benches [ ] 2
- Water fountain [ ] 3
- Street vendors/vending machines [ ] 4
- No amenities [ ] 5

27. Are there wayfinding aids?
- No [ ] 1
- Yes [ ] 2

28. Number of trees shading walking area
- None or Very Few [ ] 1
- Some [ ] 2
- Many/Dense [ ] 3

29. Degree of enclosure
- Little or no enclosure [ ] 1
- Some enclosure [ ] 2
- Highly enclosed [ ] 3

30. Powerlines along segment?
- Low Voltage/Distribution Line [ ] 1
- High Voltage/Transmission Line [ ] 2
- None [ ] 3

31. Overall cleanliness and building maintenance
- Poor (much litter/graffiti/broken facilities) [ ] 1
- Fair (some litter/graffiti/broken facilities) [ ] 2
- Good (no litter/graffiti/broken facilities) [ ] 3

32. Articulation in building designs
- Little or no articulation [ ] 1
- Some articulation [ ] 2
- Highly articulated [ ] 3

33. Building setbacks from sidewalk
- At edge of sidewalk [ ] 1
- Within 20 feet of sidewalk [ ] 2
- More than 20 feet from sidewalk [ ] 3

34. Building height
- Short [ ] 1
- Medium [ ] 2
- Tall [ ] 3

35. Bus stops
- Bus stop with shelter [ ] 1
- Bus stop with bench [ ] 2
- Bus stop with signage only [ ] 3
- No bus stop [ ] 4

Subjective Assessment: Segment…

Enter 1,2,3, or 4 for 1=Strongly Agree 2= Agree, 3=Disagree, 4=Strongly Disagree
- ……is attractive for walking. _____ 1
- ……is attractive for cycling. _____ 1
- ……feels safe for walking. _____ 1
- ……feels safe for cycling. _____ 1

Kelly J. Clifton, PhD - National Center for Smart Growth - University of Maryland, College Park

Appendix 2

Survey Questionnaire

Walkability Survey Questionnaire for Osman Pasa/Salamis Street				
Participant's Information				
Gender	male□	female□		
Age (year)	below 18□	18-35□	35-50□	over 50□
Occupation	student□	shop keeper□	unemployed□	other□
Frequency of visits per week	less than 1□	1-2□	3-5□	more than 5□

Please complete the following questionnaire by placing a CROSS (X) in the appropriate box.

Question	**very poor**	**poor**	**average**	**good**	**very good**
1. What is the level of safety you feel when you walk in the street?	☐	☐	☐	☐	☐
2. How easy is crossing the street?	☐	☐	☐	☐	☐
3. How convenient do you have access to public transport?	☐	☐	☐	☐	☐
4. How available are the car park zones?	☐	☐	☐	☐	☐
5. How do you evaluate accessibility of the street by ambulance, fire truck and police car?	☐	☐	☐	☐	☐
6. How proper the sidewalks are arranged for people with disabilities (ramps, lift, tactile paving)	☐	☐	☐	☐	☐
7. How easy is accessing to the main street from the side streets?	☐	☐	☐	☐	☐
8. What is the level of comfort do you feel when you walk in the street?	☐	☐	☐	☐	☐
9. How do you evaluate cleanliness of the street and sidewalks?	☐	☐	☐	☐	☐
10. How connected and uninterrupted are the pedestrian paths?	☐	☐	☐	☐	☐
11. How universal design principles are considered in the connections of traffic roads with sidewalks and pedestrian crossings	☐	☐	☐	☐	☐
12. How enough is the space between sidewalks and traffic roads?	☐	☐	☐	☐	☐
13. How adequate is the lighting for night use on the pedestrian paths?	☐	☐	☐	☐	☐
14. How do you evaluate accessibility to security facilities in emergency?	☐	☐	☐	☐	☐
15. What is the connectivity status of the street?	☐	☐	☐	☐	☐
16. How do you evaluate the degree of walkability of the street?	☐	☐	☐	☐	☐
17. How free are the facades from signs of vandalism (graffiti, etc.)	☐	☐	☐	☐	☐
18. How pleasant is the shops' window decoration?	☐	☐	☐	☐	☐

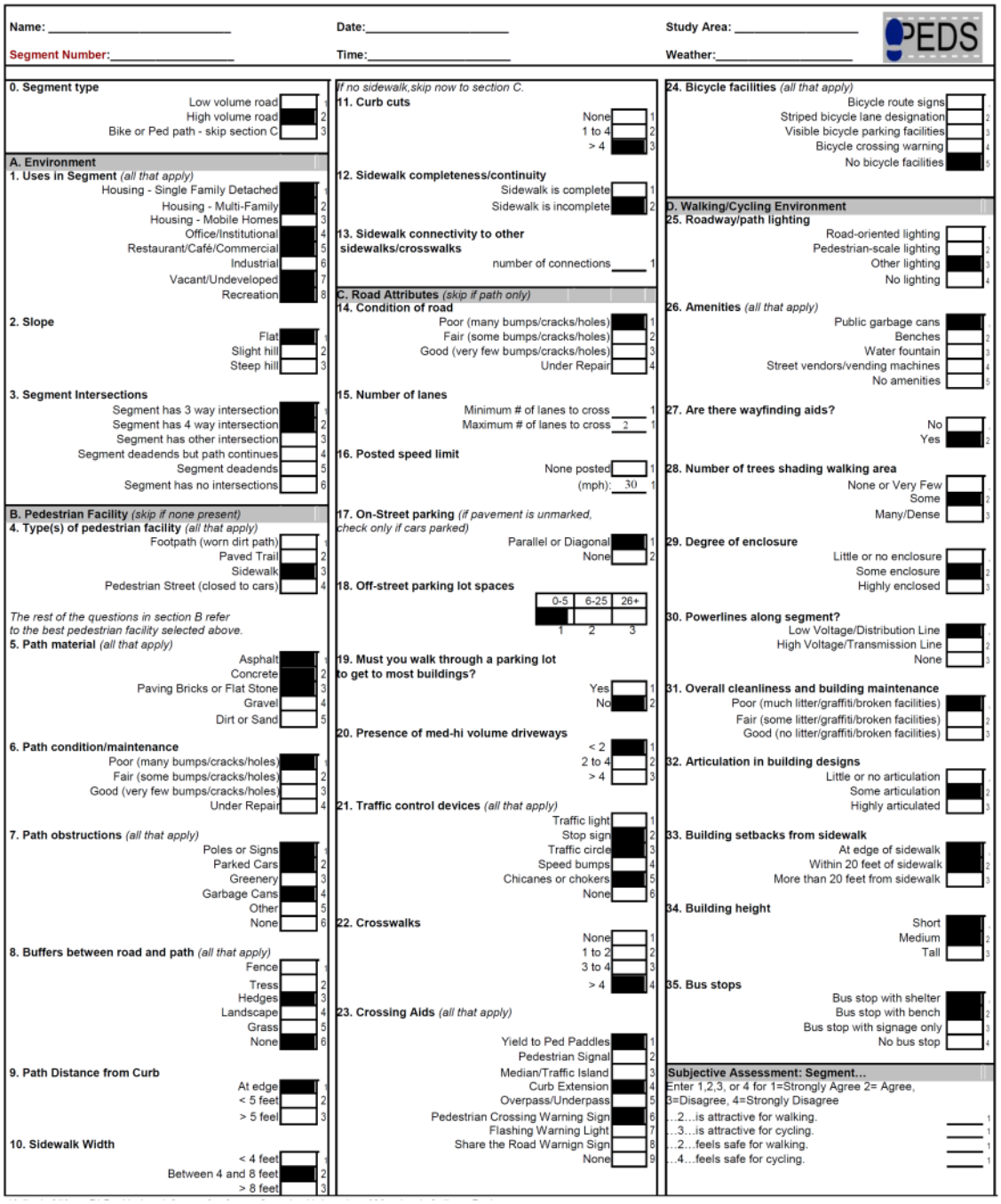
Question	very few	few	some	sufficient	numerous
19. How many traffic signs are there in the street?	☐	☐	☐	☐	☐
20. How many of services (WC, baby care, etc.) are there in the street?	☐	☐	☐	☐	☐
21. How many street furniture is there in the street ?	☐	☐	☐	☐	☐
22. How many traffic slowing devices is there in local area?	☐	☐	☐	☐	☐
23. How many bins are there in sidewalks?	☐	☐	☐	☐	☐
24. How many shading elements providing comfort conditions are there?	☐	☐	☐	☐	☐
25. How many intersections are there for pedestrian crossing?	☐	☐	☐	☐	☐
26. How many pleasant design features you see in the area?	☐	☐	☐	☐	☐
27. How many beautiful views you see in the surroundings?	☐	☐	☐	☐	☐
28. How many shops are in the street within easy walking distance?	☐	☐	☐	☐	☐
29. How many alternative paths are available to access the street?	☐	☐	☐	☐	☐
30. How many social activity areas are in local area?	☐	☐	☐	☐	☐
31. How many quality restaurants and cafes are there in the area?	☐	☐	☐	☐	☐
32. How many orientation signs for pedestrians are there on the street?	☐	☐	☐	☐	☐
33. How many of roadside trees/bushes/gardens are there?	☐	☐	☐	☐	☐

Question	strongly disagree	disagree	neutral	agree	strongly agree
34. You can do most of your shopping in this street.	☐	☐	☐	☐	☐

Question	quite insufficient	insufficient	tolerable	sufficient	quite sufficient
35. How adequate is the width for sidewalks?	☐	☐	☐	☐	☐

Appendix 3

PEDS Audit for Ismet Inonu Boulevard



Name: _____ Date:_____ Study Area: _____

Segment Number:_____ Time:_____ Weather:_____

PEDS

0. Segment type
Low volume road 1
High volume road 2
Bike or Ped path - skip section C 3

A. Environment

1. Uses in Segment *(all that apply)*
Housing - Single Family Detached 1
Housing - Multi-Family 2
Housing - Mobile Homes 3
Office/Institutional 4
Restaurant/Café/Commercial 5
Industrial 6
Vacant/Undeveloped 7
Recreation 8

2. Slope
Flat 1
Slight hill 2
Steep hill 3

3. Segment Intersections
Segment has 3 way intersection 1
Segment has 4 way intersection 2
Segment has other intersection 3
Segment deadends but path continues 4
Segment deadends 5
Segment has no intersections 6

B. Pedestrian Facility *(skip if none present)*

4. Type(s) of pedestrian facility *(all that apply)*
Footpath (worn dirt path) 1
Paved Trail 2
Sidewalk 3
Pedestrian Street (closed to cars) 4

The rest of the questions in section B refer to the best pedestrian facility selected above.

5. Path material *(all that apply)*
Asphalt 1
Concrete 2
Paving Bricks or Flat Stone 3
Gravel 4
Dirt or Sand 5

6. Path condition/maintenance
Poor (many bumps/cracks/holes) 1
Fair (some bumps/cracks/holes) 2
Good (very few bumps/cracks/holes) 3
Under Repair 4

7. Path obstructions *(all that apply)*
Poles or Signs 1
Parked Cars 2
Greenery 3
Garbage Cans 4
Other 5
None 6

8. Buffers between road and path *(all that apply)*
Fence 1
Tress 2
Hedges 3
Landscape 4
Grass 5
None 6

9. Path Distance from Curb
At edge 1
< 5 feet 2
> 5 feel 3

10. Sidewalk Width
< 4 feet 1
Between 4 and 8 feet 2
> 8 feet 3

If no sidewalk,skip now to section C.

11. Curb cuts
None 1
1 to 4 2
> 4 3

12. Sidewalk completeness/continuity
Sidewalk is complete 1
Sidewalk is incomplete 2

13. Sidewalk connectivity to other sidewalks/crosswalks
number of connections ____ 1

C. Road Attributes *(skip if path only)*

14. Condition of road
Poor (many bumps/cracks/holes) 1
Fair (some bumps/cracks/holes) 2
Good (very few bumps/cracks/holes) 3
Under Repair 4

15. Number of lanes
Minimum # of lanes to cross ____ 1
Maximum # of lanes to cross 2 1

16. Posted speed limit
None posted 1
(mph): 30 1

17. On-Street parking *(if pavement is unmarked, check only if cars parked)*
Parallel or Diagonal 1
None 2

18. Off-street parking lot spaces

0-5	6-25	26+
1	2	3

19. Must you walk through a parking lot to get to most buildings?
Yes 1
No 2

20. Presence of med-hi volume driveways
< 2 1
2 to 4 2
> 4 3

21. Traffic control devices *(all that apply)*
Traffic light 1
Stop sign 2
Traffic circle 3
Speed bumps 4
Chicanes or chokers 5
None 6

22. Crosswalks
None 1
1 to 2 2
3 to 4 3
> 4 4

23. Crossing Aids *(all that apply)*
Yield to Ped Paddles 1
Pedestrian Signal 2
Median/Traffic Island 3
Curb Extension 4
Overpass/Underpass 5
Pedestrian Crossing Warning Sign 6
Flashing Warning Light 7
Share the Road Warnign Sign 8
None 9

24. Bicycle facilities *(all that apply)*
Bicycle route signs 1
Striped bicycle lane designation 2
Visible bicycle parking facilities 3
Bicycle crossing warning 4
No bicycle facilities 5

D. Walking/Cycling Environment

25. Roadway/path lighting
Road-oriented lighting 1
Pedestrian-scale lighting 2
Other lighting 3
No lighting 4

26. Amenities *(all that apply)*
Public garbage cans 1
Benches 2
Water fountain 3
Street vendors/vending machines 4
No amenities 5

27. Are there wayfinding aids?
No 1
Yes 2

28. Number of trees shading walking area
None or Very Few 1
Some 2
Many/Dense 3

29. Degree of enclosure
Little or no enclosure 1
Some enclosure 2
Highly enclosed 3

30. Powerlines along segment?
Low Voltage/Distribution Line 1
High Voltage/Transmission Line 2
None 3

31. Overall cleanliness and building maintenance
Poor (much litter/graffiti/broken facilities) 1
Fair (some litter/graffiti/broken facilities) 2
Good (no litter/graffiti/broken facilities) 3

32. Articulation in building designs
Little or no articulation 1
Some articulation 2
Highly articulated 3

33. Building setbacks from sidewalk
At edge of sidewalk 1
Within 20 feet of sidewalk 2
More than 20 feet from sidewalk 3

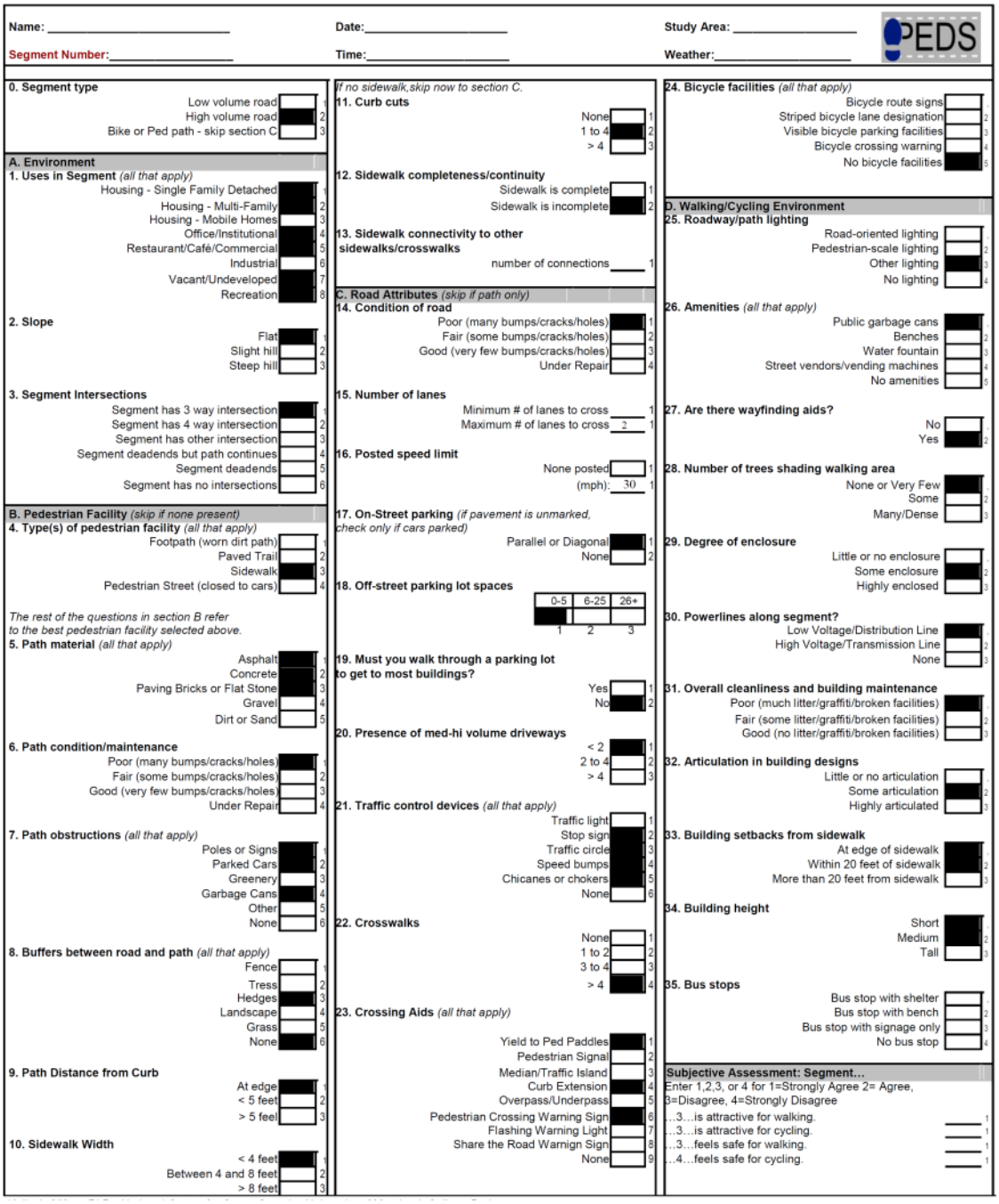
34. Building height
Short 1
Medium 2
Tall 3

35. Bus stops
Bus stop with shelter 1
Bus stop with bench 2
Bus stop with signage only 3
No bus stop 4

Subjective Assessment: Segment...
Enter 1,2,3, or 4 for 1=Strongly Agree 2= Agree, 3=Disagree, 4=Strongly Disagree
...2...is attractive for walking. ____ 1
...3...is attractive for cycling. ____ 1
...2...feels safe for walking. ____ 1
...4...feels safe for cycling. ____ 1

Appendix 4

PEDS Audit for Osman Pasa Street



Name: _____ Date:_____ Study Area: _____

Segment Number:_____ Time:_____ Weather:_____

PEDS

0. Segment type
Low volume road 1
High volume road 2
Bike or Ped path - skip section C 3

A. Environment

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Housing - Multi-Family 2
Housing - Mobile Homes 3
Office/Institutional 4
Restaurant/Café/Commercial 5
Industrial 6
Vacant/Undeveloped 7
Recreation 8

2. Slope
Flat 1
Slight hill 2
Steep hill 3

3. Segment Intersections
Segment has 3 way intersection 1
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Segment deadends 5
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B. Pedestrian Facility *(skip if none present)*

4. Type(s) of pedestrian facility *(all that apply)*
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Sidewalk 3
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The rest of the questions in section B refer to the best pedestrian facility selected above.

5. Path material *(all that apply)*
Asphalt 1
Concrete 2
Paving Bricks or Flat Stone 3
Gravel 4
Dirt or Sand 5

6. Path condition/maintenance
Poor (many bumps/cracks/holes) 1
Fair (some bumps/cracks/holes) 2
Good (very few bumps/cracks/holes) 3
Under Repair 4

7. Path obstructions *(all that apply)*
Poles or Signs 1
Parked Cars 2
Greenery 3
Garbage Cans 4
Other 5
None 6

8. Buffers between road and path *(all that apply)*
Fence 1
Tress 2
Hedges 3
Landscape 4
Grass 5
None 6

9. Path Distance from Curb
At edge 1
< 5 feet 2
> 5 feet 3

10. Sidewalk Width
< 4 feet 1
Between 4 and 8 feet 2
> 8 feet 3

If no sidewalk,skip now to section C.

11. Curb cuts
None 1
1 to 4 2
> 4 3

12. Sidewalk completeness/continuity
Sidewalk is complete 1
Sidewalk is incomplete 2

13. Sidewalk connectivity to other sidewalks/crosswalks
number of connections ____ 1

C. Road Attributes *(skip if path only)*

14. Condition of road
Poor (many bumps/cracks/holes) 1
Fair (some bumps/cracks/holes) 2
Good (very few bumps/cracks/holes) 3
Under Repair 4

15. Number of lanes
Minimum # of lanes to cross ____ 1
Maximum # of lanes to cross 2 1

16. Posted speed limit
None posted 1
(mph): 30 1

17. On-Street parking *(if pavement is unmarked, check only if cars parked)*
Parallel or Diagonal 1
None 2

18. Off-street parking lot spaces

0-5	6-25	26+
1	2	3

19. Must you walk through a parking lot to get to most buildings?
Yes 1
No 2

20. Presence of med-hi volume driveways
< 2 1
2 to 4 2
> 4 3

21. Traffic control devices *(all that apply)*
Traffic light 1
Stop sign 2
Traffic circle 3
Speed bumps 4
Chicanes or chokers 5
None 6

22. Crosswalks
None 1
1 to 2 2
3 to 4 3
> 4 4

23. Crossing Aids *(all that apply)*
Yield to Ped Paddles 1
Pedestrian Signal 2
Median/Traffic Island 3
Curb Extension 4
Overpass/Underpass 5
Pedestrian Crossing Warning Sign 6
Flashing Warning Light 7
Share the Road Warnign Sign 8
None 9

24. Bicycle facilities *(all that apply)*
Bicycle route signs 1
Striped bicycle lane designation 2
Visible bicycle parking facilities 3
Bicycle crossing warning 4
No bicycle facilities 5

D. Walking/Cycling Environment

25. Roadway/path lighting
Road-oriented lighting 1
Pedestrian-scale lighting 2
Other lighting 3
No lighting 4

26. Amenities *(all that apply)*
Public garbage cans 1
Benches 2
Water fountain 3
Street vendors/vending machines 4
No amenities 5

27. Are there wayfinding aids?
No 1
Yes 2

28. Number of trees shading walking area
None or Very Few 1
Some 2
Many/Dense 3

29. Degree of enclosure
Little or no enclosure 1
Some enclosure 2
Highly enclosed 3

30. Powerlines along segment?
Low Voltage/Distribution Line 1
High Voltage/Transmission Line 2
None 3

31. Overall cleanliness and building maintenance
Poor (much litter/graffiti/broken facilities) 1
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At edge of sidewalk 1
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More than 20 feet from sidewalk 3

34. Building height
Short 1
Medium 2
Tall 3

35. Bus stops
Bus stop with shelter 1
Bus stop with bench 2
Bus stop with signage only 3
No bus stop 4

Subjective Assessment: Segment…
Enter 1,2,3, or 4 for 1=Strongly Agree 2= Agree, 3=Disagree, 4=Strongly Disagree
…3…is attractive for walking. ____ 1
…3…is attractive for cycling. ____ 1
…3…feels safe for walking. ____ 1
…4…feels safe for cycling. ____ 1

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

03.10.2019

Dear Mohamad Darwich

Your application titled **"Walkability of Shopping Streets: Comparison of Salamis and Dereboyu Streets in North Cyprus"** with the application number YDÜ/FB/2019/69 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

'Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this documen