# ANALYZING SAFETY TOWARD A WALKABLE CAMPUS: A CASE-STUDY OF MIDDLE EAST TECHNICAL UNIVERSITY (METU)

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# ABSTRACT

## ANALYZING SAFETY TOWARD A WALKABLE CAMPUS: A CASE-STUDY OF MIDDLE EAST TECHNICAL UNIVERSITY (METU)

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Walkable places are one of the most common features of sustainable, vibrant and healthy cities in the world. Building walkable cities can be a strategy to mitigate some of the problems related to sustainability. As a part of a city, university campus sites provide learning, working and sometimes living environments where mobility and pedestrian walkability should be considered as important design factors to achieve sustainable urban environments. Walkable environments should be the spaces which provide campus users with easy access to the networks of connected facilities, and a sense of safety. This research studies the walkability capacity of the Middle East Technical University (METU) campus, a large, well-established Turkish state university in Ankara, with about 28,000 students, 2,318 academic staff and 7,348 temporary residents. It focuses on the safety and security issues regarding the physical features, sense of safety, and traffic safety of the university campus. The research employed a single case study method, by using a questionnaire survey of 240 users in six different zones, direct observation, archival studies and spatial analyses. The findings of the analyses on METU campus show that the campus users in general perceive the METU campus as walkable, although they see safety and security as the prominent problem against its walkability capacity.

In addition to this, the lack of connectivity in some parts of the campus, drivers' careless use of cars, the inadequate quality and width of pedestrian paths, insufficient lighting, and flocks of dog are the major obstacles affecting the safety and security, thereby the quality of the walkability on the university campus. The sustainability principles of urban space, i.e. inclusiveness, equality and social justice, are also endangered by the lack of sufficient concern for people with different abilities. This research suggests design and management recommendations to improve the safety and security, and thus enhances the walkability capacity of the campus.

Keywords: Walkability, safety, pedestrian-friendly, campus planning, sustainable, campus design

# ÖZ

## YÜRÜNEBİLİR BİR KAMPÜSE YÖNELIK GÜVENLİK ANALİZİ: ORTA DOĞU TEKNİK ÜNİVERSİTESİ (ODTÜ) ÖRNEĞİ

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Kentsel mekanlarda yürünülebilirlik, sağlıklı, yaşanabilir ve sürdürülebilir şehirlerin ve şehircilik anlayışının yaygın özelliklerinden biridir. Yürünebilir şehirler inşa etmek, sürdürülebilirlik ilkeleri doğrultusunda kentlerin problemlerine çözüm bulmak gerekir. Şehrin bir parçası olarak üniversite kampüsleri, öğrenme, çalışma ve bazen de yaşam ortamları sağlarlar. Sürdürülebilir kentsel mekanlar geliştirmek için hareketlilik ve yaya yürünebilirlik düzeyinin önemli tasarım faktörleri olarak göz önüne alınması gerekir. Yürünebilirlik düzeyi yüksek kentsel çevreler, kampüs kullanıcılarının kendilerini güvende hissederek, kampüsün farklı kullanım alanlarına kolay erişim sağlayan alanlar olmalıdır. Bu araştırma, yaklaşık 28.000 öğrencisi, 2318 akademik personeli ve 7.348 geçici yaşayan nüfusuyla Ankara'da köklü bir Türk devlet üniversitesi olan Orta Doğu Teknik Üniversitesi'nin (ODTÜ) kampüsünün yürünebilirlik kapasitesini incelemektedir. Bu araştırma, fiziksel özellikler, güvenlik duygusu ve trafik güvenliğini kapsayan konulara odaklanarak kampüsün yürünebilirlik kapasitesini incelemektedir. Araştırmada, altı farklı bölgeden toplanan 240 kampüs kullanıcısıyla anket yapılmış; doğrudan gözlem, arşiv çalışmaları ve mekansal analizler kullanılarak, tek örneğe dayalı vaka araştırma yöntemi uygulanmıştır. ODTÜ kampüsündeki analiz bulguları, kullanıcıların ODTÜ kampüsünü genel olarak "yürünebilir" olarak algıladığını göstermektedir. Ancak,

aynı kullanıcılar, güvenlik problemini yürünebilirlik kapasitesini olumsuz etkileyen bir sorun olarak görmektedirler. Buna ek olarak, kampüsün bazı bölgelerindeki ulaşım ve bağlantı eksikliği, sürücülerin araçlarını dikkatsiz kullanmaları, yaya yollarının yetersizliği ve darlığı, aydınlatmanın azlığı ve köpek sürüleri, kullanıcılar açısından kampüs güvenliğini olumsuz etkileyen diğer önemli problemlerdir. Dezavantajlı grupların kampüs tasarımında yeterince dikkate alınmaması nedeniyle, kapsayıcılık, eşitlik ve sosyal adalet gibi kentsel mekana ilişkin sürdürülebilirlik ilkeleri üniversite kampüsünde karşılanamamaktadır. Bu araştırma, kampüsün güvenliğini ve dolayısıyla yürünebilirliğinin kapasitesini artırmak için kampüs tasarımı ve yönetimine yönelik öneriler sunmaktadır.

Anahtar Kelimeler: Yürünebilirlik, güvenlik, yaya dostu, kampüs planlaması, sürdürülebilir kampüs tasarımı

*to my beloved family*

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# CHAPTER 1

# INTRODUCTION

The purpose of this chapter is to introduce the problem and to present its significance. A brief overview of the methodological structure that was used in this study was also presented.

## 1.1. Definition and statement of the problem

The most sustainable, dynamic and the healthiest cities in the world have some similarities, but above all, these cities are walkable places. Walkability is the most practical tool for people to meet their needs and means of accessing and participating in urban life (Akkar Ercan & Belge, 2017). Nowadays, cities are facing many environmental, social and health problems and diseases related to inactivity like obesity and diabetes, polluted air and environment, lack of social activities, and many other complex problems. Some of these problems are directly related to how the cities were built. By building walkable environments, many of these problems can be mitigated, and such places can turn into more vibrant and attractive communities to live.

The purpose of walking can be transportation, recreation or exercise. To encourage pedestrians to walk, the environment should be comfortable and safe; it must also make walking easy and have paths with reasonable distances (Ford, 2013).

The literature review on walkability shows that there are many parameters that make an environment walkable such as land use, density, connectivity, safety, accessibility, build form, attractiveness, diversity and comfort. All of these features are important to decide to walk or not.

Why do walking and walkability matter? Walkability has long been an "ideal," however, recent studies show that walkable communities have a positive effect on the price of housing, decreasing crime, supporting health and helping to have democratic cities (Florida, 2014). Jane Jacobs (1961) defines walkability as essential for urban liveliness; this vitality and pedestrian activity cause surveillance on the streets, which helps to make streets safer. Some comprehensive definitions in the literature define walkability in terms of walking characteristics such as comfort and safety (Abdulla, Abdelmonem, & Selim, 2017).

Universities, as a part of a city, are learning, working and often living environments, in which pedestrian walking is an important design factor to achieve a sustainable urban environment (Keat, Yaacob, & Hashim, 2016). A walkable campus in this sense should have all the features that facilitate and promote a walking lifestyle. Such characteristics as mixed land use, sidewalks, connectivity, safety, and visual attractiveness are among the motivating aspects that encourage students to walk.

This study is conducted to understand the level of campus walkability, in Middle East Technical University (METU) which is chosen as a case study. A well-established and big Turkish public university, METU was founded on November 15, 1956. Its major goals of establishment were to train skilled workforce in different fields of natural and social sciences for Turkey and other Middle Eastern countries. Currently, METU has about 28,000 students, undergraduate and graduate from several countries, 2,318 academic staff and 7,348 temporary residents. The campus area is 4,500 hectares, and the forest area is 3,043 hectares.[1]

[1] History of METU, Retrieved from https://www.metu.edu.tr/

## 1.2. Aims and objectives of the study and the research questions

The aim of this study is to question how far METU campus is safe in terms of walkability in six different zones for all people with diverse abilities and needs. It discusses an in-depth analysis on METU campus walkability capacity as well as the factors which affect its safety. Among the different variables of a walkable environment, this study focuses particularly on one effective factor, which is "safety" and studies the quality of the environment and users' interaction with it in reference to safety factor.

The main question of this research is: How far METU campus is walkable in terms of safety and security measures? The secondary questions to be answered within the scope of this study are as follows:

- What are security and safety measures for a walkable environment?
- What affects users to choose a path for walking in different times of day and night?
- What are the positive and negative parameters related to space (campus) for walking?
- Do users think that METU campus is a pedestrian friendly environment?
- How walkable are different zones on METU campus?
- What problems do different zones on METU campus have in terms of safety?
- What needs to be improved in terms of safety (physical features, sense of safety, and traffic safety)?

Based on these questions, this study focuses on four objectives. The first one is clarifying the notion of walkability and its scope. The second objective is explaining safety as an indicator of walkability. The third is showing how safe METU campus

is for walking. Finally, this research aims to present suggestions to improve campus safety for walking.

### 1.3. Research method

This thesis discusses the elements of walkable environment that make it usable for all users. Walkability in this research is defined as the quality of walking environment that ensures safety for the pedestrians. The study employs a single case study method. It uses four major sources of evidence which are based on qualitative and quantitate data:

- Written documents which contain reports, books, articles, thesis, and research studies.
- Spatial analyses by using different mapping technics
- Direct observation and producing evidence through photos which support the discussion
- A questionnaire survey filled in by users on METU campus (see Appendix A for questionnaire)

The respondents of the questionnaire survey may not necessarily live in the campus, but use it for different purpose like transport, leisure, exercise and alike. By using the questionnaire as a research tool, the study aimed to show the relationship between the actual situation in the study area and respondent's point of view.

The target areas for the walkability and safety audit consist of six main zones in the campus. Zones were identified according to the different characteristics (uses, user profiles), the frequency of pedestrian activities, and they cover the whole walkable area in the university:

- The first path covers the area from the East dormitories to MM building and the faculties.
- The second area is located between A4 entrance gate, shopping center and MM building –faculties.
- The third path is the main pedestrianized route is between MM building and faculties.
- The fourth path is from A1 entrance gate to School of Foreign Languages and to MM building and faculties.
- The fifth path is from the West dormitories and Guesthouse to MM building and faculties.
- The final path is from ODTÜ Kent to main pedestrianized route.

In order to examine the campus's walkability, safety criterion was evaluated in three sub-contexts: physical features, sense of safety, and traffic safety.

### 1.4. Structure of the thesis

The study consists of six chapters. The first chapter identifies the objectives and overall framework of the research, and the existing problems in addition to the research methodology. Chapter 2 provides information about walkability, its definitions, origin and benefits, as well as theories that support this idea and provide a theoretical outline for the dissertation. According to the research background, and brief review of current researches, this chapter identifies a set of measures for assessing safety in terms of walkability.

Chapter 3 aims to report accurately the research methodology. It describes the process of research, how data is gathered, and which method and tools of analysis are applied. Moreover, it provides details of where, when and with whom the survey is done. Additionally, Chapter 4 describes the case study area and the history of METU, and briefly explains the preliminary campus planning. The last part of this chapter has a review of the previous researches done on walkability in METU. Chapter 5 provides an in-depth safety and walkability analysis of METU, and

discusses one of the six zones, highlighting the strong and weak sides of each zone, and states participants' ideas. Chapter 6 demonstrates the results of the research and offers suggestions on how the walkability capacity of METU campus can be enhanced.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1. What is walkability? Definition, origin, and benefits of walkability

Oxford Dictionary defines the walkable environment as "an area or route suitable or safe for walking" or of a destination "close enough to be reached by walking".[2] A walkable environment supports and encourages walking by providing comfortable and safe spaces and by connecting people within varied destinations in a reasonable period of time and effort. "Every journey begins and ends on foot, every other transport mode is dependent on walking; but walking is independent of every other transport ways".[3] Furthermore, walkable streets are urban public spaces with the highest priority for pedestrians and are known by different names in different countries; for example, car-free, auto-free, traffic-free, auto-restricted zones or pedestrian areas, pedestrian malls and walkable streets. Developing a walkable environment can increase the accessibility of citizens, and so it can maximize the transportation system performance. A street can be turned into a pedestrian zone for many reasons, such as providing accessibility, easing traffic problems, and strengthening some of the land uses and also for economic and social concerns (Kashaniju, 2010).

The main characteristic of the walkable spaces is their social aspects. Walkable streets link buildings and activities through space, and increase social experiences (Carmona, Heath, Tiesdell. 2003). The worldwide influential periods like the industrial revolution, the world wars and the economic downturns have changed the

[2] Dictionary, O. E. (2007). Oxford English dictionary online.

[3] Walkability: Creating great cities by putting pedestrians first, MCLAREN, C., 2015., Retrieved from https://www.thediscourse.ca/scarborough/walkability

influence of social issues on urban space and environment and thus have led to a reconsideration of the interconnection between people and the environment. This idea is articulated in the theories and ideas of Donald Appleyard (Livable Streets, 1981), Christopher Alexander (A new theory of urban design, 1987), Jane Jacobs (The death and life of great American cities, 1961), Kevin Lynch (The Image of the City, 1960), and Francis Tibbalds (Making People-Friendly Towns: Improving the Public Environment in Towns and Cities, 1992). These theoreticians considered the significance of social and functional aspects of public space for improving the quality of life and environment. One of the factors they all highlighted is walkability. Accordingly, the importance of human presence and walkability in urban space are often thought to be the most important sign of civilization (Tibaldes, 2001).

Walkability is also considered in recent theories, along with theories of Sustainability, Smart Growth, and New Urbanism. Some researchers today have even tried to find an algorithm or an index such as Walk Score and the State of Place to measure walkability in different neighborhoods.

This emphasis on walkability which has started specifically in Europe has become a wide spread movement spreading to the world. Table (2-1) presents the number of towns and cities that created pedestrian zones in their central areas in three European countries and in North America (Feriel, 2013).

Table2-1. Number of cities that created pedestrian zones (Feriel, 2013)

| **Countries** | **1960** | **1970** | **1980-1982** |
|---|---|---|---|
| West Germany | 35 | 110 | 300 |
| United Kingdom | 0 | 20 | 108 |
| France | 0 | 7 | 266 |
| United States/Canada | 2 | 28 | 70 |

However, different from the above mentioned arguments, in ‘The Next American Metropolis: Ecology, Community, and the American Dream’, Calthrope says,

without pedestrians, public places such as parks, squares, sidewalks will be only obstacles. Pedestrian is a missing member of the community, and the street design must meet the need of easy, safe and fast pedestrian access by providing appropriate vehicle and pedestrian visibility distances, stop signs and clearly marked pedestrian crossings at signalized intersections (Calthorpe, 1993).

Mumford says that the concept of pedestrianisation is not a new idea, over thousands of years all the cities fundamentally depended on walking for mobility needs (Mumford, 1961).

In Renaissance, the patterns of streets have changed, because of using different geometric patterns, huge vistas, and religious landmarks. Some guidelines for the design of streets design in this period were documented. For example, Andreas Palladio (1518-1580) recommended that carts and pedestrians should be separated out (Sen, 1999).

There were also instances where the struggle between wheeled traffic and pedestrians. For instance, Julius Cesar, the Roman Emperor, forbade chariots from the Roman streets between sunrise and sunset to organize traffic and pedestrian movement (Hass-Klau, 1990).

One of the first serious movements for organizing pedestrian-focused street goes back to the late 1940s. The goal of this idea was to protect the historical parts of European cities from the occupation of cars and revitalizing the social aspect of cities public spaces. For example, in the United States, one of the early pedestrian zones dates back to the 1960s, an ambitious project to pedestrianize Madison Avenue in New York city was promoted by the mayor of the city between 1971 and 1973.

From the early 1980s, the question of sharing public space between pedestrians and motor vehicles began to emerge under the influence of the woonerf or residential yards experiments applied by the municipalities all over the Netherlands. In Dutch streets, where pedestrians have priority, all vehicles are allowed access but in a

walking pace. Appleyard observed that woonerf principles had some negative aspects; nevertheless, these kinds of developments reclaim space for pedestrians in car-dominated residential neighborhoods (Feriel, 2013).

The concept of pedestrian also discussed by authorities from different fields and city designers since the 1990s. During that time it was used in academic papers to describe the built environments that encompass walkable neighborhoods. Walkability is frequently connected to the New Urbanism, an urban design approach that emerged in the 1980s as an answer to increased suburban development. The term became widespread in academic publications in the 1990s. Later, in 2000 in London, a global gathering held, and it was the first Walk 21. This conference intended to acknowledge the importance of notion of walkability, and present successful research and practices of walkability. Walk 21 summed up in the fields of "*policy, research, resources, communications and practice*".[4]

## 2.2. Theories and principles which support walkability

### 2.2.1. Theories: sustainable development- new urbanism- smart growth

The following theories support walkability as a green form of transportation. The relation between walkability and built environment with social and physical aspects make environment vital, safe and easy to use.

#### 2.2.1.1. Sustainable development

Sustainability is an approach used in the world today, in terms of economic, social or environmental context. Sustainability is the approach to solve the issues in

[4] Walk21-I: London, England https://www.walk21.com/london

urbanization especially in urban areas. Scholars working on walkability claim that walkable environments enhance the economic, social and environmental pillars of sustainable development in cities. Increasing walkability is one of the approaches that can be used to create sustainable cities because walking which is a clean form of transportation has a key role in increasing social interaction, and also it supports equality and social justice.

According to the United Nations, there are 17 goals for sustainable development. Goal 11 is making cities inclusive, safe, resilient and sustainable (Habitat III- the United Nations Conference on Housing and Sustainable Urban Development- held in Ecuador, 2016). It emphasizes on the role of cities in sustainable development and underlines the accessible, safe, efficient and sustainable motorized and non-motorized (cycling and walking) transport.[5]
According to the UN report, for achieving sustainable cities, by 2030, all should have access to adequate, safe and affordable housing green and public spaces and services. Providing accessible and safe roads and transportation and considering the needs of elders, women, children and people with disabilities were emphasized.

**1-Environmental aspect**

In terms of environmental matters, walkable streets which encourage people to walk or bike to their destinations are one of the main solutions to reduce the number of automobiles. For further destinations, it is also the key to use public transportation such as bus and rail, as a result we will have fewer cars on streets resulting in reduced air and noise pollution. In a walkable environment, there is not only more space in the streets for users but also it provides opportunities for the extra planting and improving street furniture and landscape (Boozani, 2013). Moreover, by reducing car journeys, we can achieve goals for sustainability. Furthermore, walkable neighborhoods consume energy and water more efficiently than car-

[5] New Urban Agenda, Habitat III, 2017, Retrieved from http://habitat3.org/wp-content/uploads/NUA-English.pdf

oriented neighborhoods. Increasing walkability can reduce people dependency on automobiles, thus it reduces human's role in climate change and global warming (Kaczynski & Glover, 2012).

**2-Economic aspect**

From an economic point of view, walkable streets will increase the amount of pedestrian movement that could raise "the passing trade", which means that people will go to stores, coffee shops or restaurants easier and they will enjoy strolling without any fear of vehicles (Boozani, 2013). On the other hand, in most large cities with heavy vehicular traffic, every year both the government and the private sector have to incur large economic losses in terms of air pollution related costs and medical expenses. For example, a study done by WalkScore, a website that measures walkability shows that every 1 point increase in WalkScore was related with a $500 to $3,000 rise in property values (Speck, 2012). Another positive effect that walkability can cause is it significantly reduces living costs. Families in communities with more mixed land uses and more choices of transportation systems spend 50% less on transportation than households in automobile-dependent neighborhoods.[6]

**3- Social aspect**

Walkable environments generally lead to the creation of social spaces. They help social interactions among people from different ethnic, religious, gender or economic backgrounds. Walking is not only a socially equitable mode of transport that is available to most across classes, including children and seniors. It also promotes sociability; in this vein, a study in Coalway, Ireland, suggests that people who live in walkable neighborhoods have higher level of "social capital", and are

[6] https://www.fhwa.dot.gov/

more likely to know their neighbors, trust others, and get socially engaged with each other (Leyden, 2015).

As Boozani (2013) states that from a social point of view the effect of the walkable neighborhood could be seen in two areas, namely mental and physical health of the community. To give an example for the first one, obesity is often the result of not having physical activity. On the same issue Wheeler (2004) states that when outdoor activities and walkability are supported by neighborhoods, obesity and cardiovascular disease decline. Moreover, the sense of physical isolation among residents could also be avoided or mitigated by increasing the amount of physical encounter (Boozani, 2013). Besides social interactions and sense of place and personal connection with the neighborhoods landscape will increase (Wheeler, 2004).

Pedestrianized streets in many cities also serve as cultural and entertainment plazas where people meet and greet not only during ordinary days but also during holidays and festive seasons as well. Free of vehicle traffic streets, in many cases by landscaping, street furniture and sidewalks help to create a comfortable environment for people to engage in various social activities (Iranmanesh, 2008).

Briefly, by increasing the number of pedestrians, opportunities for social interaction and community integration increase. A pedestrian friendly environment brings vitality to an urban area, which is a major goal of many cities and societies. As Allan B. Jacobs, in ' Great Streets!' explains 'street' is a place for social and commercial encounter and community interaction (1995).

#### 2.2.1.2. New urbanism

New urbanism, also called neotraditional planning, is an approach which became popular in the 1980s. This movement promotes walkable blocks and streets, wide

range of housing and shopping choices in close proximity, and accessible public spaces. To summarize, new urbanism focuses on human scaled urban design and emphasizes the physical characteristics that traditionally make successful neighborhoods. [7]

It is also closely related to regionalism, environmentalism and the broader concept of smart growth. The movement also includes a more pedestrian-oriented variant known as New Pedestrianism, which has its origins in a 1929 planned community in Radburn, New Jersey (Arth, E. 2010). This movement discourages the vehicle-only streets and supports the pedestrian friendly streets in the planning of architectural items, sidewalks and on-street parking lots (Sen, 1999). As seen in Figure (2-1) a public space in Washington D.C. people can interact there in public life.

Figure 2-1. a public space in Columbia Heights, Washington, D.C. [8]

[7] What is New Urbanism? Retrieved from https://www.cnu.org/resources/what-new-urbanism

[8] Ibid

In Congress of the New Urbanism in 2001, there was a discussion of some key terms related to walkability, namely sustainability and quality of life, urban design concepts like connectivity, mixed-use and diversity.

Walkability in terms of new urbanism refers to a place that is distanced not more than 10 minutes' walk to a workplace or home. During CNU 24.Detroit, the annual meeting of the Congress for the New Urbanism, Gary Parr (2016) highlighted the subject in the center of all talks was walkability; the topics of discussion were how to give people a reason to walk, or how to make residents feel safe while walking and how to provide a comfortable walking environment. [9]In the most recent CNU Congress for the New Urbanism, May 2017 Steve Mouszon, in his article, "Sidewalk cafes: Silver bullets for walkable places", discusses that one of the most important reason to make people walk is not the built environment or the idea of walking itself, but the presence of people in that place. He emphasizes the role of sidewalk cafe as the most powerful tool we can use to enhance people's desire to walk. Also, he mentions some design considerations such speed limit, bollards, and planters. For example, Figure (2-2) shows a street with lights in the early evening, crowded with people, walking and eating at sidewalk cafes.

[9] New Urbanism Starts with Walkability, Retrieved from https://www.commercialarchitecturemagazine.com/new-urbanism-starts-walkability/

Figure 2-2. High-quality cities[10]

#### 2.2.1.3. Smart growth

In the middle of 1990s, the Smart Growth movement emerged. This concept emphasizes the importance of wide pedestrian walkways with green stripes to inspire pedestrians with a positive experience of walking. Smart growth is an urban planning theory that concentrates on growth in compact walkable urban centers, bicycle-friendly, and complete streets. One of its goals is to distribute the costs and benefits of development and promote public health equally. There are ten accepted principles that define smart growth. Some of these principles focus on mix land uses, creating walkable neighborhoods, providing a variety of transportation choices, making development decisions predictable, fair, and cost effective, encouraging community and stakeholder collaboration in development decisions.

An essential part of smart growth is walkable neighborhoods that are suitable places for living, working, learning and playing. These neighborhoods should have

[10] Gehl architects presentations from workshop 21st June 2010, Retrieved from https://www.slideshare.net/GehlArchitects/gehl-architects-presentations-from-workshop-21st-june-2010

housing, offices, and retail areas and service places (such as stops of public transit, schools, libraries) within easy and safe walking distance. On the other hand, neighborhoods can be attractive places for all users if they are accessible by a wide range of users, cyclists, transit riders, and drivers.

These neighborhoods also must constitute mixed land use and compact urban fabric, as well as safe and inviting pedestrian corridors. The indicators of Smart Growth are as follows:

"• Access and proximity to key community resources (i.e., retail and service locations, recreational spaces)

• Street connectivity and walkability

• Availability and quality of public transportation

• Health and safety metrics employed as a complement to these measures" [11]

In Table (2-2) three theories that support walkability are presented. These theories dwell on accessibility for all, improving safety and reducing environmental problems.

[11] Integrating Indicators of Smart Growth and Walkability into Real Estate Listings, Etre, N (2011), Retrieved from https://www.newpartners.org/2011/docs/presentations/fri/NP11_Etre.pdf

Table 2-2. Walkability in different theories

| Theory | Reviewed dimentions related to walkability |
|---|---|
| **Sustainable Development** | ❖ Environmental<br>- Reduction in air and noise pollution<br>❖ Economic<br>- Increase in passing trade<br>- Reduction cost of solving environmental problems<br>❖ Social<br>- Promoting sociability<br>- Walking is equitable mode of transport<br>- Improving mental and physical health<br>- Creating inclusive, safe and resilient |
| **New Urbanism** | ❖ Human-scaled urban design<br>❖ Accessibility<br>❖ Walkable neighborhood |
| **Smart Growth** | ❖ Walkable neighborhoods with goods and also services within easy and safe walk<br>❖ Availability and quality of public transportation<br>❖ Street connectivity and walkability |

### 2.2.2. New digital assessment applications of walkability

#### 2.2.2.1. Walk score

Walk Score is an application that rates the walkability of neighborhoods. It uses an algorithm to measure the walkability; 100 is the highest score which means a place is a “paradise” for walkers, and zero shows that users need to use an automobile. High scores indicate that a user has most of the routine needs nearby

and can reach them on foot such as dry cleaners, banks, grocery stores, schools, parks, and restaurants. Distance to each of these services determines the points, e.g. for facilities within a five-minute walking, the application gives the highest score, and zero points for more than 30 minutes walking.[12]

It is also possible to assess the capacity of cycling in an area. Users can get a bike score that measures whether a location is good for biking. In addition, a transit score which measures access to the public transportation can be accessed by people if they prefer that method.

Lerner is CTO of Walk Score (2014) states that Walk Score helps people to find more accessible and pedestrian friendly neighborhoods for living. It is available in some countries such as Australia, Canada, and United States. He adds that it is meaningful to use this application in countries that have mixed urban environments, in other words those which have a mix of walkable urban places and sprawling suburban area. However, in European cities such as Amsterdam, Copenhagen, and Paris, it cannot be utilized because the notion of walkability is very different in these cities.

According to Walk Score, a neighborhood needs several characteristics to be defined as walkable. Firstly, it needs a center; it can be a main street or a public space. Secondly, there must be enough people doing businesses or keeping the space alive. Additionally, there must be a number of public places, parks, mixed use businesses, schools, and workplaces. Finally, streets should be designed for cyclists, pedestrians, and vehicles.

One weakness in Walk Score rating is that street design such as sidewalks and safe crossing, traffic speeds, and trees which are important criteria in walkability are not taken into consideration. Also, safety issues such as safety from crime, auto accidents, and lighting are not included in the rating (Forsyth, 2015).

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[12] Walk Score Methodology, n.d. 2019, Retrieved from https://www.walkscore.com/

#### 2.2.2.2. State of place

State of Place (SOP) is an analytical application that helps planners and authorities to build cities and neighborhoods that are more walkable, and livable.

More than 290 items that are related with different urban design categories, such as trees, pavements, amenities are collected which are used to help users decide whether to walk or drive. Walkability is not just about accessing from point A to B or quality of endpoints, it is about feeling safe, comfortable and pleased during walking. These gathered data in micro-size provides a comprehensive view of walking capacity of the environment. All these make this tool more effective for planning and policy making. The SOP index includes 10 urban design dimensions and as a result of this, two neighborhoods with the same walkability rate may have different walking capabilities. These indexes consist of density, aesthetics, traffic safety, connectivity, parks & public spaces, personal safety, form, facilities, biking and walking amenities, and proximity. [13]

To illustrate, places with an index of 80 to 100 has high-quality for walking. These places have a balanced combination of uses, good pedestrian facilities and connectivity, and are pleasurable for walking. In the following, according to the SOP if

- scores are from 80 to 100, places are very walkable
- scores are from 60 to 80, places are still reasonably walkable
- scores are between 40-60, neighborhoods in this range provide average walkability (most of the neighborhoods in the State of Place database are in this range).

[13] State of place index & profile, n.d. 2017, Retrieved from http://www.stateofplace.co/howitworks

- scores are between 20-40, they do not have enough traffic safety, pedestrian and bike amenities, and are mostly car-oriented.
- scores are between 0-20 on the index, they lack walkability and quality of place

In summary, these two applications have similar criteria for measuring how walkable an area is. They have some advantages such as being easy to understand and are based on Google local database which updates automatically.

### 2.3. Examples from around the world

As mentioned in the first chapter, the movement of making cities walkable extended from several European cities to the world. In this part, two cities, an European and an American city are selected as successful examples for walkable cities: Portland in the state of Oregon which has a history of creating a wonderful pedestrian scale in the USA, and Copenhagen, which is one of the world's greatest pedestrian-friendly and safest cities.
In the following section, their principles and strategies toward walkability of these two cities will be compared.

**PORTLAND**

Portland city authorities made a series of decisions, starting in the 70s that would change the way 'Portlanders' live, and over decades they have driven 20 percent less. As a result, they have saved four miles, or 11 minutes a day, and 3.5 percent of all income earned in Portland has not been spent on driving. Moreover, it has attracted young workers because people want to live in that sort of city (Speck, 2012).

Portland has instituted policies to differentiate itself from other American cities. It set up a city boundary to limit sprawl, reduced the width of roads, and increased cycling infrastructure. The city has a Pedestrian Master Plan, whose purpose is to establish a 20-year framework for improvements that will enhance the pedestrian environment and promote walking as a means of transportation.

Additionally, Samuel Francis Adams, mayor of Portland (2012) states this city provides people with decent and safe places to walk. If people are given the opportunity to walk and bike in their neighborhoods without the fear of cars, they will become more interested in walking and biking. As a result of these changes, "Pedestrian Design Guide" was introduced. According to this guide, the walking path should be accessible and safe for everyone. Moreover, the pedestrian network should be connected to each other and be easy to use. Another principle which supports walkability is promoting sense of place by providing good places, or amenities such as furniture, art, paving and planting. Also, Portland's city council in 2010 adopted a Bicycle Plan, which aims to attract riders, strengthen policies and build more bicycle parking.[14]

## COPENHAGEN

Copenhagen is one of the world's greatest pedestrian cities. Over the last several decades, planners have taken numerous small steps to transform Copenhagen from a car-oriented city into a people-friendly one. "In Copenhagen, we have pioneered a method of systematically studying and recording people in the city," says Jan Gehl, a Danish architect (Kemp& Stephani 2015).

In 1962, Copenhagen's old main street became its first car-free street. It's now the central route of the city's pedestrian street system. For achieving pedestrian focused street, Copenhagen applies some policies and strategies as follows: converting

[14] Portland Pedestrian Design Guide, June1998, Retrieved from https://www.portlandoregon.gov/article/437808

streets into pedestrian streets, gradually reducing traffic, honoring the human scale, encouraging student living, promoting cycling as a main means of transportation, and making bicycles available.

As can be seen from these examples, these two cities have some similar policies namely:

- Making cycling as a key mode of transportation
- Increasing public activities, with diversity of land uses like resturants, cafes and public squares
- Promoting sense of place
- Connectivity and convenient connections between destinations
- Safety
- Accessiblity to all

Urban managers in these two cities have recognized the benefits of cycling and walking for environment, tourism, economics, and society (Makovsky, 2002).

### 2.4. Assessing the capacity of walkability in urban space

A review of literature on walkability shows that various parameters have been highlighted in different studies. Parameters such as, land use, density, connectivity, safety, accessibility, build form, attractiveness, diversity, comfort among others were used in those studies. For example, according to a Columbia University study, urban planners measure walkability with factors known as the "five Ds": "density, diversity, design, destination accessibility, and distance to transit" (Ewing & Cervero, 2010).

Alfonzo (2005) discusses the needs that people consider when deciding to walk. In her research, called “the hierarchy of walking need”, she defines a hierarchy of needs in a diagram and classifies the walking needs into five levels (Figure 2-3).

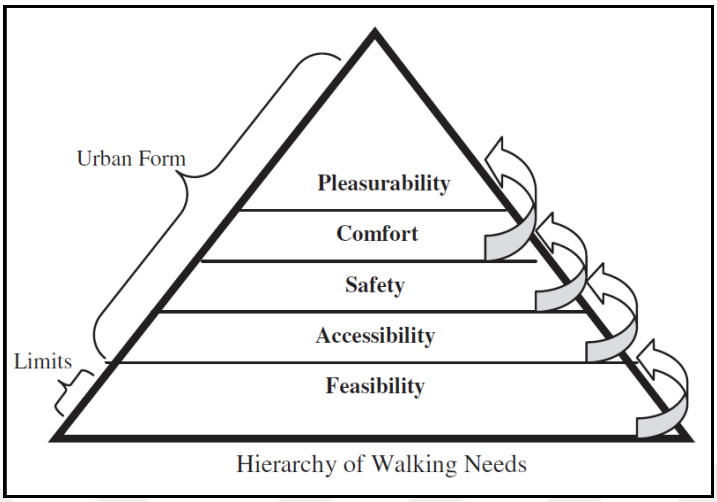


Figure 2-3. Hierarchy of Walking Needs (Alfonzo, 2005)

The basic need in this study is feasibility which is related to personal boundaries, whereas all the other levels are related to urban form such as accessibility, safety, comfort and pleasurability. Feasibility refers to how practical a walking trip is; feasibility factors like mobility, time, or other responsibilities may affect the choice of a trip way, walking or other forms of transportation. However, in 'hierarchy of needs', Maslow (1954) has identified some needs which are basic and more fundamental than others. According to him, an individual should satisfy the basic needs before going to higher-order needs.

It is the same in Alfonzo hierarchical structure; an individual would not consider higher-order need in his or her decision to walk if the most basic needs were not satisfied. For example, if the environment is not safe to walk, the user would not think of the comfort or pleasurability of that environment. In other words, a comfortable or pleasurable street cannot motivate the user to walk, if it is not safe enough to walk. She has pointed out some considerations about this hierarchy; stating that in order to proceed to the next level of need, the earlier one doesn't have to be fulfilled completely (Evans, 2009).

Monteiro and Campos (2012) conducted another research, titled '*A proposal of indicators for evaluation of the urban space for pedestrians and cyclists in access to mass transit station*'. In this research, they present indicators to assess urban spaces for walkers and bikers in terms of accessing public transportation stops. They categorize six indicators: density, diversity of land use, urban design, facilities for pedestrians, safety and security, characteristics of pedestrians, accessibility and mobility.

In addition, in study titled 'Evaluating new urbanism's walkability performance', Al-Hagla, (2009) presents an inclusive approach for measuring walkability based on a combination of its conceptual and applicable aspects. He uses 20 indicators based on New Urbanism for assessing walkability.

Reid Ewing and colleagues (2006), in their research 'Identifying and Measuring Urban Design Qualities Related to Walkability', show that perceptual qualities affect walking behavior. The following figure illustrates some physical features as well as urban design qualities and personal reactions such as sense of safety, sense of comfort and level of interest that shape the overall walking behavior (Figure 2-4).

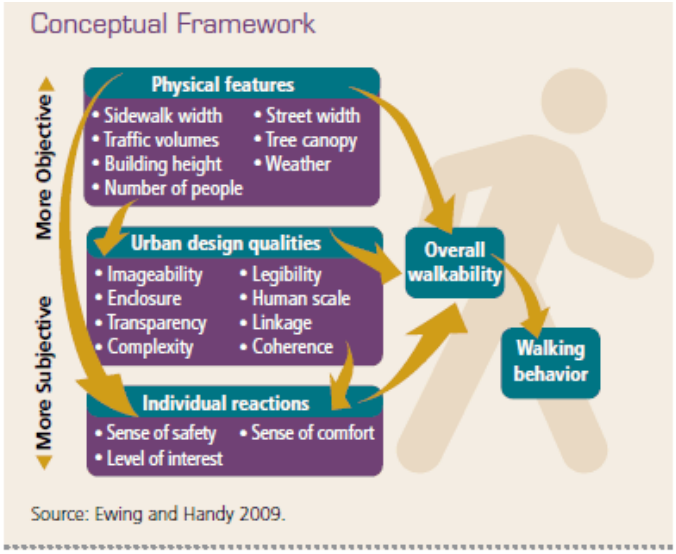


Figure 2-4. Conceptual Framework of walkability

Micheal Southworth (2005) in his article “Designing the Walkable City” states that the significant issue for people to prefer walking to driving is the quality of walkable environment. He highlights six measures for achieving walkable cities; connectivity, linking with other means of transportation, accessible land use patterns, safety, quality of path and path context are these criteria. He suggests evaluating the existing walkability settings and walking behavior in different location, then having a review on standards and rules and making a revision.

Zuleyha Sara Belge in her thesis “Increasing walkability capacity of historic city centers” explained the terms of ‘livability’ and ‘quality of life’ and their components. The focus of her study was on ‘walkability’ as a measurable concept in urban design. She sets 8 parameters for walkability: attractiveness, convenience, connection to open space, safety, street patterns, quality of path, linkage with other transportation modes, connectivity of path networks, and accessibility. Summary of these studies are presented in the following table (Table 2-3).

Table 2-3. Walkability in practical cases

| | Authors | Issues |
|---|---|---|
| **1** | **Mariela Alfonzo** | Feasibility, accessibility, safety, comfort, pleasurability |
| **2** | **Monteiro and Campos** | Density, diversity of land use, urban design, facilities for pedestrians, safety and security, characteristics of pedestrians, accessibility and mobility |
| **3** | **Al-Hagla** | Attractiveness for walking, safety for walking, traffic volume, sidewalk condition, segment continues, sidewalk complete, land uses, number of traffic lanes, buffers present, speed limit, building setbacks, path setbacks, on street parking, traffic control devices, transit stops, walk through parking lots, crossing aids, lighting, number of street trees, driveways |
| **4** | **Micheal Southworth** | Connectivity, linkage with other modes, fine grained land use patterns, safety, quality of path and path context |
| **5** | **Reid Ewing and colleagues** | Physical features, urban design qualities, safety, comfort and level of interest |
| **6** | **Zuleyha Sara Belge** | Attractiveness and convenience, connection to open space, safety, street patterns, quality of path, linkage with other transportation modes, connectivity of path networks and accessibility |

## 2.5. Safety as the primary parameter of walkability

> *"If the physiological needs are relatively well gratified, there then emerges a new set of needs, which we may categorize roughly as the safety needs (security; stability; dependency; protection; freedom from fear, from anxiety and chaos; need for structure, order, law, limits; strength in the protector; and so on)."(Maslow, 1970: P39)*

Maslow proposed a theory that defined five hierarchical needs, lower needs in the pyramid must be satisfied before attending to needs higher. These needs are: physiological, safety, love and belonging, esteem and self-actualization (Figure 2-5).

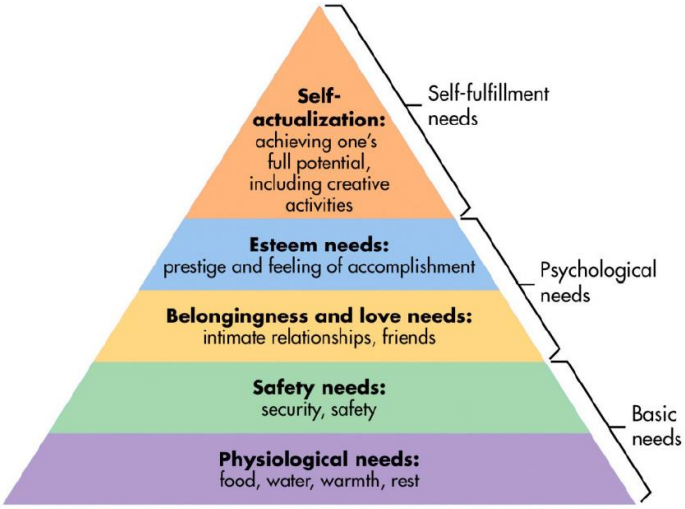


Figure 2-5. Maslow's Hierarchy of Needs (McLeod, 2017)

When all physiological needs are met the **safety needs** and needs for security can become active and when the needs for safety and for physiological are fulfilled, the next class of needs for **love, affection and belongingness** can arise (Jerome, 2013). This level of needs is social and involves feelings of belongingness, need for interpersonal relationships and sense of connection can meet in this level.

Although safety is closely related to other features of the walkable environment, lack of safety is one of the most important obstacles to walkability. Complete streets movement defines streets as places designed to be safe and functional for all users with different range of ability and age. Walkable communities offer safe and welcoming streets which can boost users' activities and present sufficient accessibility to different mode of transportation (Forsyth, 2015). Also, Mehta (2014) in his study "evaluating public space" affirms that "safety is the feel safe from the social and physical factors—from crime and traffic."

According to Southworth (2005), environments that support fast commute cannot be safe, pleasurable or amusing for walkers and bikers, and it is more likely that people get injured in crashes. For example, in American cities which are car-oriented, walking or cycling is dangerous and not so easy. In comparison, in most European cities, it is safer for passengers and cyclists to walk because of many progresses in urban design, regulations and policies. Moreover, Krambeck and Shah (2006) state that walkable environment is a place which is safe, secure and convenient to travel on foot. Unsafe environment can be a barrier to walk or interact with people. If the surrounding environment is pleasant, safe and comfortable, and destinations are clearly linked through a network, people are more likely to walk. There are many factors that may influence a person's level of safety such as urban form, land use, and sense of belonging to a certain environment. This idea is supported in the research of Powell et.al. (2003), they present people who are aware of safe and convenient places to walk are much more likely to walk (41.5 %) than people who are not aware of such places (27.4%).

Several researchers have studied the association between walkability and safety with complex findings. However, limited studies have concentrated on safety and security as the main issue of walkable spaces. On the other hand, safety and security was considered in public spaces throughout the world, especially with increasing ethnic groups, religious differences, immigration issues (Abdulla et al., 2017).

Jeff Speck in his speech in TEDx (2013) figures out four fundamental elements for a walkable city. He states in typical American cities which most people own cars, the temptation is to drive all the time, If we want people to walk, we have to offer a walk that's as good as a drive, it means you need to offer four things simultaneously, it needs to be a proper reason to walk, the walk has to be safe and feel safe, the walk has to be comfortable, and interesting.[15]

In defined literature, safety is evaluated in two aspects, **actual** and **perceived** safety.

### 2.5.1. Actual safety

Actual safety is attained through safe physical features in the urban environment, street design, traffic policies, lighting, and continuity in sidewalks, pedestrian enclosure, separation, quality of path and safe crossings. Actual safety can be disturbed by crime, traffic or hazards caused by physical features of urban environment (Lambert, 2005). In addition, Alfonzo in the chart of "hierarchy of walking need" categorizes the features that affect the feeling of safety under three groups. Urban design features (Graffiti, abandoned buildings, and first floor windows), type of land use (Bars, liquor shop and so on), and presence of people (presence or absence of threatening groups) are these issues.

Further, another important feature of safety in walkable environments is traffic. For achieving safe traffic movement for both pedestrians and drivers is traffic calming policies which separate pedestrian and vehicular traffic, to create safe journeys and to slow down traffic.

Traffic lights, regulation for low speed and monitoring systems, signals as crosswalks assist pedestrians to cross safely without fear of accident or running.

[15] The walkable city, TEDcity 2.0, Retrieved from https://www.ted.com/talks/jeff_speck_the_walkable_city

Moreover, narrow streets are another item to slow down traffic as the three issues to slow vehicular traffic and improve pedestrian safety (Appleyard,1981).

Southworth (2005) come up with strategies to slow down traffic, such as speed bumps, raised crosswalks, narrow streets, rough pavement, roundabouts, and landscaping. Also, a line of trees through sidewalk create a buffer zone between road traffic and pedestrians.

Abdulla et al. (2017) referring to Tandogan and Ilhan (2016) and mentioned if safety needs are not met appropriately, thus fear comes to the forefront. Further Abdulla et al. added in developing nations, lack of crossings, lack of separation road traffic and pedestrians, street vending activities, and poor lighting leads to a lack of safety.

### 2.5.2. Perceived safety

The second aspect of safety is perceived safety which describes users' perceived risk, regardless of standards or environment safety background. For instance, we may consider traffic signals as safe. However, in different situations, these signals may result in an accident, so regardless of these standards and rules it is about protecting pedestrians from the feeling of crime or the hazard of road traffic.[16] In addition, the perception of safety is one of the key components that influence people decisions to walk in their neighborhood or not. "The safer pedestrians feel on the street, the more they will use it" and this this as much as reality is related to perception too (Kolody, 2002).

Further, Mehta (2014) states that many factors have an impact on perceived safety from crime, it can be physical features and maintenance, the sense of place, different land uses, changes and modifications in the environment, and the presence or

[16] A Guide for maintaining pedestrian facilities for enhanced safety, 2019 Retrieved from https://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa13037/chap5.cfm

absence as well as type of different groups of people. About the same issue, Lynch (1981) states that a city should meet the biological needs of people and provides a safe environment for their activities. Moreover, Jacobs (1961) claims that for having more activities on streets there should be a higher degree of surveillance, which leads to safety. This issue is controversial and can change depending on the subjective experiences of people. For instance, during this research when I affirmed the presence of people in the campus to a participant, she mentioned that she doesn't feel safe in places with too many people. Similarly, Soomeren (2013) claims that the main principles may not always be true, and depending on the environment, the approaches can differ.[17]

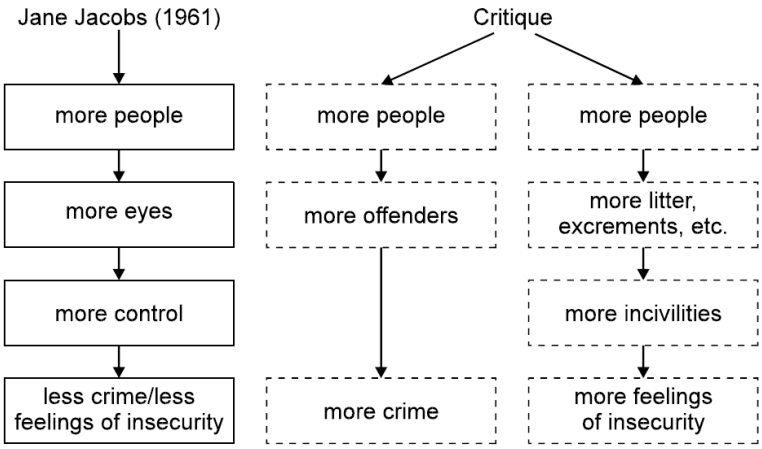


Figure 2-6. Two approaches about surveillance in cities (Paul van Soomeren, 2013)

Contrary to Jacobs' opinion, Soomeren claims that more people can create more offenders and more litter and incivilities, which can end up with insecurity and crime. Therefore, the contrast between the number of people and safety are not just a matter of subjective experiences, but a measurable criterion depending also on the

[17] A set of European CPTED Standards for Secure Cities Safe & Secure cities through Urban Design and Planning: standardizing the process, Soomeren, P.V., 2013

environmental conditions. Thus, the relationship between safety and number of people is related more to perceived safety rather than actual safety.

In addition, Newman (1972) in Defensible Space theory identifies three characteristics: “territoriality, natural surveillance, and image and milieu”. Later CPTED multi-disciplinary approach (Crime Prevention through Environmental Design) has been developed based on these characteristics. These principles, besides considering crime, are used as an approach for increasing quality of life and livability (Bennetts, 2017).

The principles of CPTED are firstly, natural surveillance or monitoring and visibility; for instance, available parking areas, buildings entrances, doors or windows and adequate lighting at night. The second one is defensible space. In other words, there should be public and private areas enabling people to have sense of "ownership". Related to this, it is found in the research of Perkins, Meeks, and Taylor (1992) that personalization of property or private plantings made the street safer. The third principle is connectivity and managing access with lighting, landscaping, and designing entrances and exits. The fourth one is intermingled functions of land which makes it possible to use the area for different purposes at night and day time. Mixed land uses which contain residential, shops and services with a well integration with public transport increase surveillance. The last principle is Image which means keeping an area well maintained, trimming trees and bushes, trash cans and secured walkways (Bennetts, Soebarto, Oakley, & Babie, 2017a).

Bennetts et al. (2017) explore the relationship between CPTED principles and people safety and comfort in an urban area. By doing the survey and in-depth interviews, they found out that there is an overlap between CPTED principles and feeling safe. Activity of users on the streets and connectivity followed by familiarity with the environment and well-used spaces are the most important factors. It is emphasized that safety is essential for cities’ livability, so it should be investigated. Bennetts et al. (2017) try to study what makes people feel safe in addition to absence

of crime or fear of crime. This research explains the importance of urban design features, mixed uses and different build forms and connectivity between spaces in promoting livability and safety.

One of the theories that investigate the influence of social conditions and community features on people behavior is "prospect and refuge theory". The theory of "prospect and refuge" tries to answer why certain environments feel secure and, in that way, they meet basic human psychological needs. These environments that meet such psychological needs will often provide people with the capacity to observe (prospect) without being seen (refuge) (Dosen & Ostwald, 2013).

*"At the heart of prospect-refuge theory is the idea that the qualities and attributes of a space-particularly including volume, configuration and access to natural light and outlook-can significantly influence a person's emotional response to that space. For example, Kaplan (1983) maintains that an enclosed space will evoke a feeling of safety or relaxation while a view from that space can add levels of stimulation and excitement. Hildebrand (1991) also argues that a certain combination of spatial and formal complexity and order is required in order to uncover the particular prospect-refuge relationship present in domestic architecture (Dosen & Ostwald, 2013, p.5)."*

In addition, several researches show that demographic factors related with perceived safety are gender and age that are the most considered demographic features in relation to fear of crime in urban environments.

*"Westover (1985) described a link between fear of crime and avoidance behavior of park visitors regarding gender. In this study, female respondents who feel unsafe reported more avoidance behavior males. When age factor is considered, elderly people have been found more fearful of crime than young people and have avoided to use the parks where crime is perceived a problem, although the risk of victimization for them is low (Ferraro and La Grange, 1987; Godbey and Blazey, 1983; Ortega and Myles, 1987). This result can be explained by physical*

*inefficiencies of the elderly. In contrast to results of many other studies, Mc Coy et al. (1996) found out that elderly people did not have high levels of fear (*Doğrusoy & Zengel, 2017, p. 5*).”*

### 2.5.3. Conceptual model to measure safety capacity of case study - METU

After reviewing the theoretical framework and related literature the following conceptual model, and subsequently the questionnaire is designed.

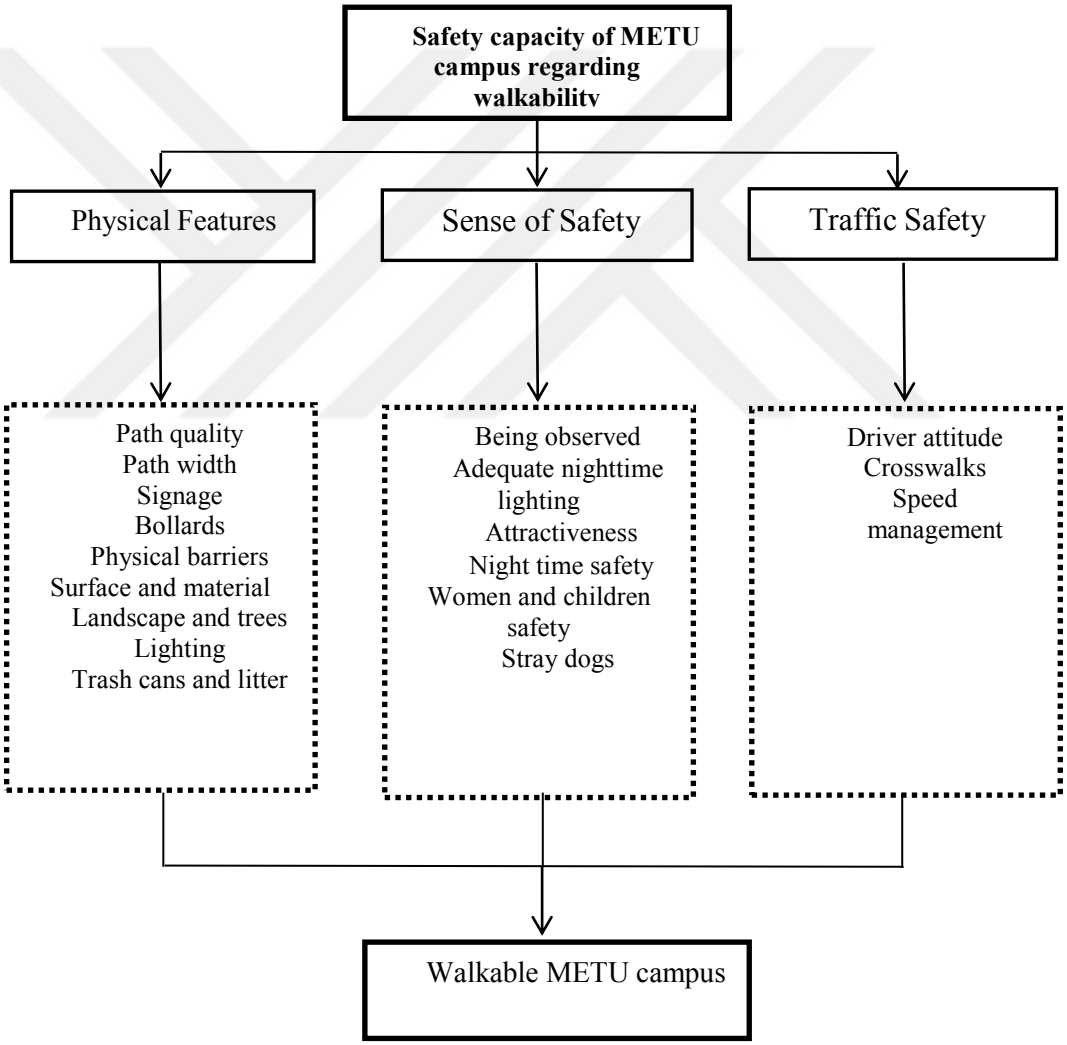


Figure 2-7. Conceptual model to measure safety of METU

After reviewing the literature on safety, the following table and subsequently the questionnaires are designed to measure the safety on the METU campus. Three dimensions of safety are considered; physical features, sense of safety and traffic safety.

Table 2-4. Major Attributes of Safety

| Issue | Dimension | Variable |
|---|---|---|
| **Safety** | **A- physical features** | a-1- path quality<br>a-2- path width<br>a-3- signage<br>a-4- bollards<br>a-5- physical barriers<br>a-6- surface and material<br>a-7- landscape and trees<br>a-8- lighting<br>a-9- trash cans and litter |
| | **B- sense of safety** | b-1- being observed<br>b-2- adequate nighttime lighting<br>b-3- attractiveness<br>b-4- night time safety<br>b-5- women and children' safety<br>b-6- dogs |
| | **C- traffic safety** | c-1- driver attitude<br>c-2- crosswalks<br>c-3- speed management |

### 2.5.4. Safety assessment criteria

**A-1- Path quality**

Path quality, one of the walkability indicators, is related to physical design of the street and to have a comfortable walking environment it is a basic need. In detail, “sidewalk width”, “paving quality”, “street furniture”, “street signs”, “street lightning” and “street trees” are the aspects of quality of path (Akkar Ercan & Belge, 2017). High quality pedestrian paths are one of the most essential elements that promote walking and physical activities. This quality increases pedestrian safety and satisfaction about the environment (Frackelton, Grossman, & Castrillon, 2013).

**A-2- Path width**

The appropriate sidewalk width is 1.53 m, which meets the minimum requirements of walking, resting, cycling and skating. Unnecessary widths reduce the feeling of enclosure. Mainly, the appropriate sidewalk width allows pedestrians to realize the structure, usage and entry points of the route. Further, the appropriate sidewalk width ensures smooth operation of the different parts of the sidewalk and also pedestrians can move comfortably (Lambert, 2005, Litman, 2010).

According to ADA (The Americans with Disabilities Act) the minimum sidewalk width for accessible travel is 91.5 cm. additionally, some turning space is necessary for a user with wheelchair or to pass by other pedestrians. A (1525 mm) minimum width can help turns and passing space. Besides, natural safeguard provided by trees protecting pedestrians from out-of-control cars.

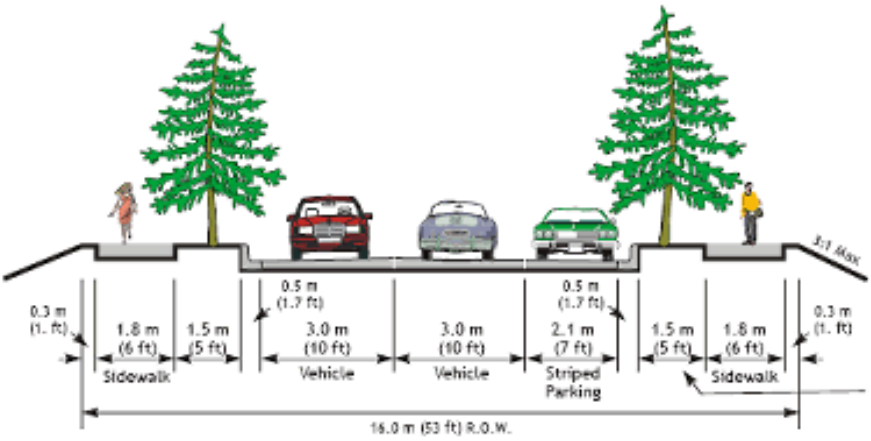


Figure 2-8. Example of recommended sidewalk width

( Federal Highway Administration University Course, 2006)

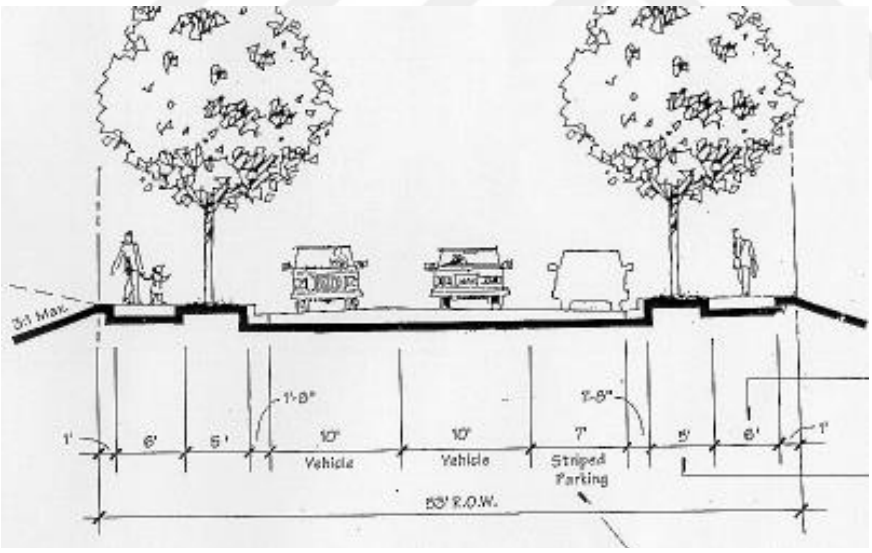


Figure 2-9. Example of recommended sidewalk width

(Course, Bicycle, & Transportation, n.d.)

## A-3- Signage

Kevin Lynch published his book "The image of the City" (1960) and started the Legible Cities movement. Later in Bristol in the late 1990s, when city planners were working on city-center regeneration projects, the idea of Legible Cities was raised again (Poole, S. 2014). The Bristol Legible City project as a successful example, prepared some principles for this project as follows:

- "Don't make me think!" – easy to use maps or signs
- "What I need, when I need it" – avoiding too much information
- "Connectivity" – showing connecting paths, areas and transportation options
- "Clean up – remove unnecessary disorders, have as few signs as possible, as many as needed" (Herbes, n.d.)

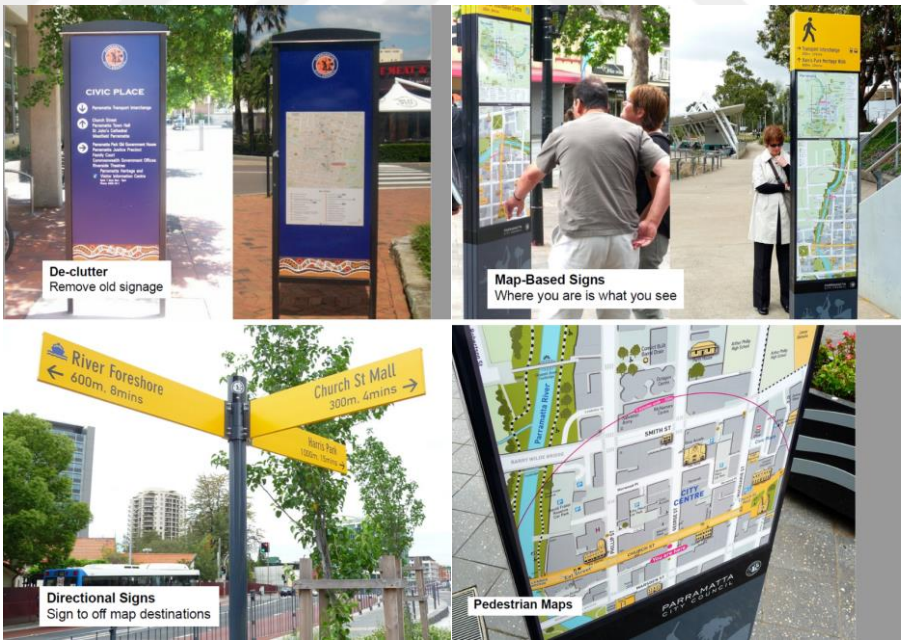


Figure 2-10. Good practices of wayfinding projects (Herbes n.d.)

Urban wayfinding planning and implementation manual (a research published by Sign Research Foundation and International Sign Association), defines essential design elements and sings to guide pedestrian inside an area to find way that includes:

- Pedestrian directing signs: these signs guide pedestrians directly to destinations.
- Map Signs: these maps should define the district and the main landmarks and destinations within that area.
- Directories: these are maps with a directory of additional information such as addresses, phone numbers or extra information.[18]

**A-4- Bollards and barriers for separation from vehicle traffic**

Separation of sidewalk from vehicular route is a concern of physical safety. Pedestrians and vehicles should be able to use a path without compromising pedestrians' safety; therefore, both routes should be separated as much as it is possible.[19] While designing or analyzing safety of a street the question how pedestrians and cycle riders should be kept away from traffic flow should be considered. According to Kolody (2002) "sidewalks, medians, boulevards, on street parking, and parallel routes" help to separate people from vehicles.

As stated by Health and Safety Executive, the most effective way to do this is to separate pedestrians from the vehicles by providing totally a separated route for pedestrian. For total segregation footbridges and subways can be the other solutions.

[18] Wayfinding, U. (2013). Urban Wayfinding Planning and Implementation Manual, 1–66. (https://signresearch.org)

[19] Managing health and safety, Retrieved from https://www.hse.gov.uk/

Another operative method is installing protecting barriers, guard rails and markings.[20]

Bollards are mostly used for restricting vehicle movement or separating pedestrians from traffic. Plants, trees, rocks, surface changes or other materials can also be used to achieve the same effect with a better aesthetic look. In addition, while placing bollards, it should be considered that wheelchairs, scooters and prams movement should not be restricted. Furthermore, safety and visibility must be ensured. The maintenance of such elements should be easy and appropriate materials should be selected.[21]

Figure 2-11. Examples of using bollards[22]

[20] Managing health and safety, Retrieved from https://www.hse.gov.uk/
[21] Global Street Design Guide, n.d. Retrieved from http://www.aucklanddesignmanual.co.nz/
[22] Ibid

**A-5- Path quality**

Path quality is a measurement which can increase the actual safety. A well-designed sidewalk and qualified ground of streets is important in terms of making walking more comfortable and easy to walk for all groups of users, especially handicapped people (LA-Walkability Checklist, 2008, p. 15).

**A-6- walkability for people with disability**

Many features of urban infrastructure have been designed for average people. However, there are populations with higher chances of disability. Many of existing infrastructures fail to meet the needs of elderly inhabitants and people with disabilities. Characteristics of elder groups and people with disability consist of reduced choices, slowed walking period, vision difficulties, slowed reaction times, and trouble in uphill walking (Suh et al., 2017).

Many countries try to find solutions and ways to enhance these groups walking quality. As an example, the Americans with Disabilities Act (ADA) states that "A public entity may not deny the benefits of its programs, activities, and services to individuals with disabilities because its facilities are inaccessible. A public entity's services, programs, or activities, when viewed in their entirety, must be readily accessible to and usable by individuals with disabilities. This standard, known as 'program accessibility', applies to all existing facilities of a public entity. Public entities, however, are not necessarily required to make each of their existing facilities accessible" (Suh et al., 2017).

**A-7- Landscape and trees**

Public green spaces and water areas are essential for city life. Playgrounds, fields and gardens provide recreational opportunities for the public, create ecologically healthy environment by filtering the noise, light and air of the city and provide views

and landscape image by framing development sites (Montgomery, p.111, 1998). Trees also help to separate vehicle traffic and pedestrians. Moreover, parks and open areas provide people with the opportunity to get socialize, for example strolling around, have lunch or dinner, watch concerts and other cultural events (Montgomery, p.111, 1998).

**A-8 & B-2 Lighting**

Lighting is another essential element to create a safe environment for walking. Sufficient lighting system can make sidewalks visible and increases the safety of pedestrian. Direct observation in METU campus, shows that in all main paths there is appropriate lighting and the average distance between them is 65m, which can differ according to the street type. Lighting in pedestrian-focused streets can improve walking activities at night time and increase the sense of safety (Emery, 2003 and Gassaway, 1992, cited in Southworth, 2005: 251). Pedestrians on a pedestrian friendly street design can benefit from three sources of lighting; first one is the street lighting, the second one is the lamps which usually reach between and below most trees, and the last one is the light produced from stores or buildings (Nabors, Zegeer, Gelinne, Lefler, & Bushell, 2010)

**A-9- Maintenance and cleanliness**

"By maintaining the overall structure of the neighborhood, reducing litter and other sources of disorder, residents are encouraged to maintain the quality of their homes and other features that increase safety and security" (Roberts, 2018) In other words, a regular maintenance and cleanliness of walking paths will increase atractivness of walking area.

"Lack of cleanliness in a city is often blamed on the local authority since ensuring urban cleanliness is one of the primary responsibilities of a local authority."

However, Hing, & Gunggut (2012) in their research 'Maintaining urban cleanliness: a new model' explain and compare different models about urban cleanliness.

**B-1- Presence of people**

One of the most important reasons to make people walk is not the built environment or the idea of walking itself, but the presence of people in that place can play essential role. As mentioned, one of the principles of CPTED is natural surveillance or monitoring this indicates that activity of users on the streets and connectivity followed by familiarity with the environment and well-used spaces are the most important factors to feel safe. A research indicates that presence of people can lessen the feeling of anxiety while people walk along the street and it adds encouragement pedestrian to walk that increases "eyes on the street" (Bennetts, Soebarto, Oakley, & Babie, 2017)

Another study on "university student safety experiences in an Australian regional city" has come to the conclusion that fear about safety is also influenced by the presence or absence of people when walking alone at night. Furthermore, urban design features enhance attendance of people and pedestrian movements (Ratnayake, 2017).

**B-3- Presence of active buildings**

As discussed in this chapter, one principle of CPTED is increasing natural surveillance through the planning and arrangement of buildings. Regarding to this, Bennetts et al., 2017, in their study highlight *"the importance of activity for creating a feeling of safety and comfort is perhaps one of the most important aspects observed in the case study. Where there was no activity, regardless of whether it was during a bright day, a dark night or in a well-illuminated area, the space did not feel as safe as those areas where people could be heard and seen. This harks back to the importance of Jane Jacobs' theory that a well-used city street is a safe street".*

**B-4- Feeling safe in night time walk**

"The literature has found that female residents tend to feel more vulnerable than male residents, particularly at night, as women generally experience greater concerns about defending against offenders." (Park & Garcia, 2019 p.2)

Park & Garcia also add "street lighting is a major concern at night, followed by pedestrians' familiarity, sidewalks and pedestrian infrastructure, hidden spots and shadows, and nearby businesses."

**B-5- Women's and children safety**

Rapid urbanization and the migration of female to cities have increased the vulnerability of women to sexual violence in public spaces. Inadequate public services in urban areas create an environment where sexual violence against women can grow. The needs and requirements for safety of women are rarely reflected in urban planning and policies. There is not enough recognition of sexual violence and the role of urban planning in creating safe cities for women. Women's lives would be made safer by reliable and regulated public transport, universal and accessible facilities and well lighted streets in poor urban areas (Kelly, 2014)

Furthermore, UN Women, Safe Cities Module defines a safe city as a place where women can enjoy public spaces and public life without fear of being assaulted. A city that at home or street there is not violence against women. Further a city where there is not discrimination against them regarding their economic, social, political, and cultural rights, a city where women have right in decision making (Lambrick & Rainero 2010).

Kristen Day (1999) argues safety and women's fear of sexual assault in her research. She analyzes two college campuses to answer what physical features distress women's perception of safety. She noted the most feared places include alleys, underpasses, crevices in building exteriors, isolated stairways, long and narrow entries or paths, and parking lots. Physical features emphasize trees and

bushes, dumpsters, and insufficient lightning. Other key features include absence of other people, separation, and especially night time.

**B-6 Stray Dogs**

Tasker (2007) state that "definitions of stray dogs are inherently problematic and judgements regarding when a dog is considered to be a stray varies from country to country and may be subject to local and national regulations. Indeed, any dog found unaccompanied by a responsible person in a public place may, in some countries, be considered as stray and collected accordingly."

**Part C- traffic safety**

In this part drivers' behavior and attitudes, crosswalks, and low speed limit measured. Perceptual or physical safety is important for both walkers and drivers; however, pedestrians are the vulnerable groups and can be affected by safety problems. Safety is important because it directly affects people's willingness to walk. "The safer pedestrians feel on the street, the more they will use it" (Kolody, 2002).

Regarding crosswalks, in a well-designed crosswalk, curb ramps should be provided for access between the sidewalk and roadway for people using wheelchairs, pushchairs, walkers, crutches, handcarts, bicycles, or who have mobility restrictions that make it difficult to step up and down high curbs.[23]

[23] https://www.fhwa.dot.gov/

Figure 2-12. Good example of crosswalk (Burden, 2006)

Figure 2-13. Good example of crosswalk (Lucas, n.d.)

# CHAPTER 3

# RESEARCH METHODOLOGY

This chapter describes the research methodology used in this thesis. It describes, in details, the approach and process of the research that was carried out, such as data collection strategies, designing the survey/questionnaire, the logic behind questions in the survey, and the methods of analysis. As mentioned in chapter one, this study focused on one critical component of walkability, which is safety. It examined the issue of safety using 18 different indicators. This research employed a single case study method. Middle East Technical University (METU), one of the well-known universities in Turkey, was used as a case for research analysis in detail. The research employed a questionnaire given to 240 respondents who may or may not live in the area, but may use the campus for different purposes such as work, study, shopping or leisure. Responses to the questionnaire show the correlation between the actual situation in the study area and the respondents' views. Moreover, photos and field notes were prepared to identify the strengths and weaknesses in different zones of the campus in terms of safety and walkability.

## 3.1. The questionnaire and background of respondents

The questionnaire was used to reveal the perceptions of the individuals who use the streets (i.e., students, academics, staff, visitors, and working population). The survey included 40 questions or statements. There were two types of questions: open-ended and close-ended. Close-ended questions were prepared according to the Likert Scale, with five response categories: strongly agree, agree, undecided, disagree, strongly disagree. Moreover, six open-ended questions designed to be

answered, these questions allow respondents to answer freely, and give more details and specific responses.

While conducting the questionnaire, I have asked the questions according to the sequence of strongly disagree, disagree, undecided, agree and strongly agree. Although some argue (Başar, 2010) that this sequence is not right and undecided should be at the end of this sequence or omitted. The research presents the result in its original form. And do not want to change the sequence. In some questions, 20- 25 % of the respondents chose the 'undecided' option, whereas, in some questions, 45% of the respondents chose the same option. And this option, which was chosen by the respondents for the same safety criterion, differs from one zone to another. Thus, in the position of "undecided" among the sequence of the questionnaire -whether it is positioned in the middle or the end- does not matter for this research. Those who chose 'undecided' are evaluated as the other groups who responded as agree, strongly agree, strongly disagree and disagree.

The research examined every zones of the case study for a week between 7.00 and 22.00 for certain intervals such as 7.00-9.00 when people arrive to the campus, 12.00-14.00 when people have lunch, 16.00-18.00 when people leave the campus and 21.00-22.00. Also, I took notes and photos in several period of the research questionnaire participants selected via a convenience sample method which uses participants who are readily available in the university campus.

The survey was conducted with respondents from different age, gender, education and occupation groups in order to capture varying perceptions. Four 'age' groups were identified among the respondents; 'young' between 18-25 years; 25-35 years and 'middle-aged' between 35-44 and 45-54 years. These age groups are categorized according to the walkability capacity of people. Out of a total of 240 participants who answered the questions, 75.8% and 20% were in age groups of 18-24, and 25-34, respectively.

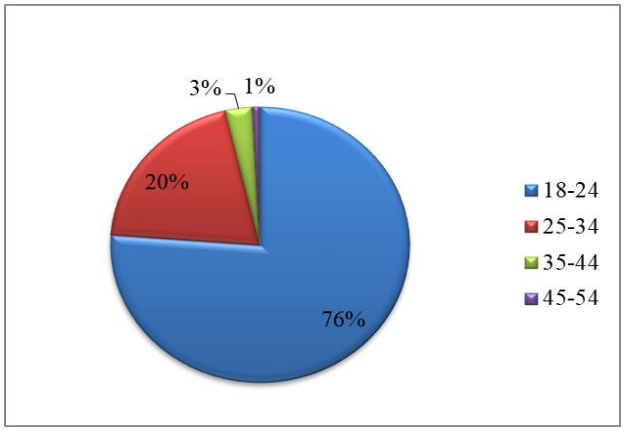


Figure 3-1. Age of participants

Figure 3-2 shows the distribution of respondents based on their educational or degree-seeking status. Among the 240 respondents, a vast majority consisted of undergraduate students (78%), followed by M.S. and Ph.D. students (11.3%).

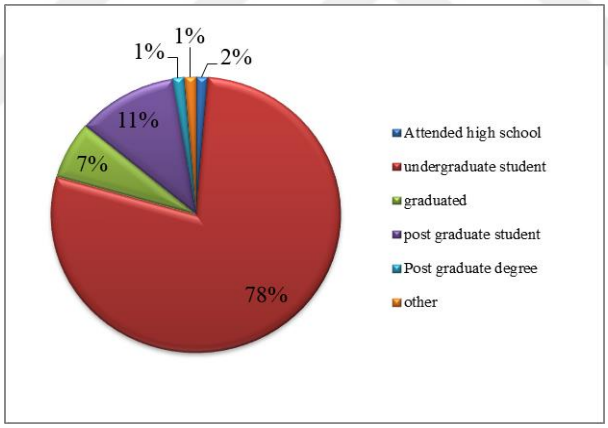


Figure 3-2. Education level of the respondents

With respect to the gender of the respondents, 41% were male, and 59% are female (Figure 3-3). Moreover, 47.3% live on campus, while 52.7% live off campus.

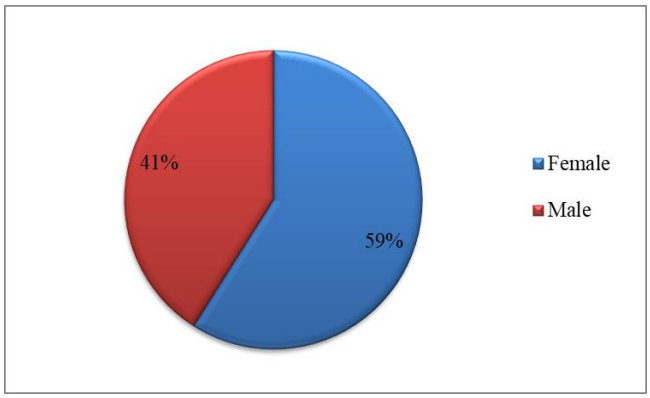


Figure 3-3. Genders of the participants

### 3.2. Method of analysis regarding walkability indicators

This section explains each walkability indicator and the research tools that were used for analyzing the case study area. Data was collected from four main sources. The first one included written documents such as relevant reports, books, articles, theses, and research studies. The second source was direct observation and photos. The third one was preparing spatial analyses by preparing various maps to support the discussion of each part. The last source of evidence was the questionnaire filled in by the users of the METU campus.

The first part of the analysis in Chapter 4 focused on the historical development of METU campus, reviewing the preliminary campus planning and its construction over several years. Additionally, review of previous research on the walkability of METU campus and their findings were taken into account. The second part of the analysis was given in Chapter 5 focuses on walkability and safety capacity of the METU campus. The study was applied to six different zones on the campus. This research particularly considered three major attributes of safety (physical features, sense of safety, and traffic safety) (Table 2-4).

The main question in this survey is whether users thought METU campus is walkable or not. The main question and the secondary questions and tools of research are presented in Table 3-1.

Table 3-1. Questions asked to the respondents

| |
|---|
| **Main question**: Do you think METU campus is a pedestrian-friendly space?<br>**Sub-questions:**<br>- How often do you use this route? (There are 6 different routes in the survey)<br>- Do you enjoy walking on the campus? If not, what are the problems?<br>- What do you like about walking on the campus?<br>- What do not you like about the campus in terms of walking facilities?<br>- What would you like to see on the campus in terms of walking facilities?<br>- What do you think should be improved on the campus in terms of walkability?<br>- Which part of the campus is easier and more comfortable to walk?<br>- Which part of the campus is more difficult and uncomfortable in terms of walkability? |
| **Research tools:**<br>- Maps<br>- Direct observation (photos)<br>- Questionnaire |

Regarding physical features, nine different variables (path quality, path width, signage, bollards, physical barriers, surface and materials, landscape and trees, lighting, trash cans, and litter) are investigated (Table 2-4, part A).

Table 3-2. Assessment of physical features

| |
|---|
| **Main question**: What problems do different zones in METU campus have in terms of physical features?<br>**Sub-questions:**<br>- Do paths have good quality for walking?<br>- Are sidewalks and paths wide and flat?<br>- Are there barriers and gaps on paths?<br>- Are paths clean and enjoyable?<br>- Are paths suitable to walk for people with disability, parents carrying prams, or bicycle riders? |

| |
|---|
| - Are there enough bollards to separate car traffic and pedestrians?<br>- Is there enough lighting to have a safe walk at night?<br>- Are there signage on the paths such as maps or signs leading to different parts and zones in the campus? |
| **Research tools:**<br>- A map presenting path quality<br>- A map presenting path width<br>- A map presenting lighting system<br>- A map presenting street furniture<br>- Direct observation (photos)<br>- Questionnaire |

In this part (Table 2-4, part B) whether METU campus fulfills the requirements for providing its users with sense of safety is questioned. To answer this, another set of main and sub-questions were formulated (Table 3-3).

Table 3-3. Assessment of sense of safety

| |
|---|
| **Main question**: Is sense of safety provided on the METU campus?<br>**Sub-questions:**<br>- Is it safe to walk at any time of day and night considering the activities and presence of people around?<br>- Is there enough lighting at night time?<br>- Are there active buildings that make walking safe?<br>- Is there a feeling of safety at night time?<br>- Is METU campus safe and secure to walk for women and kids?<br>- Do flocks of dogs make walking unpleasant? |
| **Research tools:**<br>- Maps<br>- Direct observation (photos)<br>- Questionnaire |

In the third part, the survey tried to collect answers to questions regarding traffic safety, and whether any traffic program or tools were in place to reduce traffic flow speed. Additionally, respondents' perception of driver behavior toward pedestrians was also assessed (Table 3-4).

Table 3-4. Assessment of sense of safety

| |
|---|
| **Main question**: How does traffic distract the pedestrian?<br>**Sub-questions:**<br>- Do drivers have a good attitude towards pedestrians?<br>- Are there well-designed crosswalks?<br>- Does METU campus need speed management?<br>- Are pedestrian lights and zebra crossings conveniently located?<br>- Do you feel safely separated from the road traffic?<br>- Do you think roundabouts, humps or other measures help improve the pedestrian safety? |
| **Research tools:**<br>- Maps<br>- Direct observation (photos)<br>- Questionnaire |

# CHAPTER 4

## GENERAL FEATURES OF METU CAMPUS

A university is a base for education, and a forum for learning and living. Moreover, it is essential for a campus to be attractive. Universities in West countries cannot be compared because of issues related to system which differs in each country. To have a well-organized campus, it needs a master plan to pursue the development and utilizing it for learning and research. The master plan is closely linked to the academic program and management approach. While developing campuses, it is significant to protect "areas that must not be changed" and keep the balance between areas that would change, and be respectful to the history and traditions of campuses. [24]

For an example of some basic policies campus master plan of university of Fukui (2007) highlights "The university will use land and buildings effectively and undertake development that facilitates flexible use and also The university will make safety a priority and secure a campus environment in which students and staff can conduct their activities with peace of mind." [25] in other part of research, it is stated while planning traffic flow lines considering public space plan, and planning car parks and bicycle parks properly is important to guarantee safety, for example by means of separating pedestrians and cars. Moreover, it is important to ensure the safety of the campus as a whole, including the outdoor environment, as well, of course, as the safety of individual facilities.

[24] Guide to the Creation of a Strategic Campus Master Plan - Aiming for the Creation of Attractive Campuses with Unique Characteristics - https://www.nier.go.jp/shisetsu/pdf/e-masterplan.pdf
[25] Ibid, p33

### 4.1. A history of METU campus

Middle East Technical University (METU) was founded on November 15th, 1956, with a goal to contribute to the development of Turkey and Middle East countries, and it focuses on preparing young people to become qualified for work life in different fields of natural and social sciences. It is a pioneering university in modern education, and presents new approaches and innovations to Turkish education system.

At the beginning of 1957-1958 academic year, the Faculty of Architecture, Faculty of Engineering and Faculty of Administrative Sciences were established. The following year, the Faculty of Arts and Sciences was established. METU started education officially under the title of "Middle East High Technology Institute" in 1956. Later it was given the name "Middle East Technical University". Now, there are a total of 41 undergraduate programs in five faculties in METU.
As of the academic year 2018-2019, there are 107 graduate and 69 doctorate programs available in Graduate Schools of Natural Sciences, Social Sciences, Informatics, Applied Mathematics, and Marine Sciences Graduate Schools.

With a strong emphasis on merit and excellence in scientific, cultural and intellectual studies as well as the existence of accomplished and qualified METU graduates, the university has become one of the well-known and respectable institutions in Turkey. Today, the University employs about 791 faculty (professors, associates professors etc.), 225 academic instructors and 1.273 research assistants. The university offers education to over 28.000 students. The total number of the alumni is about 120.000. [26]

METU campus is located on the southwestern part of Ankara. All faculties and departments are located on the same campus which covers about 4.250 hectares of land on the southern side of the İnönü Boulevard also known as Ankara – Eskişehir highway. Most of the campus structures and all the faculties and departments are

[26] General information about METU, n.d. Retrieved from https://www.metu.edu.tr/history

located at the northern part of the campus area which is practically seen as “METU Campus” in daily life.

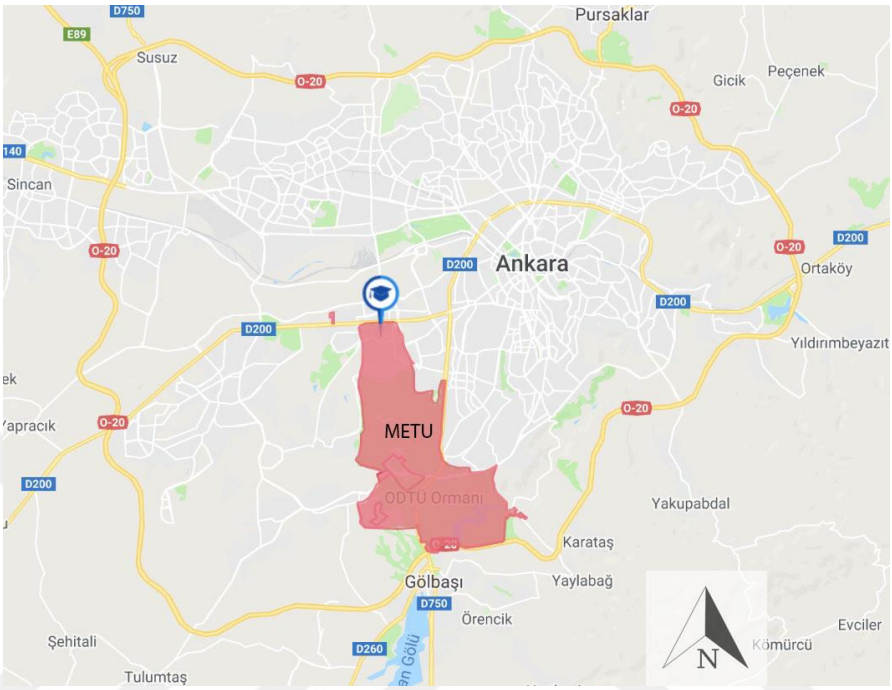


Figure 4-1. Location of METU campus in Ankara

## 4.2. History of campus formation and design principles

The current settlement plan of the campus is the winning design in a national project competition, which was held in 1961 and evaluated by an international jury. The design proposal of Altuğ and Behruz Çinici was chosen as winner project. The construction of the settlement started on 12 May 1961 with the building of the Faculty of Architecture the construction of the buildings envisaged according to the plan of Altuğ and Behruz Çinici continued until the end of the 1970s.

The campus, which is five kilometers from the city center of Ankara, was founded on an area with unique topographic, geological and agricultural characteristics. As

designed by Altuğ and Behruz Çinici in the initial plan, approximately 800 out of 4500 hectares is reserved for settlement.

According to Altuğ and Behruz Çinici's preliminary campus planning report, the main aim of the plan was to create "a university city". For this purpose, Altuğ and Behruz Çinici designed the campus in three different zones (Figure 4-2).

- Academic zone consisting of several departments which are connected with a "alley", completely pedestrianized offering space for a variety of pedestrian activity.

- Administration and student center, which consists of two nodes, and central library, auditorium, fine art galleries, administration building, and the cafeteria.

- Non-academic zone, consisting of dormitories, staff housing, social facilities and sports areas (Büyükcivelek et al., 2016). [27]

[27] Translated by the author

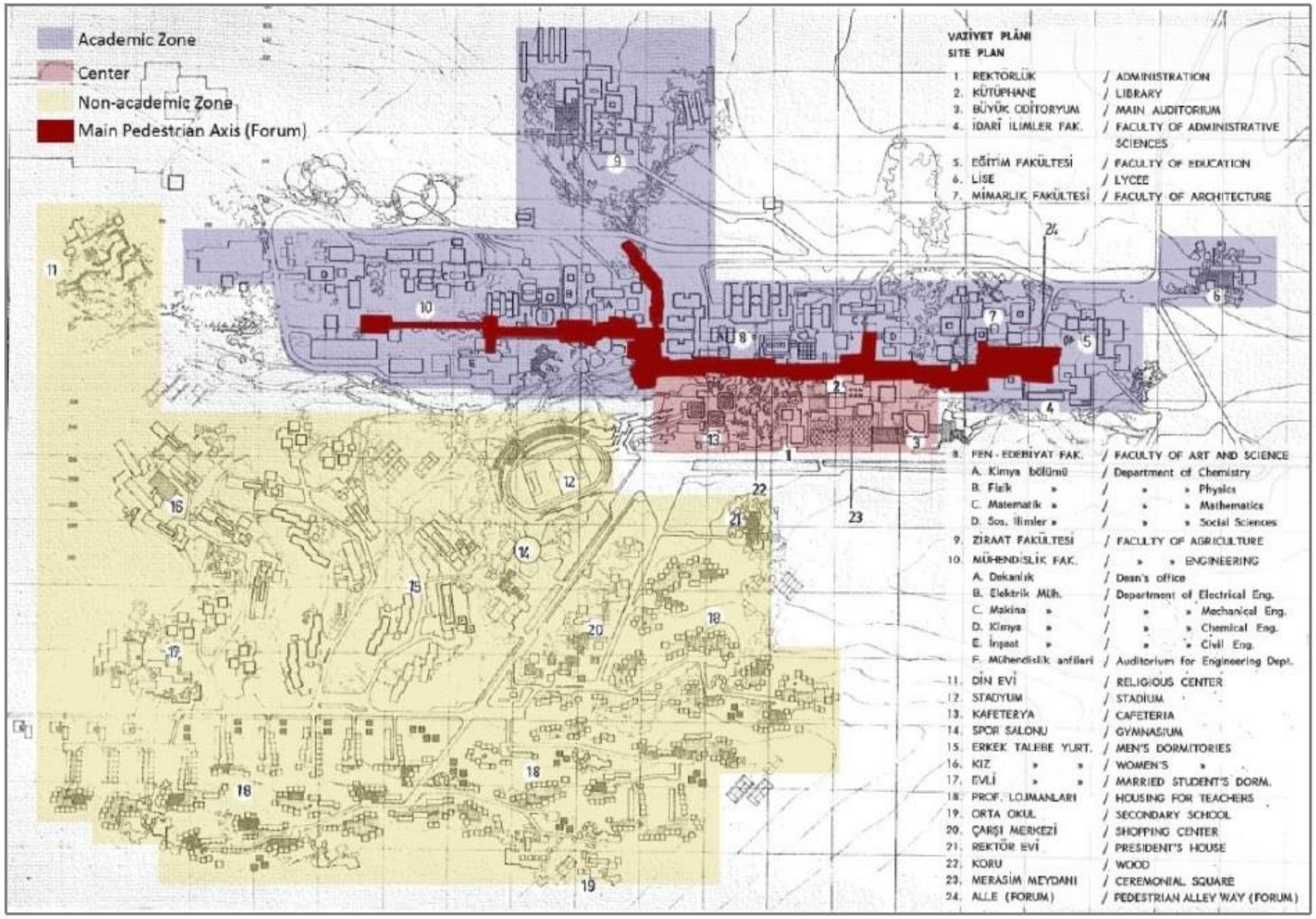


Figure 4-2. Master plan prepared by Altuğ and Behruz Çinici (Sıla Akman, 2016

According to the Altuğ and Behruz Çinici master plan, factor of time is taken into account to connect the zones. The longest distance from one destination to the other is 20 minutes and in the main pedestrian axis the connection in between two for ends is within a 10-minute walk. This 1.5 km long axis as a backbone is the heart of social life in the campus which gathers people to interact with each other. For this reason, vehicle routes and parking lots are located in the outer side of this area. This pedestrian backbone is called “alley” (alle in Turkish).

There are severeal resting areas on the main pedestrian axis. These resting areas extend through the interior area of the buildings, and supported with garden pools that provide a micro-climatization of the environment. The trees planted in front of the buildings provide shade. As a result of this integrated relationship between the spine and the structures, a spatial continuity is provided between the outer spaces and the interiors.

The main design principles of METU Campus according to the master plan prepared by the Çincis in 1961 (Büyükcivelek et al., 2016) is as follows:

- Prioritizing pedestrians in the transportation system
- Separation of vehicles and pedestrian circulation,
- Indoor-outdoor association and spatial permeability,
- Integrating water into public spaces, continuity of green space, material and shape integrity,
- Characteristic fullness-emptiness ratio (built and unbuilt areas pattern)

METU is considered as a leading and successful example of university campus planning and design in Turkey. A design group in Faculty of Architecture of METU prepared a manual of strategical development on space and design. According to this manual the below basic principles may guide the future design practices are

established in order to maintain the tradition of creating high quality education, research and living space.

- Spatial integrity: The original design created in the past, takes the principles of integrity and continuity into account in the creation of the present and future structures of the campus.

- Historical continuity: The historical settlement is physically protected. The development areas are reproduced by taking the original design principles into consideration. These principles ensure the regular maintenance and repair of the physical landscape elements (floor coverings, stairs and walls, etc.) as well as the maintenance and development of the natural elements.

- Accessibility: Developing facilities to provide fast, efficient, comfortable and equal access opportunities among campus land uses (campus, Techno Park, education, sports hall, ODTÜ Kent, and dormitories).

- User safety and security: Evaluation of products and systems used in the campus in terms of user safety take precautions to minimize the risks of accidents.

- Usability: Evaluation of products and systems used in the campus in terms of usability, functionality, intelligibility and user satisfaction.

- Natural sustainability

    - Identifying structure and construction conditions together with nature,

    - Developing proposals to minimize CO2 emissions and considering the ecosystem inside and outside the campus as a whole

- Reforestation of hard-to-use land, developing alternative techniques for energy production and use.

- Social sustainability:
  - Integration of outlying areas into the general movement system,
  - Increasing the areas of gathering and meeting,
  - Providing joint working areas, and
  - Creating a multi-disciplined event space.
- Participation: All kinds of spatial arrangements and construction decisions related to the future of the campus should be taken by participation of all the relevant units of METU. Thus, this would improve the sense of ownership towards the campus. Planning the design process in accordance with the principles of participatory design and ensuring the participation of different stakeholders in the process (Büyükcivelek et al., 2016).
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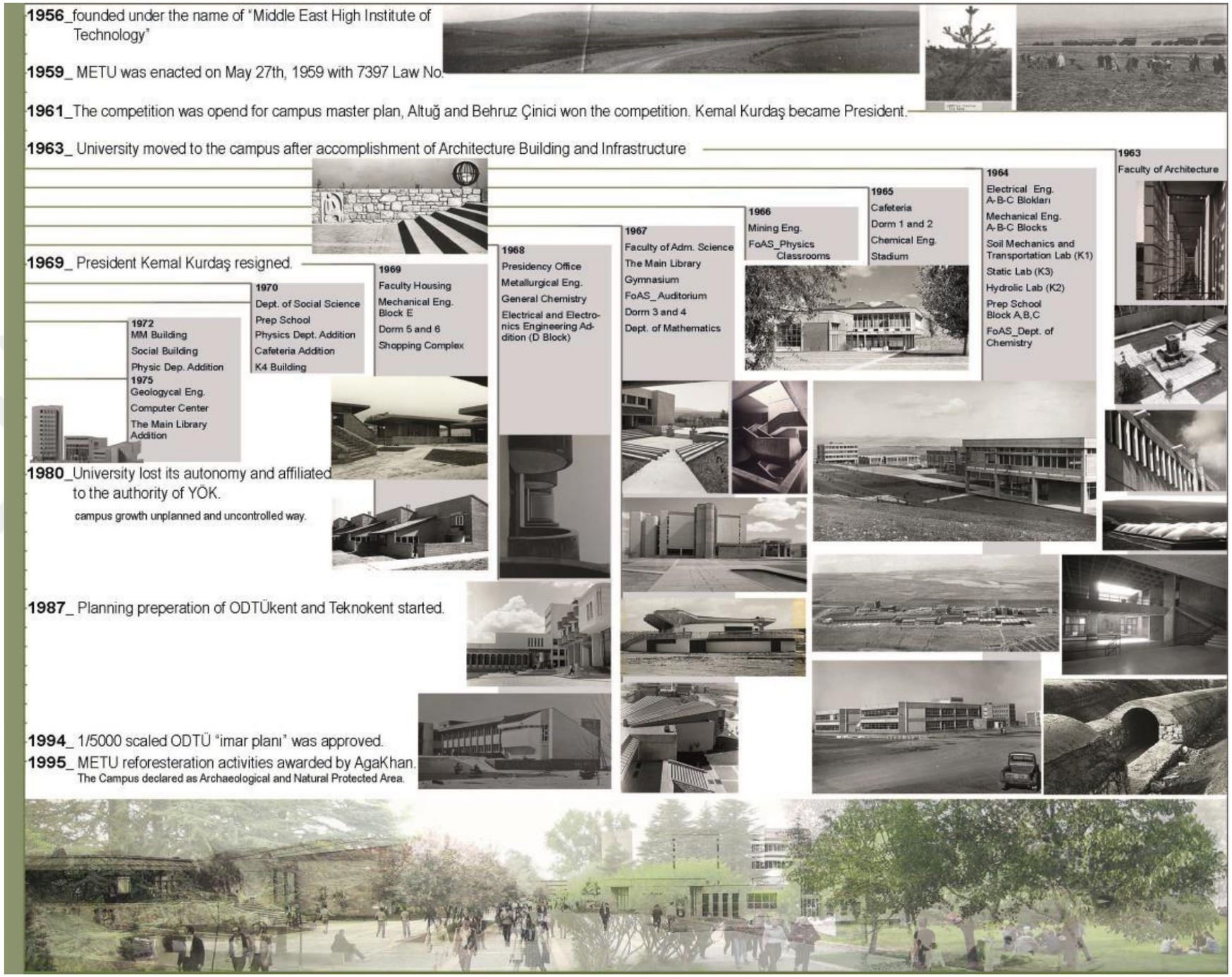



Figure 4-3. Timeline of the Campus

Source: (Akman, 2016)

### 4.2.1. Development zones and areas

The campus comprises nine zones as academic areas, dormitories, faculty houses, sport areas, cultural and commercial areas, service buildings (such as technical directories affiliated to Presidency), METU Techno Park, METU College and METU Forest.

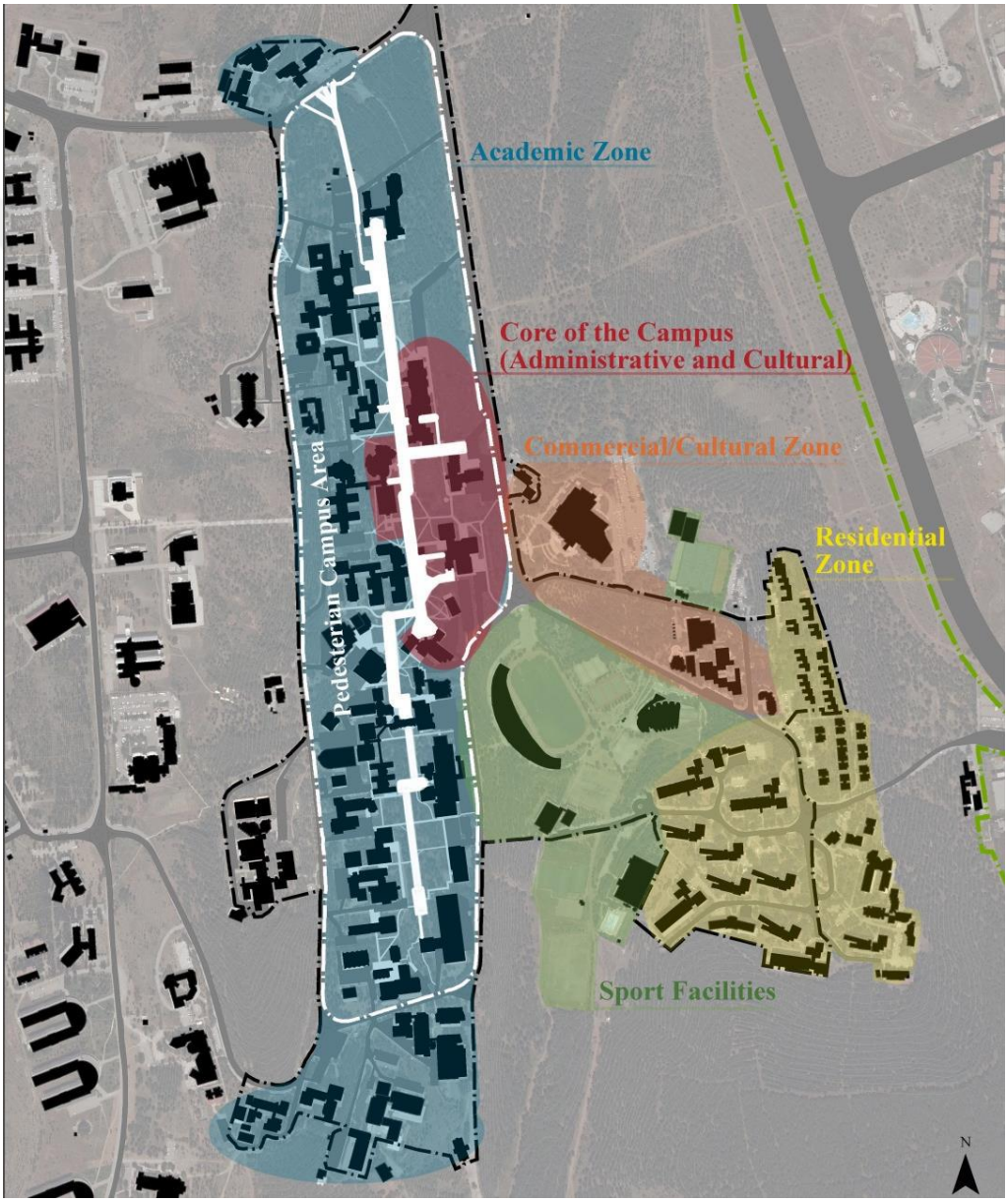



Figure 4-4. Zones according to function (Akman, 2016)

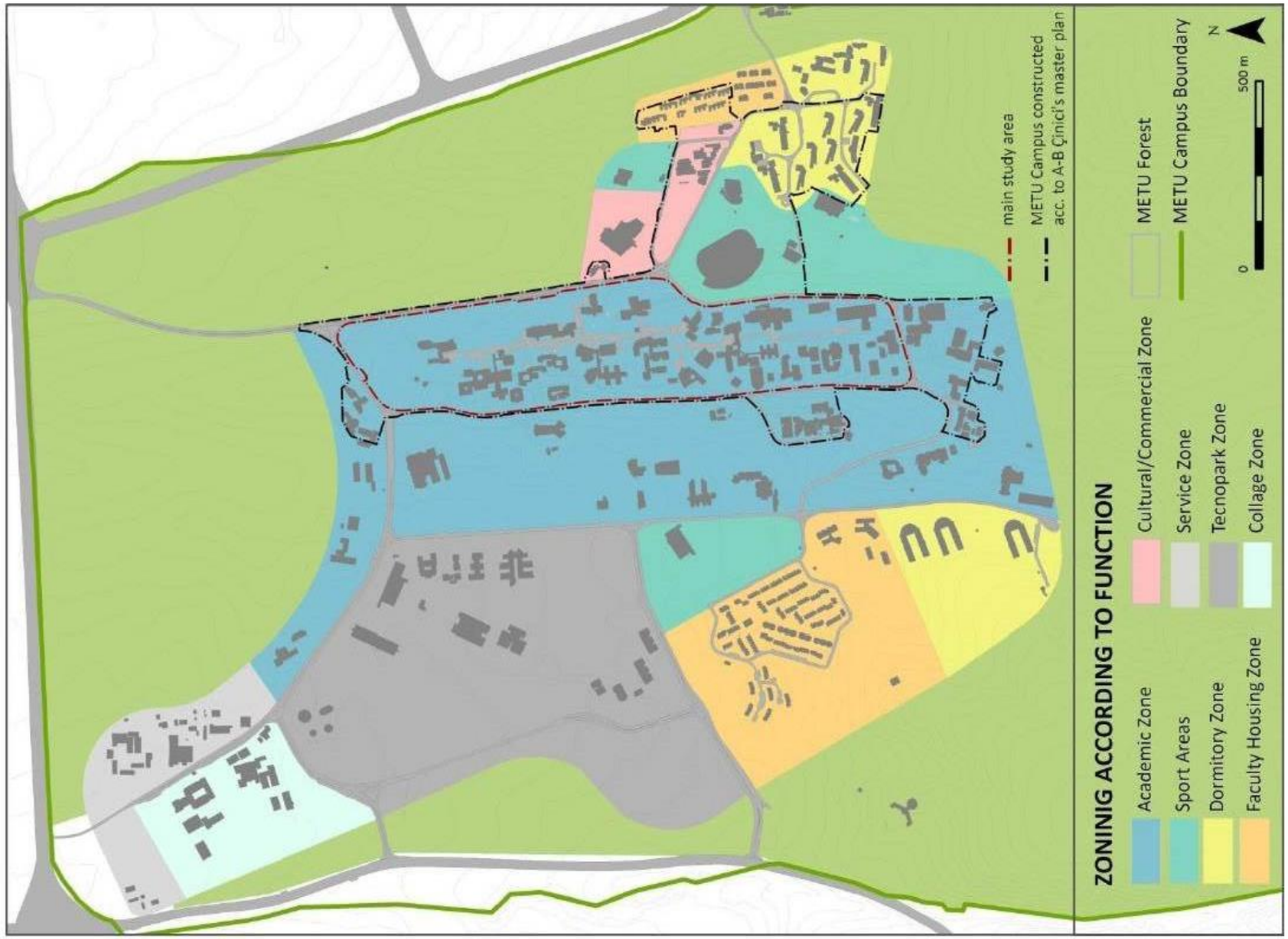



Figure 4-5. Zoning according to function (Akman, 2016

Strategic design approach as specified in the 2016 manual discusses the built areas of the settlement and the areas that can be developed in the future on three basic axes. These three axes, extending in the north-south direction, have been defined in terms of the existing structured areas of the settlement, the spatial needs of these areas and the topographical data of the settlement. The aim is to ensure the spatial integrity of the settlement, especially the pedestrian backbone, based on the design decisions made in the past and apply this very same plan into the new development areas. In this regard, each of these three axes is further enhanced by pedestrian paths extending through the east-west line and the traffic roads. (Figure 4-6)

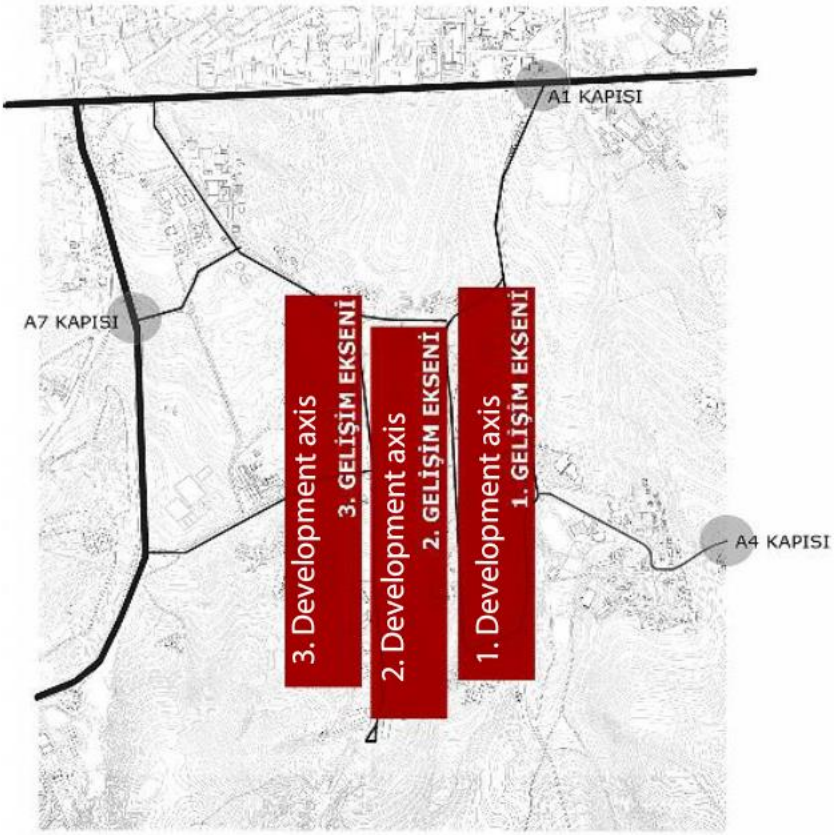



Figure 4-6. Axes of development in METU (Büyükcivelek et al., 2016)

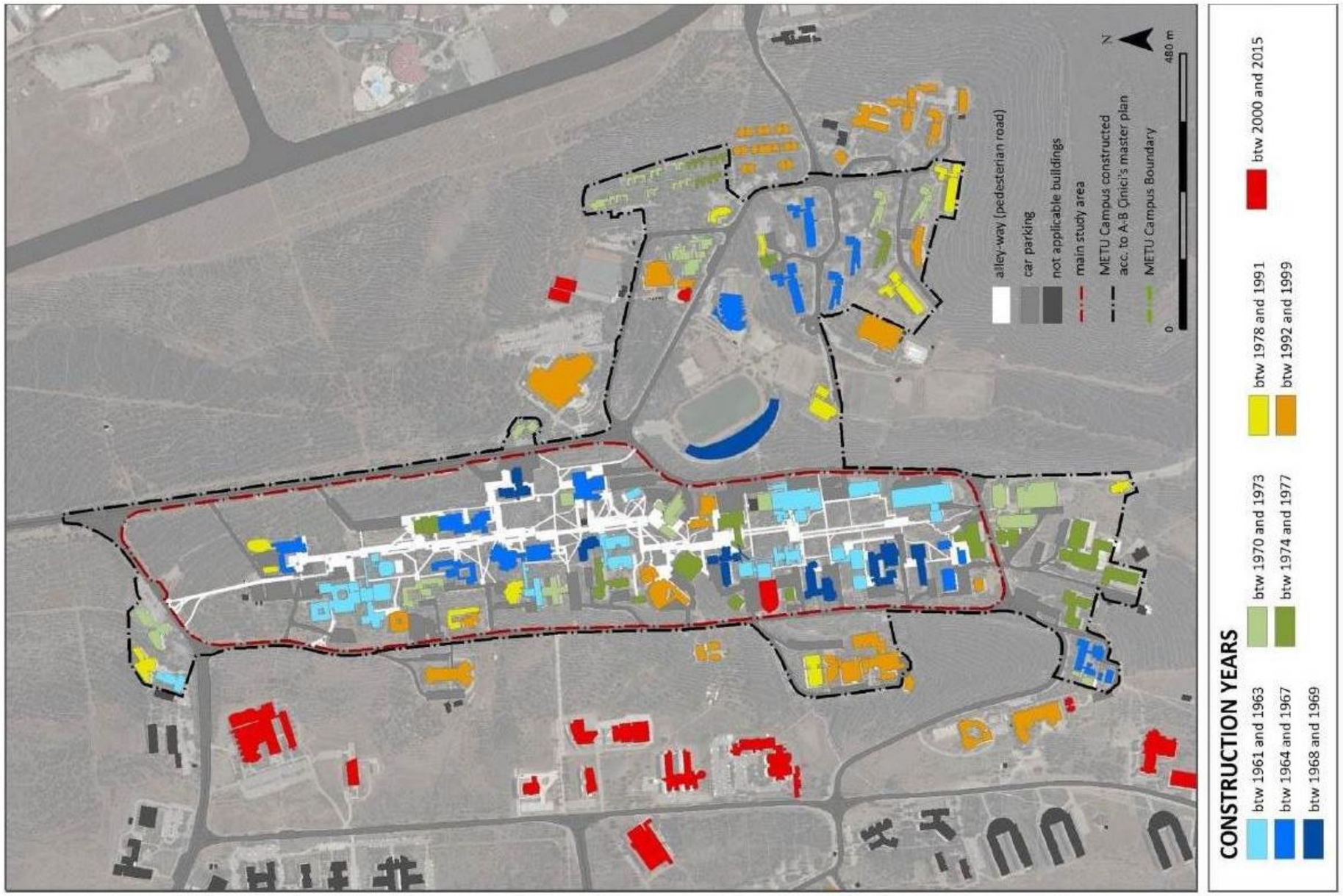



Figure 4-7. Construction timeline of the buildings (Sıla Akman, 2016)

In the figure (4-7) the construction timeline in these three axes are illustrated. The first axis is the main campus zone, which was developed between 1961 and 1969. The second axis is the transition zone for the upcoming spatial growth that was developed between 1970 and 1999. The third zone is Techno Park – ODTÜKent developed between 2000 and 2015.

"The campus has a characteristic figure-ground pattern with its fragmented and linear buildings. Buildings are articulated to the main pedestrian axis with determinant distant, and open and built-up area's continuity is provided along the pedestrian axis." (Akman, p. 33, 2016)

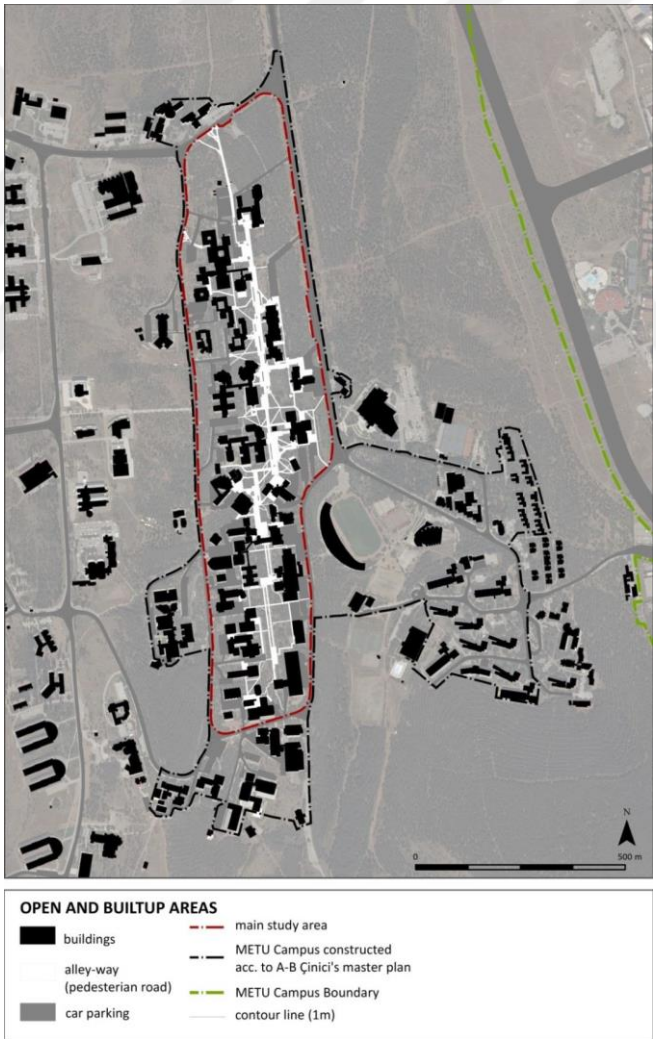



Figure 4-8 Open and Built-up Areas (Sıla Akman, 2016)

The following figure presents campus structures, gates and boundaries. In the north of the campus, high-rise business buildings are lining up Eskişehir Highway. In the east, there are government agencies and dense residential areas, the south the campus ends up with Gölbaşı district. Other university campuses such as Bilkent Campus and Hacettepe Campus and residential areas are located in the west. There are four entrance gates to the campus which are A1 and A2 at the north, A4 at the east and A7 at the west. (Figure 4-9)

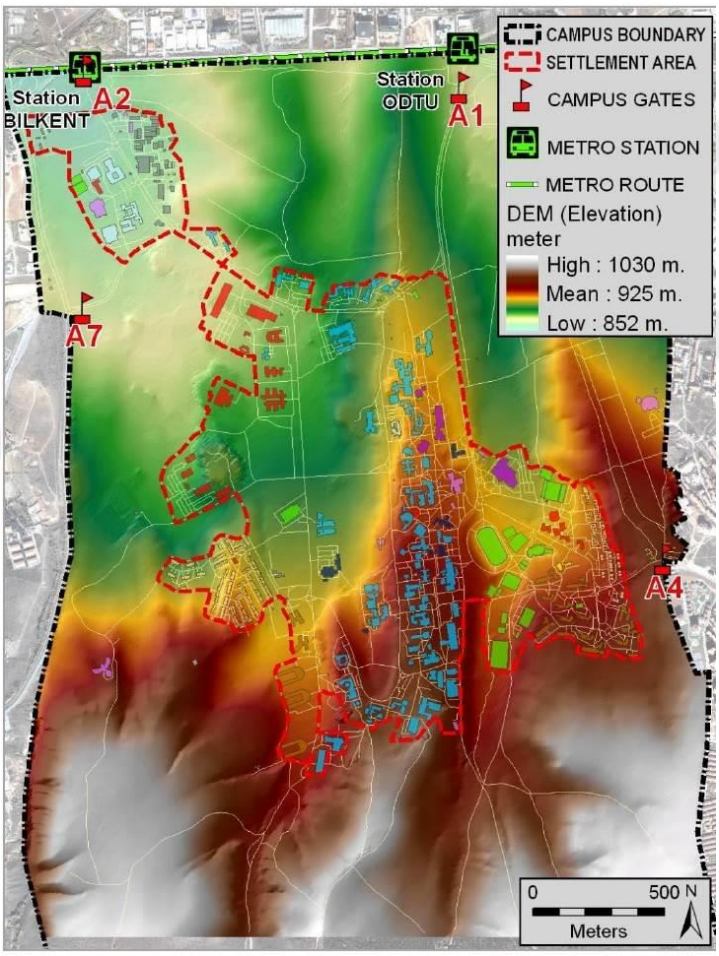



Figure 4-9. Accesses to the campus (Cem Güllüoğlu, 2005)

### 4.2.2. Linkage

According to the 2016 prepared manual strategic plan, settlement areas which have already been built and which will be constructed in the near future appear as linear slices on three basic development axes in north-south direction. It is recommended to design new development areas be organized through pedestrian axes similar to their location in the first development zone. Two additional pedestrian axes are proposed to be integrated into these vertical paths (Büyükcivelek et al., 2016).

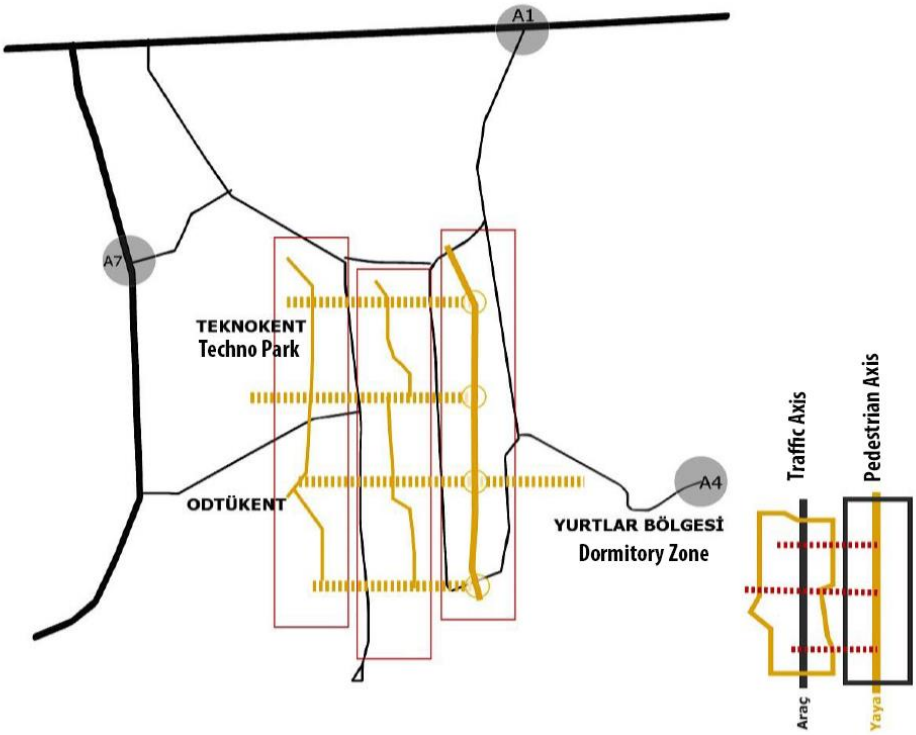



Figure 4-10. Integrative connections between the axes of METU campus (Büyükcivelek et al., 2016)

### 4.2.3. Transportation system

METU Campus has a transportation system, in which by considering scale and topography, pedestrian movement is the top priority. As the distance increases, means of transportation would change from pedestrian, to bicycle, then to public transportation and finally to private vehicle. Transportation strategies of the METU campus can be defined under four main headings; pedestrian circulation strategy, bicycle transportation strategy, public transportation strategy, and private car strategy. One of the most important result of Karataş (p.33, 2015) research 'Determination of pedestrian level of service for walkways: METU campus example' from the survey is "the high walking preference within campus transportation. 68 % of the students prefer walking as a first alternative while going somewhere in the campus. This shows us there is a high demand to walking in the campus movements and there should be more effort on walking, walkway infrastructure and etc."

## 4.3. Landscape

Initial plan for the METU re-forestation and landscaping program began in 1958 regarding two aims. First, to solve the problem of air pollution in Ankara. Second, to create a green zone in Ankara. For this reason, 4,500 hectares land was donated to the university by the Turkish government. By 1960, METU Directorate of Afforestation and Landscaping selected appropriate plants for campus land, besides in 1961, the re-forestation program was launched.[28] The METU Afforestation Project was awarded the International Aga Khan Architecture Prize in "innovative concepts" category in 1995 and was deemed worthy of an award by the TEMA Foundation in 2003 "for its support for turning an arid land into a green area and contributing to the struggle against desertification. "In the figures blow, developments in the campus landscape due to re-forestation and landscaping program presented.

[28] Re-Forestation Programme of METU | Aga Khan Development Network. (n.d.). Retrieved from http://www.akdn.org/architecture/project/re-forestation-programme-of-metu

Figure 4-11.General view from the built environment of the campus in 1964 (Aga Khan Development Network)

Figure 4-12. General view from the built environment of the campus in 1987 (Aga Khan Development Network)

Figure 4-13. General View from the built environment of the campus in 2019 (Photo: Mehmet Çetin)

## 4.4. Review of previous research on walkability of METU campus and their findings

In one of the recent studies on METU campus, Negin Froughisaeid (2018) in her thesis *"Students' perception of safety in the physical environment of a university campus"* studied the design features that have an impact on the users' perception of safety in the university environment and how these attributes affected such a perception. She referred to Jon Lang (1994); who suggests "five concerns in developing a behavioral program to provide for people's safety and security needs, degree of segregation, natural and artificial surveillance, appropriate level of privacy, sense of orientation and sense of place, social and geographical." She has done interviews with 25 students using 14 open-ended questions to find the relation between these five parameters and perception of safety. She divided the campus into three zones, academic zone, recreational zone and residential zone. After introducing and discussing topics like 'perception of safety and perception of safety in campus environment', 'safety and women' and 'Refuge-prospect model', she presented the findings and analyses of interviews. In the following, I mention the aspects chosen from her study and its results.

Sense of place: 92% of participants can locate themselves in the campus or they can guess the function of a building.

Sense of orientation: 60 % cannot locate themselves during the first month of their use of the campus area.

Control: for attaining control we need privacy to act freely and to have opportunities to recede from people and functions. In METU campus, most of the students who live in campus have shared rooms in the dormitories and that's why 72% of the participants are not satisfied with levels of privacy in campus.

Surveillance: Froughisaeid mentions that natural and artificial surveillance is the most important element of perception of safety in her research. Presence of people on the campus makes the interviewees feel comfortable. However, 16 out of 25 students feel isolated on campus, 13 of these participants live in the west

dormitories. One component of safety related to surveillance featured as lighting, although there is enough lighting in main roads and areas, but in the shortcuts and places far from the central area 64 % of participants say there is not enough lighting.

Evaluation of the results of this study showed that many interviewees described the campus as a confusing complex of roads, without enough lighting in shortcuts, and the signage is mostly for drivers and not for pedestrians. In the western area, there is no opportunity for socializing, and segregating the functions becomes problematic for people who live in western area. The students who live in the west dormitories felt isolated, and complained about guests' vehicles.

According to this research, the most unsafe areas in METU campus are, A1 gate to KKM, shortcut from the west dormitories to the Mechanical Engineering department, and the shortcut between the departments of architecture and business administration. The safest areas are considered to be the eastern dormitories, Devrim Stadium, shopping center and library. The characteristics that made these areas safe included good lighting, easy access to different facilities, availability of transportation, and presence of other students. At the end of this research, the author suggested that in the west dormitories some places and activities can be increased to give a chance to students to participate and socialize, which in turn raises the vitality in this area. Secondly, the lighting and maintenance can be improved in thewestern dormitories (Froughisaeid, 2018).

Another study titled "determination of pedestrian level of service for walkways: Metu campus example" is done by Pinar Karataş (2015). She claims that to encourage walking and shifting it towards more sustainable modes, such as walking, cycling and public transit on the campus. First, it is important to understand and evaluate walkability and walking concepts. While walkability assessment studies mainly deal with perception and built environment aspects, engineering studies focused on evaluating pedestrian level of service (PLOS) based on flow and infrastructure capacity measures.

For evaluating walkability and PLOS, this study collected necessary data, for PLOS three methods were explained under three subtitles; i) pedestrian counts, ii) infrastructure data, and iii) vehicular traffic data. For first part of data collecting, survey was conducted on total of 102 count points with 6 different time periods to capture the mobility in the morning, during noon and in the evening. The infrastructure data on walkways, sidewalks and crosswalk have an approved impact on walking choice, first stage was the collection of accurate features such as width of sidewalk/ walkway, presence of trees, buffer, median and issues like network complexity -building articulation -complexity of spaces - transparency - buffer - shade trees good Awnings - physical component/ condition.

Study shows that both walkability and pedestrian level of service have similar dimensions of i) user characteristics, ii) traffic characteristics, iii) land use characteristics, iv) infrastructure characteristics and v) safety/ comfort characteristics.

She highlights "lightning and the buffer area created by trees, parked car are very important under safety/comfort issues. As safety precautions, crosswalks, presence of a median and traffic lights seem important. In-campus speed limit should importantly decrease in spite of current low speed limits." (Karataş, p.21-34, 2015). She summarizes that vehicular speed and lighting affects the actual and perceived safety of pedestrians along a roadway

Through the evaluation of METU Campus pedestrian activity and PLOS ratings, it is concluded that,

- The definitions of "walking" network have to be reevaluated carefully.
- GIS enables strength in the display of pedestrian mobility, and contributes greatly to understanding of walking pattern.

- Even short-term manual counting of pedestrian activity over a campus requires much manpower, mainly because the concept of “walkway” and “path choice” for walking is very flexible.
- Pedestrian perception on walkability and walking should be determined by respondents for each count location respectively to include the perception into a new model.
- The current available PLOS methods are totally different from each other because of their perspectives and may result in very different and even contradicting ratings.
- At these contradicting rating points, it is important to conduct further survey with the pedestrians to decide which method captures the reality more.

It is important to understand individual perceptions of walking, which can be observed with surveys. Pedestrian surveys and walking network data must eventually lead to flexible and disaggregate mathematical models of walking choices that will in turn provide information on the parameters that would encourage or discourage walkability. It is necessary to develop cheap but precise technologies and tools to monitor pedestrian volumes and directions.

# CHAPTER 5

## HOW SAFE METU CAMPUS IS FOR WALKING?

The aim of this chapter was to evaluate METU campus with respect to the walkability capacity based on the indicators of safety described in Chapter 2 (Table 2-4). To achieve an overall view of METU campus, these indicators are examined in six main zones of the campus, Zone 1: technopolis technopolis (Teknokent) is the research and development park located on the west of the university, Zone 2: east dormitories includes fourteen students' dormitory buildings, and "The stadium is the crucial connection point between academic and residential zones and meets the pedestrians coming from the Alley. The sports facilities include the stadium, gymnasium, open sports areas such as tennis courts and football fields, Baraka Gym, outdoor and indoor swimming pool." (Akman, p.57, 2016), Zone 3: A1 gatedoor which is one the four entrance gates to the campus, Zone 4: A4 gatedoor entrance gate on the east of university, Zone 5: west dormitories includes dormitories and METUtown (ODTÜKent) on the southwest, and Zone 6: main pedestrian axis "The defining layout of the campus is formed along the pedestrian axis which is the spine of the campus, named as "Alley" by the users. The Alley extends along the ridge from north to south in accordance with the soft terrain topography. Throughout the Alley, academic units are located on the west side and generate education area, while president's office, the main library and cafeteria take part other side (on the east) and form center. The focus of the intense social activity occurs here and this cultural and intellectual interaction place, the spine, can be named as "Forum" or the main major class of the university in where people are gathering and interacting continuously." (Akman, p.63, 2016)

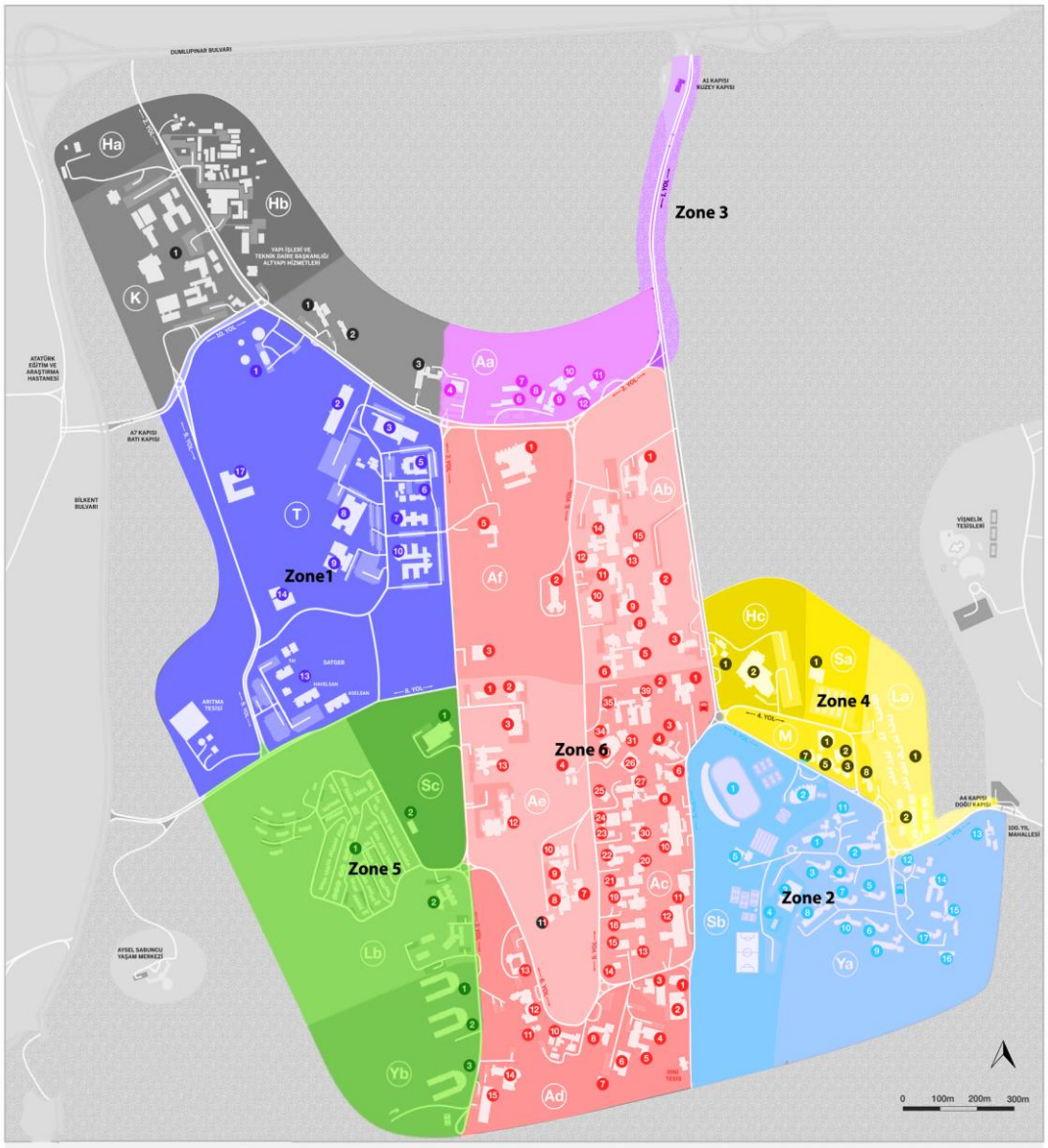



Figure 5-1. The six main zones of the METU campus used in the case study

## 5.1. General findings and analysis of the participants' view

47.5% of the respondents live on campus, while 52.5% live off campus. In response to the second question in the questionnaire, the frequency of the participants' uses of paths on campus: 46.3% of them used one of the routes in the six different zones mentioned before more than once a day and 25% used a path a few times a week.

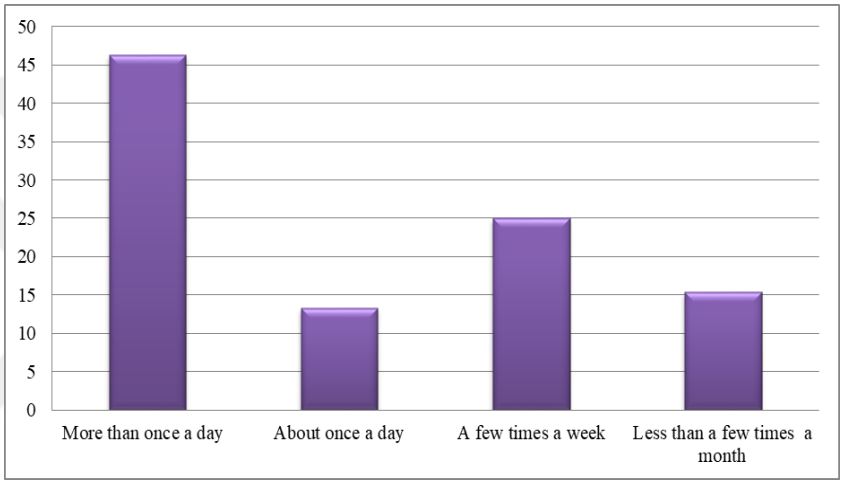



Figure 5-2. Frequency of walking around on the METU campus

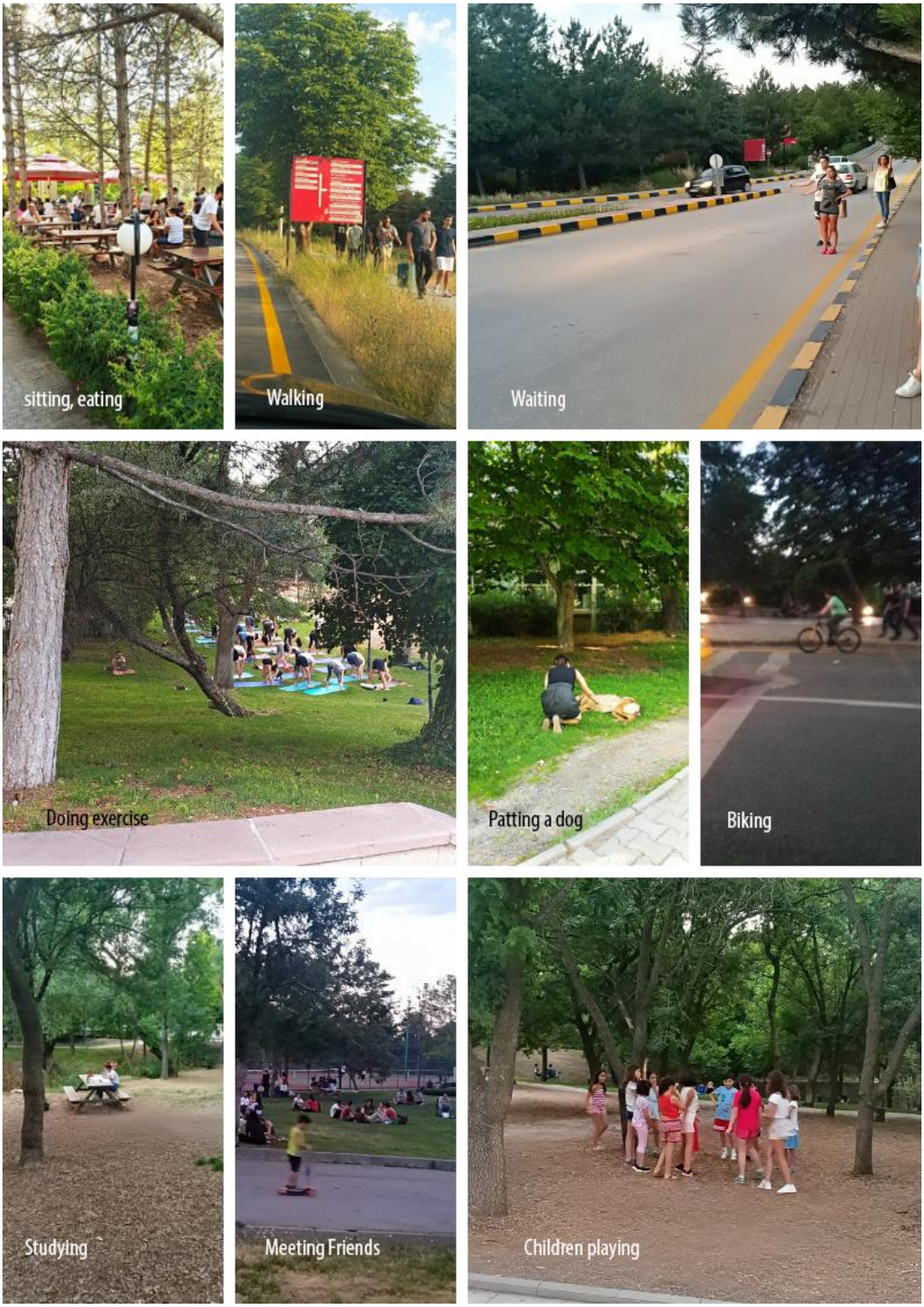



Figure 5-3. Pedestrian activities in the METU campus (Source: Personal Archive)

Question 3 was to find out how pedestrian-friendly METU campus is. Among the 240 participants, 71.3% felt that METU campus is pedestrian-friendly and 26.3% said that it is not. 6 participants did not answer this question.

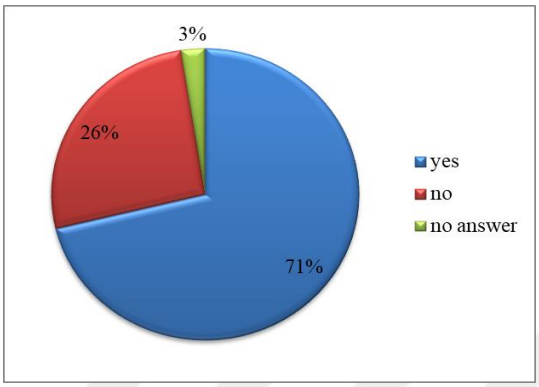



Figure 5-4. Is METU campus pedestrian-friendly?

There are many motivations for walking, such as recreational activity or to travel around. 52% of the respondents said they walk for transport to reach a specific location on campus such as a shopping center, bus or minibus station, or departments. 37.9% walk for both transport and recreation and only 9.6% walk for recreation and physical activity.

In the following table participants' comments about whether they think the campus is pedestrian friendly or not are presented.

— I think METU campus is pedestrian-friendly because:

Table 5-1. Positive points of view of participants

| Users comments | Interpretation of the participants' comments |
|---|---|
| "…there is priority for pedestrians in campus"<br><br>"…it is safe for walking at day time, but not at night, stray dogs make it difficult to walk, and we need to take a taxi"<br><br>"…in comparison with the whole city, yes, it is walkable, but sidewalks are not enough".<br><br>"…there are a lot of alternative ways to reach a place"<br><br>"…without using a car and only by walking, we can reach everywhere"<br><br>"…there are many careful drivers who obey the traffic rules, but in general it depends on drivers' attitude"<br><br>"…there are elevators for people with disabilities"<br><br>"…it is intertwined with nature, I love hearing the chirping of birds, the clean air, and silence, animals that are strolling and living with people." | Most users that mentioned METU campus is pedestrian-friendly mentioned that there is priority for pedestrians on campus, and they find it walkable in day time, but it is not the same for night usage. Users think that the campus is accessible because of many alternative routes to reach different destinations.<br><br>Drivers in comparison with the other parts of the city respect pedestrians, and they find it attractive for walking because of green spaces around. Moreover, giving priority to pedestrian circulation increases the quality of space.<br><br>In good examples of walkable cities, it is highlighted that connectivity and continuous direct routes and convenient connections between destinations make that environment walkable. As can be seen on the METU campus, there are lots of alternatives routes to reach destinations.<br>Another highlighted topic in sustainable development is access to safe, inclusive and accessible, green and public spaces. As the participants stated, METU campus is intertwined with nature, which makes walking pleasurable. |

— I think METU campus is not pedestrian-friendly because:

Table 5-2. Negative points of view of participants

| Users comments | Interpretation of the participants' comments |
|---|---|
| "…the connections between the west dormitories and the main campus area are not safe"<br><br>"…although it is a pedestrian-friendly environment, there are drivers who don't pay attention to rules and pedestrian priority"<br><br>"…sidewalks are narrow or there might be trees in the middle of it, so it is hard to walk even for one person"<br><br>"…distances between departments or other buildings are too far"<br><br>"…traffic rules should be stricter, because there are many cars and they drive aggressively"<br><br>"…guest drivers do not realize that the campus is a pedestrian-friendly area"<br><br>"…the way to gate A4 has a sharp slope, and cars pass so fast in this route, also the sidewalks are narrow and uneven"<br><br>"...paths aren't in good quality, although cobblestone is environmentally-friendly, they are not comfortable to walk"<br><br>"…lighting is not sufficient"<br><br>"…there are many shortcuts to reach a destination but they are not safe at night"<br><br>"…dogs scared me to walk at night time, but definitely I don't want them to be taken away | As suggested in the literature of walkability, connectivity of path network is one of the important components whose lack is obvious in the zone 5 (west dormitories). It seems that there is not enough connectivity between the west dormitories and the main campus area. This finding is similar to Froughisaeid's evaluations. As she stated in her thesis, the west area is more isolated than the east dormitories, and there is not opportunity to be socialized in the west area.<br><br>Users complain about some drivers who do not pay attention to rules, and Froughisaeid also mentions that interviewees are complaining about guest cars.<br><br>As it mentioned in the literature review, people do not often walk when walking doesn't include a good experience because of heavy motor and vehicle traffic and crowded or narrow walkways. In the METU campus, most of the complaints are about narrow sidewalks, or sidewalks with trees in the middle.<br><br>Also, users feel that they are being exposed to motor vehicles on the way to Gate A4, and the sharp slope in this route makes walking unsafe.<br><br>As stated in the literature, the quality of the path network is a quality affecting the likelihood of walking and can be improved through design. |

| | |
|---|---|
| from the campus”<br><br>“…there are not enough bus rings so if there are not any cars for hitchhiking, access to the campus area will be hard”<br><br>“…from gate A1 to main campus area, this route is so silent, there are not people or any buildings around, and so it makes walking unpleasant.” | Another feature is lighting, which as users indicated, it is not sufficient.<br><br>Lack of transportation from gates to the main areas makes it hard to access destinations. |

In the question of ‘do you enjoy walking on the campus?’ 80% of participants mentioned that they enjoy walking in the campus, while 20% does not. Among those who do not enjoy walking, 42% indicated that stray dogs are the reason. For 34% of the respondents the poor quality of the pavements is the other reason in the whole campus. In the following chart, the percentages of some of the problems leading to walker dissatisfaction were presented.

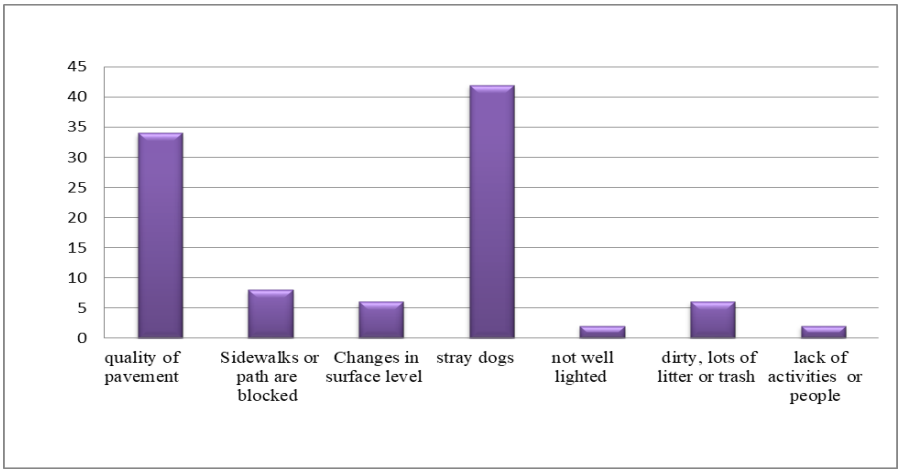



Figure 5-5. Participants’ view about problems which occurred during walking

The answers to “what improvements can be made” are listed below (Table 5.3).

Table 5-3. Improvements to be made

| Items to Be Improved | Frequency | Percent | Percent | Cumulative Percent |
|---|---|---|---|---|
| Some parts of campus sidewalks should be widened | 87 | 36,3 | 36,6 | 36,6 |
| Needs more grass, flowers, or trees | 26 | 10,8 | 10,9 | 47,5 |
| Needs more benches or places to sit | 43 | 17,9 | 18,1 | 65,5 |
| Needs well lighting | 62 | 25,8 | 26,1 | 91,6 |
| Needs public art or other appealing features | 10 | 4,2 | 4,2 | 95,8 |
| Other | 10 | 4,2 | 4,2 | 100,0 |
| Total | 238 | 99,2 | 100,0 | |
| Missing | 2 | 0,8 | | |
| Total | 240 | 100 | | |

Participants also mentioned their expectations in terms of walking facilities, and wrote down what they wanted to see in the campus. Here are some responses:

– I wish we had wide sidewalks and special routes for walking.

– I think the routes need a better lighting.

– We need facilities, for example resting areas of good quality such as benches, and other facilities such as trash bins.

– Improving sidewalks and getting dogs under control.

In the following participants are asked which areas are more comfortable or uncomfortable to walk on campus. The result is presented in the map below (Figure 5-6).

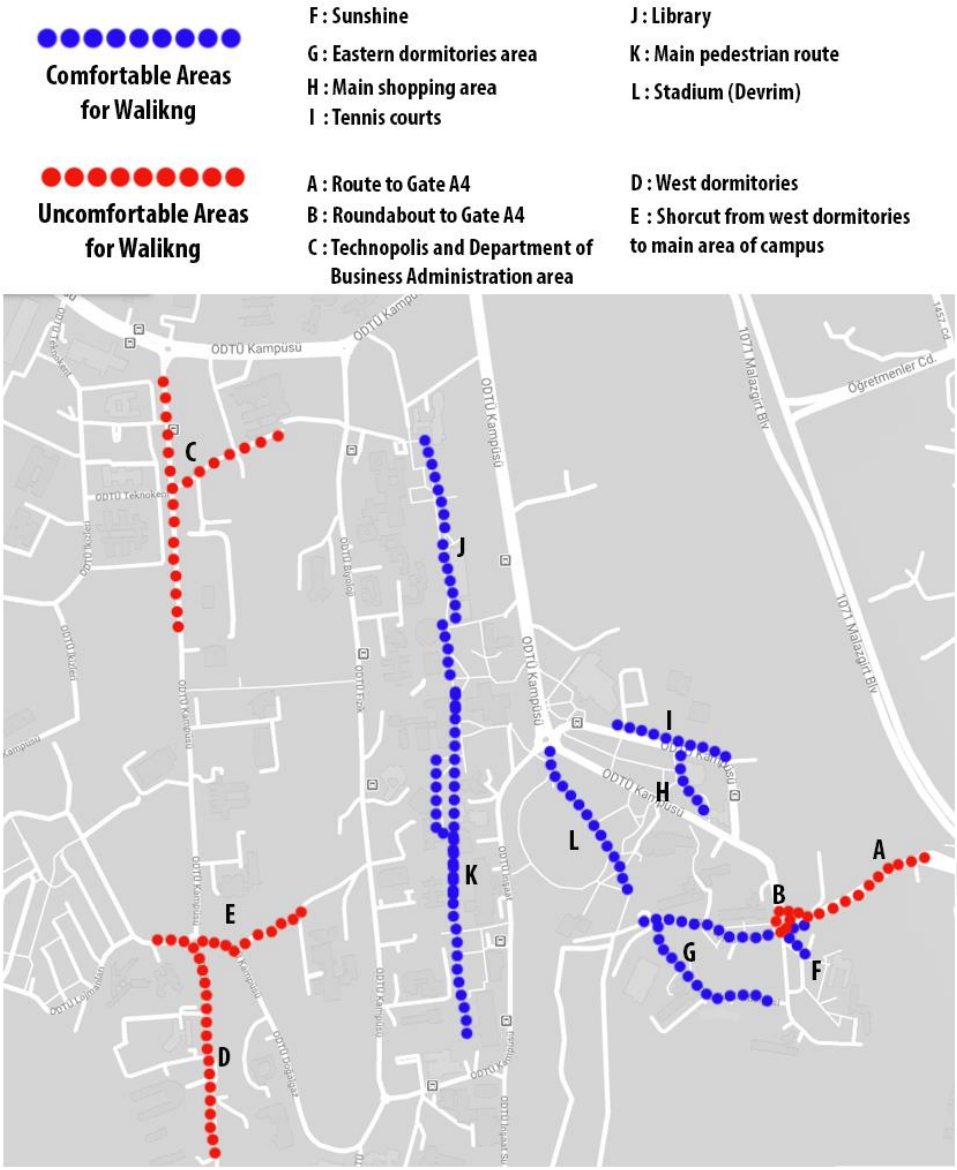



Figure 5-6. Participants' view about comfortable and uncomfortable areas for walking

The route from sunshine to gate A4 has a sharp slope, sidewalks are of bad quality and they are so narrow. People feel unsafe because it is uneven, narrow and slippery on rainy and snowy days, and users feel in danger when they walk there. This route is one of the most uncomfortable areas.

Roundabout to gate A4 is so crowded by cars and it is really hard to walk there. There is not any zebra crossing or traffic light.

Technopolis area, lack of pavement and low quality of existing pavements makes it uncomfortable to walk.

West dormitories, Lack of feeling safe, lack of lighting and safety at night makes it uncomfortable to walk in this area.

Shortcut from west dormitories to main area of campus, lack of lighting at night, presence of stray dogs cause participants feel uncomfortable.

Figure 5-7. Uncomfortable Areas for walking

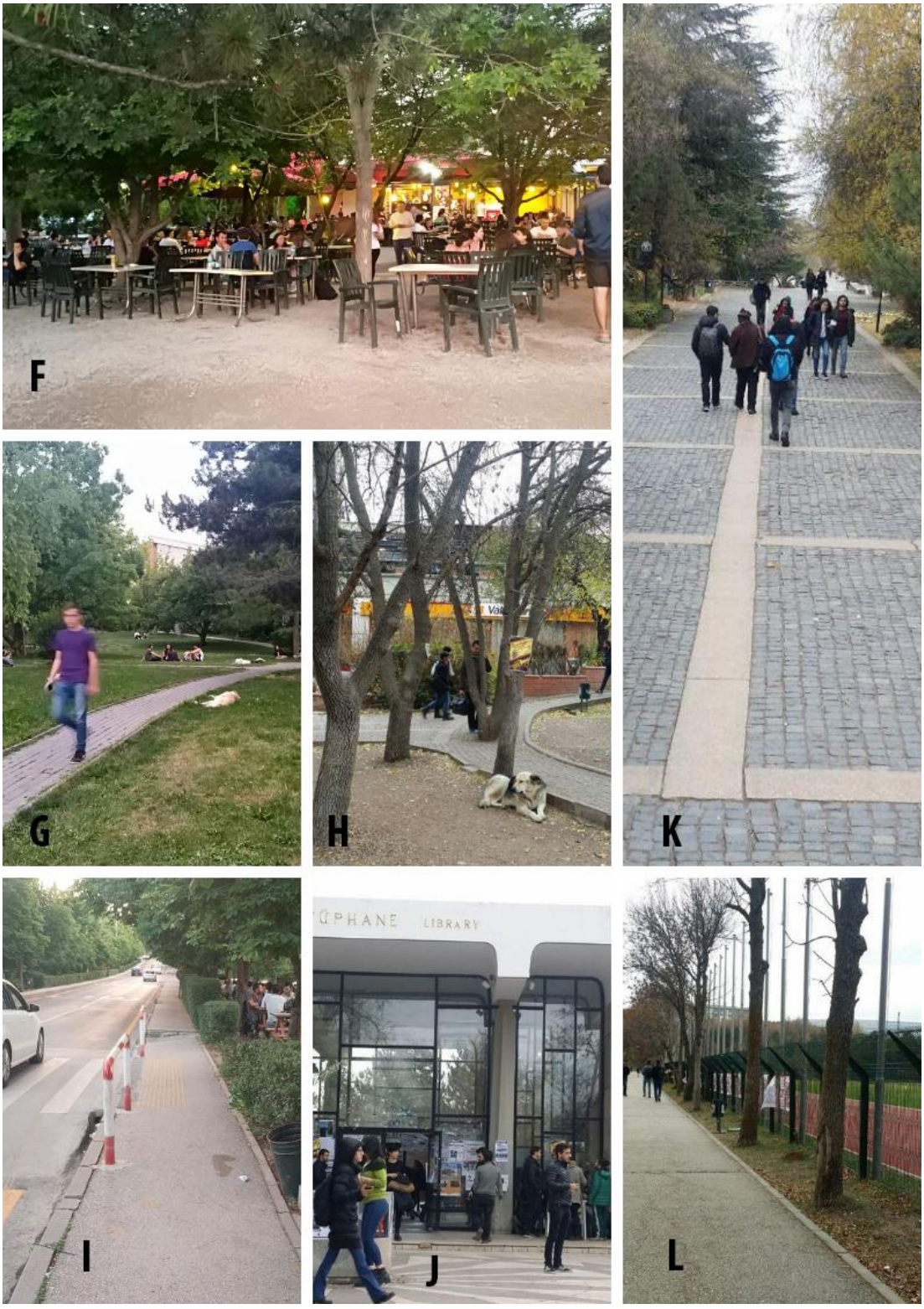



Figure 5-8. Comfortable areas for walking

## 5.2. A-Physical features

### 5.2.1. A-1- Path quality

For the case of METU campus, participants were asked whether paths have good quality for walking in different six zones (Figure 5-9).

One of the participants said:

*Pavements should have better quality, we need a comfortable environment for pedestrains.*

Other participant mentioned:

*Most of the pavements and routes especially the central area of the campus is in good condition in terms of quality, but in the other parts of the campus, we cannot see such an effort, because of this, I changed my dormitory and moved to east dormitory.*

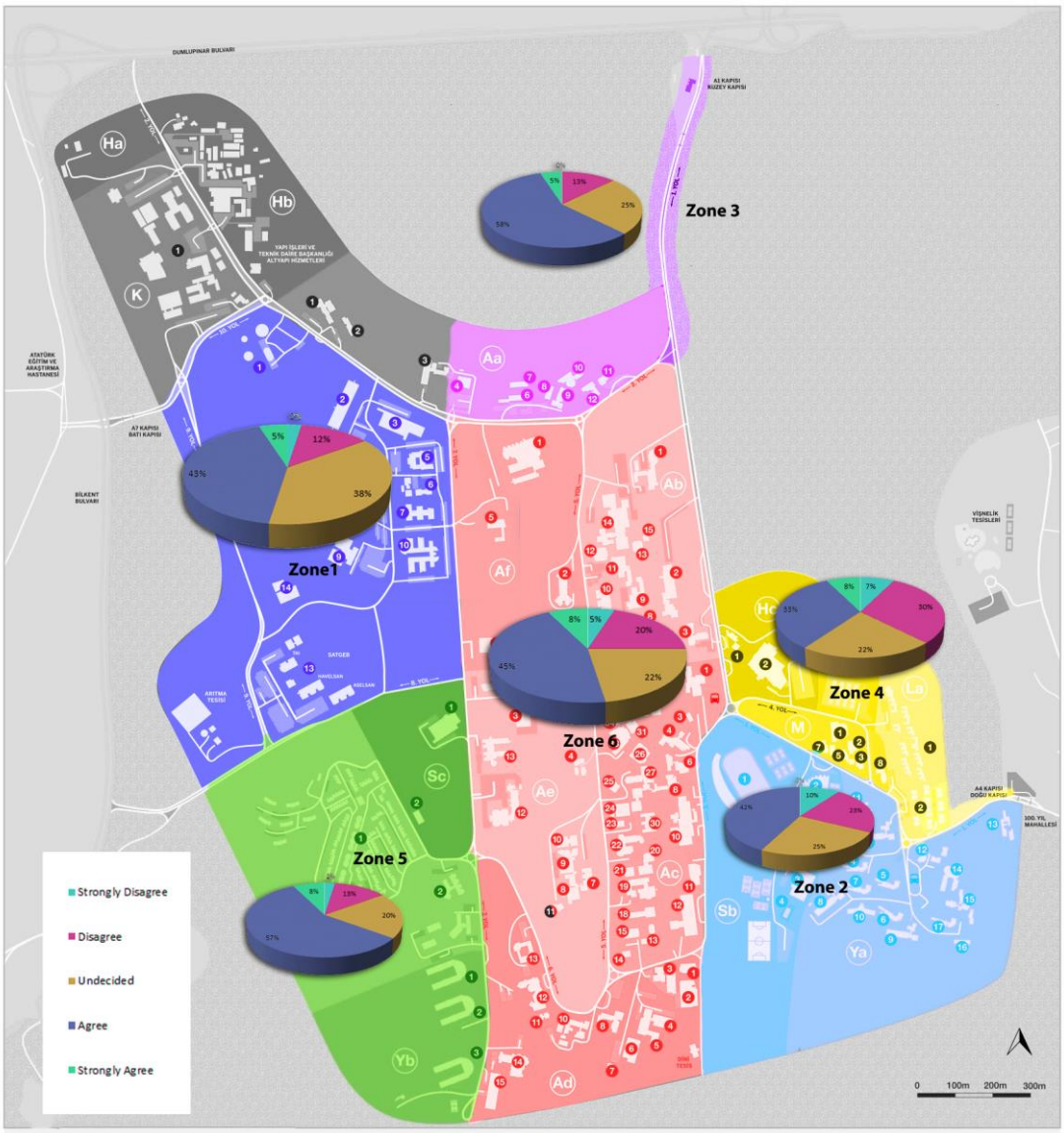



Figure 5-9. Paths quality

Respectively, participants in zone three with 58% and zone five with 57%, zone 1 with 47.5% zone six with 45%, zone 2 with 42% and zone 4 with 40% agreed that paths have good quality for walking.

### 5.2.2. A-2- Path width

The following figures show the width of sidewalks and walkways in six zones in METU campus 36.6 % of participants are seeing the widening of the paths is necessary. Among those who do not enjoy walking, 34% considers that poor quality of the pavements is one of the reasons.

Responses show that, 41.7% of the participants do not agree with the statement that sidewalks and paths are wide, and just 33.4% think that sidewalks and paths are wide enough for walking.

Figure 5-10. Zone 1 (Technopolis research area) sidewalk width

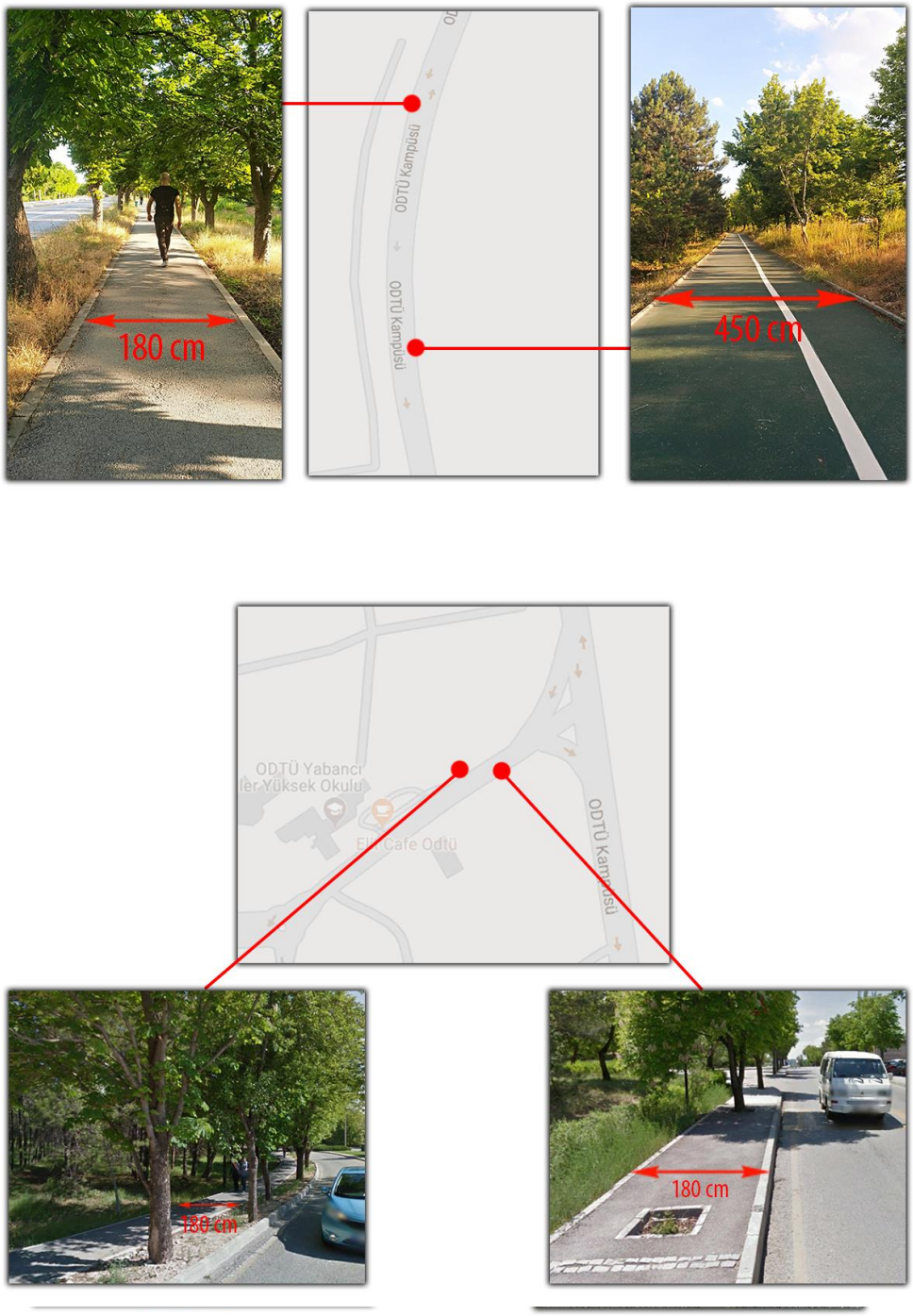



Figure 5-11. Zone 3 (A1 entrance gate to School of Foreign Languages) sidewalk width

Figure 5-12. Zone 4 (A4 entrance gate) sidewalk width

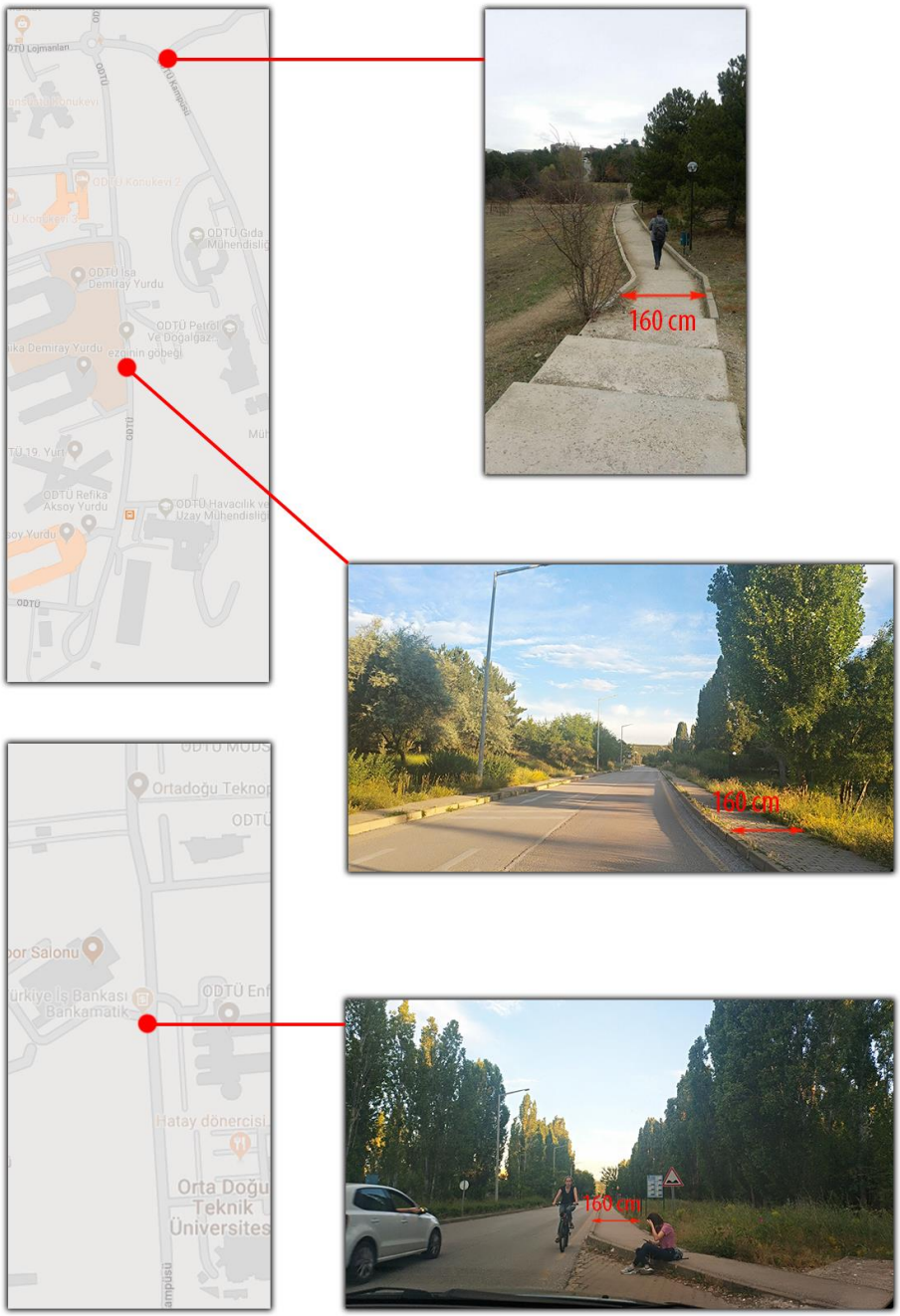



Figure 5-13. Zone 5 (West Dormitories) sidewalk width

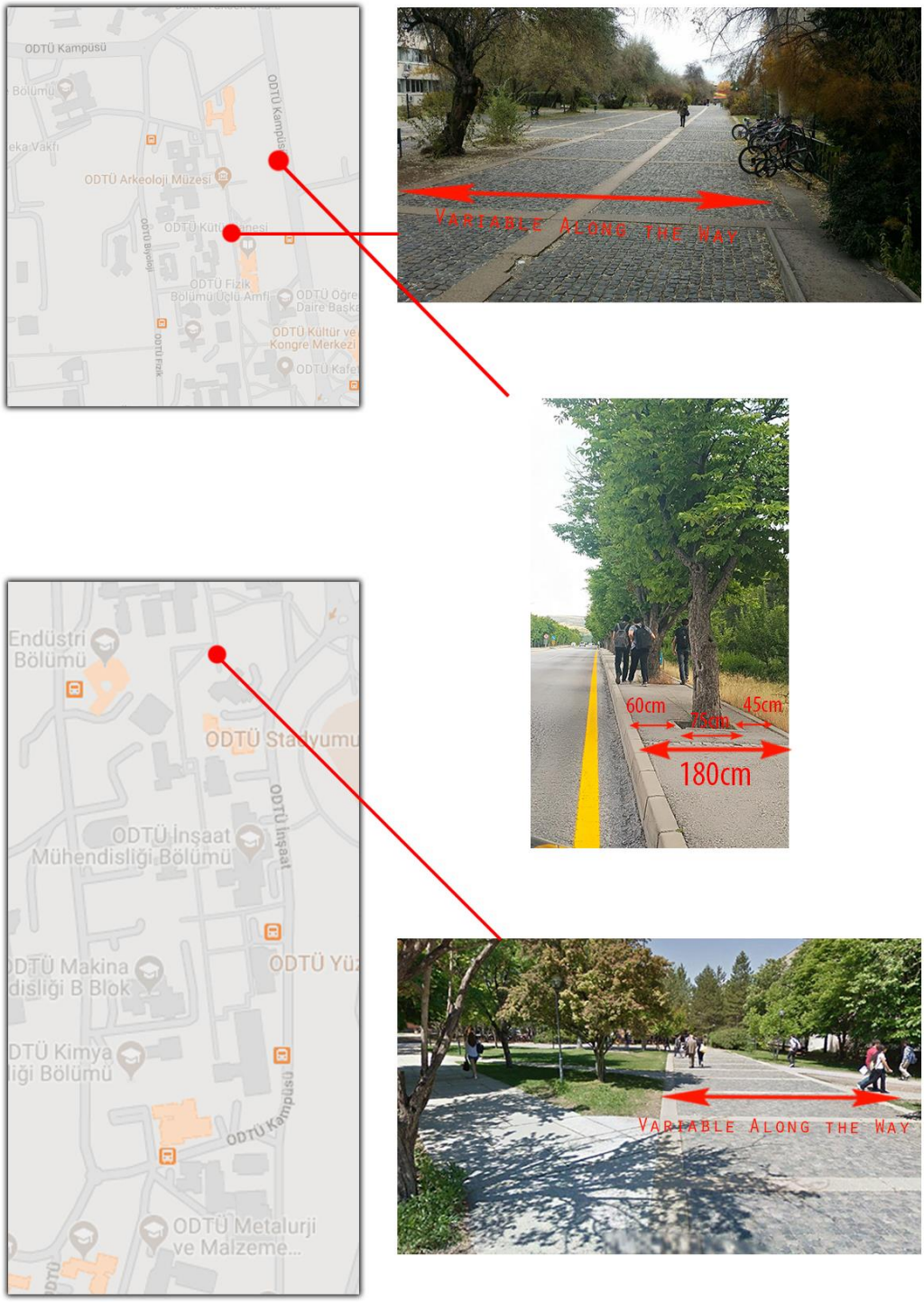



Figure 5-14. Zone 6 (the main pedestrian axis) sidewalk width

The analysis of data and direct observation and documentation of current situation of pedestrian paths shows that zone 4 (A4 entrance gate to shopping center and to MM building) with 47.5% disagreement about whether pathways are wide enough or not, has the highest dissatisfaction. Unfortunately, when I was doing this survey, İrem Kütük a student lost her life in an accident on this route (Figure 5-15). Moreover, participants' responses and photos show that from the foreign language department to the rectorate the sidewalks having trees in middle make the movement of pedestrian difficult.

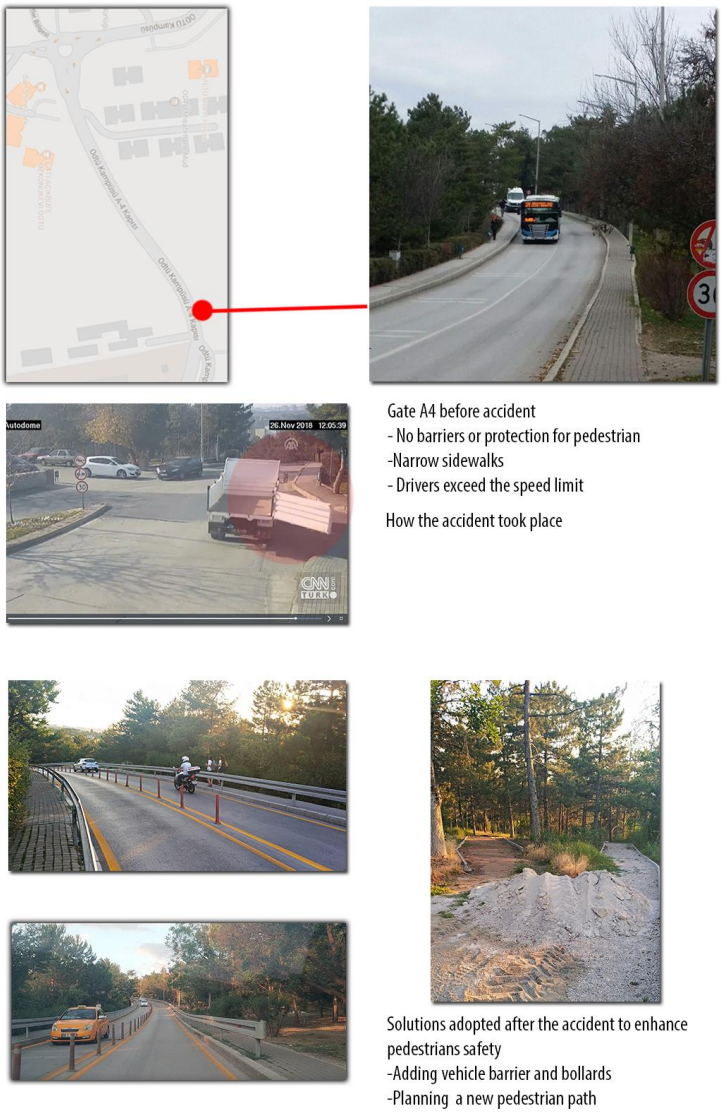



Figure 5-15. Zone 4 (A4 entrance gate) sidewalk width analysis

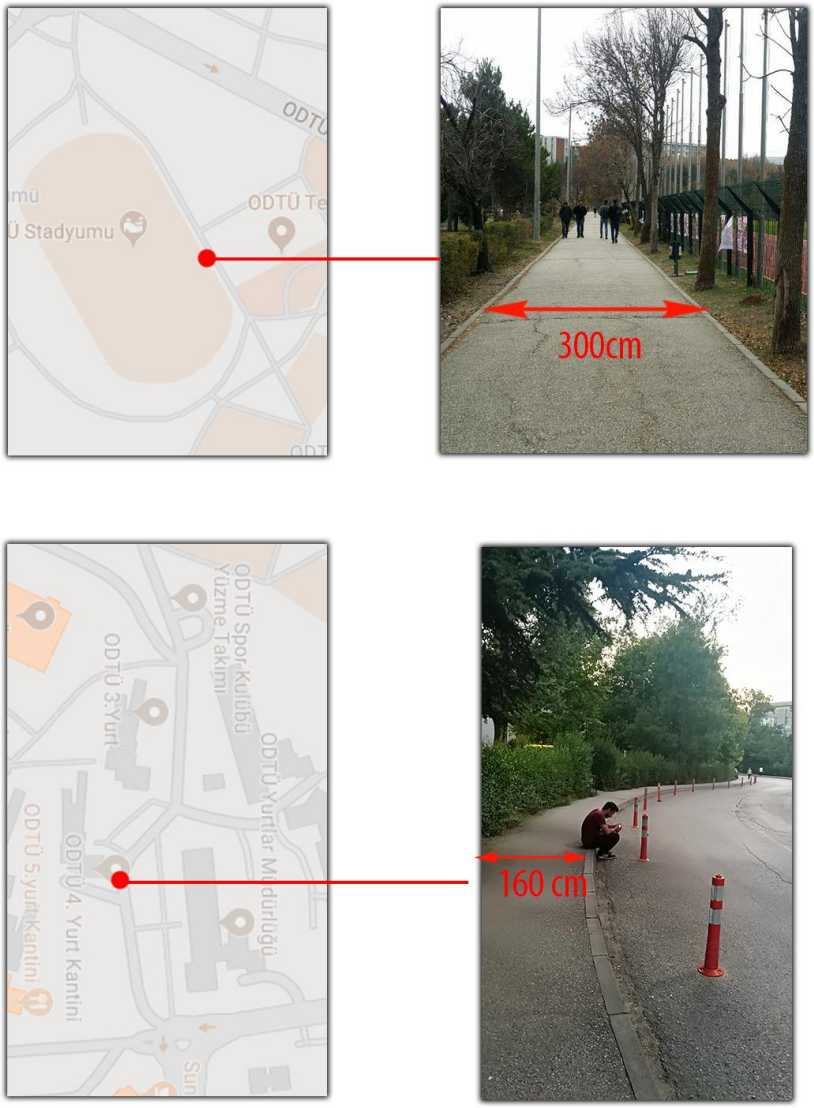



Figure 5-16. Zone 2 sidewalk width

### 5.2.3. A-3- Signage and wayfinding maps

The following bar chart analysis describes the condition of signage and wayfinding maps in six zones in METU campus.

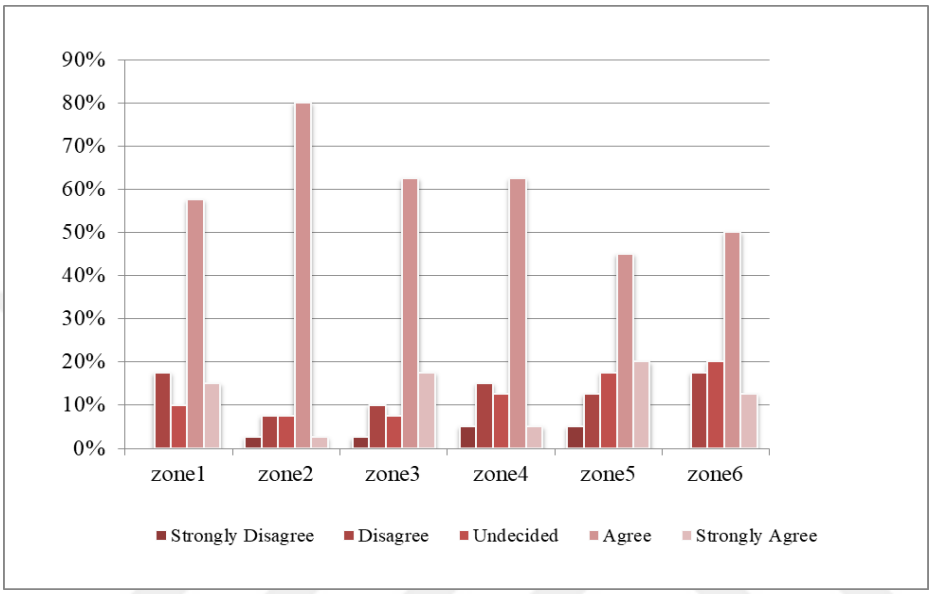



Figure 5-17. Availability of signage and maps

The result shows that zone 5 (West dormitories) and zone 6 (Main pedestrian axis) have the lowest satisfaction with pedestrian wayfinding signs. Sıla Akman in her research on METU main pedestrian path, mentions that one of the accessibility problems in this zone is insufficient navigation and representation signs. She also recommends that the existing information boards should be improved. She also mentions that unpleasant, unqualified and broke signboards should be removed. The following pictures present the current condition of signs along the campus. In some cases, signboards are not visible because of trees or bushes, some of them need to be updated. In especially zone 6 more information signboards should be added and the presentations must be enhanced. In addition, like other design elements, central areas are in better condition than other areas such as zone 5 in terms of good sign boards.

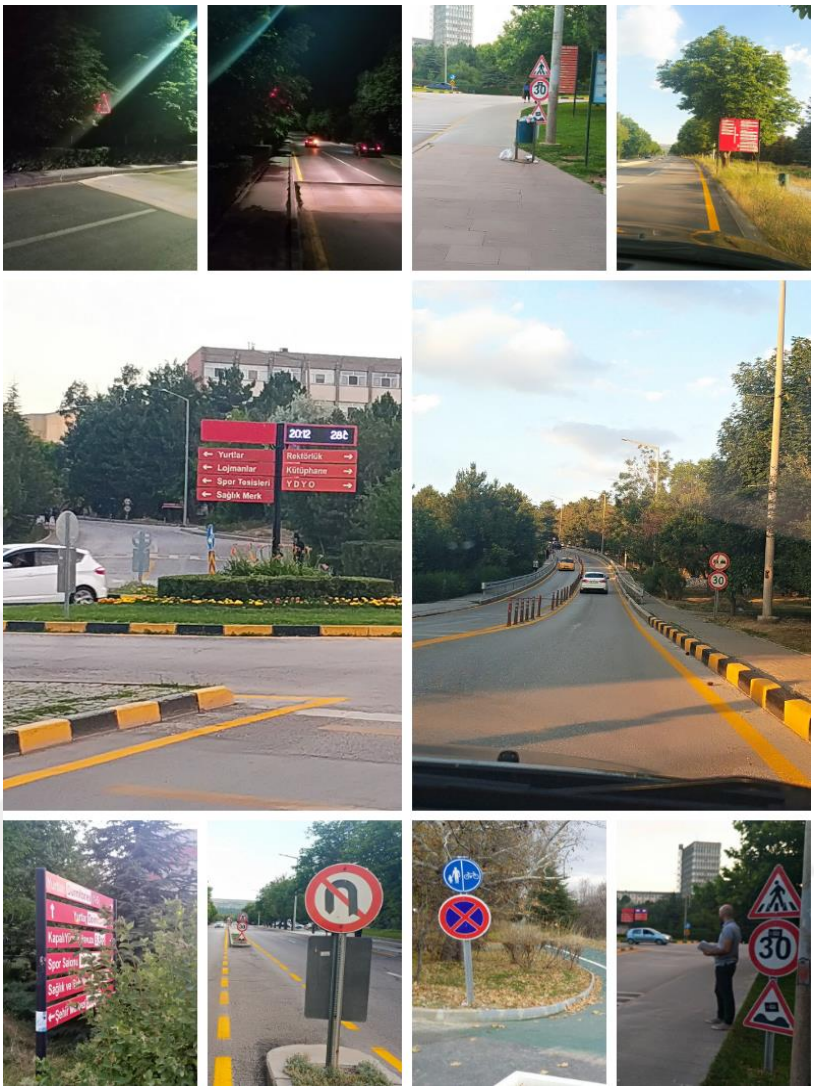



Figure 5-18. Photos of signage and maps (part1)

Overall results show that 71.7% of the participants agree with the idea that paths have sufficient signage, maps or signs, and it is easy to find way in different parts and zones in campus.

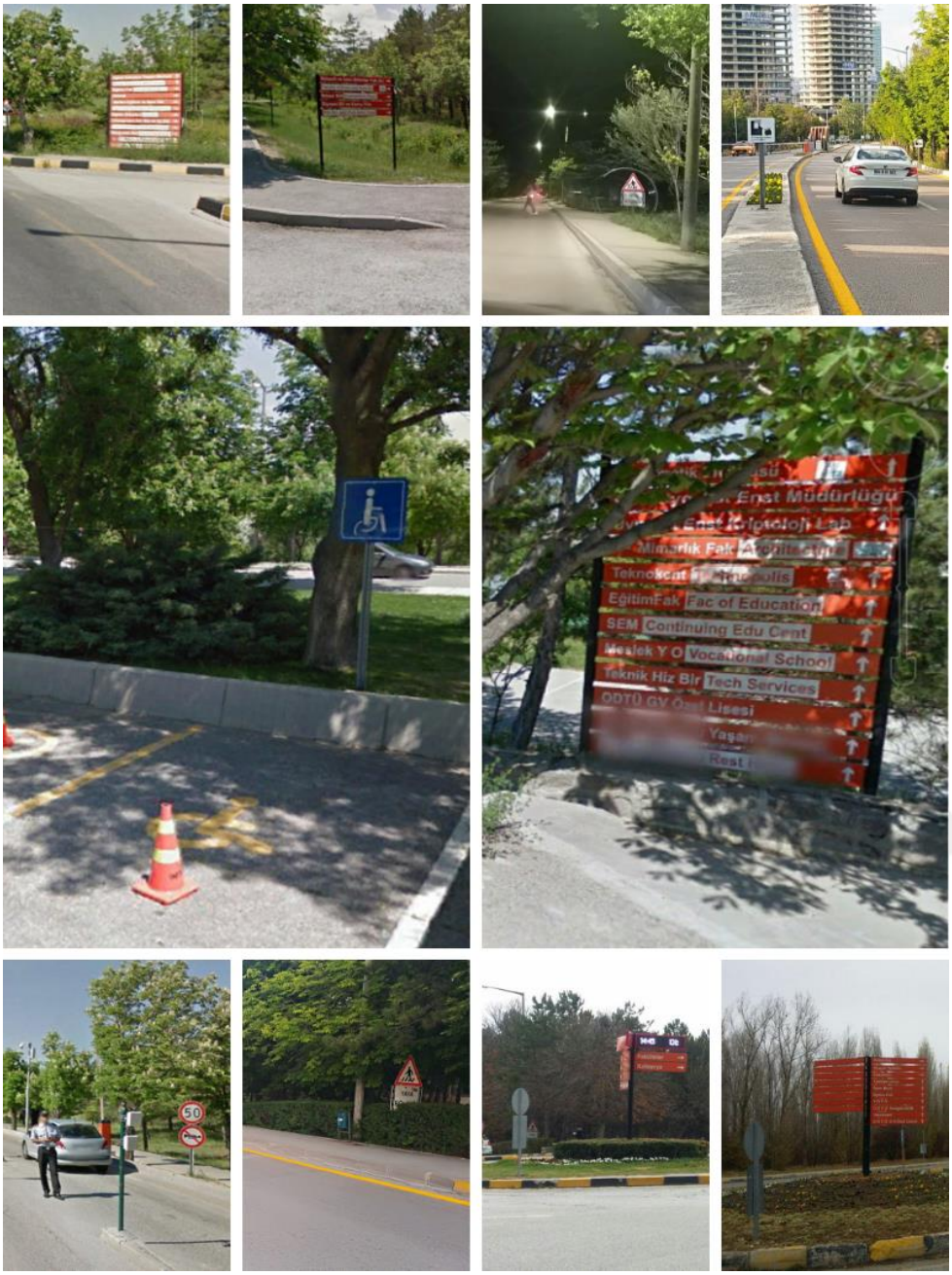



Figure 5-19. Photos of signage and maps (part2)

### 5.2.4. A-4- Presence of bollards and barriers for separation from vehicle traffic

Direct observation shows that lack of protective barriers in the METU campus causes pedestrians feel unsafe. There are not separated paths for cyclists, or in crosswalks there are not bollards or special paths for people with disabilities. As the photos present only in few spots in the central area of the campus these elements are located. The result of the questionnaire illustrates that there is not a clear idea about this aspect of safety: in general, 34.6% of participants thinks there is enough separation from traffic, while 31.7% don't agree and 33.8% of them remain undecided.

Figure 5-20. Examples of protective barriers in METU campus

Figure 5-21. Examples of protective barriers in METU campus

### 5.2.5. A-5- Path quality regarding gaps, barriers, cracks and holes

As mentioned in part A-1, path quality is one of the essential measures for increasing safety. In general, 51.3% of users do not agree that there are not gaps and barriers on paths, they think that surface pavement, and walkways quality is poor for walking. The results show that the highest rate refers to zone1 (Technopolis).

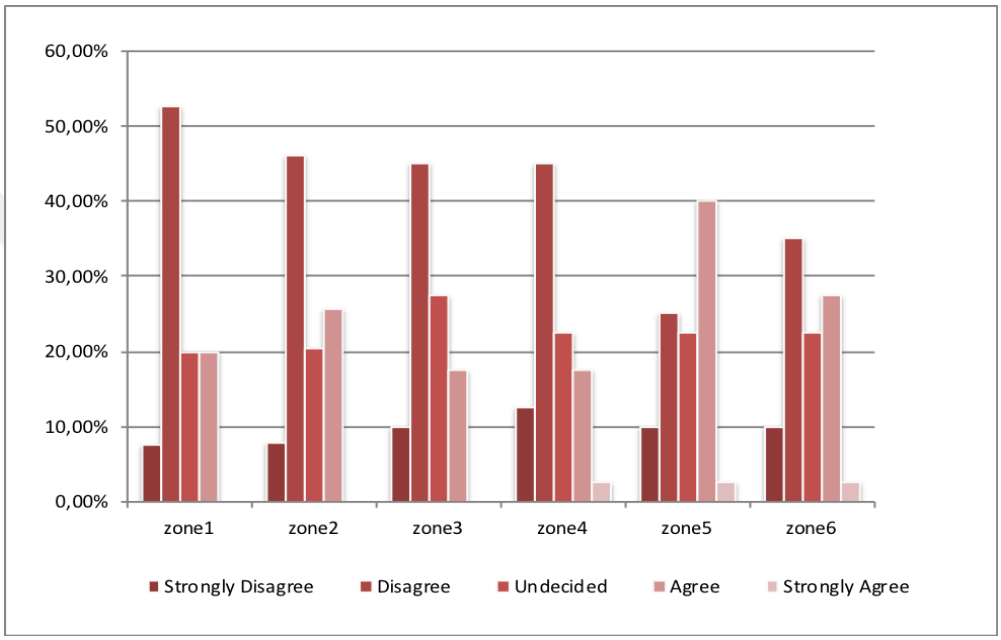



Figure 5-22. There is not barriers and gaps on paths

Figure 5-23. Poor qualities of pavements and pathways regarding obstacles, gaps, and crack

### 5.2.6. A-6- For people with disability, or parents carrying prams paths are easy to walk on

Regarding this statement 58.8% of the participants do not agree and 24.2% of the participants are undecided. They mention that METU campus pathways are not comfortable to use, apart from a few crosswalks (Figures 5-25, 5-26), the rest of the crosswalks are not suitable for people with disabilities or parents with prams. Tactile paving is installed only a few limited places.

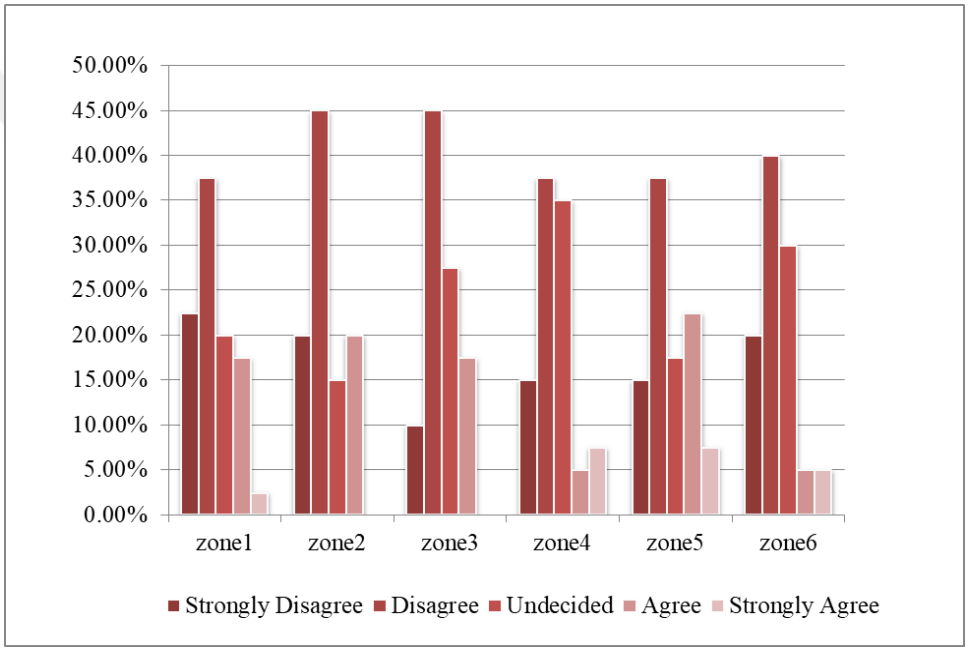



Figure 5-24. Walkability of paths for people with disability, or parents carrying prams, or cyclists

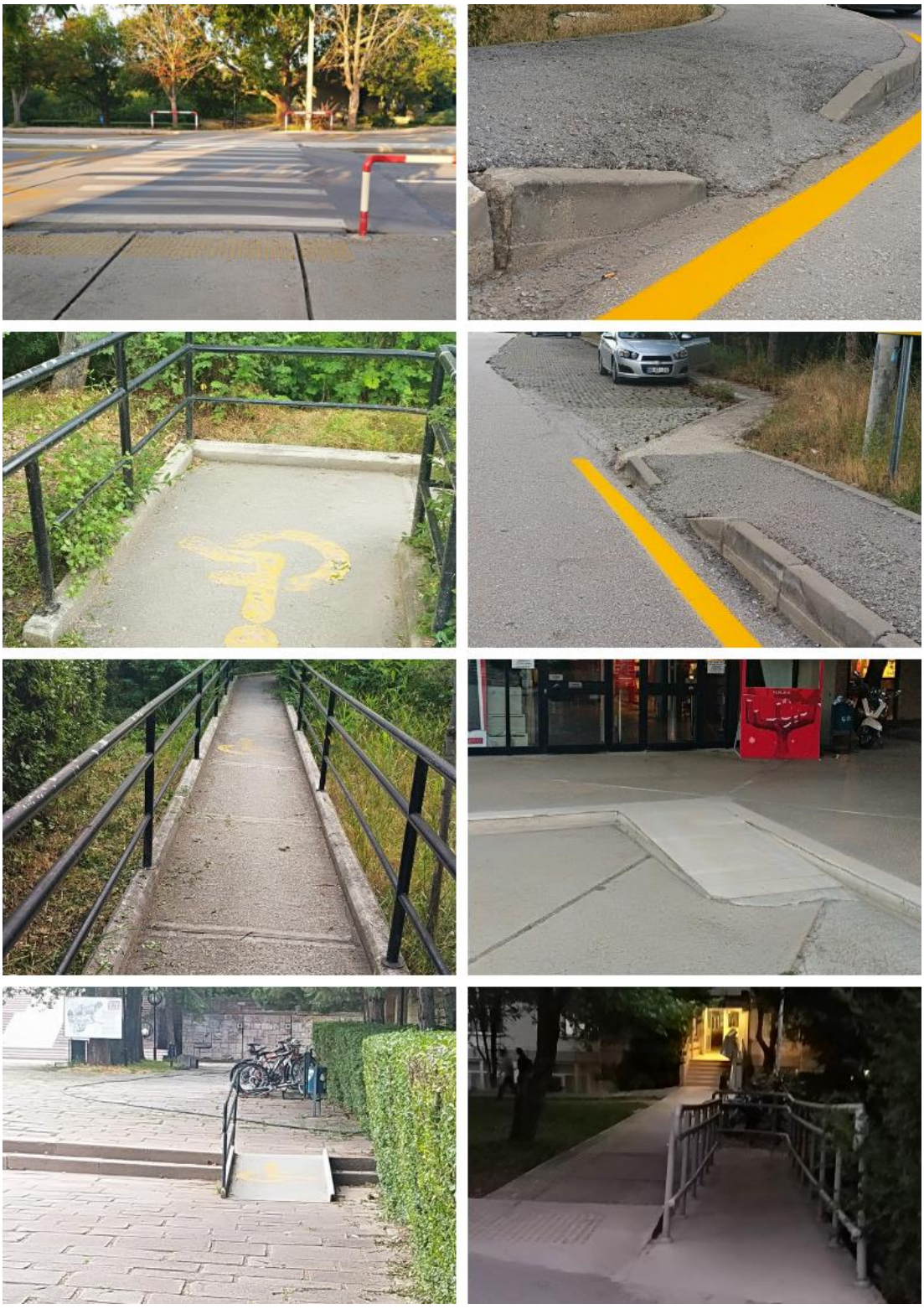


Figure 5-25. Walkability of paths for people with disability, or parents carrying prams

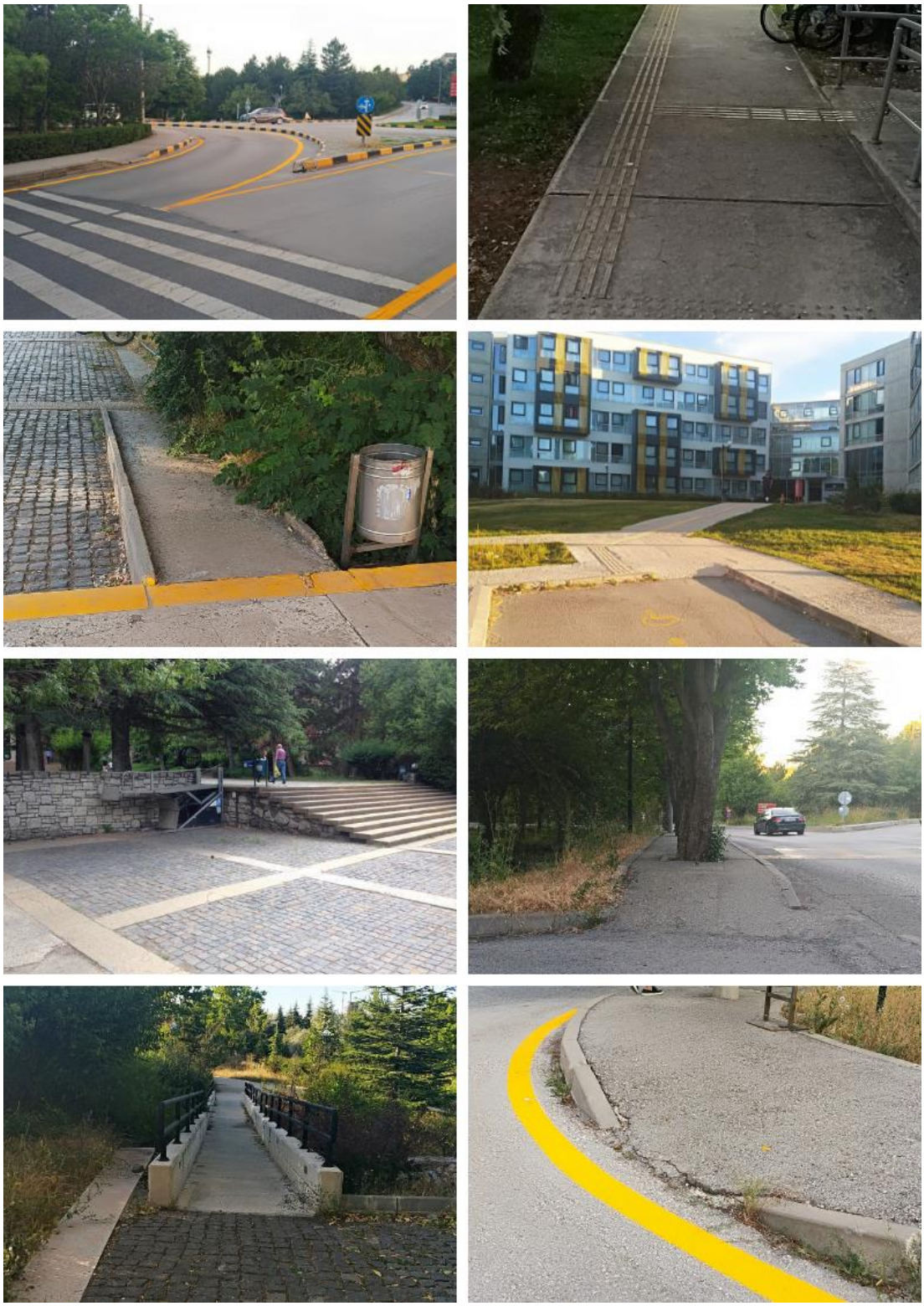


Figure 5-26. Walkability of paths for people with disability, or parents carrying prams

### 5.2.7. A-7- There are trees and bushes along the paths to provide shade and enjoyable environment

A large number of participants (79.2%) find METU campus green and enjoyable enough to walk. Some participants mention the west dormitories (zone 5) need more trees and vegetation.

However, like most of the physical features discussed, in the central areas of the campus, maintenance and landscaping is in a better condition than the other zones, such as zone 5.

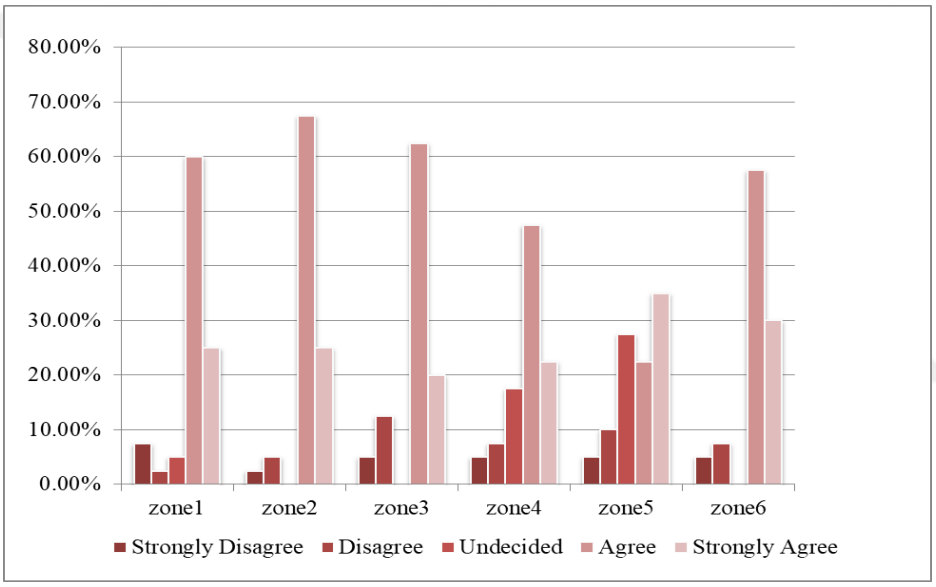



Figure 5-27. There are enough trees and planting to provide enjoyable environment for walking

### 5.2.8. A-8- Lighting

Regarding the lighting quality in METU campus, 31.3% of participants claimed that the campus is a well-lighted space, while 38.8% of respondents disagreed with the statement, 30% of the participants are undecided. Not surprisingly, in zone 6 (main pedestrian axis) 60% of participants disagreed and are unsatisfied with the lighting quality. Users in zone 4 (A4 gate) 40% are also dissatisfied.

The following pictures show METU campus lighting; in picture A (recently built bicycle path) lighting is not sufficient, street lighting provide light for this path but it is not satisfying. Pictures B, C, D belong to the west dormitories area, zone 5 and show that lighting in this zone is adequate, but the lack of presence of people decreases sense of safety, picture L is from the shortcut from west dormitories to faculties where lighting is not provided. Zone 6 (main pedestrian axis) shown in pictures I, J is not well illuminated, there is some lighting but definitely is not enough. Picture K from zone 4, shows that the street light is not sufficient for lightning everywhere, it is necessary to put lamps between these areas. Pictures N, O, P are from zone 2 (east dormitories) and show that lighting is adequate. However, the presence of people may have led to an increased safety perception there.

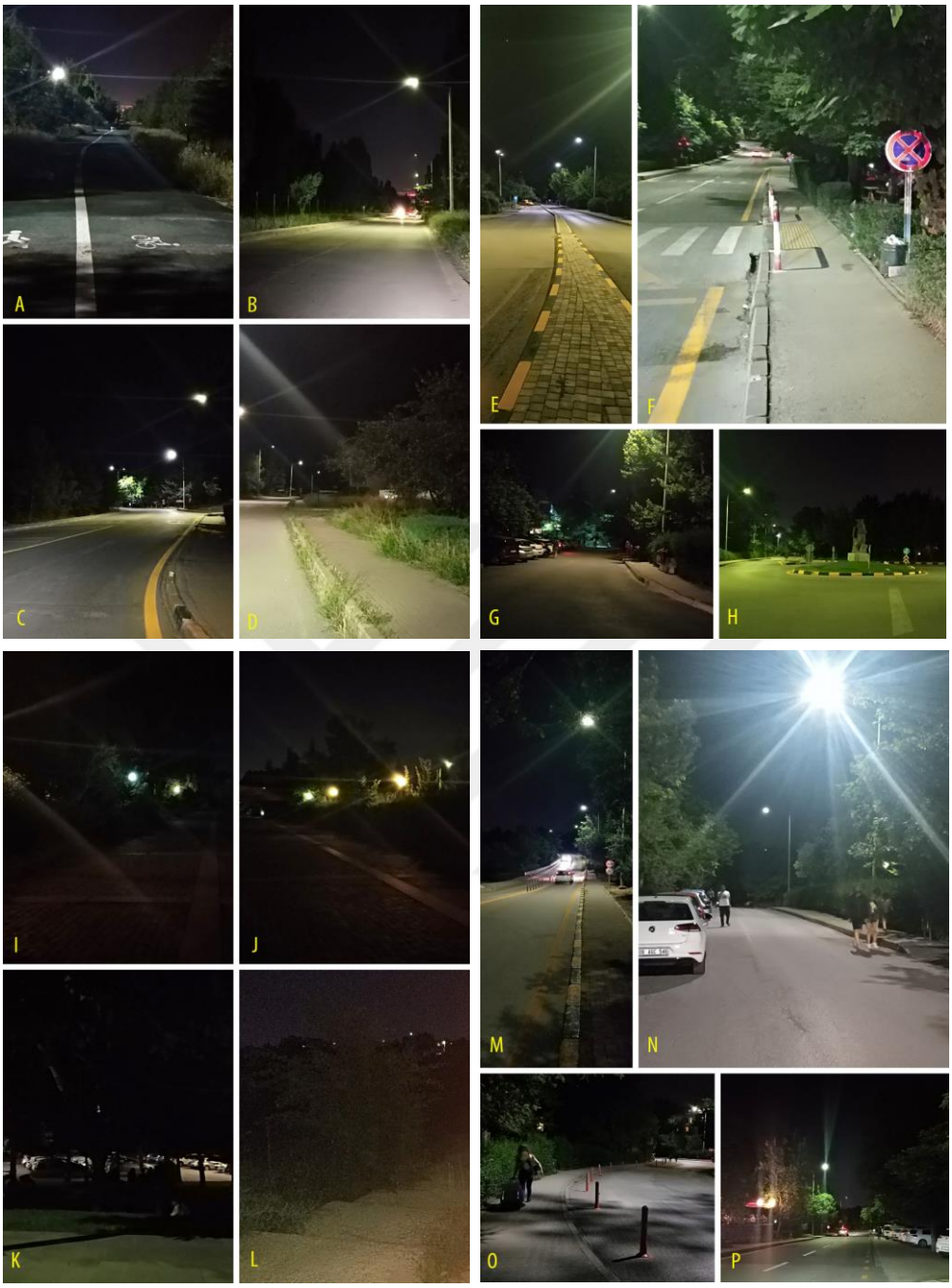



Figure 5-28. Photos of METU campus lighting

### 5.2.9. A-9- Maintenance and cleanliness of paths

This part of survey questions whether maintenance and cleaning of walkways are done frequently or not. Pedestrians are asked whether they think pathways are clean and pleasant to walk or not. The result shows that 67.1% of participants agree with the statement, and 10 % don't agree with that. The least satisfying zone is east dormitories with 42.5%.

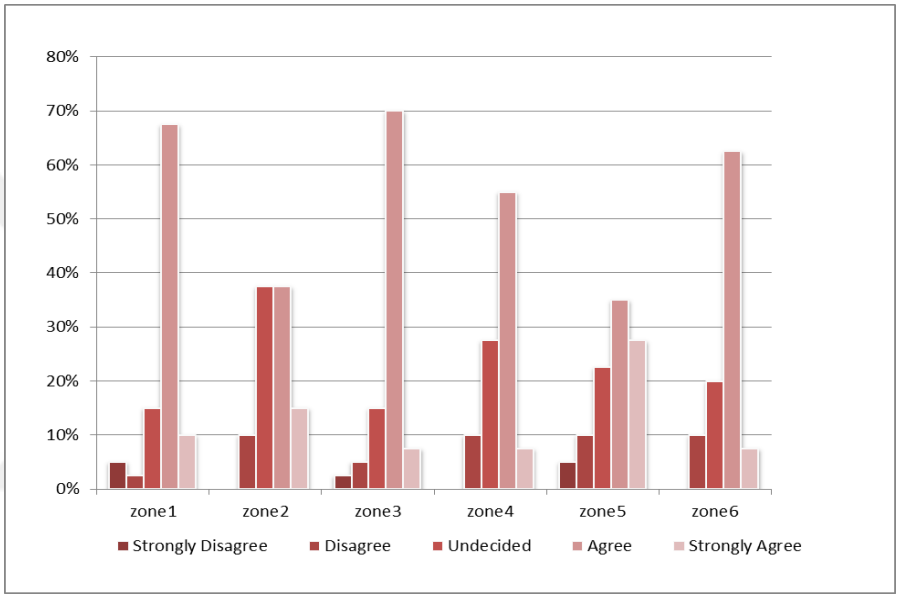



Figure 5-29. Paths are clean and enjoyable to walk

The result of direct observation also shows that there are not serious problems but there are shortages of garbage bins in different places or bins' size are not sufficient for the population, besides the existing bins are not properly installed. In the following pictures we can see the open garbage bins or overfull bins which do not create a pleasant view. In some areas there is a lack of bins, and the distance between the bins is not proper.

Figure 5-30. Lack of bins and inappropriate installing

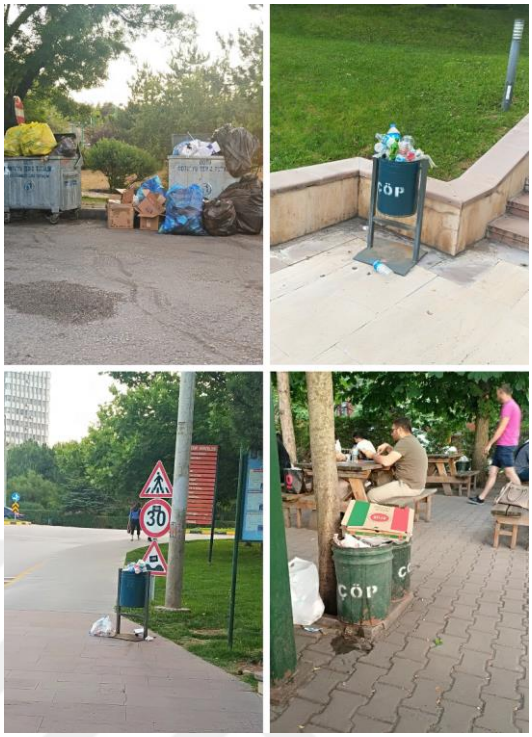



Figure 5-31. Open and overflowing bins

### 5.3. B- Sense of safety

#### 5.3.1. B-1- Presence of people

Regarding the presence of people, it was asked to participants, whether it is safe to walk at any time of day in terms of activities and presence of people around. Among 240 participants 56.3% said that the campus is safe to walk at any time of day, and 21.7% of them don't agree with that, 22.1% are undecided (Figure 5-32). As results show the presence of people in the campus makes interviewees feel comfortable. However, participants who are residents of zone 5 (west dormitories) have the lowest satisfaction rates.

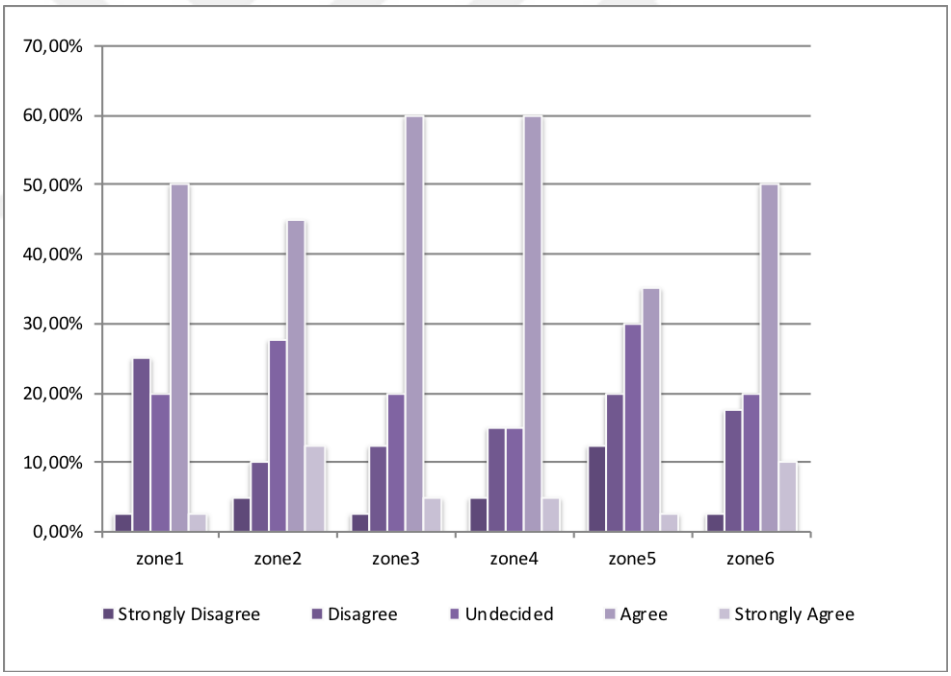



Figure 5-32. Presences of people

### 5.3.2. B-2- Lighting at night

Lighting, sidewalks, streets, crosswalks and green areas in METU campus are considered to understand the safety and security of the pedestrians in night-time. Participants are asked whether METU campus is visible enough during dark hours. The analysis of participants' views shows that 31.3% of the participants agree that there is enough lighting at night. On the other hand, 39.5% of them do not agree. 28.8% of the participants are undecided. As on-site observation approves, zone 6 (main pedestrian axis) with 40% has lacks lighting facilities, respectively zone 1 (techno polis) users are not satisfied.

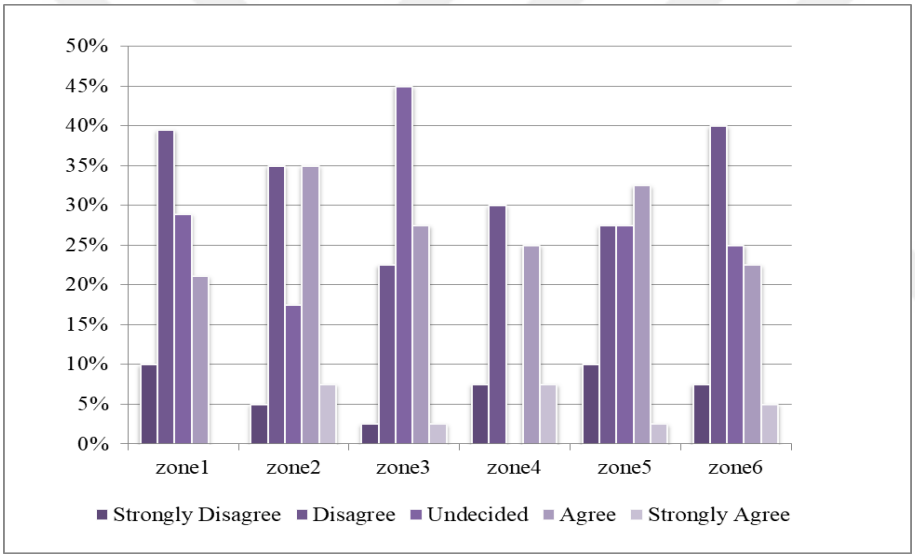



Figure 5-33. Lighting at night

### 5.3.3. B-3- Presence of active buildings

In METU campus, zone 2, (east dormitories) having the most actively used buildings such as cafes, shopping center, dormitories, sport centers and canteens has the highest satisfaction; 57.5 % of participants in this area think that they could be heard and seen. Not

surprisingly, zone 6 (main pedestrian axis) which especially don't have any active building except library in the evening, have poor illumination which causes users feel more unsafe than the other zones. In summary 36.1% of the participants agree that there are active buildings, so they feel safe to walk, but 26.7% of them do not agree 30.4% of the participants are undecided (Figure 5.34).

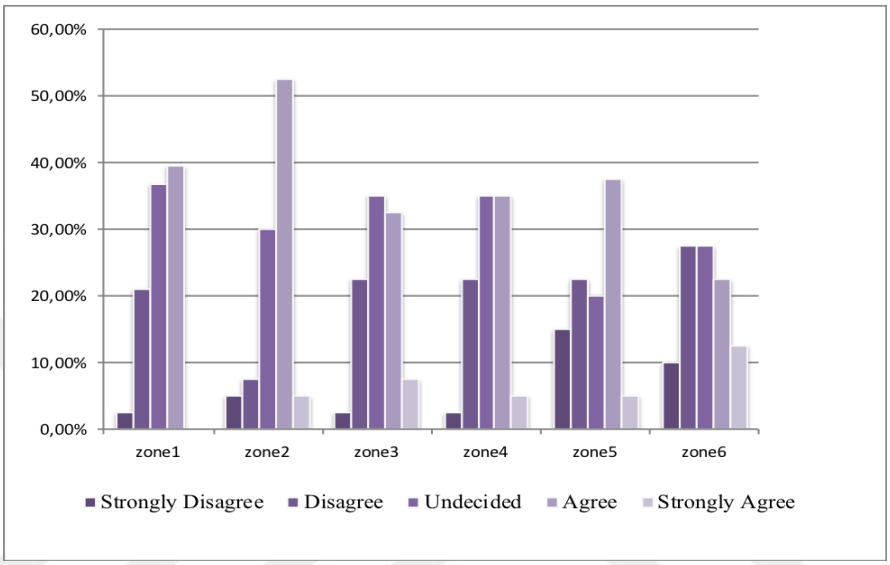



Figure 5-34. Presences of buildings

### 5.3.4. B-4- Feeling safe in night time walk

This part aims to find out whether participants feel safe late at night, and which zones has the highest and lowest safety rate. In an overall look, 43.7% of the participants agreed on this idea; 30% of respondents do not agree, 26.3% of the participants are undecided. In a more detailed analysis, respondents in zone 2 (east dormitories) with 60% claimed that they feel safe at night time, the results of the direct observation shows that having people and active buildings and good quality of lighting in this zone makes walking more comfortable and pleasant despite of some dissatisfactions. In addition, in zone 3 (A1 gate door) respondents with 57.5 % and in zone 4 (A4 gate door) with 55% expressed their agreement. On the other hand

respondents in zone 1 (technopolis), zone 5 (west dormitories), and zone 6 (main pedestrian axis) have a less ratio of satisfaction (Figure 5.35).

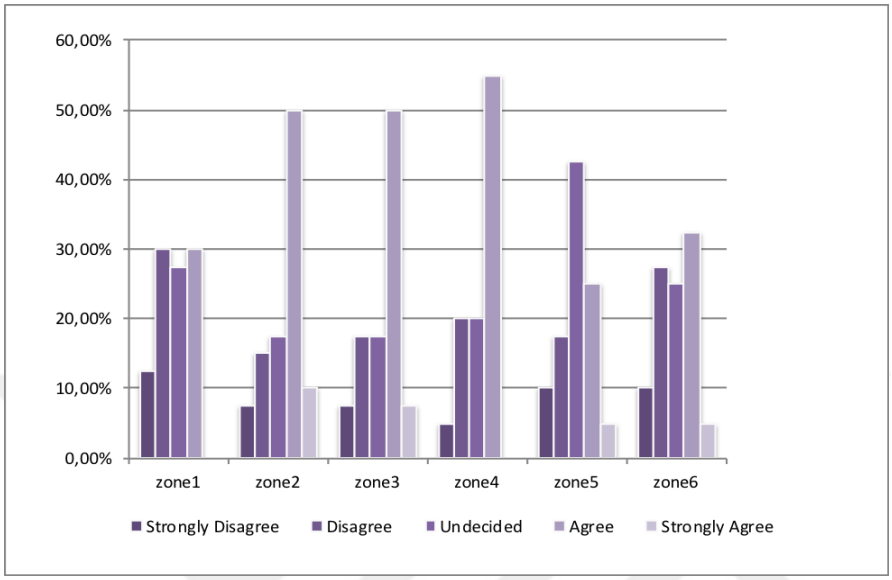



Figure 5-35. Feeling safe at night time

Some participants described their experiences of night time in the campus as such:

*"I wish bus rings work late at night at least 1 or 2 am with more frequent travels"*

*"METU campus is great to walk in day time, but at night becasue of inappropriate lighting and dogs, walking at night is not a good choice"*

*"I am a dog lover and want to see them in campus, but sometimes they are so aggressive at night"*

*"Late at night guest vehicle drivers can be abusive, but in general and in compare with other campuses it is safe and comfortable"*

*"I think after 10 pm in general sense of safety decreases; despite of my love to dogs when I face with them because of poor lighting I don't feel comfortable"*

*"I am a resident in west dormitories, this area is so isolated so at night time, transportation is a big problem, I think we need more frequent buses, I don't feel*

*safe when I do hitchhiking especially at night, If I prefer walking dogs scare me, this situation is better in central area of campus, presence of people, better lighting and crowd makes me feel better."*

### 5.3.5. B-5- Women's and children safety

As for the survey carried out on METU campus, it was asked to participants to share their ideas about the safety of women and children in the campus. The survey results show 56.9% of the participants claimed that METU campus is safe and secure to walk for women and children, whereas 19.8% of respondents disagreed with this statement; and 26.9% of the participants are undecided (Figure 5.36).

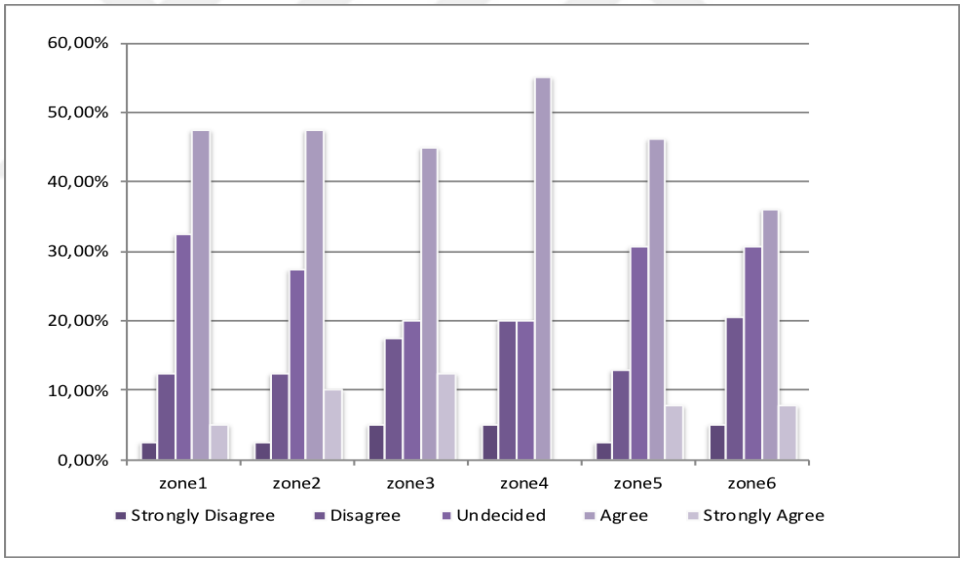



Figure 5-36. Safety of women and kids

### 5.3.6. B-6- Stray dogs

Among 20% of the users who don't enjoy walking in the METU campus, 42% mentioned that stray dogs are the reason for their dissatisfaction. Therefore, this issue needs to be more accurately assessed in another study.

The following figure shows the survey results, it was asked to the participants whether walking is unpleasant because of stray dogs. 65.8% agrees with the statement while, 15.9% of them do not agree with that, and 17.5% of the participants are undecided (Figure 5-37).

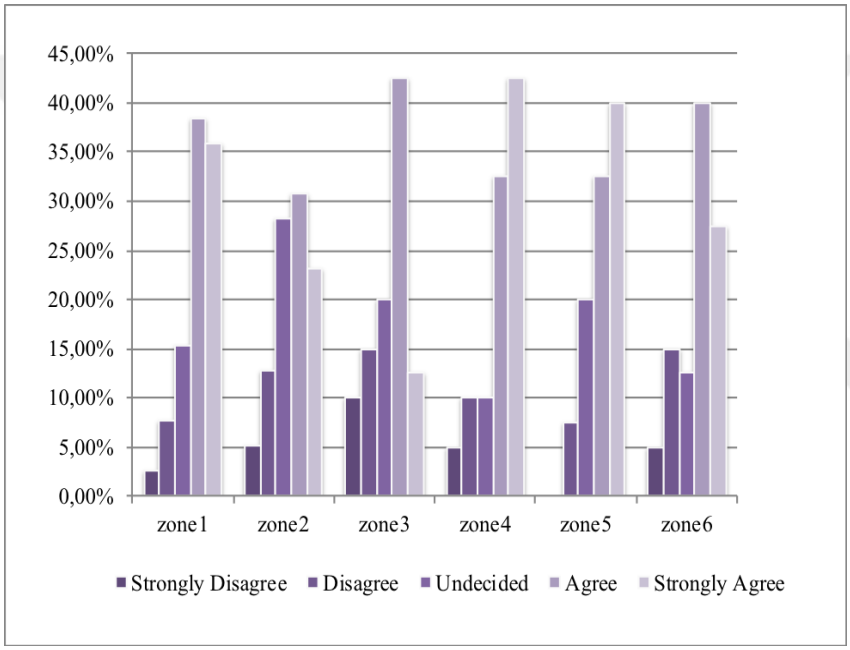



Figure 5-37. Walking is unpleasant because of stray dogs

Froughisaeid (2018) who gathered official data from the administration of METU also demonstrated that there were many dog attacks between 2009 and 2016.

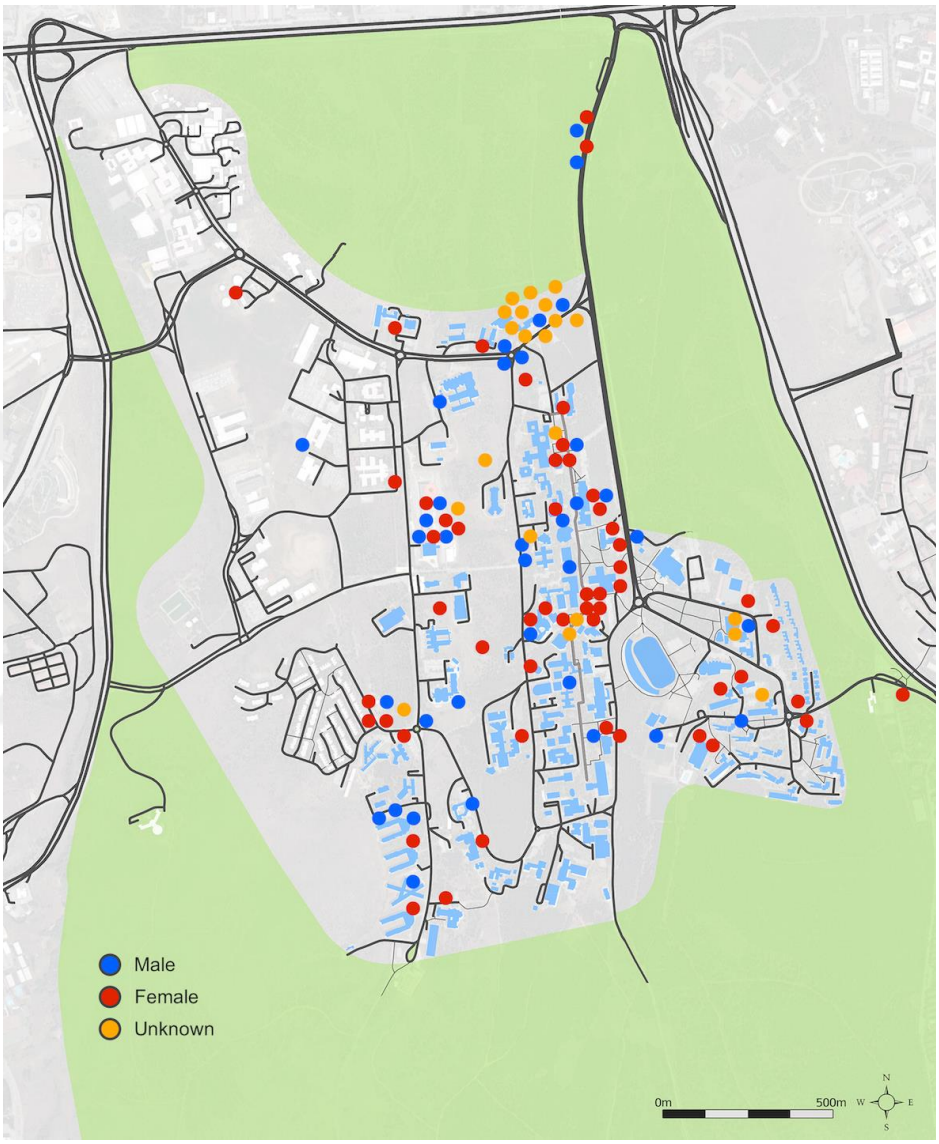



Figure 5-38. Distribution of dog attacks in METU campus between 2009 and 2016 (Froughisaeid, 2018)

As the result of this survey and previous research show in all zones there are dog attacks, and as respondents state there are dissatisfaction about stray dogs present in the campus. However, most of the users don't want to take them out of the campus or be harmed. Closer monitoring or specified sites for this population of dogs inside the campus with the help of volunteers, visitors, the university community and researchers can help to solve the problem.

### 5.4. Traffic safety

Another dimension of safety is to protect pedestrians from vehicular traffic. It can be perceptual safety or physical safety, for example, the separation of sidewalk from traffic line is the concern of physical safety, while the noise of cars on streets that makes people nervous is associated to the perceptual safety (Evans, 2009, p.365-385; Wheeler, 2001, p.35, 38, 62).

Participants in the third part of questionnaire were asked to express their ideas about the attitude and behavior of drivers. The quality of crosswalks is analyzed both in the questionnaire and direct observation. The last part is about the traffic calming.

#### 5.4.1. C-1- Drivers behavior and attitudes

Regarding to this issue, it was asked participants to say their ideas about drivers' attitude to pedestrians: how they behave in traffic and is there a priority for walkers in the campus. Among 240 participants 65.4% claimed that drivers behave well and 5% do not agree 10.9% of the participants are undecided.

### 5.4.2. C-2- Crosswalks

This part investigated whether there are any designed, raised or textured pavements at crosswalks. As well as direct observation tried to answer whether the crosswalks are safe for pedestrians, or crosswalks are safe for elder pedestrians, people with disability, children and parents with carrying young children. Survey results show that (50.8%) claimed that crosswalks are well designed and appropriate. On the other hand, 22.5 % of them do not agree with the statement. Also, 26.7% of the participants are undecided

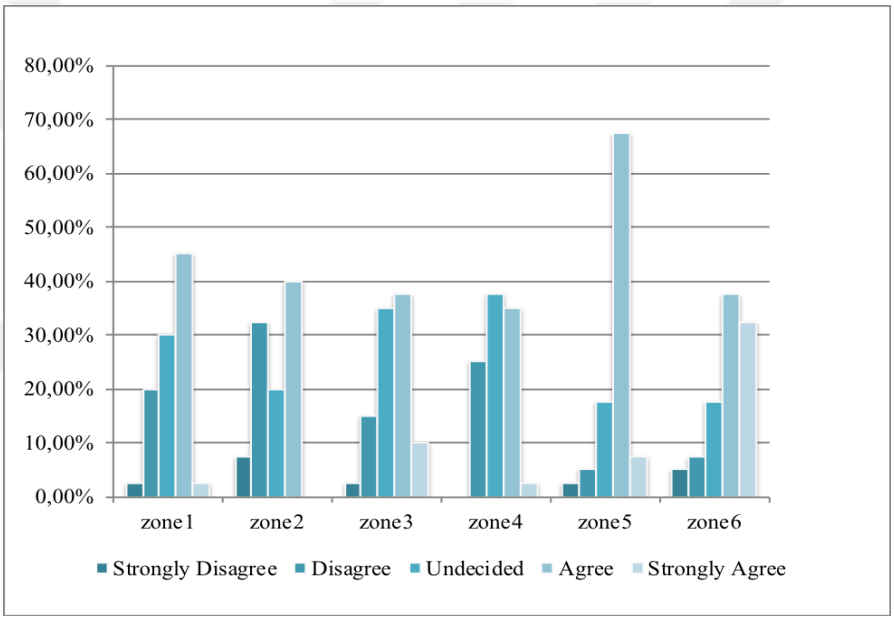



Figure 5-39. Crosswalks are well-designed

Regarding the adequacy of crosswalks, (40.5%) pedestrians in zone 2 (east dormitories) emphasized that there is a serious lack of adequate crosswalks, so passing and moving in this area is difficult, besides (25%) of respondents in zone 4 (A4 gate door) are dissatisfied with the absence of crosswalks. Direct observation shows that there are just four well designed crosswalks (Figure 5.40). In other parts of the campus crosswalks are not in appropriate condition.

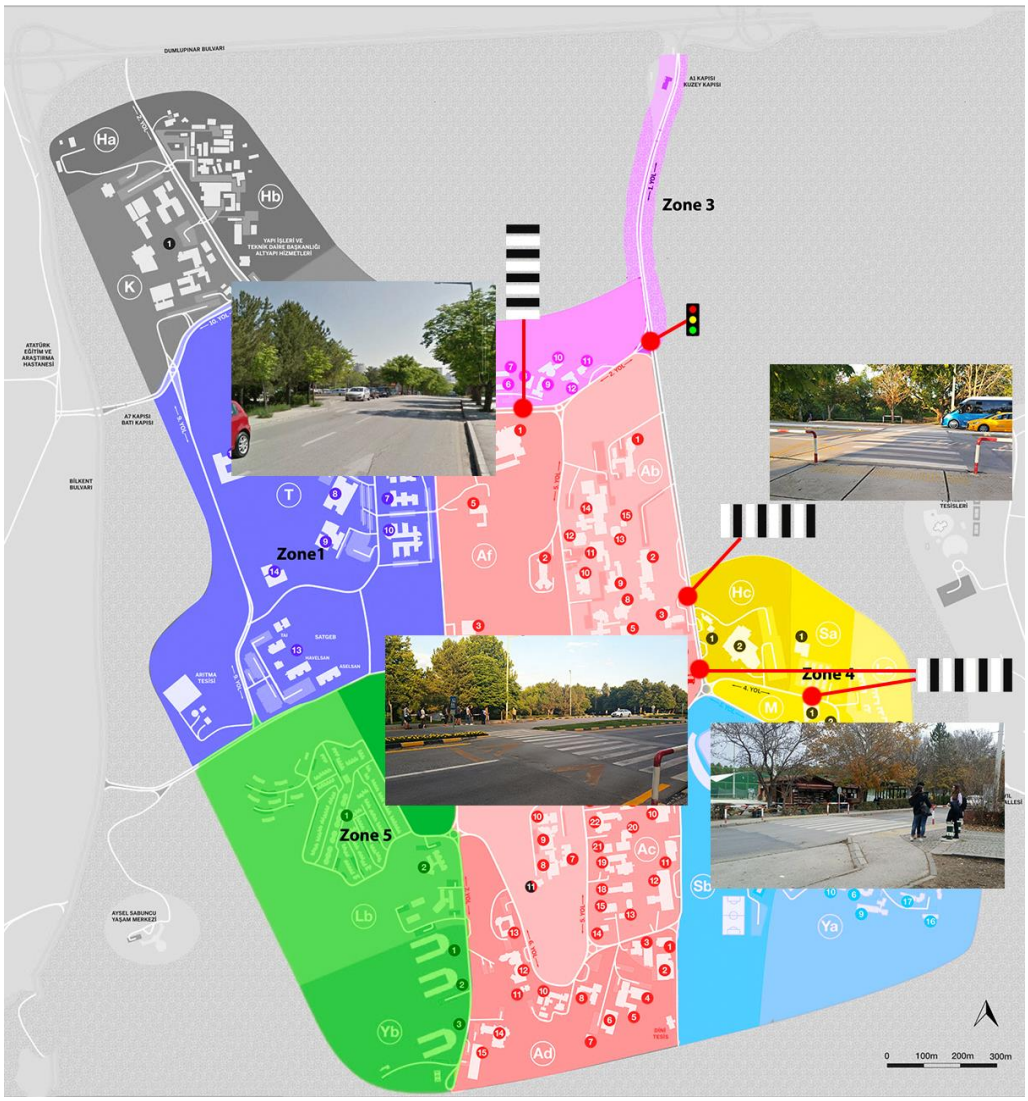



Figure 5-40. Well-designed crosswalks in METU campus

Figure 5-41. Crosswalks in poor condition across the METU campus

### 5.4.3. C-3- Low speed limit

Another significant factor for safety on street is traffic calming. It is found that speed usually causes severe accidents, so traffic calming actions become vital factors for pedestrian's safety (Çiçek, 2009). Regarding to this in METU campus, 77.5% of the participants mentioned it is necessary to have speed limit in the campus, while 12.5% of them do not agree 10% of them are undecided (Figure 5.42).

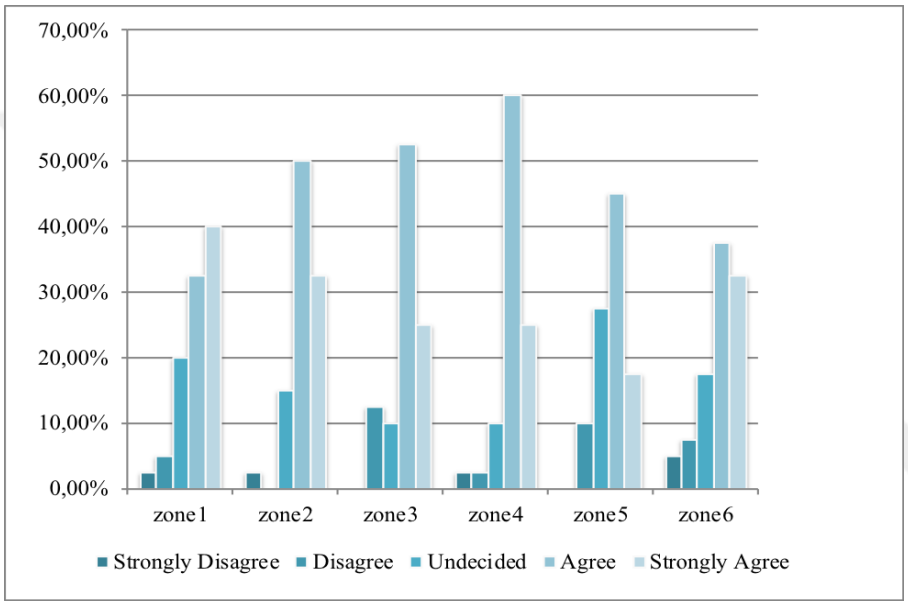



Figure 5-42. METU campus needs low speed limit

As expected, there is user dissatisfaction in zone 4 (A4 gate door) 85% and in zone 2 (east dormitories); 82.5% of respondents agreed with the statement. After the recent fatal accident in the campus which resulted in the death of a student, the university officials installed a panel at the university entrance gate A1; this board reminds the drivers that the METU campus is a pedestrianized area, and the maximum speed should be 30 km/h.

Figure 5-43. Entrance Gate A1

In the last part of questionnaire 240 participants are asked to answer six general questions, with ‘yes’, ‘no’ or ‘I don’t know’ (Table 5.4).

Table 5-4. General overview of questionnaire

| Questions | | Yes | No | I Don’t Know |
|---|---|---|---|---|
| 1 | Do you feel safe while walking in campus? | 84% | 11% | 5% |
| 2 | Can you see other people around when you walk? | 92% | 5% | 3% |
| 3 | Do paths need to be well lightened If you were to walk at night? | 87% | 7% | 6% |
| 4 | Are pedestrian zebra crossings and traffic lights conveniently located? | 59% | 30% | 11% |
| 5 | Do you feel safely separated from the road traffic? | 69% | 20% | 11% |
| 6 | Is campus usable for people with disability, older people, and children? | 47% | 33% | 20% |

### 5.5. Survey results regarding gender, location of living, and age

According to the **gender** of respondents 38.7% of the males and 25.2% of the females thinks that it is safe to walk at night regarding the lighting in the campus. Moreover, 59.2% of males and 53.9 % of females think that it is safe to walk at any time of the day in terms of activities and presence of people around on the campus, but 17.4 % of males and 24.4% of females do not have that idea. In addition, 39.8% of males and 25.9% of females agree with that there is enough lighting at night, but 29.6% of males and 46.1% of females do not agree with the statement. The following statistics show that 54.6% of males and 74.3% of females say walking in the campus is unpleasant because of stray dogs. In part C on traffic safety. The female users (79.5%) think low speed limit should be applied in METU campus, while (68.4%) of male users also have the same requests.

Regarding to the **location of living** of participants, 47.1% of them live in campus while 52.5% of them do not. There is also a participant who does not information. Surprisingly 66.6% of the participants living in the campus and 76.2% of the participants who do not live in the campus stated that the signage on the paths such as maps or signs are adequate for way finding. To add 24.1% of the participants living in the campus and 28% of the participants who do not live in the campus says there are not barriers and gaps on paths in the campus. Also 56.6% of the participants living in the campus and 61.1% of the participants who do not live in the campus think that paths are not suitable for disable people or parents carrying young children. Regarding lighting 29.2% of the participants living on the campus and 33.4% of the users live off campus considers that it is safe to walk at night. In terms of activities and presence of people around on the campus, 52.2% of the participants living in the campus and 59.5 % of the participants who do not live on the campus think that it is safe to walk at any time of day. In regard to stray dogs, 76.8% of the respondent living in the campus and 57.6% of the participants who do not live in the campus mentioned walking at the campus is unpleasant because of dogs. Surprisingly, 73.4% of the participants living in the campus and 79 % of the

participants who do not live in the campus think there should be a low speed limit. In general, 80.9% of the participants living in the campus and 85.7% of the participants who do not live in the campus feel safe while walking on campus.

In this research, 182 participants **age**d (18-24), 48 participants aged between 25 and 34, 7 participants aged (35-44), and 2 persons (age range 45-54). This shows that the majority of users were young people and there is not much diversity in the population. The results reveal that users of (25-34) with 27.1% agreement and participants age (18-24) with 37.3% of satisfaction think that they are properly separated from traffic. On the other hand, about 74.2 % of users aged (25-34) think the paths in the campus is not proper for elder group or people with disability, while 56.1 % of younger group think the same.

On the other hand, youngest group with 29.7 % of agreement find the campus walkable at night time regarding lighting, whereas people (25-34) with 39.6% agreed about the statement. In the following questions 58.8% of participants aged (18-24), and 50 % of respondents of (25-34) years old, described the METU campus walkable in every time of day and night. However, 28.7 % of the youngest group believed that the lighting in night time is sufficient, while 45.8% of older group think the same. Also 45% of the youngest group thinks there are enough active buildings around to make the environment safe, while it is 35.4 % for the next age group. 48.9 % of the youngest participants feel safe when they walk at night time; while it is 27.1% for people aged 25 to 34 agreed with the statement, this percentage is 28 for users aged 35-44. Regarding safety of women, kids, accordingly age groups from young to middle-aged with percentages of 53.4, 54.1 and 42.9 agreed about safety for these groups. In the part C traffic safety, 100% of participants with ages (35-44) agreed about low speed limit in the campus, this percentage is 83.4 % for (25-34) age category and 72.5% for respondents of (18-24) ages.

## 5.6. METU campus in walk score

In chapter two, two digital assessment application was introduced. One of them is Walk Score; it is an application that rates the walkability of neighborhoods. It uses an algorithm to measure the walkability; 100 is the highest score which means a place is perfect for walkers, and zero means users need to use car for traveling.

Result about METU campus shows that the walk score of this location is 50, which means to some extent it is walkable; some errands can be accomplished on foot.

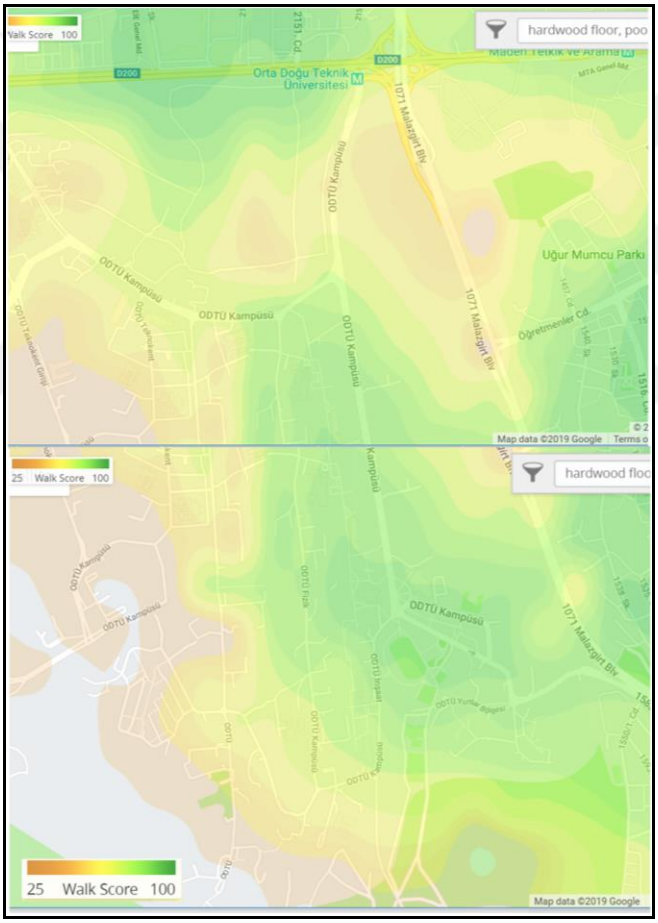



Figure 5-44. METU campus' Walk Score[29]

[29] Walk Score Methodology, n.d. 2019, Retrieved from https://www.walkscore.com/

According to the result of Walk Score zone 2 (east dormitories), zone 4 (A4 gate door) and a part of zone 6 (main pedestrian axis) have the highest score for walkability, Dumlupınar Boulevard is mentioned as the base point for doing analysis, as indicated by the blue dot on the map.

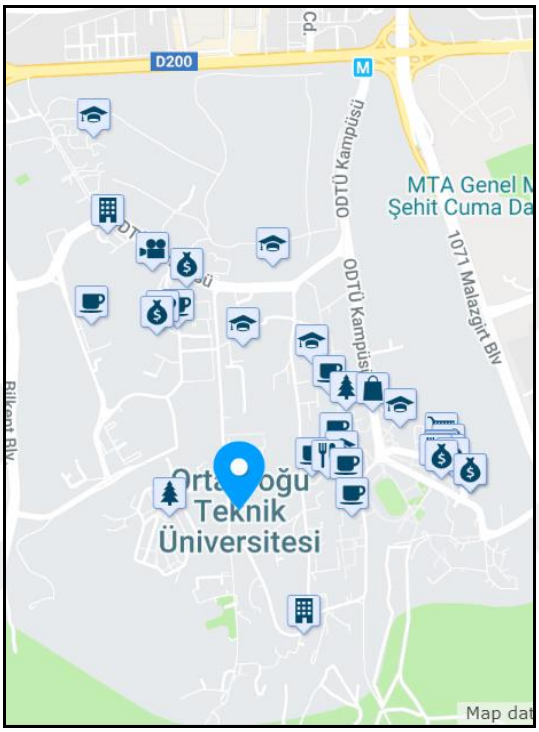



Figure 5-45. Services and facilities nearby METU campus[30]

Distance to each of these services such restaurants, coffee shops, grocery stores, schools, parks determines the points, e.g. for facilities within a five-minute walking, the application gives the highest score, and zero points for more than 30 minutes walking. According to Walk Score, the top 5 walkable campuses in the USA are: The first one is Cambridge, with walk score 87 (Harvard University and MIT). In the second rank Berkeley, with score of 79 (University of California at Berkeley), the

[30] Ibid

third one is Providence, walk score 76 (Brown University). Fourth and fifth are Evanston, walk score 74 (Northwestern University) and Hempstead, Walk Score 71 (Hofstra University).

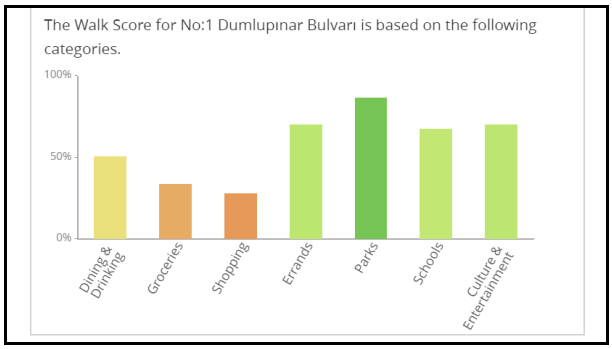



Figure 5-46. Walk Score categories for METU campus [31]

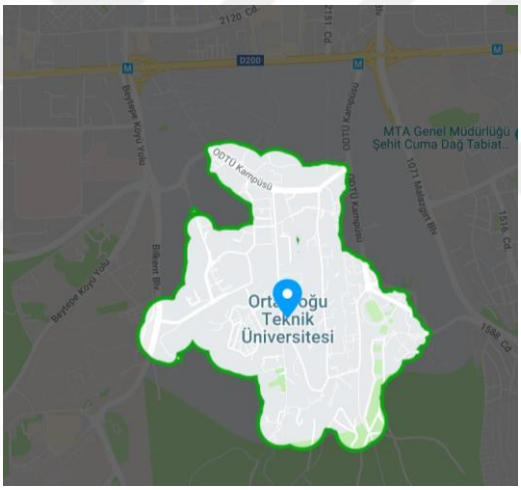



Figure 5-47. The traveled distance in twenty minutes walking[32]

It states that driving is expensive; walking is not. Due to high costs of driving students drive less. Frontier Group acclaimed between 2001 and 2009, the annual number of miles driven by 16 to 34 years old declined about 23 %.

[31] Ibid

[32] Ibid

# CHAPTER 6

# CONCLUSION

The final chapter summarizes the METU campus case study in order to remind the main problems, the research methodology, the findings, and discusses the study outcomes and assessments. It also aims to recommend guidelines with respect to the theoretical studies of walkability, safety, sustainable development in order to find appropriate answers to the research questions.

## 6-1. Overview of the research

This study aims to investigate the "walkability" capacity of the METU campus and analyses the relationship between walking and a safe and secure environment. As the Maslow's hierarchy of needs pointed out, (actual) safety is an essential element of quality of life. Furthermore, urban safety is essential to ensure sustainable development of urban environment. Urban safety ensures safe life of the population on the basis of a combination of several factors such as natural, architectural, social, ecological, technological structure. Therefore, it is a complex notion (Rastyapina & Korosteleva, 2016). Moreover, this research explores the perceived safety of 240 users at the METU campus, which offers spaces for education, work and residency. Consequently, walkability in university campuses should be considered as an important design factor for achieving sustainable environment. A walkable campus should have all the features that assist a walking lifestyle.

This study is conducted to evaluate safety as an important component of walkability. In other words, the lack of safety is one of the most important obstacles to walkability. This research attempts to clarify some issues, such as security and safety measures for a walkable environment, effective factors in choosing a route to walk, positive and negative factors related to the METU campus for walking, and

questions of how far different zones of METU campus are walkable, and what needs to be enhanced in terms of safety are investigated.

The safety indicators are defined based on the literature review. The METU campus includes different character areas; this research identified six different character zones to investigate their safety levels. A variety of research tools - qualitative and quantitative- are used in this study to gather information. The survey is conducted in the form of a questionnaire. In order to analyze the data, IBM SPSS 23.0 software was used, and by using medians the comparison table was prepared. A desk-based assessment was used as a research tool for the analysis. As I live and study in the METU campus, I had the chance to directly observe the character zones of this research in several periods of time to recognize the problems. By taking photos, the concerns considered in relation to walkability capacity of the campus are identified and documented. The outcomes for each zone were compared to each other to specify the differences and similarities between safety capacities. In addition, the study results have revealed the strengths and weaknesses of the six zones in terms of safety in order to develop strategies and policies.

## 6-2. Comparative evaluation of the six zones

This study seeks to reveal strengths and weaknesses, problems and potentials of the METU campus. The main notion behind this analysis is the increasing safety problems which have reduced the walkability capacity of the university campus. Therefore, by revealing strengths and weaknesses of different areas, this research suggests that some strategies for improvement can be adopted to improve the walkability, liveability and sustainability capacity of the campus.

A comparative evaluation of the six zones of the METU campus is available in Table 6-1. It presents each main safety dimensions' differences and similarities, as well as potentials and problems. For making comparisons, a three-leveled scale is used.

Table 6-1. Comparative evaluation of the six zones according to safety dimensions

| | **Zone 1** | **Zone 2** | **Zone 3** | **Zone 4** | **Zone 5** | **Zone 6** |
|---|---|---|---|---|---|---|
| **A-Physical features** | ** | * | *** | ** | *** | *** |
| **B-sense of safety** | * | *** | ** | ** | * | * |
| **C-traffic safety** | ** | ** | ** | *** | * | ** |

| *** | **High** | ** | **Normal** | * | **Low** |
|---|---|---|---|---|---|

According to tables 6-1 and 6-2, the strongest zone is zone 6 (the main pedestrian axis) and the weakest zone is zone 1 (technopolis research area). The comparative evaluation results also reveal that feeling safe does not necessarily depend on high-quality environmental conditions. To be specific, zone 2 (east dormitories) has the lowest score for physical features, but it has the high satisfaction for sense of safety.

On the other hand, zone 5 (west dormitories) and zone 6 (the main pedestrian axis) are rated as areas with high quality of physical conditions, but they have the lowest rate for sense of safety.

Table 6-2. Rating format question analysis

| **Rating Format Questions** | | | **Participant Answer** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Issue** | **Dimension** | **Variable** | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 | Total |
| Safety | A- Physical features | a-1-Paths have good quality for walking | 3 | 3 | 4 | 3 | 4 | 4 | **21** |
| | | a-2- Sidewalks and paths are wide and flat, with no cracks or holes | 3 | 2 | 3 | 3 | 3 | 3 | **17** |
| | | a-3- There is signage on the paths like maps or signs leading different parts and zones in campus | 4 | 4 | 4 | 4 | 4 | 4 | **24** |
| | | a-4-For separating traffic and walkers there are enough bollards | 3 | 3 | 3 | 3 | 3 | 3 | **18** |
| | | a-5- There is not barriers and gaps on paths | 2 | 2 | 2 | 2 | 3 | 3 | **14** |
| | | a-6- For people with disability, or parents carrying prams, or learner cyclists' paths are easy to walk on | 2 | 2 | 2 | 2 | 2 | 2 | **12** |
| | | a-7- There are trees and bushes along the paths to provide shade and enjoyable environment | 4 | 4 | 4 | 4 | 4 | 4 | **24** |
| | | a-8- It is safe to walk at night, regarding lighting | 3 | 3 | 3 | 3 | 3 | 2 | **17** |
| | | a-9- Paths are clean and enjoyable to walk | 4 | 4 | 4 | 4 | 4 | 4 | **24** |
| | | **Total score** | **28** | **27** | **29** | **28** | **29** | **29** | |
| | B- sense of safety | b-1-It is safe to walk at any time of day in terms of activities and presence of people around | 4 | 4 | 4 | 4 | 3 | 4 | **23** |

(Continued) Table 6.2. Rating format question analysis

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | b-2- There is enough lighting at night | 2 | 3 | 3 | 3 | 3 | 3 | **17** |
| | | b-3- There are active buildings, so I feel safe to walk | 3 | 4 | 3 | 3 | 3 | 3 | **19** |
| | | b-4-Feeling safe in night time walk | 3 | 4 | 3 | 3 | 3 | 3 | **18** |
| | | b-5- It is safe and secure to walk for women and kids | 4 | 4 | 4 | 4 | 4 | 3 | **23** |
| | | b-6-Walking is unpleasant because of stray dogs | 4 | 4 | 4 | 4 | 4 | 4 | **24** |
| | | **Total** | **20** | **23** | **21** | **21** | **20** | **20** | |
| | c-traffic safety | c-1-Drivers behave well | 4 | 4 | 4 | 4 | 3 | 3 | **22** |
| | | c-2-There are well-designed crosswalks | 3 | 3 | 3 | 4 | 3 | 4 | **20** |
| | | c-3-There should be a low speed limit | 4 | 4 | 4 | 4 | 4 | 4 | **24** |
| | | **Total** | **11** | **11** | **11** | **12** | **10** | **11** | |

Table 6-2 compares the variables with each other by placing them in order. For the analysis, medians are used to prepare the comparison table. Variables scored between 1 and 5.

In part A -physical features- the highest figure related to a3, a7 and a9 shows that there is signage like maps or signs on the paths leading to different parts and zones in the campus. METU campus has trees and bushes along the paths which provide shade

and an enjoyable environment. The last item which is related to paths shows that they are clean and pleasant to walk (Table 6-2).

Regarding part B, which is related to **sense of safety**, b6 represents the highest score due to lack of safety because of stray dogs. B6 is followed by b5 and b1 which represent respectively lack of safety for women and kids, and lack of people around. The lowest score goes to b2 due to sufficient lighting at night-time (Table 6-2).

Part C is related to **traffic safety**, and in this part c3 and c2 have the highest scores, which means that most of the participants want low speed limit on the campus, as well as well-designed crosswalks (Table 6-2).

Moreover, the evaluation of questionnaire results in the zones of the case study area shows that:

Zone 2 (east dormitories) gets the **lowest score for physical features**.

Zone 5 (west dormitories) gets the **highest score for physical features**.

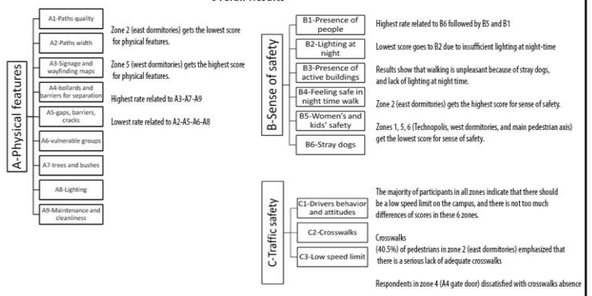
In the second part -sense of safety- results show that walking is unpleasant because of stray dogs, and lack of lighting at night time.

Zone 2 (east dormitories) gets the **highest score for sense of safety**.

Zones 1, 5, 6 (technopolis, west dormitories, and main pedestrian axis) get the **lowest score for sense of safety**.

In part C -traffic safety- the majority of participants in all zones indicate that there should be a low speed limit on the campus, and there is not too much differences of scores in these 6 zones (Table 6-2).

## Overall Results




Zone 1

less than half of users think paths have good quality.

According to users sidewalks are not wide enough for walking properly, direct observation Figure (5-12) shows this area needs good quality of pavemnet and wide sidewalks.

This is not a separation between vehicle flow and pedestrains in one side of street.

According to the results in Zone 1 more than the other zones quality of walkways are poor. Figure (5-26)

Similar to the other zones, Zone 1 is not suitable for people with disability.

Regarding the presence of people, this zone is not active at night time, because all buildings are closed after office hours and there is lack of active building and people. However, 30% of users believe lighting is sufficient, while 22.5 % disagree.

Respondents in zone 1 have a less ratio of satisfaction about feeling safe at night.

Like the other zones, stray dogs is problematic in this zone.

Lack of well-designed crosswalk and traffic light is obvious in this zone.

Zone 5

This zone has the highest score for physical features.On the other hand get the lowest score for sense of safety.

Insufficient navigation and representation boards in this zone is one of the accessibility probems.

Similar to the other zones, quality of path is poor in this zone.

participants in this zone, face several transportaion problems during their daily journey. Long distances between this zone and central area, long gap between ring buses, lack of lighting in shortcuts are some of the problems.

lack of gathering points for incearings social interactions and presence of people is another problem.

There is lack of bus stop shelter, and resting areas and furnitures like benches.

There is lack of well-designed crosswalks, safety bollards.

Similar to the other zones, Zone 5 is not suitable for people with disability.

Zone 3

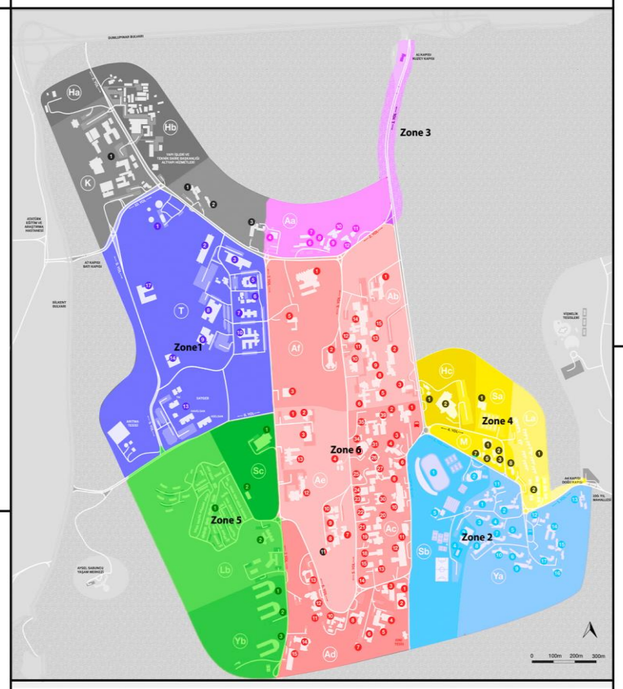
Participants in zone three with 58% agreement say path has good quality.

in zone 3 (A1 gate door) respondents with 57.5 % have a less ratio of satisfaction about safety at night time.

A line of trees make seperation between traffic and pedestrains and it makes walking enjoyable.

Similar to th eother zones stray dogs make walking difficult in this zone, especillay at night time.

Accessibility from this zone to Zone 5 (west dormitories) is a problem especillay in day time, lack of buses and other public transportation means.




Zone 6

This zone as a spine of the campus has a big role in gathering people and providing socilizing opportunities.

There is problems in accessibility for people with disabilities.

There is lack of regular maintenance and conservation.

As Figure (5-26) presents, in some areas of this zone, paving is not in a good quality.

This zone gets the lowest score for sense of safety, regard to lighting. and presence of people.

Way finding signs and represetation boars are not sufficient.

Like the other zones, stray dogs is problematic in this zone.

Zone 4

This zone (A4 entrance gate to shopping center and to MM building) with 47.5% disagreement about whether pathways are wide enough or not, has the highest dissatisfaction.

Lack of the seperation from traffic is one the main problems in this area.

Lighting in main streets is sufficient while in shopping area or tennis court there is lack of lighting.

55% of respondent expressed their agreement about feeling safe at night time.

There is lack of adequate crosswalks in this zone.

85% of respondents in this zone want low speed limit in METU campus.

According to Walk Score this zone has high walkability score due to easy access to services such as restaurants, coffee shops, grocery stores, schools, green areas.

Large group of pedestrians agreed on the idea of widening sidewalks.

Pavement of sidewalks are not in good quality.

Like the other zones, stray dogs is problematic in this zone.

Zone 2

This zone has the lowest score for physical features, but it has the high satisfaction for sense of safety.

60% of the respondents in zone 2 (east dormitories) claimed that they feel safe at night time, the results of the direct observation confirms this result.

More than 80% of respondents in this zone agreed with the statement believe that METU campus needs low speed regulations.

Presence of active buildings such as cafes, shopping center, dormitories, sport centers and canteens has increased sense of safety in this area, in such a way that 57.5 % of participants in this area think that they could be heard and seen.

Pavement of sidewalks are not in good quality.

Good quality of lighting in this zone makes walking more comfortable and pleasant.

There is a serious lack of adequate crosswalks, so passing and moving in this area is difficult.

According to the result of Walk Score zone 2 (east dormitories), zone 4 (A4 gate door) and a part of zone 6 (main pedestrian axis) have the highest score for walkability.

Like the other zones, stray dogs is problematic in this zone.

Figure 6-1. Survey results in six zones of the case study

## 6-3. Discussion and concluding comments

As highlighted in the literature review, safety ensures safe life of the population on the basis of a combination of several factors such as nature, architecture, social and ecological structure of an environment. Thus, it is a complex notion. Therefore, in order to express an opinion about the safety of an environment, several researches with different approaches are needed to be conducted. However, the conceptual model of this research can be used in future researches with the addition of some features regarding the peculiar characteristics of the case study area. For example, if there are ethnic groups, different religious communities, immigrants and crime problems, these issues can be taken into account.

**Firstly,** it is important to know the characteristics of demographics to interpret the findings of such researches. Also, understanding the participants' educational and cultural characteristics helps to know who are using the space. In this case study, a large part of the users were young people, aged between 18 and 24. In addition, almost all of the users were university students or graduates. Moreover, compared to some urban areas, there is no gender-specific structure in METU campus, which means that it is not male-centered. The presence of female participants was even more than male participation. Therefore, the findings of this study cannot be generalized to the whole city or the other universities campuses.

**Secondly,** this research confirms that female participants feel significantly less safe than male users at night-time walk; they think lighting is not sufficient. Also, compared to males, a smaller percentage of females think that campus is safe for walking at any time of the day. Another reason for this difference is the presence of stray dogs, so that female users, 20% more than males, feel unsafe. Moreover, regarding the traffic, females more than males demand low speed regulations and speed control.

This dissatisfaction concerning urban areas with different political, economic, social and environmental contexts can differ in its intensity. As mentioned before, one of the major goals of sustainable development is making cities inclusive, safe.

Needs of elders, women, children and people with disabilities were also emphasized in this theory. Therefore, by using participatory methods in urban management, and increasing awareness of gender justice, it is possible to create safer and more inclusive cities. For that reason, women can be involved in the urban planning and design process, so that their quality of life may not be affected negatively by actual or potential urban safety.

A recent report by the EU's URBACT program June 2019, entitled, "Gender sensitive public space? Place making and spatial justice through the perspective of gender" discusses how cities are working to do modifications to achieve 'Gender Equality'. The report summarizes the outcomes of discussions as follows:

- involving women and girls in urban design process,
- paying more attention to the voice of all women,
- connecting theories of inclusive public space and needs of females with updated knowledge,
- in the process of collecting and analyzing data give importance not only gender but also other indicators such as age, ethnicity, disability, and class,
- learn how to integrate women-friendly spaces with women-only spaces,
- apply participatory methods,

The report reveals that, even in Sweden, which has many accomplishments about gender equality, male and female perception of safety in urban public spaces, is not equal. Fear of crime is in general 10-15 % higher among women than men, and 50% of women described feeling unsafe in 'vulnerable areas'.[33]

[33] Gender sensitive public space? Place making and spatial justice through the perspective of gender Edited on 24 June 2019, Retrieved from https://urbact.eu/gender-sensitive-public-space-placemaking-and-spatial-justice-through-perspective-gender

**Thirdly,** results of this study demonstrate that walkability capacity of an area is not related only to the physical environment, but feeling safe also plays a key role in attracting people to public spaces for walking. As previously mentioned, perceived safety is far beyond the environmental or physical quality requirements. Therefore, an area with a high physical satisfaction level does not necessarily have to create a high sense of safety. However, many researchers believe that sense of safety might be improved by considering the design and physical modifications (Ratnayake, 2013).

**Fourthly,** survey results reveal that participants who live on-campus feel less safe than those who live off-campus. Also, on-campus residents are more dissatisfied with their living area. However, it was expected that on-campus residents feel safer since they have more experience and social interaction in the campus where they live, study and work. Besides, this population is more aware of the cultural and social norms within the university. Therefore, it seems that living and being familiar with an environment is not sufficient for feeling safe and being satisfied. On the other hand, as Maslow's hierarchy of needs revealed, sense of belonging can arise only when safety and security needs are fulfilled.

In this respect, McMillan & Chavis (1986) introduce four prominent indicators that create or maintain a sense of community. They define a sense of community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan & Chavis, 1986: 9).

Thus, by increasing the sense of community and level of attachment and sense of belonging in the campus, students and other residents' quality of life and their satisfaction with their environment can be improved.

**Fifthly,** since most of the participants are young, (182 out of 240 are between the ages 18-24), there is no significant difference in the results belonging to different age groups. Still, there are some points to be considered. More than other age groups, the youngest group believes that lack of lighting at night is problematic. However, they

find themselves safer when they walk around at night more than the other age groups. Elder age groups give more importance to problems such as the quality of the pavements and separation from traffic.

**Sixthly,** the results of the research can change according to the focus of the sample population. For example, if the survey conducts the questionnaire for the first year students, or mostly outsiders, the old people, the results might be different. Therefore, the idea of safety perception is an issue with multiplicity. It is a complicated issue, which has various dimensions, not only related to the design of public space, but also management and maintenance, and use of the space. Consequently, such research should be conducted by focusing on the different user groups to have a broader understanding and viewpoint for the safety and security, therefore, walkability capacity, of the METU campus.

Furthermore, based on the findings presented and discussed here, there are other safety aspects underlying users' evaluation of the characteristics of METU campus walk that can influence people's decision whether to walk or not.

To Design and improve ***infrastructure*** for pedestrian safety, it was stated earlier that a sufficient condition of ***physical features*** does not mean a high sense of safety. However, there is a positive and significant relationship between the feeling of safety on the METU campus and the quality and adequacy of the infrastructure.

- ***Path quality*** is one of the main features in terms of increasing the actual safety of pedestrians. The paths' quality of the METU campus is obviously poor. The results of the direct observation show that uneven pavement, unsafe level changes of sidewalks, and barrier along the sidewalks make walking more uncomfortable and undesirable for all groups of uses. Besides, big number of survey contributors agreed that the paving, which are uneven, slippery, deformed or damaged, obstacles and barriers along sidewalks put pedestrians' safety at risk.

  Moreover, ***sidewalk width***, ***furniture***, and ***signs*** are the other components of quality of path. The survey on the users of METU campus shows that

the larger of pedestrians agreed on the idea of widening sidewalks, especially in zone 4 (A4 entrance gate to shopping center and to MM building) and from foreign language department to rectorate sidewalks with tree in middle make the movement of pedestrian difficult. Despite the location of trees is wrong, they should be kept and well-cared and maintained, as they provide a significant level of shading for walkers in summer.

Street ***furniture*** is another factor has an effect on walkability, the direct observations and taken photos show that, placement and in some case size of street furniture such as bins, benches and lamps is not sufficient. There is lack of furniture in zone 5 is obvious, this zone needs more benches and resting equipment, also abounded bus stop shelters should be removed and new ones should be installed in active bus stops. Additionally, unpleasant and unqualified or broke furniture need be removed throughout the university campus. In active shortcuts and in central and crowded zones (2-4-6) more bins with different sizes are required.

Although a high percentage of participants stated that street ***signs*** were sufficient, this percentage was lower in zone 5 and 6 than the other areas. Direct observation confirms that there is lack of adequate navigational and representational signboards, invisible and unqualified signs should be improved. Besides there is interesting result of survey, 66.6% of the on-campus residents and 76.2% of the participants who live off campus stated that the signage on the paths such as maps or signs are adequate for way finding.

- ***Separation*** is another element of actual safety of pedestrians. As mentioned before, sidewalks, medians, boulevards, on street parking, and parallel routes help to separate people from vehicles. In METU campus case, curbs on sidewalks provides a separation between pedestrians and

vehicle area, but in some areas the narrow pedestrian width makes people feel exposed to traffic and it endanger their safety. Also, in some parts presence of trees separate pedestrians from vehicles. In addition, lack of separated and continuous bike lane is one the other safety issues.

Another issue of Separation is the on-street parking in zones (2-4), although it provides a significant separation between pedestrians and traffic, but these cars creates some conflicting zones between car users and pedestrians and prevent pedestrians passing and moving easily, and endanger their safety. Apart from dolmuş stations in two parts of the campus, dolmuş stops are not also clearly delineated.

- Existence and condition of facilities for convenience walk of ***older and disabled people, also parents carrying children*** is another topic to be considered, direct observation and participants' point of view reveal that although there is some modified area which offers easy and continuous walk, but they are not adequate. Unfortunately, a few street crossings with elevated paving surface are not enough to provide such a continuous and safe sidewalk pattern on METU campus.

- In terms of ***maintenance and attractiveness,*** although METU campus is enjoyable for walk in term of presence of green areas, users in west dormitories area think that this zone needs more vegetation and landscaping. In addition, observations showed that the lack of regular maintenance of METU campus, including the outer area appeared to be a problem in terms of the authorities. Furthermore, according the survey participants, idea there is a significant lack in east, and west dormitories.

***Perceived safety*** is another main factor that has an effect on walking capacity in public spaces; this aspect of safety is debatable in different dimensions.

- As discussed in the literature review, in addition to the actual safety of the built environment, one of the most important reasons to make people walk is the ***presence of people*** in that place. It means that natural surveillance or monitoring can lessen the feeling of anxiety while people are walking along the street and it is encouraging pedestrians to walk. The findings of this study are consistent with these theories. Zone 2 (east dormitories) although has the lowest score for physical features, but the participants in this area have high sense of safety. In addition, zone 5 which has quiet and inactive surrounding, and it is isolated from the central areas of the campus, people have low sense of safety. Therefore, as Jackson& Stafford, (2009) claim, active outdoor and social interactions between people may have positive effects on both psychological and physiological indicators of social health; in addition, it is a potential prevention of psychological stress. Finally, we can note that by planning effective meeting spaces in such isolated area, they can be perceived as safe and as more enjoyable to walk.

  A part of this monitoring is done by active buildings around. Due to the educational and administrative use of buildings in the campus, monitoring does not happen properly from the buildings. In the METU campus, 57.5% of participants stated that they could be heard and seen due to active buildings such as cafes, shopping center, dormitories, sport centers and canteens. Not surprisingly, zone 6 (main pedestrian axis) where most education and office buildings are closed after working hours, does not have any active building except the library. With low number of users after working hours, and poor illumination, this zone's users feel more unsafe than other zones.

  However, there is a disagreement among researchers about the positive effect of presence of people. One group believes that the presence of more people increases safety in environment. The other group of experts as well as several participants in the study stated that more people equal high rate

of crime and more litter and more incivilities, which leads to decreasing safety and security. It can be a topic for future researches whether the presence of people really causes safety or unsafety in a public space.

Night time perceptual of safety is lower than day time, regarding lack of lighting in many areas of the campus. In general, 39.5% of participants agreed that there is not appropriate lighting. This means that the environment is not visible enough to have a pleasant walk. This percentage is higher in female users than male users. As Abdulla et al. (2016) indicate, women rarely use open spaces at night with poor lighting at night. In the METU campus, zone 6 (main pedestrian axis) and zone 1 (Technopolis) are the weakest zones in terms of lighting, respectively. Moreover, 60% of the respondents in zone 2 (east dormitories) claimed that they feel safe at night time, the results of the direct observation confirms this result. The presence of people is high in this zone and there are many active buildings such as cafes and restaurants, gym, taxi and bus stop as well as good quality of lighting.

- One of the main obstacles to feeling safe is the presence of stray dogs. 74.3% of female and 54.6% of male participants agreed that walking is unpleasant because of stray dogs. Especially early in the morning, night time and in the winter it is more problematic. However, most of the respondents added notes that they do not want dogs to get hurt at all.

Regarding the last part -traffic safety-, observation and questionnaire results indicate the lack of sufficient traffic safety infrastructure, such as traffic lights, bollards for separation, well-designed crosswalks, special pedestrian and bike ways. The majority of participants mentioned that it is necessary to impose speed limit in the campus. Especially in zone 4 (A4 gate door) and in zone 2 (east dormitories) more than 80% of respondents agreed with the statement.

## 6-4. Suggestions

According this survey it can be claimed walking capacity of the METU campus is somewhat high. However, it depends on which part of the campus you walk on. Although there is satisfaction because of green space and clean environment, but as mentioned in the Discussion section the six zones of the campus have some weaknesses. On the other hand, there are several strong points, but also there is room for improvement. To further increase the safety of the METU campus, there are issues that should be addressed on a priority basis.

- As noted in Chapter 5, the problem associated with ***stray dogs*** is one of the factors threatening the safety of pedestrians. Although some action is being taken for the stray animals under the Law No. 5199 on the protection of animals, but it seems that it is necessary to develop new policies and strategies to solve the problem. On the other hand, Özkan (2017) noted that the METU campus spread over 45 km² and is one of the last natural protected areas for wild animals in Ankara. He discussed the devastating effects of stray cats and dogs on natural ecosystems at length. For example, there is a decline in the number of foxes and wild rabbits in parallel with the increase of wild dogs in the Yalıncak hills since the beginning of the 2000. In addition to reviewing the existing laws and actions, a comprehensive study should be undertaken to identify the problems associated with stray dogs and cats, formulating effective legislations for stray animals' control. In this regard Tasker (2007) claims successful stray control is more likely to be related to a number of features such as *comprehensive, operative and compulsory legislation, control of breeding, environmental management, and cooperation between authorities and animal welfare groups.*

- As highlighted by this research, by way of ***participatory planning,*** a sense of community and level of attachment to the campus can be increased. As

a result, students and other inhabitants' quality of life and their satisfaction with their environment would improve. In brief, with a participatory, democratic and user-centered planning process, and concentrating on sustainable urban development goals much more progress can be made in this area. While with non-participatory, centralized, top-down, politicized management development in neighborhoods and in this case the university campus will face obvious inadequacies. The findings of this survey propose future studies that address the university students and users' participation in planning and decision making.

- As underlined in Discussion section, one of the findings of this research is differences in perception of safety among men and women respondents. Consequently, this issue can be a potential topic for future research. Although both male and female users can be affected by the environment and safety issues, additional research is needed about women's safety on the METU campus, and related issues such as gender equality and awareness about empower women safety in a campus environment.

- Goal 17 (objective 17-2) of METU strategic plan (2018-2022) is emphasized to improve the on-campus transportation system, an environmental-friendly, energy-saving, smart, unobstructed, accessible, and safe public transportation system. It aims to reduce private vehicle traffic by providing the essential infrastructure to encourage pedestrian and bicycle flow.

  However, this research found significant problems about the transportation system. **Firstly**, according to the data collected from the participants and my personal experiences as a habitant in zone 5, participants in this area face several problems during their daily journeys from the western dormitories to the main area of the campus and faculties and gates.

Although there are regular buses on the campus, but due to some reasons, transportation in this area is a concern. For instance, long gap between buses in the evening, lack of buses at late-night hours, or a few numbers of buses on the weekends, during semester holidays, and summer school affect the quality of life of the residents of this zone. Walking on the main roads because of long distances between destinations takes more time, which is problematic in hot summer days, or in winter due to temperatures. Although there are shortcuts between west dormitories and main areas, but it seems they are useful only in crowded hours because of presence of people and day light. However, in the evening or quiet hours, lack of lighting, fear of dogs, lack of people force users to use alternative shortcuts or solutions. Therefore, people in this zone have to take a taxi for their daily needs which is not low-cost, or they have to solve this problem by hitchhiking which can be unsafe, unreliable and time-consuming. In summary, people need to be able to reach to the desired location on the campus every day without having to deal with these issues.

**Secondly**, the existing bike route is deficient since it does not cover a large area in the campus and there is no continuity on this route. In addition, unavailability of rental bicycles or scooters is a major reason for the failure of this route. However, with respect to safety and comfort, this route is an off-street and protected path it can be a choice for a short safe biking. As Dehghanmongabadi, & Hoşkara (2018) mentioned, universities can raise awareness in communities by adopting and modeling sustainable concepts in their own environments. Many universities and private transportation companies in the world have been successful in sustainable transportation and promote this to the society. Therefore, to achieve this goal of strategic plan of the METU a comprehensive study, followed by a detailed bike path plan, can bring the university campus closer to the goal of sustainable development.

As an example, JUMP by Uber creates on-demand electric bikes and scooters. This company claims that by designing user-friendly hardware and software, they help create a world that it's safe and easy for everyone to get around. [34]

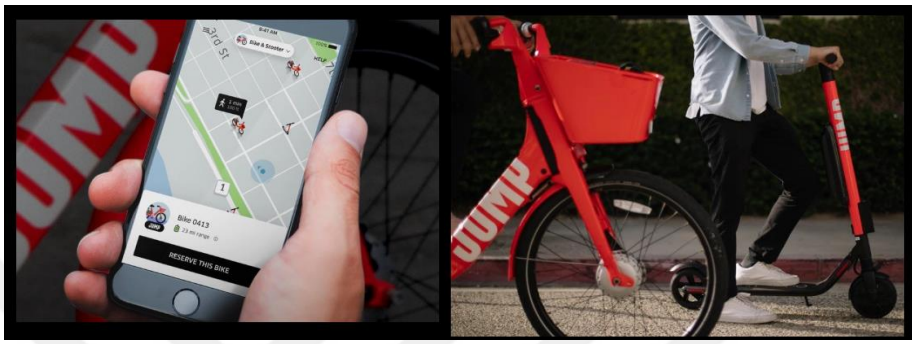



Figure 6-2. On-demand e-bikes & scooters [35]

Figure 6-3. On-demand e-bikes & scooters (Wineskin, Flickr)

By using the 'app', users can select bike or scooter from the menu, locate and reserve a JUMP bike or scooter nearby. Then it can be unlocked by entering user PIN on the bike or just by scanning the QR code on the scooter. At the end of the trip, the user will lock the bike or scooter to a rack and park it. The company's motto

[34] https://jump.com/about/

[35] Ibid

in universities is to get the students and staff away from vehicles, decrease congestion, and provide a healthy, sustainable, and low-cost transportation solution.

- It is also mentioned in another section of the strategic plan that establishing graduate-researcher guest house - in zone 5 (west dormitories) - to fulfill the housing needs of the research assistants, graduate students is another significant development for the university.

  However, this research shows zone 5 and 6 (western dormitories and technopolis) are the areas where students have less sense of safety. Participants' comments and analyzing these locations identified some serious problems that effect perceived safety and quality of life of the individuals in a negative way. The most considerable issues in regard to the sense of safety in the western area of the METU campus are the absence of people. The second issue is lack of places to bring people together and increasing social interactions. These gathering places such as a cafe, restaurant not only create western parts more livable places but as well increase natural surveillance for the surroundings. This lack of public places makes participants feel isolated, and segregate from the areas therefore; users in these zones feel less satisfied and safe.

Based on the nature of the problems in this study, additional recommendations for improvement can be helpful.

— **physical feature**

- In zones 1, 2, 4, 5, 6 sidewalks need some degree of repair and maintenance. Especially in zones 2 and zone 4, walking paths should be widened, and careful consideration must also be given to the accessibility and continuity of the new project of paving the path way in zone 4. Damaged sidewalks make the METU campus less accessible, especially for the users who use wheelchairs, walking

stick, or the other pedestrians. Accessible sidewalks should be considered as an important issue and more executive laws should be applied to sidewalks.

- Another accessibility problem is insufficient navigation and representation boards, especially in zones 5 and 6. Also along the campus unqualified and broken signboards should be repaired or removed.

- Improve lighting of the zone 6 (main pedestrian axis), the shortcuts connecting west dormitories to the central areas. Also in zone 4, in gathering areas like tennis courts and green area in front of shopping center lighting needs improvement.

- In order to have an attractive environment, there must be regulations in advertisements, public vehicle stops (bus and mini buses), all signs and signages.

- For having inclusive and accessible campus for all, sidewalks and ramps at all intersections and crossing must be redesigned for pedestrians with wheelchairs or other vulnerable groups. In addition, more facilities and services should be assigned, and adjustments should be made to ensure that people with disability can access to the faculties, housing and other goods and services.

- Adequate furniture such as bench, bin, lamps, flower pots etc. should be introduced to the public space. This furniture should be

harmonious with general design theme of the campus, to create a comfortable environment for everyone.

- Well-designed transportation plan and schedule would increase the quality of life and satisfaction of users.

- Increase monitoring and controlling all vehicles by means of surveillance cameras on campus and raise the penalty for speeding.

- traffic calming measures, such as raised or textured pavement at crosswalks, safety bollards, speed barriers especially should be implemented and increased not only in central areas like zones 2 and 4, it is also necessary to apply in surrounding zones (1 and 5).

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# APPENDIX

The questionnaire of the case study of METU campus

**Age**

18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65 or over ☐

**Education**

Attended high school ☐ undergraduate student ☐ graduated ☐ post graduate student ☐

Post graduate degree ☐ other _____

**Sex**

male ☐ female ☐

**Profession**_____

1- Do you live in campus?

Yes ☐ No ☐

2- How often do you use this route?

More than once a day ☐

About once a day ☐

A few times a week ☐

Less than a few times a month ☐

3- Do you think, METU campus is a pedestrian-friendly space?

If yes, why? _____

If no, why? _____

I) 4- Do you enjoy walking in the campus?

Yes ☐

No ☐

There are some problems such as:

Poor quality of pavement ☐

Blocked sidewalks or path ☐

Surface level ☐

Stray dogs ☐

Not well lighted ☐

Dirty, lots of litter or trash ☐

Few pedestrians or lack of activities ☐

Other _____

5- I am walking for

☐ Transportation - to reach a specific location e.g. shops, bus stop, school

☐ Recreation - walking for enjoyment or physical activity

☐ Transport and recreation

6- What do you like about walking in the campus?

7- What do not you like about the campus in terms of walking facilities?

8- What would you like to see in the campus in terms of walking facilities?

9- What do you think should be improved in the campus in terms of walkability?

Some parts of the campus sidewalks should be widened ☐

Needs more grass, flowers, or trees ☐

Needs more benches or places to sit ☐

Needs well lighting ☐

Needs public art or other appealing features ☐

Other _____

10- Which part of the campus is easier and more comfortable to walk?

11- Which part of the campus is more difficult and uncomfortable in terms of walkability?

12- How does the vehicular traffic disturb the pedestrian movement?

13- Do drivers behave well?

Yes ☐

No ☐ they …….

Drive fast ☐

Don't stop while people crossing street ☐

Treat the pedestrians with disrespect ☐

14- Which transportation facilities are connected to the pedestrian network in this area?

Bike facilities ☐

Public bus facilities ☐

Private bus facilities ☐

Private cars ☐

Car-pool ☐

None ☐

Part B of the questionnaire of the case study of METU campus

| **Rating Format Questions** | | | **Participant Answer** | | | | |
|---|---|---|---|---|---|---|---|
| **Issue** | **Dimension** | **Variable** | Strongly Disagree | Disagree | Undecided | Agree | Strongly Agree |
| Safety | A-physical features | a-1-paths have good quality for walking | | | | | |
| | | a-2- Sidewalks and paths are wide and flat, with no cracks or holes | | | | | |
| | | a-3- there is signage on the paths such as maps or signs leading to different parts and zones in the campus | | | | | |
| | | a-4- There are enough bollards to separate car traffic and pedestrians | | | | | |
| | | a-5- there are not barriers and gaps on paths | | | | | |
| | | a-6- paths are easy to walk for people with disability, or parents carrying prams, or learner cyclists | | | | | |
| | | a-7- there are trees and bushes along the paths to provide shade and enjoyable environment | | | | | |
| | | a-8- It is safe to walk at night, regarding lighting | | | | | |
| | | a-9- paths are clean and enjoyable to walk | | | | | |
| | B- sense of safety | b-1-it is safe to walk at any time of day in terms of activities and presence of people around | | | | | |
| | | b-2- there is enough lighting at night | | | | | |
| | | b-3- active buildings that make walking safe | | | | | |
| | | b-4-feeling safe while walking at night time | | | | | |
| | | b-5- safe and secure to walk for women and kids | | | | | |
| | | b-6-stray dogs making it unpleasant to walk | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | c-Traffic safety | c-1-drivers behave respectfully | | | | | |
| | | c-2-well-designed crosswalks | | | | | |
| | | c-3-necessisty of low speed limit | | | | | |

Part C of the questionnaire of the case study of METU campus

| General Questions | | Yes | No | I don't know |
|---|---|---|---|---|
| 1 | Generally, do you feel safe on this walk? | | | |
| 2 | Can you see other people around as you walk? | | | |
| 3 | If you were to walk this path at night, would it be well lit? | | | |
| 4 | Are pedestrian lights or zebra crossings conveniently located? | | | |
| 5 | Do you feel safely separated from the road traffic? | | | |
| 6 | Do you think roundabouts, humps or other measures help improve the pedestrian safety? | | | |
| 7 | Is campus usable for people with disability, older people, and children? | | | |