

Achieving Sustainable Transportation at EMU Campus

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ABSTRACT

In the twenty-first century, the issue of need and implementation of sustainability has become a serious topic of discussion between scholars and theorists in different communities. In this regard, the higher education institutions are one of the key social communities around world. A kind of institutions of higher education are university campuses which the basic responsibility of them is to foster their students for life by increasing their awareness, skills, information and values needed to make future. Furthermore, education is humanity's finest expectancy and most effective means in the search to reach sustainable development. From this perspective, university campuses have ability to contribute and create awareness of sustainability which can be combined into everyday life of their communities as well as can be the ideal location and the best starting point to test out the concepts of sustainability.

In the recent years, according to the rapid uncontrolled growth in population, urbanization, spatial expansion and motorization, the main challenge around world is the issue of transportation which play crucial role in sustainable development by its substantial impacts on economics, environment and the community. Hence, transportation sector is an important element in sustainability. Consequently, sustainable transportation idea is appeared from the sustainable development concept in the transportation sector.

Based on initial discussion, this research reviews the sustainability within university campuses by concentrating on sustainability in transportation sector. In this regard, this study will help to understand the definitions, aims, needs and elements of

sustainability as well as definitions, aims, needs, indicators, impacts and kinds of sustainable transportation in university campuses. In continuous, all dimension of transportation sector at Eastern Mediterranean University (EMU) campus in Famagusta, North Cyprus as case study and problem area will be examined toward achieving the main aim of this research which is to set up a guideline to have a sustainable transportation system and a pedestrian friendly environment in EMU campus, with the intention of improving the quality of the campus environment.

This study is aimed to be a case study research and action research. The methodology for data collection in this study is based on qualitative and quantitative techniques. For data evaluations, the statistic results and qualitative analysis used to clarify the existing situation and problems of transportation sector at EMU Campus environment. In the end, due to all results, a guideline will be provided for achieving sustainable transportation at Eastern Mediterranean University Campus which is the main aim of this study.

Keywords: Sustainable Development, University Campuses, Sustainable transportation, Eastern Mediterranean University.

ÖZ

Yirmibirinci yüzyılda, sürdürülebilirlik kavramına ve uygulanmasına olan gereksinim farklı toplumlarda pek çok araştırmacı ve kuramcı tarafından vurgulanmaktadır. Yüksek öğretim kurumları, dünyada, en önemli sosyal topluluklardan biridir. Yüksek öğretim kurumları arasında üniversitelerin en temel görevi, öğrencileri geleceğe hazırlamak üzere duyarlılıklarını, bilgilerini, becerilerini, değerlerini ve sorumluluklarını artırmaktır. Bunun yanında, eğitim ise, sürdürülebilir kalkınmaya ulaşma yolunda insan yaşamının en etkili aracıdır. Bu bakış açısıyla, üniversite kampüsleri, toplumların gündelik yaşamı içinde sürdürülebilirlik hakkında farkındalık yaratabilen ve sürdürülebilirlik kavramının test edilebildiği en ideal yerlerdir.

Son yıllarda, kontrol altına alınamayan nüfus artışı, kentleşme, mekansal yayılma ve motorizasyona bağlı olarak, ulaşım konusu; sürdürülebilir kalkınma üzerinde, ekonomik, sosyal ve çevresel etkileriyle, dünya üzerindeki en önemli konulardan birisi olmuştur. Bunun sebebi, ulaşım sektörünün, sürdürülebilirliğin en önemli elemanlarından biri olmasıdır. Buna bağlı olarak, sürdürülebilir ulaşım fikri, ulaşım sektörü içinde sürdürülebilir kalkınma kavramından ortaya çıkan bir kavram olmuştur.

Bu ilk görüşler ışığında, bu araştırma, üniversite kampüsleri içindeki sürdürülebilirlik kavramını, ulaşım sektöründeki sürdürülebilirliğe odaklanarak irdelemektedir. Bu bağlamda, söz konusu çalışma, sürdürülebilirliğin tanımları, gereksinimleri ve elemanları yanında, üniversite kampüslerindeki sürdürülebilir ulaşımın amaçları,

gereklilikleri, göstergeleri, etkileri ve tiplerini anlamaya yardımcı olacaktır. Bunun yanında, bu araştırma, çalışma alanı olarak seçilen, Kuzey Kıbrıs, Gazimağusa kentindeki Doğu Akdeniz Üniversitesi (DAÜ) kampüsünde, kampüs yaşam çevresinin kalitesini arttırmaya yönelik olarak, sürdürülebilir ulaşım ve yaya dostu bir kampüs alanına ulaşmak üzere bir dizi öneri geliştirmeyi hedeflemektedir.

Bu çalışma hem bir alan çalışması hem de uygulamaya yönelik bir araştırma şeklinde ele alınmıştır. Bu araştırma içinde bilgi toplama yöntemi olarak niteliksel ve niceliksel yöntemler kullanılmıştır. Toplanan verilerin değerlendirilmesinde ve DAÜ kampüsü içindeki ulaşım sektörü sorunlarının ve mevcut durumunun tespitinde, istatistiki veriler yanında, niteliksel analizler kullanılmıştır. Kuramsal bilgilerin toplanmasında, ayrıntılı bir kütüphane araştırmasına da dayalı olarak yürütülen bu araştırmanın sonunda, DAÜ kampüsünde, sürdürülebilir bir ulaşım sistemine erişebilmek üzere bir dizi öneri geliştirilecektir.

Anahtar Kelimeler: Sürdürülebilir Kalkınma, Üniversite Kampüsleri, Sürdürülebilir Ulaşım, Doğu Akdeniz Üniversitesi, Gazimağusa.

To My Family

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Chapter 1

INTRODUCTION

1.1 Problem Statement

The university campuses are kinds of educational milieu and also distinct communities. Currently, the number of students who are interested in studying at universities is increasing every year. Many of students prefer to live and spend their time inside university campuses. Thus, universities must have a sustainable development plan for their campuses to define a sustainable living community. Sustainable development is the “development that meets current needs without compromising the needs of future generations” (Steg and Gifford, 2005, p. 62), by focus to finding a proper balance between environmental, social and cultural as well as economic qualities. One of the main factors in sustainability in campus development plans is transportation inside campus, having significant impacts on economic, social and environmental qualities of the campus environments. Accordingly, transportation in university campuses have effects on the environment such as, disturbance to teaching, loss of natural environment and greener, despoliation of the visual environment by parking provision, air pollution, noise pollution, energy consumption, traffic congestion, land use and health effects on staff and students (Ruckelhaus, 1989; Tolley, 1996; Litman, 2003a; Steg and Gifford, 2005; Balsas, 2001).

University transportation has also effects on neighboring communities in different ways, such as parking traffic, service access and off campus housing. Furthermore, car usage in university's transportation is inefficient over short distances and is a major contributor to global warming. Today, one major problem with automobiles is the limitation of parking areas which is also a common problem on university campuses. In general, car-based transportation has a lot of hidden costs. Many countries around the world have begun developing sustainable transportation policies to encourage people to make changes in lifestyle and travel behavior. According to the definition of sustainable development, sustainable transportation can be a "transportation system that meets current transport needs without compromising of future generation ability to meet their transport needs" (Steg and Gifford, 2005, p. 62). Obviously, university campuses are privileged places to connect to the concept of sustainability and to help reshape society's transportation (Shoup, 1997; Dober, 2000; Balsas, 2002; Macbeth, 2004).

Based on these initial discussions, the focus of this research is the means of sustainable transportation planning on university campus environments. The problem area, and thus the field study in this research is the Eastern Mediterranean University (EMU) campus in Famagusta, North Cyprus. Eastern Mediterranean University (EMU) was established in 1979 and today about 14000 students from 68 different countries study at EMU – approximately 5000 of them which are almost 35 percent of student living inside the campus. EMU campus area is around 2200 acres which is divided into two parts and there are fifty buildings inside campus area. 4 kinds of transportation systems can be observed in EMU campus, i.e. public transportation by university shuttle busses, private cars, walking, and cycling; yet transportation system to and from, and on campus is designed more onto automobile, while two

modes of transportation systems - walking and bicycling around university campus are also used by the students. However, the facilities for the pedestrians and cycles – such as shaded walkways, bicycle paths, secure bicycle parking and signage, are not provided efficiently, nor the roads for vehicles carry positive contemporary characteristics for traffic and transportation. Accordingly, it can be argued that a proper transportation master plan is needed for improving the quality of the EMU campus.

1.2 Aims, Objective and Research Question of the Study

Sustainable transportation on university campus is focusing on the negative and positive values of transportation which are apparent now or in the not-too-distant future. Furthermore, transportation systems on campus environments are moving to sustainability by focusing on sustainable transportation indicators. There are a variety of indicators on sustainable transportation such as quality of walking, cycling, public transit, and driving on accessibility category and also land use, energy use, health consequences of transport, crash costs, noise pollution, waste, climate change and CO₂, CH₄ emissions (Litman, 2008a; Steg and Gifford, 2005).

Accordingly, the main aim of this research is to set up a guideline to have a sustainable transportation system and a pedestrian friendly environment at EMU campus, with the intention of improving the quality of the campus environment. Based on the main aim, the major objectives are set as:

- Discussing the benefits of sustainable transportation inside campuses.
- Understanding various ways to moving towards a more sustainable transportation on campus environments.

- Discussing the effects of sustainable transportation on pedestrian friendly environments inside campuses.
- Finding out the problems of EMU campus in terms of transportation.

Accordingly, the following research question will be answered as a part of this thesis:

- What are the ways to achieve sustainable transportation at EMU Campus?

Thus, the output of this research will be a transportation master plan for sustainable transportation at EMU campus, supported by design guidelines for pedestrian walkways, bicycle routes and vehicular traffic routes.

1.3 Research Methodology

This study/thesis is designed to be a case study research and action research. The methodology of the study is based on theoretical and survey methods. Initially, the study will begin with a literature review on campus environments and sustainable transportation in university campus environments. This part will involve theoretical work through documents on previous studies and examples which are related with the same subject. The second part of the research is the case study, in which a detailed analysis and data collection on site (in the EMU campus) will be done through site analysis and a questionnaire survey as well as interviews. Thus, the research will both use qualitative and quantitative research techniques.

1.4 Structure of the Thesis

This thesis involves of five chapters. The first chapter is the introduction of thesis which will clarify the central problems; the research question, main purpose and objectives of the study, the case study and the used methodology for data collection and examination.

The second chapter provides a comprehensive review on sustainable campus environment by focused on short background of concept of sustainability or sustainable development. Then it will explain the definitions and aims of sustainable campus in general, likewise need for sustainability in university campus environment and elements of sustainability in university campus environment.

The focus of third chapter is on sustainable transportation planning in university campus environments. In this regards, definition and aims of sustainable transportation, indicators and impacts of sustainable transportation planning, need for sustainable transportation in university campus environments and kinds of sustainable transportation systems and strategies in university campus environments will describe. Then, several examples of implementations of sustainable transportation management strategies in university campus environments will examine to give an overview of what has been done in other university environments. Besides, this chapter is final part of theoretical framework which produces a guideline for process.

Chapter four is concentrated on the case study of Eastern Mediterranean University (EMU) campus. The initial part in this chapter is the analysis methodology which will be used to evaluate and examine a variety of data and information, which has been collected from the study area to illustrate the findings out of existing situation of transportation sector at EMU campus. Then, general information about university including location, history and functional characteristics of EMU campus will be reviewed in general. Finally, all dimensions of the transportation and accessibility in/around EMU campus will be examined in detailed.

Last but not the least, chapter five will present the conclusions of the research which is a guideline for achieving sustainable transportation at EMU campus.

Chapter 2

AN OVERVIEW ON SUSTAINABILITY IN UNIVERSITY CAMPUS ENVIRONMENTS

2.1 Introduction

Today, the development processes are combined with quick economic growth, the deterioration of environment and lack of human health conditions as well as social separation. The fast economic growth is linked with the intensification of industrial and commercial regions, low environmental values, lacking housing conditions, and material and energy resources consumption. These development processes affect environment and human health on global level and increase risks of global environmental and human health conditions. These threats are reasons for creating sustainability in all aspects of human life (Weiland, 2006). In 1972, the first reference to sustainability in global scale was published by the United Nation Conference in Human Environment in Stockholm (Drexhage and Murphy, 2010). It continues, in 1987 with a report widely published by the world commission on Environment and Development to definition of sustainability to address the problem between environment and development processes (Harris, 2003). This report known as the Brundtland report included a definition of sustainable development: “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 45). Brundtland report was accepted by the *United Nations General Assembly* and it has spread as a political approach in a lot of countries around world. Furthermore, in 1992, the

elements of sustainability set out at the UNCED in Rio de Janeiro, and a sustainable development defined as “improving the quality of human life while living within the carrying capacity of supporting eco system” (Zuhairuse et al., 2009, p. 273). It is generally accepted that sustainability demands for a recognizing and merging between the three crucial scopes of: environmental protection, social justice, and economic expansion (Figure 1) (Drexhange and Murphy, 2010). In other words, sustainability is branded by economic development based on social justice and good organization in the use of natural resources (Alshuwaikhat and Abubakar, 2008).



Figure 1: Three Interlinked Dimension of Sustainable Development (Carr, 2008, p. vi)

In the twenty-first century, the issue of need and implementation of sustainability has become a serious topic of discussion and one of the crucial challenges in different social communities. However, university campuses are one of the key social and individual communities around world which are places where people with different lifestyles and backgrounds come together to study and live. The main aim of establishment of universities is according to present needs for high level of knowledge about all sort of human life. Furthermore, the important purpose of higher level education is distributing knowledge, developing skills, and makeing people

responsible for bringing change in behaviors, values and lifestyles (Abd Razak et al., 2011).

Briefly, education is humanity's finest expectancy and most effective means in the search to reach sustainable development (UNESCO, 1997). Hence, university has ability to contribute and create awareness of sustainability that can be combined into everyday life (Jain and Pant 2010). In this regard, the first official manifesto and substantial effort to define sustainability in university campus environments was Talloires Declaration that made by university managers. This declaration signed by twenty-two university managers to obligation to environmental sustainability in Higher Educational Institutes in French in 1990. Today, more than 300 colleges and universities from over 40 countries signed this document (Lukman and Glavic, 2007; Ciegis and Gineitiene, 2006; Becker, 2007). Talloires Declaration expressed, "Universities educate most of the people who develop and manage society's institutions". Moreover, it added that "For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future" (Ciegis and Gineitiene, 2006, p. 59). This declaration stated ten crucial action strategies which universities must take for achieving sustainability in Higher Educational Institutes. Becker (2007) mentioned these ten actions strategies at his dissertation which are listed in the following:

1. Increase awareness of environmentally sustainable development;
2. Create an institutional culture of sustainability;
3. Educate for environmentally responsible citizenship;
4. Foster environmental literacy for all;
5. Practice institutional ecology;
6. Involve all stakeholders;
7. Collaborate for interdisciplinary approaches;
8. Enhance capacity of primary and secondary schools;
9. Broaden service and outreach nationally and internationally; and
10. Maintain the movement. (p. 11)

Consequently, university campus environments are perfect places to encourage idea for sustainable development according to basic aim of establishment of university. Furthermore, nowadays a lot of universities have embarked to discovery suitable strategies to implementation of sustainability into all aspect of polices and activities (Weenen, 2000). Hence, the purpose of this chapter is clarifying definition and aims of sustainable campus and why today need for sustainability in university campus environments is essential as well as elements of sustainability in university campus environments.

2.2 Definitions and Aims of Sustainable Campus

Campus sustainability is a global issue because universities campuses are such as “small cities” by reason of their population, size, challenges and variety of activities in campuses that have many influences on the environment. Thus, numerous numbers of universities around the world started to promote sustainability in all aspects of their campus development and their systems. However, the sustainability promotion in each university is based on purposes and polices of university to achieve a sustainable campus. For several universities, having a master plan or environment policy means that they have a sustainable campus but some universities believe that sustainable campus will be achieved if the university development polices respecting all national and international declarations such as environmental protection, green building, etc. At this stage, according to three main scopes of sustainable development and university development polices, there is a variety of definitions to a sustainable campus which each university should express their own definition and idea of what a sustainable university is about (Alshuwaikhat and Abubakar, 2008; Velazquez et al., 2006; Wright, 2002).

An example of definition of sustainable university published by The Pennsylvania State University in an Indicator Report in 2000 which Shriberg (2002) in his PHD thesis mentioned this definition perhaps can be the best definition of a sustainable university because it is a combination of vision and aims. Indicator Report of The Pennsylvania State University presented that a sustainable university is:

- 1) A university whose long term prospect for continuing to exist is good; specifically such a university behaves in ways that sustains the integrity and biodiversity of the local and planetary ecosystems upon which all life depend.
 - 2) A university whose core values include: respect for the biota and natural processes, mindfulness of place, living within planetary limits, accounting for full costs, and civic responsibility.
 - 3) The kind of university that Pennsylvania State is striving to become.
- (p. 52)

Besides, a sustainable university is defined by L. Velazquez et al and L. Cole who are two theorists that these definitions presented a wide perspective on definition of sustainable campus. L. Velazquez et al (2006) defined a sustainable university campus as:

A higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles. (p. 812)

Moreover, L. Cole (2003) mentioned sustainable campus as:

The one that acts upon its local and global responsibilities to protect and enhance the health and well-being of humans and ecosystems as well as he added that it actively engages the knowledge of the university community to address the ecological and social challenges that we face now and in the future. (p. 30)

Due to definitions above and, direct and indirect influences of higher education on local, regional, national and international values about holistic facets of life, involving economic qualities, environment protection and social equality; the theories will base its arguments on the idea that the main goals of sustainable campus

is creating healthy campus environments by attention to ecological challenges, social justice, economic and human's health to minimizing the university's activities impacts on surrounding communities and own members as well as promoting sustainable lifestyle by educating current and next generations according to responsibility of universities to communities and societies.

2.3 Need for Sustainability in University Campus Environments

University campuses are a kind of institutions of higher education that the basic responsibility of them is to foster their students for life by increasing their awareness, skills, information and values needed to make future. Hence, university campuses have potential for educating the future generation of decision makers and also to offer solutions to greatest existing worldwide challenges and tomorrow's problems through their research activities in various branches. Historically, universities are areas of learning and studying the universe for current and following generation. These institutions of higher education have the unique freedom to the creation of new knowledge and improve new ideas as well as comment on society (Weenen, 2000; Cole, 2003; Cortese, 1999).

Accordingly, the university campuses are educational districts that are designed for use in the teaching, learning, researching and residence of students as well as involve the open spaces, buildings and other physical elements which are in the educational milieus (Isiaka and Siong, 2008). In this regard, university campus can be a laboratory which students learn to examine complex issues and advance actual solutions by concentration on their institute and their own behaviors. Consequently, according to the above explanations and this note that universities are hearts of universal knowledge as well as the United Nations Educational Scientific and

Cultural Organization (1997, p. 16) noted that: “Education, in short, is humanity’s best hope and most effective means in the quest to achieve sustainable development” (Shriberg, 2002, p. 84), the university campuses are the ideal location and the best starting point to test out the concepts of sustainability (Isiaka and Siong, 2008; Shriberg, 2002).

Accordingly, demand for sustainability in university campus environments have been increasing between advocates of sustainability in higher education to create changes in colleges and universities. For instance, Cortese (1999) who is former Dean of Environmental programs at Tufts university wrote: “If we are to achieve a sustainable future, institutions of higher education must provide the awareness, knowledge, skills, and values that equip individuals to pursue life goals in a manner that enhances and sustains human and non-human well-being” (p. 8).

In this regard, there has been a common question between university decision makers: Why university campus environments must be sustainable? Hence, in the past decade, many experts and theorists have addressed this question. One of the theorists who answered this question is Creighton that Shriberg (2002) stated his answer is the most basic answer (Shriberg, 2002). Creighton (1998) said: “Since universities are generally long-lived institutions, they should be concerned with the long-term health and livability of their community and region” (p. 6). Furthermore, Cortese in 1992 said “Universities bear profound responsibilities for increasing awareness, knowledge, technology, and tools to create an environmentally sustainable future. Universities have all the expertise needed to develop an intellectual and conceptual framework for achieving this goal. They must play a strong role in education, research, policy development, information exchange and

community outreaching to help create an equitable and sustainable future'' (Lukman and Glavic, 2007, p. 104). Moreover, Breyman (1999) presented an answer that: "U's have the resources, vision, opportunity and responsibility to lead themselves and their societies towards sustainability, one step at a time" (Shriberg, 2002, p. 54).

As Strauss (1996) stated:

Colleges and universities are large institutions with complex power structures and significant ecological, social and economic impacts. They are very much part of the 'real world', even though many students deny this in their everyday speech. As such, colleges set examples of institutional behavior and have the potential to show that organizations can make environmental protection a priority in their operations. More than this, schools can serve as laboratories where students learn to put ideas about sustainability into action. (p. 37)

Ultimately, due to the above mentioned statements as well as the importance and position of university in local and international communities, establishment of sustainability in all aspects of university campus environments is essential. Hence, need for sustainability in university campuses according to three main pillars of sustainable development and effects of university campuses on society including social, environment and economic as well as educational role of universities in communities can be divided into 4 parts including:

- The need of sustainability in university campuses due to social and cultural effects of campus environments;
- The need of sustainability in university campuses due to environmental effects of campus environments;
- The need of sustainability in university campuses due to economic effects of campus environments;
- The need of sustainability in university campuses due to educational effects of campus environments.

The need of sustainability in university campuses due to social and cultural effects of campus environments

Higher education milieus have contributed to the social and cultural advance of the communities that they are located. Hence, university campuses are special places that have a particular social and cultural responsibility on community and thus on societies (Chatterton and Goddard, 2000; Viebahn, 2002). In this regard, Cortese (1999) stated: “Society has conveyed a special charter on institutions of higher education. Within the United States, higher education institutions are allowed academic freedom and a tax-free status to receive public and private resources in exchange for their contribution to the health and well-being of society through the creation and dissemination of knowledge and values” (p. 8). Furthermore, sustainability supporters stress that “colleges and universities owe it to society to move toward sustainability” (Shriberg, 2002, p. 56).

Accordingly, application of sustainability in university campuses has many positive effects on societies and their culture because universities have a momentous contribution to the development of universal society as well as production and training of culture and new values among societies with regard to teaching, research activities, services, operations and public notification toward sustainability. As consequence, higher education institutions should be cores for producing sustainable development patterns that would be well-matched with society as well as should be centers for leading society toward sustainability. As a whole, moving toward sustainability in higher education institutions will be a basic driver for moving society toward sustainability. Since, higher education institutions are substantial centers of teaching, learning and research which affect future and current leaders

through their students and graduates as well as they are leverage points which reflect and inform community mindsets (Viebahn, 2002; Shriberg, 2002; Cortese, 1999).

The need of sustainability in university campuses due to environmental effects of campus environments

In recent years, many scholars and advocates have extremely attempts for transforming higher education institutions into centers that teach the values of environmental sustainability. Hence, according to the key responsibility of universities in communities, many of these attempts have been concentrating on change of research and teaching ways as well as rethink curricula in universities to support students for learning new skills, awareness and values, in order to foster alumni as responsible citizens who will move communities to creating a sustainable environment. Besides, they also focus on the ways which higher education institutions consumption resources and use waste as well as keep their own campus environments healthy. Since, in the past decade, there is a rapid growth in the number of students, academic staffs and administrative personnel as well as accordingly university's activities through teaching, research and support services accordingly. These growths in university's activities and student numbers have direct and indirect impacts on environment. These impacts can be on various aspects of the environment including land use, energy use, materials use, environment pollutions such as air and noise pollutions and increased poverty of natural ecosystems (Mat et al., 2009; Alshuwaikhat and Abubakar, 2008; Ciegis and Gineitiene, 2006; Chase, 1998).

Hence, the requisite for environmental education and environmental sustainability in university campuses have been mentioned by many experts in different articles. For instants, Creighton (1998) stated, "Environmental efforts can be a selling point for

the university, both within its community and with prospective students” (p. 6). As, Cortese (1999) wrote: “There is a growing student demand at colleges and universities in the United States and internationally for environmental education and for institutions to reduce the environmental impact of their own operations” (p. 3). Moreover, The Talloires Declaration (1990) claimed: “. . . universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future” (Chase, 1998, p. 1). Consequently, the need of sustainability in university campus environments is essential to degradation negative impacts of university campuses on environment as well as university campus environments should be a model for communities to move toward sustainability.

The need of sustainability in university campuses due to economic effects of campus environments

University campuses are established as educational and research centers that play an important role for economic growth and development, life quality and economic equity in communities through research, training and generating new knowledge, skills and initiatives. Besides, university campuses are large economic entities that have directly impacts on their respective regions economic through procurement activities, services, operating their facilities and expenditures on goods as well as generating employment staff and faculty. Moreover, higher educational institutes have a main role in fostering industries and testing technologies by supporting their research and educating activities (Parsons and Griffiths, 2003; Universities UK, 2009; Universities UK, 2006).

However, these educational milieus are also one of the biggest consumers of resources, products and services such as energy, water, transportation and paper as

well as one of the biggest waste producers in communities throughout their daily operations. Hence, university campuses have widespread impacts on their local economic. Consequently, universities must establish sustainability in all part of campus environments to better identify and control the full cost of all daily operations and activities as well as reduce the consumption of resources and product of waste (Ciegis and Gineitiene, 2006; Universities UK, 2009).

The need of sustainability in university campuses due to educational effects of campus environments

University campus environments are the biggest educational communities around the world. Furthermore, the multiple roles of universities in communities are including research, teaching, providing new knowledge, skills and technologies as well as prepare their graduates as effective and responsible citizens. Thus, the establishment of sustainability in all aspects of campus environments gives an opportunity to higher education institutions to use their campuses as a sustainable model to educate their students (Abd Razak et al., 2011). Moreover, students have many chances to learn, get experience and have practice a sustainable lifestyle during their study and then after graduation transfer these experiences and practices into their daily lives (Stewart, 2010; Legacy, 2004). However, a sustainable campus creates an educational environment that can improve formal learning as well as contribute to informal learning. Besides, sustainability in the realms of university campuses curriculum and academic research is vital. Professor David Orr, Chair of Department of Environmental studies at Oberlin College said that university campuses are like “living laboratories”. Establishment of sustainability in these “living laboratories” creates opportunity for staff to work, students to learn and faculty to teach within a sustainable system that is a perfect model for the world community. Hence, the need

of sustainability in all parts of university campuses is essential to improve university's performance (Legacy, 2004).

Consequently, existing university campuses necessitate more development from time to time. Hence, applied of sustainability concept in all parts of university campus environments is extremely necessary until the campus environments been healthy, with a successful economy through energy and resources preservation, waste decline and effective environmental management, and encourages equity and social justice in its activities. Besides, as proposed by Cortese (1999) sustainability should be combined within the key role of universities including teaching, learning and research processes. However, activities in a sustainable university campus environment do not have negative effects on natural environments and human communities. Finally, sustainable university campuses help local, national and international societies in ensuring healthy environmental, social and economic future (Alshuwaikhat and Abubakar, 2008; Shriberg, 2002; Ciegis and Gineitiene, 2006).

2.4 Elements of Sustainability in University Campus Environments

The sustainability is certainly a subject that is in the interest of environmental as well as economic and social sectors. Thus, for achieving sustainable university campuses, creation of sustainability elements in different aspects of these three main pillars in university campus environments is essential. However, there are many ways to the development of sustainability in university campuses which are depending on the strategies of universities to achieve sustainability in their campus environments (Zuhairuse et al., 2009; Weenen, 2000; Weiland, 2006; Becker, 2007). Hence, due to various researches (Zuhairuse et al., 2009, p. 276; Weenen, 2000, pp. 32-33; Becker,

2007, p. 15) the important basic elements toward achieving sustainable campuses and planning to the development of sustainability in university campuses can be listed as:

- Campus Site Design and Planning Management,
- Campus Transportation Management,
- Campus Energy Management,
- Campus Water Management,
- Campus Waste Management,
- Campus Use of Material Management,
- Curriculum Management,
- Wellness Management,
- Governance Management.

For the purpose of this thesis, these elements are grouped under 4 items, which are:

(i) Campus Site Design and Planning Management, (ii) Campus Environment and Economic Management, (iii) Campus Social and Educational Management and (iv) Campus Transportation Management. The following sub-sections will briefly explain the first three of these elements, before the thesis concentrates on the last element – campus transportation management as its main focus, in the next chapter.

2.4.1 Campus Site Design and Planning Management

The main objective of a university campus is to bring together different people with their intellectual background and ideas in an educational milieu to provide potential for social and scientific exchange. Besides, the physical elements and quality of this educational milieu are extremely important, therefore; campus site design and planning has significant role and directly effects on performance of university campus environments. Since, campus site design and planning is an important sector of the land-use planning process in university environments that is a general

assessing of site and location of physical elements on site as well as organizing facilities and activities on the site. The main and effectual physical elements in university campus environments can be involving buildings, public open spaces, green areas, playfields, streets, car parking areas, pedestrian paths and sidewalks, bike lines and bicycle parking areas, signage, furniture and lighting as well as infrastructure and utilities. Accordingly, paying attention to all physical elements in campus site design and planning management is essential if a university campus wants to have a prosperous campus site design and planning that create a sustainable environment to meet the various need of an educational institution toward achieving main aim of educational campuses and also to have a beneficial campus site design and planning that be patronage for reducing use of land and negative impacts on environment as well as increasing the aesthetics in the campus environment and surrounding communities (Russ, 2002; Richardson and Lynes, 2007; University of Pennsylvania, 2012).

However, the location of buildings in site and design of buildings in university campuses play important role to maximize the opportunity for achieving sustainability in these educational milieus. Each building's design should be relating to its surrounding structures and environments as well as public ways include streets, pedestrian paths and bike lines which are adjacent to them. Furthermore, entrances of buildings should be visible and contribute to liveliness of adjacent streets and palaces. Since, building entrances are the suitable places for gathering and meeting places as well as social interaction. Moreover, buildings should be more energy and resource efficient. In continuous, public open spaces have significant role in university campuses which provide places for meeting, discussion and promoting the sense of community between members of university. Moreover, location and

condition of streets, car parking areas, pedestrian paths, bike lines and bicycle parking areas as well as location and quality of signage, lighting and furniture within campus environments, and their linkage and accessibility to other elements are extremely important to create active and sustainable campus environments. Furthermore, in all physical elements paying attention to use of energy and materials is a key factor so use of recycled materials and decline the use of non-renewable resources is important (University of Pennsylvania, 2012; Russ, 2002).

Consequently, implementation of campus site design and planning as well as paying attention to all physical elements will be the best way to enhance the academic mission and creates unity across site characteristics as well as to improve visual, environment, social and moral values of the campus. Hence, a campus site design and planning management should be functional and will be responsible to conservation of environment and ecosystem as well as should identify and implement a numbers of strategies and polices for improving the overall sustainability of the university campus environments (Zuhairuse et al., 2009; Richardson and Lynes, 2007; University of Pennsylvania, 2012;).

2.4.2 Campus Environmental and Economic Management

According to various researches, the main and basic elements in environmental and economic management in university campuses toward achieving sustainability in university campus environments include energy, water, waste and use of material management, which are explained briefly in the following.

Campus Energy Management

The energy consumption within university campuses is like a small city. Hence, energy management should be one of the main priorities in universities policies as well as having this issue in the strategic plans of universities is essential. Decline in

university campuses' energy requirements have direct effects on energy and money saving as well as quality of environment. Thus, efficient usage of energy for lighting, air conditioning and ventilation, transportation, heating, auxiliary service and other such operations must be a significant strategy inside university campuses. Obviously, to maximize the use of renewable energy sources or clean energy sources such as: wind power, solar power, hydropower and geothermal power; to minimize the use of non-renewable energy sources and utility power will be the best way for conservation of energy sources and achieving zero-carbon energy use that is a primary challenge in universities as well as cities. The goals of energy management strategies in university campuses are to decrease the total energy consumption of buildings and facilities inside campus, reduce energy cost and decline impact on environment as well as educating the students and staffs towards achieving sustainability in campus environments and their local communities (Zuhairuse et al., 2009; Backer, 2007; Hoe, 2011).

Campus Water Management

The main goal of campus water management is to reduce the water consumption that can be achieved by collection of rainwater and storm water and also reuse of wastewater for purposes such as: watery plants and irrigation and cooling tower. Furthermore, educational programs, irrigation systems design and efficient landscape design with native plants and grasses will be good strategies to encourage the campus community to preserve water in campuses environment (Alshuwaikhat and Abubakar, 2008; Backer, 2007).

Campus Waste Management

One of the main challenges that universities all over the world are facing toward their responsibility to environment is the growing of solid wastes in their campus

environments. The activities and operations at the university campuses are generator of various kinds of waste such as paper, cans, plastic, glass and so on. Hence, a good campus waste management should be establishment for reducing the waste produced on the campus and reuse of waste for the conservation of resources as well as to create a healthy campus environment. One of the most solid wastes in universities campuses according their educational activities is paper. Thus, reduction and recycling strategies towards waste paper in university campuses is essential. Ultimately, efficient campus waste management strategies must be able to decrease working and resources costs throughout university environments as well as negative impacts on campus environments (Hoe, 2011; Ramirez, 2006).

Campus Use of Material Management

University campuses are ecological areas with biological, cultural, and landscape frameworks for its materials use. Hence, uses of local and green materials have a lot of benefits such as: reduce the transportation costs, minimizing the energy use and decline the environment impacts. Furthermore, choosing suitable building materials are important in campus building design strategies because production of the building materials has effects on environment quality and resources depletion. Besides, the main targets of campus use of material management is reducing the non-renewable materials consumption and use of recycled material in campus construction projects as well as control the use of materials through educational activities in campus environments (Thomashow, 2011; Hoe, 2011).

2.4.3 Campus Social and Educational Management

The important and basic elements of social and educational management toward achieving sustainability in university campuses include curriculum, wellness, and governance management, which are briefly described in the following.

Curriculum Management

There is no worldwide standard for curriculum decisions in universities. Nevertheless, university's curriculum is initial step of any university's sustainability efforts that depend on the interest, strategy and mission of the university. Assuredly, each university should have preliminary courses in all majors for providing a functional and empirical context for learning about sustainability concepts. However, in university's curriculum having sustainability majors and programs are essential for creation opportunities for deeper study. Hence, many of universities propose coursework dealing with sustainability but only several of them implement multidisciplinary approaches which directly linked to sustainability. As a consequence, university's curriculums through sustainability are null without the application in the campus environment. Ultimately, university campus environments have opportunity to teach students, staffs, visitors and community members through their activities (Thomashow, 2011; Backer, 2007).

Wellness Management

The idea of sustainability indicates that human health is directly linked to environment health. Hence, the opinion of a sustainable campus is to offer a healthful and supportive educational milieu that raises personal and community well-being. Besides, one of the crucial curricular in universities campuses is providing meaningful work that balanced with a healthy work condition and opportunities for relaxation and leisure. However, many universities start to assess students and staffs health problems which are related to stress, nutrition, meditative activities and physical condition. As a consequence, healthy university campus is a biotic and lively learning community which promotes wellness habits between students and

community members that has straight effects to health insurance costs (Thomashow, 2011).

Governance Management

Governance in campus environments is the portion of management proceedings that makes decisions towards all aspects of activities within university campus as well as governance has effects on all features of university campuses. However, the issues of governance more intricate about higher education institutions and also there is no clear definition for sustainable governance at universities. Moreover, on university campuses governance provide an accurate control on university mission, budgets, performance and policies as well as sense of balance between mission, strategies and curriculum. Thus, governance has direct effects on quality of universities. Consequently, sustainable governance be inserted into the university mission, master plan and development strategy (Knott and Payne, 2004; Pandey, 2004).

Since the focus of the research is on sustainable transportation in university campus environments, the next section will deal with this topic in depth after the summary of the chapter.

2.5 Summary of the Chapter

According to rapid growth in the world population and increase risks of environmental quality and human health condition, need and implementation to sustainability strategies in all aspects of human communities is essential. Hence, the best place for promoting of sustainability ideas is university campuses. Besides, university campuses are significant centers to teach and improve sustainability approaches and increase public awareness about sustainability. Hence, first of all, implementation of sustainability in all sectors of university campus environments involved campus planning, transportation, water, waste, energy use, material use,

wellness, curriculum, and governance is a vital approach. Furthermore, achieving sustainability in each university campus is related to its own policies and schemes. Thus, a sustainable campus will be a “living laboratory” for current and next generations of its own students, community members and visitors that they can learn and get many experiences from life in a sustainable environment and transfer them into their real and everyday life.

Ultimately, the focus of this dissertation is on sustainability in transportation sector which plays a crucial role in sustainability in university campus environments. Thus, in following chapter sustainable transportation in university campuses will be widely discussed.

Chapter 3

SUSTAINABLE TRANSPORTATION PLANNING IN UNIVERSITY CAMPUS ENVIRONMENTS

3.1 Introduction

In the recent years, the rapid uncontrolled growth in population, urbanization, spatial expansion and motorization had numerous impacts on sustainability in the all sectors of human communities. Especially, the main challenge around world is the issue of transportation which play crucial role in sustainable development by its substantial impacts on economics, environment and the community. However, sustainable transportation idea is appeared from the sustainable development concept in the transportation scope. Hence, as has been stated by many scholars transportation sector is an important element in sustainability. Unfortunately, the current transportation systems as well as increase in the number of automobile and their daily use have various negative influences on environmental quality of urban areas such as energy consumption, air and noise pollution, traffic congestion and accidents. Accordingly, the need for sustainable transportation systems and strategies which are approaches to decrease negative impacts of transportation sector is essential. Moreover, the sustainable transportation systems and strategies should be safe, comfortable and effectual on reducing ecological pollution and energy and economic consumption (Mat Yazid and Ismail, and Atiq, 2011; Qureshi Intikhab and Huapu, and Shi, 2008; Qureshi Intikhab and Huapu, 2007).

Around the world, university campuses are examples of human communities whose size and numbers of students, staffs and visitors have rapidly increased in recent years. Accordingly, the numbers of commuting to and from university campuses as well as the number of motor vehicles due to people's dependency to automobile have greatly increased which have direct and indirect impacts on quality of environments. The environmental impacts of transportation sector on campus environments are such as air pollution, noise pollution, energy consumption, and especially disturbance on work and study environment, quality of teaching and loss of visual and natural environment by providing parking facilities. Furthermore, the social impacts of transportation in university campuses are such as effects on students', staffs' and visitors' health conditions, accidents, congestion and increase in cost of constructing (Guasch and Domene, 2010; Xu and Zhang, and Rong, 2012; Limanond and Butsingkorn, and Chermkhunthod, 2011).

Increase in awareness about transportation's negative impacts on quality of university campus environments have caused university planners to focus and pay more attention on the implementation of sustainable transportation strategies including various public transportation forms and non-motorized transportation systems such as walking and bicycling. Consequently, those universities which are working towards sustainability must pay attention to issues of transportation in their strategies and they must be testing the ground for efficiency of various strategies and solutions (Guasch and Domene, 2010; Xu and Zhang, and Rong, 2012; Limanond and Butsingkorn, and Chermkhunthod, 2011).

Hence, the aim of this chapter is clarifying definition and aim of sustainable transportation as well as its indicators and impacts. Besides, need for sustainable

transportation and different kinds of sustainable transportation systems and programs in university campuses are also discussed in this chapter. Finally, several examples of implementation of sustainable transportation systems and programs in different university campus environments will be explained in this part.

3.2 Definition and Aims of Sustainable Transportation

Transportation is one of the main factors in sustainability concept which has numerous substantial effects on the quality of economic and social environment as well as physical environment. Thus, generally accepted transportation systems and activities must be sustainable to the creation of an appropriate balance between three main scopes of the sustainability concept which are environmental, social and economic qualities. Based on the definition of sustainable development of Brundtland Commission, sustainable transportation can be defined as “transportation systems that meet the needs of the present without compromising the ability of future generations to meet their own transport needs” (Steg and Gifford, 2005, p. 62). Nevertheless, there is no common and universal definition of sustainable transportation but instead several definitions have been proposed by different authors based on three elements of sustainable transportation economic, environment and social. According to these elements, the essential features of sustainable transportation were presented in three categories of definitions of sustainable transportation which are the literal economist’s definition, the environmental definition and the comprehensive definition. These three kinds of definition of sustainable transportation will be defined in following (Macbeth, 2004; Litman, 2011; CST, 2005; Steg and Gifford, 2005).

The first kind definition of sustainable transportation is economist's definition. Two instances of this definition which are explained by three famous authors and researchers in field of sustainable transportation were introduced at Organization for Economic Cooperation and Development (OECD) international conference in 1996. This international conference held in Vancouver towards Sustainable Transportation (CST, 2005; Litman, 2008b). The first example presented by Nelson and Shakow as such: "Sustainable transportation is achieved when the total future discounted per-capita social costs, both market and non-market, related to the transport system are equal to or less than the costs in a selected reference year" (CST, 2005, p. 4). The next example of this kind of definition of sustainable transportation was mentioned by Schipper that "transportation where the beneficiaries pay their full social costs, including those paid by future generations, is sustainable" (CST, 2005, p. 4).

The second category of definition is based on the concern of environmentally sustainable transportation (EST). The Organization for Economic Cooperation and Development (OECD) presented two versions of this type of definition of sustainable transportation (CST, 2005; Litman, 2008b). The shorter one is: "An environmentally sustainable transport system is one that does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources at below their rates of regeneration, and (b) use of non-renewable resources at below the rates of development of renewable substitutes" (CST, 2005, p. 4).

The longer environmental definition of sustainable transportation is:

"An environmentally sustainable transport system:

- Allows generally accepted objectives for health and environmental quality to be met, for example, those concerning air pollutants and noise proposed by the World Health Organization (WHO);
- Is consistent with ecosystem integrity, for example, it does not contribute to exceedance of critical loads and levels as defined by WHO for acidification, eutrophication, and ground-level ozone; and
- Does not result in worsening of adverse global phenomena such as climate change and stratospheric ozone depletion” (CST, 2005,p. 5)

These two categories of definition of sustainable transportation are not wide-ranging and precise. Since, in economist’s definitions of sustainable transportation definite a transportation system depending on assessment of future costs which is frequently impossible as well as in this kind of definition is not mentioned what contemporary and future services are necessary from transportation for support society towards sustainability. Furthermore, the environmental definitions just focus on sustainable use of resources as well as focus on prevention of impacts on environment and health conditions. According to lack of these two categories of definition of sustainable transportation need to a comprehensive definition is essential (CST, 2005).

Accordingly, the third type of definition of sustainable transportation is a more comprehensive definition. The best instance of this kind of definition of sustainable transportation is the definition improved by the Toronto based Centre for Sustainable Transportation in Canada in 1997. This definition is extensively accepted within European Union and also has achieved significantly acceptance elsewhere. Besides, this definition “has been reviewed by political mechanisms and received general political acceptance” (CST, 2005, p. 5).

This comprehensive definition of sustainable transportation is:

“A sustainable transportation system is one that:

- Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- Limits emissions and waste within the planet’s ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise” (CST, 2005, p. 6; Litman, 2008b, p. 5).

Finally, according to definitions of sustainable transportation above, it may be argued that: “the goal of sustainable transportation is to ensure that environmental, social and economic considerations are factored into decisions affecting transportation activity” (Litman and Burwell, 2006, p. 333).

3.3 Need for Sustainable Transportation in University Campus Environments

University campuses around the world have experienced increase in their population over the recent years. Hence, the most of these educational milieus decided to move toward sustainability for decline their own negative impacts on society, economy and environment as well as developing their educational role in communities and creating a sustainable model for other communities and thus societies. Obviously, the daily movement by automobiles to campuses is one of the main negative impacts of

universities on environmental values, economic equality and quality of life within campus communities as well as surrounding communities. Accordingly, nowadays, the issue of transportation sector is one of the biggest challenges in university campus environments as well as surrounding communities. Thus, many of universities around the world have started for searching to create transportation models away from automobile for commute to and from their campuses as well as access and mobility within their campuses without destroying environmental quality. Obviously, according to above statements implementation of sustainable transportation systems and strategies within university campuses have a lot of benefits which can be divided into environmental, economic and social benefits as well as according to main role and aim of higher education institutions, educational benefits. The environmental benefits of achieving sustainable transportation in university campuses are such as: decrease air and noise pollutions, decline traffic in campus environment and surrounding environments, reduce use of non-renewable resources and beneficial uses of land within campus as well as the economic benefits are such as: decrease the government and consumer cost which must pay for transportation. Furthermore, the social and educational benefits of sustainable transportation inside university campuses according to position of higher education institutions in societies are declared that university campus environments are a laboratory for testing and realizing new ideas of transportation strategies and systems as well as have potential to implement a multi-model of transportation policies because universities have widespread control on their road network, parking area, and land uses. Moreover, transportation approaches and policies can diffuse from university campuses to other parts of the society because the transportation systems which students learn during their study and live in campus have influence on their

transportation behavior and future transportation choices. Consequently, implementation of sustainable transportation systems and policies in university campuses according to definition and aim of sustainable transportation as well as transportation impacts on all aspects of human life and position of universities in societies is essential (Toor and Havlick, 2004; Bond and Steiner, 2006; Norzalwi and Ismail, 2011; Fund et al., 2012).

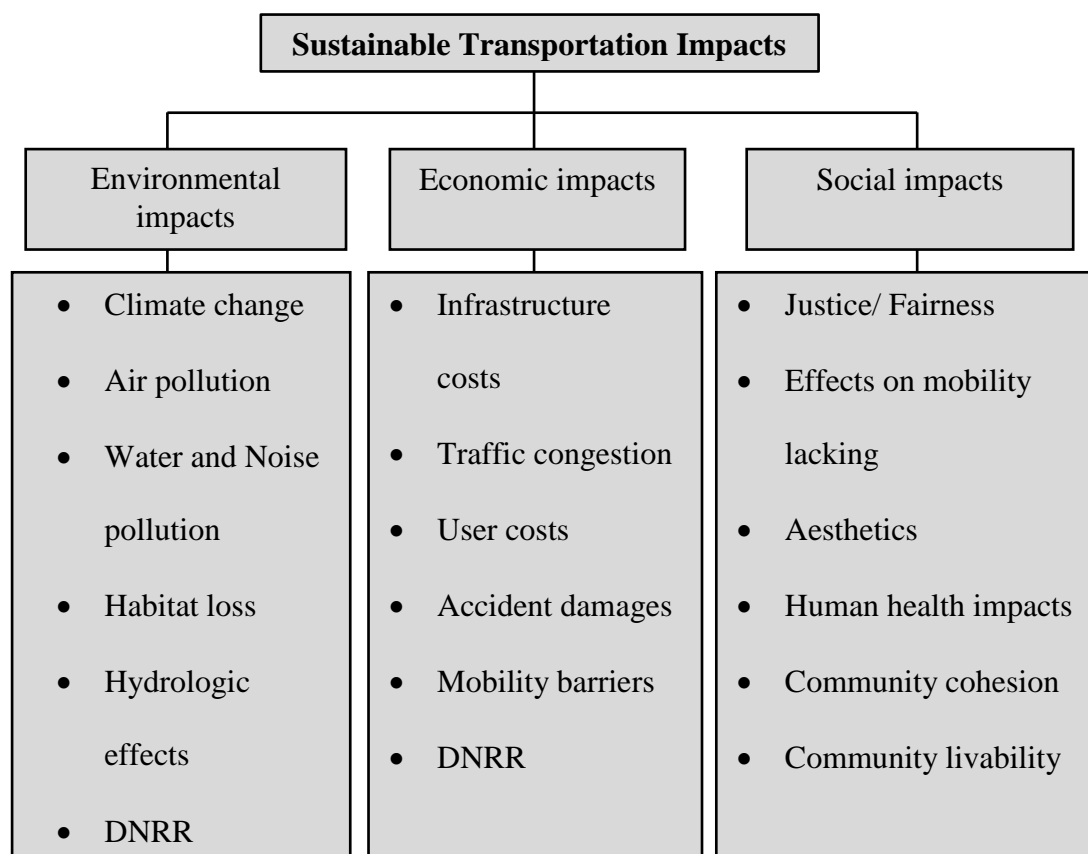
3.4 Indicators and Impacts of Sustainable Transportation Planning

One of the international incomplete arguments in transportation planning activities is about the indicators that decision-makers should use to assess improvement in the direction of sustainability. Indicators will be variables selected which are significant tools for evaluating progress and making decision toward an objective or a goal. Furthermore, transportation indicators are those variables selected which illustrate transportation condition. Besides, indicators must be easy to measure, independent, comprehensive, truthful, acceptable and understandable (Johnston, 2008; Litman, 2008b; CSD, 2011).

In continuous, sustainable transportation indicators are defined by The Organization for Economic Cooperation and Development (OECD) as “statistical measures that gives an indication of the sustainability of social, environmental and economic development” (Haghshenas and Vaziri, 2012, p. 116) and they are crucial tools for improving transportation planning. Meanwhile, indicators of sustainable transportation should be selected prudently to provide appropriate data and be used to observe sustainability in transportation. Furthermore, there have been numerous attempts to define indicators to measure sustainable transportation. Hence, there is a variety set of sustainable transportation indicators which are used. This variety of

sustainable transportation indicators reflects diverse perspectives, assumptions and goals. Accordingly, in most condition a single indicator is not acceptable therefore a set of indicators should be selected (Litman, 2008b; Haghshenas and Vaziri, 2012; Litman, 2011; Joumard and Gudmundsson, 2010).

Besides, sustainable transportation has substantial impacts on social vitality, economic equity and environment quality. Thus, impacts of sustainable transportation on communities can be divide to 3 categories include Environmental impacts, Social impacts and Economic impacts which all of them are summarized in following (Figure 2) (Litman, 2008b).



NRR: Depletion of nonrenewable resources

Figure 2: Impacts of Sustainable Transportation (Litman, 2008b)

According to these 3 groups of sustainable transportation impacts, indicators of sustainable transportation also can be divided to 3 main categories: Transportation

Environmental Indicators, Transportation Social Indicators and Transportation Economic Indicators. However, there is not a definitive and universal list of suitable indicators for sustainable transportation but the main indicators of each category which have been collected from several studies are listed in following (Table 1) (Haghshenas and Vaziri, 2012; Litman, 2011).

Table 1: Transportation Indicators (Based on Haghshenas and Vaziri, 2012)

<i>Transportation Environmental Indicators</i>
Air pollution
Energy consumption
Renewable energy type
Efficient vehicles
Noise pollution
Land consumption
Environment management
<i>Transportation Economic Indicators</i>
Local government cost and benefit
Consumer direct cost and benefit
Consumer indirect cost and benefit
Transport price
Commercial transport
<i>Transportation Social Indicators</i>
Safety
Satisfaction
Access
Transport for disabled
Equity
Citizen participation in transport decision
Security

However, comprehensive and sustainable transportation planning depend on which indicators are chosen and how data are collected. Thus, selecting a balance set of indicators to reflect mixture of economic, environmental and social goals and objective toward sustainable transportation analysis are essential. Hence, indicator selection has significant influence on analysis results as well as indicators can show which approaches are eligible or undesirable with respect to objectives and goals. In the following, there are some principles which should be applied when selecting indicators of sustainable transportation. These principles are mentioned by Litman (2008b) as follows:

- *Comprehensive* – Indicators should reflect various economic, social and environmental impacts, and various transport activities (such as both personal and freight transport).
- *Data quality* – Data collection practices should reflect high standards to insure that information is accurate and consistent.
- *Comparable* – Data collection should be standardized so the results are suitable for comparison between various jurisdictions, times and groups. Indicators should be clearly defined. For example, Number of people with good access to food shopping should specify ‘good accesses and ‘food shopping.’
- *Easy to understand* – Indicators must useful to decision-makers and understandable to the general public. The more information condensed into a single index the less meaning it has for specific policy targets (for example, *Ecological Footprint* analysis incorporates many factors) and the greater the likelihood of double counting.
- *Accessible and Transparent* – Indicators (and the data they are based on) and analysis details should be available to all stakeholders.
- *Cost effective* – The suite of indicators should be cost effective to collect. The decision making worth of the indicators must outweigh the cost of collecting them.
- *Net Effects* – Indicators should differentiate between net (total) impacts and shifts of impacts to different locations and times.
- *Performance targets* – Select indicators that are suitable for establishing usable performance targets. (p. 34)

As consequence, according to Litman (2008b) sustainable transportation indicators should be selected on their decision-making effectiveness and comfort of collection.

It is important that indicators are selected considering the principles mentioned above while also considering the local characteristics. Hence, for the case study of this research, these principles will guide us for the selection of indicators (special for the case area) together with the local characteristics.

3.5 Kinds of Sustainable Transportation Systems in University Campus Environments

The sustainable transportation systems can be divided in two categories of motorized and non-motorized modes which should provide mobility and accessibility to all users by a secure and environmental friendly mode. In the following different current kinds of motorized transportation systems as well as non-motorized transportation system are declared (Mohan and Tiwai, 1999).

3.5.1 Sustainable Motorized Transportation Systems

In recent years, according to economic development and increase in income in most countries, the numbers of motorized transportation systems have increased which let people to travel at longer distances. Public transportation systems such as: bus, taxis, train, tram and metro are sustainable motorized transportation modes in communities (Rietved, 2000; Litman, 2010b).

Public transport mode is one constituent of motorized transportation systems in university campuses. There are numerous benefits behind promoting of public transportation which several main of them are such as: reducing traffic and use of private car, minimizing land consumption and destroyed green area to build car parking, enhance the quality of environment and public health by reduce air and noise pollution as well as creating livability. Meanwhile, increasing the support of public transport mode has directly effects on enhancement of quality of life and

health condition in university campus environments because of minimizing travel cost and reducing environmental damage. Obviously, to have efficient public transportation services modifying the location of stops, adapting path service and appropriate timing as well as mixing public transport services with walking and cycling facilities are essential (Litman, 2010b; Murray et al., 1998).

3.5.2 Sustainable Non-motorized Transportation Systems

Non-motorized transportation systems so called active transportation systems or green transportation modes which play a vital and important role in the transportation sector of university campus environments and other communities. Non-motorized transportation includes all form of movements which do not depend on an engine or motor such as: walking, cycling and skating. However, there are many factors which have direct and indirect effect on the use of non-motorized transport modes such as: quality of non-motorized facilities and substructure, socio-cultural, government strategies, physical condition and the accessibility of other transport alternatives. Additionally, non-motorized transportation modes have several innate limitations such as: suitable for short distances lower speeds and smaller size of facilities. Nevertheless, non-motorized systems can be a viable mode for sustainable transportation and has many significant benefits which several important of them are in following (Figure 3) (Rietved, 2000; Rastogi, 2011; Litman, 2010c).

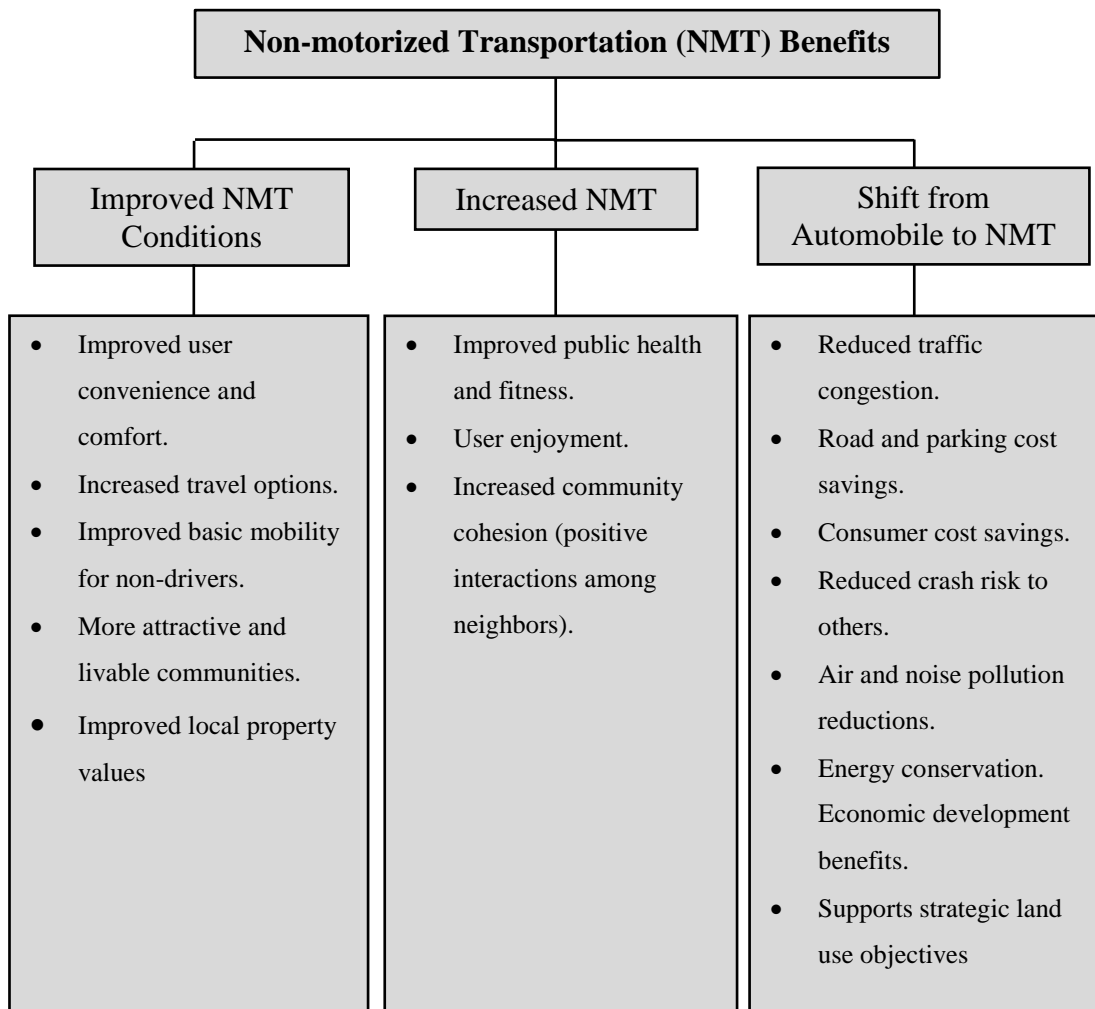


Figure 3: Benefits of Non-motorized Transportation (Litman, 2010c)

Two common modes of non-motorized transport systems especially in university campuses are walking and cycling which have been significantly promoted in recent time by reason of their advantages for decreasing transport emissions and enhancing human health condition. These two common modes are explained in following.

Walking

Walking is the oldest and the most common mode of transportation which is a part of human natural behavior and has numerous environmental, social and economic points. This kind of transport is basic mode of green and non-motorized transportation in all human communities particularly in universities campuses. Walking mode is a simple system of movement that is autonomous of any tool. However, this natural individual transportation system has many advantages such as:

increasing social health, non-environment pollution, social justice, creation of social interaction, low cost and making fairness for accessing to the facilities. Additionally, walking mode is one of the main human activities as well as it is one of the main factors of quality of life in human communities. Meanwhile, walking is the slowest type of transportation systems so pedestrian spends much time in environment. Thus, walking is the best way of interaction between human and their surrounding environment that walkers can enjoy from their around events and get truly experience. Furthermore, there are numerous effective factors toward of increasing walking in university campus environments for various purposes such as: features of the built environment and natural environment that provide safe and comfortable situation for walking, provide good condition for sidewalks and pedestrian paths by use of appropriate lighting, pavements, signage and shading elements, and improve the quality of public spaces for rest along pedestrians ways as well as good connection between pedestrian paths with bus and taxi stations (Litman, 2009; Kashani, 2012).

Cycling

Another main and active mode of non-motorized transport systems is cycling which can adds physical activity into human daily life. Travel by bicycle is faster than walking so this mode can be the better method for medium trip distances. Nevertheless, bicycles are not only significant for medium trips distances also can be as a feeder mode to contribute of public transportations. Hence, promoting this kind of transport systems in universities campuses has direct effects to improve health of university members and environmental health condition. There are many motivator factors for promoting trip by bicycle in university campuses such as: separate bike lines and good condition of network for cycling, provide safety along network for

cycling, appropriate lighting and signage, provide secure bike parking areas, having attractive scenery and being far away from vehicle traffic and noise pollution (Winters et al., 2010).

In this research, sustainable motorized and non-motorized transportation systems in the form of public transportation, walking and cycling will be taken into consideration both in the analysis stage of the case study and also for the proposal stage.

3.6 Kinds of Sustainable Transportation Management Strategies in University Campus Environments

During recent times in university campus environments to reducing private vehicle trip, improving transportation quality and holistically minimizing social, economic and environmental damage of transportation toward achieving more sustainability in transportation, many strategies and policies have been suggested. These strategies are including different management programs and various planning which have impacts on all social, economic and environmental aspects of transportation in university campuses. Besides, numerous researches indicate that a single strategy cannot be effective to achieve sustainability aims; therefore, multiple strategies are essential. However, for universities that have purpose to move their members - students, staff and visitors, from use of private car to use of effectual modes of commuting to campus toward decreasing the negative impacts of transportation including air and noise pollution, congestion and transportation injustice, implementation of different effective kinds of transportation management strategies are necessary. The main widely used strategy in university campus environments which included a variety of planning and management approaches is Transportation Demand Management

(TDM). In the following, this strategy and its current approaches in university campuses include parking management, U-Pass, promoting bicycle use and creating a pedestrian friendly campus in university campus environments are explained (Bond and Steiner, 2006; Litman and Burwell, 2006).

3.6.1 Transportation Demand Management (TDM)

Transportation demand management has appeared as a package for a range of executive policy to solve many of transportation problems such as: worries about air and noise pollution, greenhouse gas emissions and mobility and accessibility circumstance. Transportation demand management is defined as any strategy and methods which put its efforts to decline car dependency as well as using more efficiently of existing transportation modes and resources. Besides, transportation demand management encourages better organization and innovative policy to promote further effectual and environmentally conscious attitudes toward transportation that has been mentioned as the art of changing transportation behavior. Transportation demand management strategies if want to be effective, must provide truly meaningful alternatives as well as must decrease cost and increase convenience of transportation alternatives in comparable with the car. Moreover, TDM approaches must respond and be aware of significant variation in condition of communities. Transportation demand management programs can be divided in three groups of programs include positive, negative and mixed. Positive programs of TDM can increase transportation choice and access for all users by scheduling of time work hour, improving transportation facilities and carpool or vanpool programs. Negative programs can decrease transportation choice or increase transportation costs by rise of fuel tax and parking price. Mixed programs can increase choice and access for one sector of people without any negative impact on other groups of

people. Two instance of this group programs are free transportation programs and unlimited access. In addition, transportation demand management strategies have many benefits such as: saving parking and road, declined traffic crashes and congestion as well as consume of energy, increased transportation option and mobility, conservation of environment and effective use of land, and improved livability and equity in communities. Nevertheless, the choice of transportation mode to use based on existing transportation demand management strategies in place as well as behaviors and beliefs of the users. However, transportation demand management should be responding to create a balance of enhance travel choice and motivation to decline automobile travel. As consequence, there is an extensive need for combined TDM policies as part of comprehensive transportation planning in communities especially in university campus environments because creating multimodal and efficient transportation modes on university campuses would have lasting effects on transit behaviors of graduates which translates into their daily life (Ferguson, 1990; Berman and Radow, 1997; Lim, 1997; Litman, 2003b; Senft, 2005; Bond and Steiner, 2006).

Accordingly, Litman (2006) explained that TDM is composed of several categories and each of theses categories encompasses various strategies. These diverse TDM strategies and policies can be effective on travel behavior including change in travel mode, destination and time. Hence, in the following, several of these TDM strategies, which are used widely and are common in university campus environments are selected with the belief that these would guide the proposals for the case study. These strategies are including parking management, public transport park strategy (U-Pass program), Carpool program, and promoting bicycle use and creating a pedestrian

friendly campus and all these strategies are clarified in the following (Litman, 2006; Toor and Havlick, 2004).

3.6.1.1 Parking Management

Parking facility is an essential element for different kinds of transportation systems as well as is greatest common problem in university campus environments that users and planner are facing. Parking facility problems can be defined in term of supply or management. Management solutions to solve parking facilities problems are better than supply solutions because they support more policies and programs planning which effect directly in more efficient use of existing parking resources. Thus, extensive approaches to managing the parking supply are essential. These approaches are main part of a TDM strategy. Besides, parking management has significant effect on decrease parking space need and parking costs as well as it is effective on other TDM strategies in university campuses. Parking management has many social, economic and environmental benefits that several of them are facility cost savings, enhanced service quality, more livability, decrease land consumption, improved walkability and support social justice objectives. As consequence, parking management can address a broad range of problems. In following, there are several approaches toward parking management in university campuses (Litman, 2006; Bond and Steiner, 2006; Litman, 2012; Toor and Havlick, 2004).

(i) Parking restriction and supply

The supply and restriction of parking are two of the most important TDM strategies in dense areas such as university campuses. They have substantial impact on travel behaviors and overall volume of car traffic that can access the university campuses. If the parking supply in university campuses be held below the demand, users must shift to parking out site of campuses or choose other modes of transportation

systems. Thus, fewer available parking areas in university campuses encourage commuters to use other modes of transportation such as walking, biking and public transport (Toor and Havlick, 2004; Bond and Steiner, 2006).

(ii) Parking pricing

The other approach is parking pricing that means car driver pay for using parking services. However, university must charge students and all members who use parking facilities to recover costs of parking facilities. This approach has direct effects on decreasing parking demand and encourages travelers to use alternative modes (Bond and Steiner, 2006; Litman, 2012).

(iii) Parking Location

The location of parking areas in university campuses makes a difference. If parking facilities are in central or peripheral area, commuter cannot easily park in front of the buildings, therefore, both of these strategies encourage commuter to use other alternative modes such as walking, biking and public transport to save their time and straight access to buildings. Hence, location of parking has effects to decline automobile use and saving transportation costs to commuters and universities (Toor and Havlick, 2004).

3.6.1.2 Public Transport Pass Strategy (U-Pass)

U-Pass programs are the most important and popular component of TDM strategies in university campus environments. Besides, U-Pass program at university campuses encourage all members to commute by public transportation and active modes rather than private vehicles. Furthermore, U-Pass program create significantly access to users by subsidized public transportation. However, U-Pass strategy has been successful in many universities to raise public transportation use and decline demand on parking facility in campuses. Hence, there are many reasons for implementing U-

Pass strategy which 5 top of them mentioned by American university officials are included: (Brown and Hess and Shoup, 2003)

- Decrease parking demand and traffic congestion;
- Increase student and staff access to housing and university campus;
- Reduce the costs of travel and student education;
- Expand transport equity;
- Increase recruitment and retention of students;

Generally, U-Pass strategy can increase academic staff, administrative staff and student access to university campuses. This develops in accessibility to university campuses are provided by: (Brown and Hess and Shoup, 2003; Toor and Havlick, 2004)

- Offering an affordable alternative to driving;
- Developing access for people who must drive by handling parking request;
- Enhancing quality of public transport and decreasing traffic congestion;
- Decreasing travel rates for public transportation;
- Improving quality of public transportation service including more regular services, extended service hours;

Besides, implementing U-Pass strategy has many benefits for university by: (Brown and Hess and Shoup, 2003; Toor and Havlick, 2004)

- Supporting universities in achieving their environmental responsibilities
- Decreasing the demand for parking, therefore; University have more land use for educational purposes;
- Decreasing parking areas and traffic influence on surrounding areas;

Furthermore, U-Pass strategy has a lot of benefits on surrounding community and environment by decrease motorized vehicle trips, increase physical activity and public transportation and decreasing traffic, air and noise pollution. As consequence, U-Pass strategy has long term effect on use of public transport in university campuses and all communities (Toor and Havlick, 2004; Senft, 2005; Brown and Hess and Shoup, 2003).

3.6.1.3 Carpool Program

Carpool is one of the more established TDM strategies that encourage users of single-occupancy private cars to shift demand away from personal car trip. This strategy implies two or more people in a car whose commuters share a common source, route and destination. Carpooling usually involve people who live in the same neighborhood and work at. Furthermore, carpoolers have responsibility to cover the cost of fuel and parking. This strategy is most used for trips that are not well served by public transportation systems. Carpooling is efficient in small cities and rural areas that have less public transport service. Thus, carpool to be attractive for commuters whose journey takes at least thirty minutes (Toor and Havlick, 2004).

3.6.1.4 Promoting Bicycle Use and Creating a Pedestrian Friendly Campus

Walking and cycling travel are the best substitute modes for automobile trips in communities particularly in university campuses. All commuters are a pedestrian during travel to campus because the driver walks from parking, cyclist walks from bike station and user of public transport walks from public transport bus stations. Thus, walking is an inseparable part of whole travel in university campus environments. Further, walking and cycling developments principally affects short-distance travel. However, many research indicated that commuters of university campuses with well walking and cycling conditions ride public transport more than

they drive. Thus, these modes can have affect on longer travel by supporting public transport. Besides, there are various particular strategies for promoting bicycling use and creating a pedestrian friendly campus which several important ones are in following: (Toor and Havlick, 2004; Litman, 2006)

- Improve bike lines
- Improve sidewalks and pedestrian paths
- Provide safety in all time
- Create good quality of lighting
- Enhance road and path connectivity and direct connection with special shortcuts.
- Traffic calming, speed declines and vehicle limitations
- Provide good condition of built environments and public open spaces
- Create good semi open spaces to protect from sun and rain
- Provide shading elements along the ways according to climate characteristic
- Law enforcement and encouragement strategies
- Convenient and safe bicycle stations
- Well maintained facilities

As consequence, creating pedestrian friendly campuses and promoting use of bicycle in university campuses are an important objective of the transportation demand management (Toor and Havlick, 2004).

3.7 Examples of Implementation of Sustainable Transportation Management Strategies in University Campus Environments

This section examines several programs of Transportation Demand Management strategies at different university campus environments including the U-Pass program

at the University of Washington-Seattle, U-Pass Program at University of British Columbia, Bicycle Program at University of California-Davis and Reducing Single-Occupancy Cars at University of North Carolina. These examples have been chosen from one of the main references in the field of sustainable transportation in university communities - *Transportation and Sustainable Campus Communities*, which published in 2004 and authors are Toor and Havlick. They stated that, the following TDM strategies have been extremely successful in these university campus environments. Hence, it is believed strongly that these examples will guide this research when it deals with its own case study.

3.7.1 U-Pass Program at the University of Washington-Seattle

The University of Washington has more than 36,000 students and 23,000 employees. The area of university is supported by three transit agencies. Furthermore, each day more than 225,000 vehicle pass into university area. In 1989, the university initiated an expansion and this expansion added 10,000 cars a day and need to constriction of four new parking areas. Hence, the U-Pass program was started in university of Washington in 1991 with collaboration the city of Seattle. The U-Pass program in University of Washington was a major success. This achievement is connected to the concurrent implementation of increase in parking price, enhancing pedestrian and bike accessibility as well as improve transit quality in and around university campus. Besides, in University of Washington, the pass provides a good condition for university commuters to be free in choice of transportation mode according to their needs all of the time. The budget of U-Pass program in 2001-2002 academic years was about \$11.3 million that \$10 million of this fund was about contracting bus service. The revenue sources of U-Pass program in university of Washington are in following channels: (Toor and Havlick, 2004, p. 178)

- “U-Pass sales: \$ 5.6 million (50 percent)
- Parking fees: \$ 4.1 million (37 percent)
- Parking fines: \$ 0.7 million (7 percent)
- Other sources: \$ 0.8 million (7 percent)”
- *Impacts of U-Pass program at University of Washington*

In first year of implementation of U-Pass program in university of Washington, this program met 75 percent participation. In 2002, student participation was 85 percent as well as staff and faculty perception was more than 65 percent. Furthermore, during 1989 and 1996 transit ridership between students increased by 54 percent as well as between faculty and staff increased by 82 percent. Generally, transit ridership in university of Washington during 1989 and 1996 increased by 60 percent. Besides, the transit agencies increased their bus service to and from campus about 60,000 hours in the first three years. Based on university survey, since U-Pass program created in university campus the transportation mode for commuting to and from university campus has shifted extensively (Table 2) (Toor and Havlick, 2004).

Table 2: Change in the Percentage of Transit Ridership from 1989 to 2002 (Toor and Havlick, 2004, p. 181)

<i>Travel mode</i>	<i>Faculty</i>		<i>Staff</i>		<i>Students</i>		<i>Weighted Average</i>	
	1989	2002	1989	2002	1989	2002	1989	2002
<i>Transit</i>	11	24	25	36	21	39	21	36
<i>Bicycle</i>	9	9	6	5	9	4	8	5
<i>Walk</i>	7	6	6	4	31	31	23	22
<i>Other</i>	2	2	4	2	4	2	4	2
<i>Drive alone</i>	60	43	44	38	25	16	33	24

As consequence, U-Pass program is the most popular and comprehensive transportation demand management programs in human communities especially in university campuses. This program in university of Washington has resulted in shifts from private car driving to transit ridership as well as enhancement of transit systems (Toor and Havlick, 2004).

3.7.2 U-Pass Program and Carpool Program at University of British Columbia

University of British Columbia (UBC) is third largest university in Canada. In 2002-2003 academic years the population of students was around 32,000 undergraduates and 7,000 graduates in university that a quarter of them resided on campus. However, this university is the second larger commuter area in Vancouver region with more than 120,000 trips on a day; therefore, University of British Columbia is one of the major traffic generators in Vancouver region (Toor and Havlick, 2004).

TREK Program Center

In September 1997, University of British Columbia (UBC) created “the trip Reduction, Research, Education and Knowledge (TREK) program center”. The aim of this program is to find convenient and cost-effective approaches to commute to and from university campus without use of private cars. Hence, TREK has followed the establishment of TDM programs by focusing on increase the effectual transit services and transportation alternatives to university members. Accordingly, university introduced U-Pass program in university since late 1997. In September 2003, U-Pass program initiated with a compulsory student fee of \$ 20 (Canadian) per month. University’s U-Pass program have been successful and increased fifty percent in transit ridership (Figure 5) as well as decreased twenty percent in private vehicles traffic.

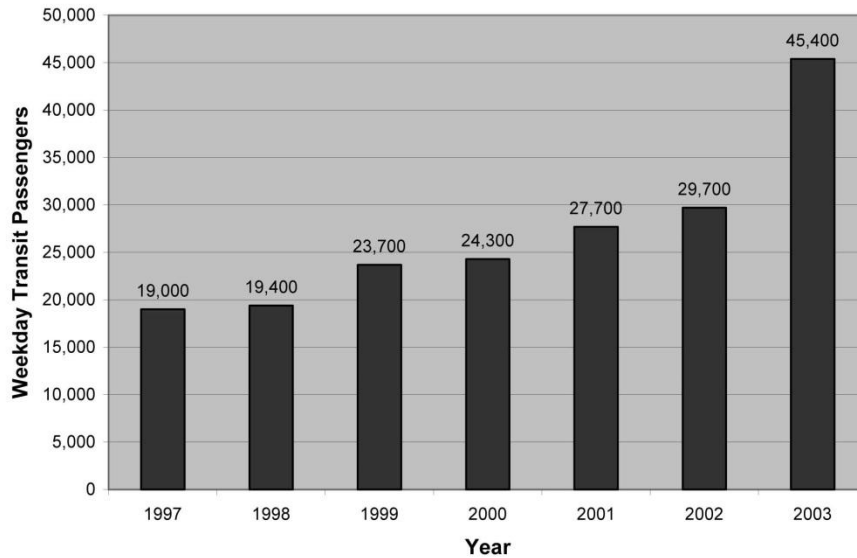


Figure 4: Change in the Percentage of Transit Ridership from 1989 to 2002 (Toor and Havlick, 2004, p. 181)

Besides, growing numbers of transit ridership in UBC campus have been effective on reduce of parking demand and traffic congestion. Furthermore, increases of parking price and supply reduction along with transit fare discounts had effects on shifting transportation mode within the University of British Columbia. Moreover, the main issue that implementation of U-Pass program faced was the demanded increase in bus service. Ultimately, University of British Columbia community members had great interest in joining the program. Finally, U-Pass program has been successful in University of British Columbia and the growing numbers of transit ridership in UBC campus has continues until now (Figure 6) (Toor and Havlick, 2004, Senft, 2005).

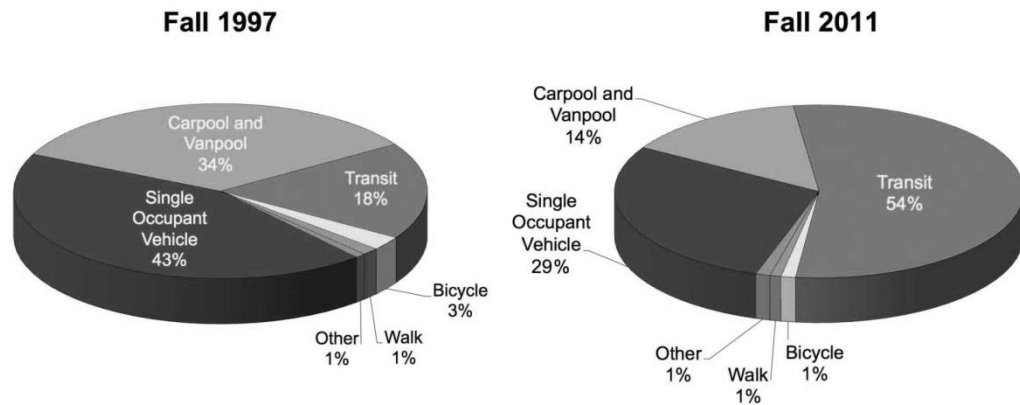


Figure 5: Transit Ridership at UBC from 1997 to 2011(UBC Transportation Report, 2012, p. 11)

Carpool Program

Carpooling in the UBC most involve of at minimum three registered students, faculty or staff of UBC who commute to university together an average of three times per week. Besides, at UBC Carpools receive preferential parking (Toor and Havlick, 2004).

3.7.3 Bicycle Program at University of California-Davis

Davis city is one of the healthiest communities between American cities because this city is best American's cycling city. Furthermore, the city of Davis is called as "a university-oriented city with a progressive, vigorous community noted for its small-town style, energy conservation, environmental programs, preservation of trees, bicycles, and quality of its educational institutions" (Toor and Havlick, 2004, p. 192). This city designed official for bicycle therefore; bike paths and bike lanes dispersed all over the city and in 2004 there were 48.8 miles of bike lanes and 49 miles of bike paths in Davis city. Hence, the University of California is responsible for connecting its own campus bike paths with city bike paths. However, university closed the core of its campus to cars and created visible bike parking areas in near all building within campus. In 1996, a campus survey illustrates that 60 percent of the students commute

to campus by bicycle or walking as well as 20 percent of academic and administration staff walked or biked (Figure 7) (Toor and Havlick, 2004).

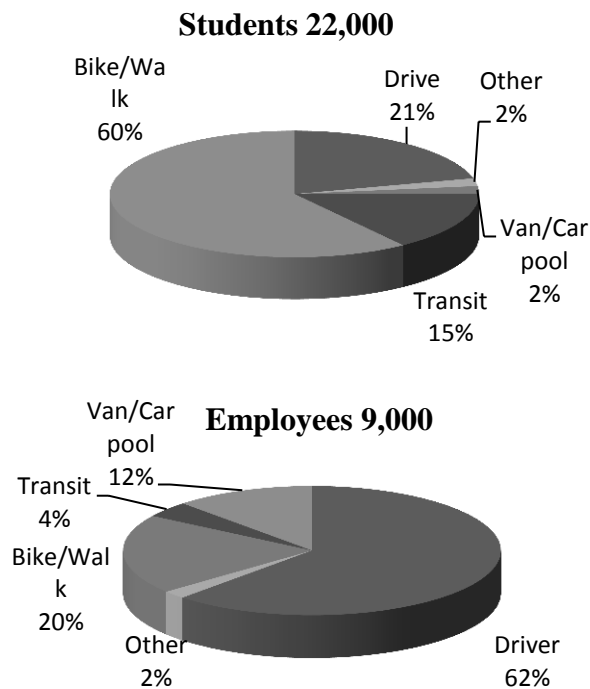


Figure 6: This Model Shows Biking and Walking are the Dominant Forms of Transportation at the University of California-Davis Campus in 1996 (Toor and Havlick, 2004, p. 194)

Thus, averaging 15000 to 18000 bikes commute to campus each day. In University of California Campus fourteen miles of bike paths joined with bike services. Furthermore, students get discounts on bike equipment such as: locks, helmets and light as well as university has offered to student bike locker that will be rented for \$20 per quarter, a full service repair shop and summer bike storage. Besides, university has offered to faculty and staff cyclist to encourage cycling such as: parking permit, bicycle free and summer bike storage (Toor and Havlick, 2004).

In continuous, the operating budget for bicycle facilities is averaging \$ 40,000 to 50,000 annually that operation budget returns from “the sale of bicycle licenses, bicycle auctions and parking fines as well as federal, state and local grants” (Toor and Havlick, 2004, p. 193). Besides, the university provides bicycle education

courses to improvement the safety and learned to bike users how repair and maintenance their own bicycles. The university and city of Davis have a helpful relationship on improvement and solve bicycle issues as well as the city bike coordinator is one of the members of university bicycle committee (Toor and Havlick, 2004).

3.7.4 Reducing single-occupancy cars at University of North Carolina

In University of North Carolina (UNC) campus, 77 % of UNC personnel commute by private cars and also due to the numbers of students, exist 17,000 parking spaces, exist a large medical complex in the center, commute by single-occupancy cars is heavy in UNC campus.

Hence, various strategies used to decrease single-occupancy cars commute to the UNC campus towards reduce the car parking and improving campus physical plan based medical facilities. Several of these strategies are included: “no freshman cars permitted on campus, free local bus passes, free shuttle bus service, make the UNC campus more pedestrian and bike friendly, access to the state-run North Carolina heavy-rail passenger service, a campus plan reduce surface parking, increase parking fees, new student housing built on campus, a campus car rental for short-term use, and photo identification of cars using the large structured parking near the medical complex” (Toor and Havlick, 2004, p. 199). All these strategies contribute to UNC till reduce use of single-occupancy cars and increase quality and greening within campus (Toor and Havlick, 2004).

3.8 Summary of the Chapter

Increase in the numbers of automobiles and their daily use in the world through the rapid growth in population and dependency of people to automobiles, have numerous negative impacts on environment, economic and social quality in communities.

Hence, those communities which are working towards sustainability must pay attention to issues of transportation in their strategies. Thus, various researchers stated that transportation sector has a significant role for achieving sustainability in communities as well as the need for sustainable transportation systems and strategies which are approaches to reduce negative impacts of transportation sector is essential.

In continuous, there is no universal definition for sustainable transportation, Hence; an initial definition of sustainable transportation based on the well-known definition of sustainable development of Brundtland Commission is defined as “transportation systems that meet the need of the present without compromising the ability of future generations to meet their own transport needs” (Steg and Gifford, 2005, p. 62). Besides, this study has focusing on following definition which is a comprehensive definition of sustainable transportation toward its main aim:

The sustainable transportation system is defined as system that: (CST, 2005, p. 6)

- “Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- Limits emissions and waste within the planet’s ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise”

One of the effectual and important communities in over the world is university campuses which recently have rapid growth in size and have experienced increase in number of members. These changes have increased the numbers of commuting to and from university campuses as well as the number of motor vehicles due to people's dependency on automobile. Obviously, increase the daily movement by automobiles to campuses is one of the main negative impacts of universities on environment values, economic equality and quality of life within campus communities as well as their local respective communities. Hence, those universities which are working towards sustainability must pay attention to issues of transportation in their strategies due to their negative impacts and main aim of higher education institutions as well as social, environment and economic effects of university campus environments on communities. As consequence, for achieving a sustainable campus paying attention to transportation sector and implementation of sustainable transportation systems and strategies within university campus environments is essential.

In continuous, crucial tools for improving transportation planning as well as evaluating progress and making decision toward achieving sustainability in transportation sector at university campuses are indicators. According to significant impacts of sustainable transportation on communities, there are 3 categories of sustainable transportation indicators:

- Transportation Environmental Indicators,
- Transportation Social Indicators, and
- Transportation Economic Indicators.

Obviously, according to aims and objectives of each research and each case area, indicators to be used will be different. Thus, for this research certain indicators will

be selected according to the aims and objectives of the research as well as considering the characteristics of the case study.

Besides, various strategies and systems have been suggested by numerous researches and scholars to create more sustainable transportation in university campus environments. According to literature, there are three kinds of sustainable transportation systems including walking, cycling and public transportation. Most research shows that a combination of systems and strategies are needed to achieve sustainability in transportation sector at university campus environments. Hence, sustainable transportation strategies must also be used to contribute to sustainable transportation systems to have a successful sustainable transportation in higher education institutions which are one of the main elements for achieving sustainable campus. Consequently, the indicators which are selected and presented in the next chapter and the existing conditions of the three kinds of sustainable transportation systems mentioned above will be examined on the case study of this research in the following chapter. In the other words, the selected indicators will be examined and discussed for the case area under each kind of sustainable transportation systems mentioned above, and this will be the content of chapter 4.

Chapter 4

A REVIEW OF TRANSPORTATION IN EASTERN MEDITERRANEAN UNIVERSITY (EMU) CAMPUS

4.1 Analysis Methodology

The methodology used for the case study analysis to collect all data needed was based on both quantitative and qualitative methods which will be summarized in this section.

First of all it is worth mentioning that, the overall analysis (natural environment, man-made environment and social analysis) of the case study of this research has been done during the Spring Semester of 2010-2011 Academic Year as a part of Urban Design Studio I (UDES 501), which is one of the compulsory courses of MS in Urban Design Program in Department of Architecture, Faculty of Architecture at Eastern Mediterranean University (EMU). The studio course was run by Prof. Dr. Şebnem Onal Hoskara, Assoc. Prof. Dr. Beser Oktay, Res. Assist. Payam Mahasti and Res. Assist. Samaneh Ghafourian and a team consisted of four Master students (Abolfazl Dehghanmoghaddi – the author of this thesis, Sina Mousavi, Nima Mousavi and Amir Rashidi) worked on the theme of “Improvement Project for EMU Campus: Designing a Pedestrian/Student Friendly Campus”, whose aim was proposing a master plan for EMU towards creating a pedestrian friendly and accessible campus environment. Thus, the initial data regarding this research has been provided from the documents / reports of the above-mentioned coursework.

Then, for the purpose of this research, for quantitative analysis, a questionnaire survey has been conducted with the aim of obtaining feedback from the EMU members about all dimensions of existing transportation sector at EMU campus environment. Thus, subjects for this method were students, faculty and staff because they are the target groups and main users of existing transportation modes and their related facilities, therefore; feedback from main group of users is indispensable to make certain that their demands are taken into account in the strategies and policies planning. Furthermore, they were encouraged to criticize all activities of their own campus and provide their viewpoints for improving the quality of campus environment and achieving a healthy as well as sustainable campus environment. In the framework of the planning procedure, this way is known as community participation (Abd Razak et al., 2011). Accordingly, the questionnaire which focused on transportation systems and their relevant facilities at EMU campus included 42 questions about commuters' characteristics and how they are currently commuting to and from campus as well as how they are moving within the campus environment (see Appendix A). Besides all, this questionnaire survey has also helped the researcher to understand the physical quality of all dimensions of multi-modes of transportation available at EMU campus, as well as to collect information about emotions of students, faculty and staff from all existing transportation systems and their related facilities.

The number of respondents in questionnaire survey was determined by a statistical technique based on the EMU's population, level of confidence 95%, the sampling error 5% and real society standard deviation between 0/05 and 0/1, as well as the fair situation of the probability occurrence 50%. Accordingly, the amount required of sample size for this research has been found to be 160 sets (De Vause, 2002).

The data obtained from the questionnaire survey were statistically examined to show the results for each mode of transportation systems and their related facilities. Moreover, for more clarification on the obtained results, some qualitative methods have also been used. These qualitative methods include interview, behavioral observation and visual site study. The interview has been done with the Environmental Affairs Administration and Campus Services Coordinator as well as the Rector's office Coordinator and the Security Unit of EMU, for understanding the university strategies and future plans in transportation sector. The other technique is behavioral observation which has been used in social science researches. This technique was used to record the conduct and reactions of students, faculty and staff to the existing transportation systems and their related facilities by using notes. Finally, the third qualitative method in this research was the visual study technique which helped the researcher to record the physical conditions of related facilities of each transportation modes to comment on the weaknesses and problems on each mode by using photographs on site. Generally, the qualitative methods collected information about physical conditions of the all existing transportation modes and their related facilities and emotions of users of them in case study. As a final point, the data collected by qualitative techniques play an important role to complete the information obtained from the quantitative methods (Abd Razak et al., 2011).

Additionally, the following indicators, among the transportation indicators presented in Table 1, page 38, are selected both by considering the principles and indicator selection criteria listed in page 39 and also by considering the main purpose of this research, for evaluating process and making decisions toward achieving sustainable transportation in the case study area. Table 3 presents these indicators together with their selection principle, related sustainability dimension and evaluation methods.

Table 3: Selected indicators for evaluating process and making decision in the case study area – EMU (Source: author)

Selected Indicators	Related Dimension of Sustainability	Assessment principle and Criteria	Evaluation Methods
Safety	Social	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Satisfaction	Social	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Access	Social	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Transportation for Disable	Social	Easy to understand	Site Analysis
		Performance target	Visual Study
			Behavioral observation

User participation in transport decision	Social	Comprehensive	Site Analysis
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Security	Social	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Transport price	Economic	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
Efficient vehicles	Environmental	Comprehensive	Questionnaire Survey
		Easy to understand	Visual Study
		Performance target	Behavioral observation
		Cost effective	

Accordingly, this chapter focuses on the existing forms of transportation at the Eastern Mediterranean University to better understand, integrate and implement sustainability into all modes of transportation at EMU campus, specifically walking, bicycling and busing. In this regard, the first part of this chapter is the analysis methodology. Then the second part of this chapter provides general information

about EMU including its location, history, mission-vision and functional characteristics. The third part focuses on transportation and accessibility in/around EMU Campus. The fourth part is the conclusion of this chapter which provides proposals for achieving sustainable transportation systems in EMU campus environment based on the existing problems in transportation sector.

4.2 General Information about EMU

4.2.1 Location

Eastern Mediterranean University is located in Famagusta city (Map 1), a small city (approximately, 40,000 residents) in the east coast of Turkish Republic of North Cyprus. The EMU campus has approximately 5 Km distance from central of city and 10 Km distance from the Walled city of Famagusta which is dating back to medieval period.

EMU campus is adjacent of two main roads of Famagusta, Salamis road and Lefkosa road, which provide access from and to campus from the city; Meanwhile, Lefkosa road divides the EMU campus environment into two parts which the north part is the main part of campus according to density of buildings and of facilities and the south part of campus is the secondary part with its low density of building and facilities, yet with availability of empty land having good opportunity for future development. The main problem in this division is the lack of access between these two parts inside campus environment because there is no vehicle and bicycle access but there is only one pedestrian bridge which provides accessibility among two parts of EMU campus (Figure 8).



Figure 7: The Pedestrian Bridge for Connection of Two Parts of EMU Campus
(Source: author)

4.2.2. History

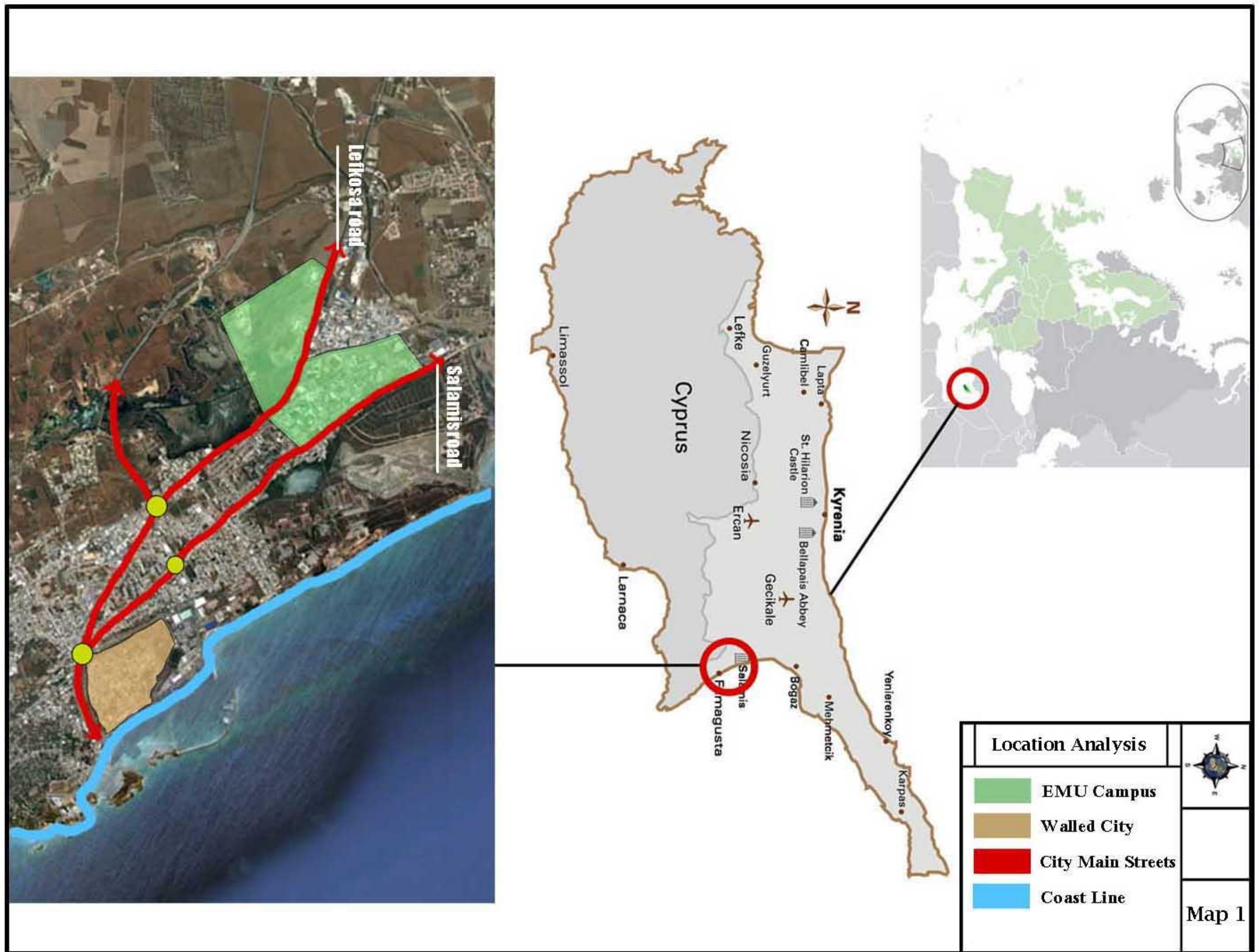
The starting point of the establishment of Eastern Mediterranean University was by the emergence of Institute of Higher Technology in 1979. This institute started its work by education to 105 students with 3 departments including Civil Engineering, Electrical Engineering and Mechanical Engineering. The main purpose of this institute was fostering an intermediate workforce along an engineer and a technician. In 1985, the governments decided for transforming the Institute of Higher Technology in to a university called '*Eastern Mediterranean University*'. Thus, the Eastern Mediterranean University Campus was established in a 2200 acre area accordingly (Strategic Plan of EMU, 2012).

Nowadays, EMU is an international university and a multicultural educational milieu with about 14,000 students coming from 68 countries and approximately 1,000 instructors from 35 different countries. Besides, there are 11 faculties including Faculty of Business and Economics, Faculty of Engineering, Faculty of Arts and Science, Faculty of Law, Faculty of Architecture, Faculty of Communication, Faculty of Education, Faculty of Health Science, Faculty of Pharmacy, Faculty of Medicine and Faculty of Tourism. Meanwhile, there are 30 departments and 2

schools including IT School and School of Foreign Languages in EMU campus environment which offer programs fully accepted by Council of Higher Education in Turkey (Strategic Plan of EMU, 2012).

4.2.3 The Mission and Vision of EMU

The main purpose of EMU is being a leading educational institute in the Middle East, North Africa and Eastern Mediterranean in the future. Accordingly, the mission statement of EMU is “To offer contemporary, sustainable and quality education at international standards, conduct research, contribute to the needs of the society and meet the needs of all stakeholders and graduate students in a multicultural environment having international knowledge and competences” (Strategic Plan of EMU, 2012, p. 4). Besides, the vision statement of EMU is “To become a preferred, participating, autonomous university open to change and development, producing science and technology and serving as a model with its multicultural diversity” (Strategic Plan of EMU, 2012, p. 4). Due to the mission and vision statement of EMU, a strategic plan is designed for 2012 to 2015 which “the implementation of the strategic plan will bring EMU to a higher level both in terms of international recognition and the attainment of international standards in higher education” (Strategic Plan of EMU, 2012, p. 3). As can be followed from the mission and vision of EMU, and as a critical point, there is no information regarding what kind of campus concept is and will be offered to its users and its city.

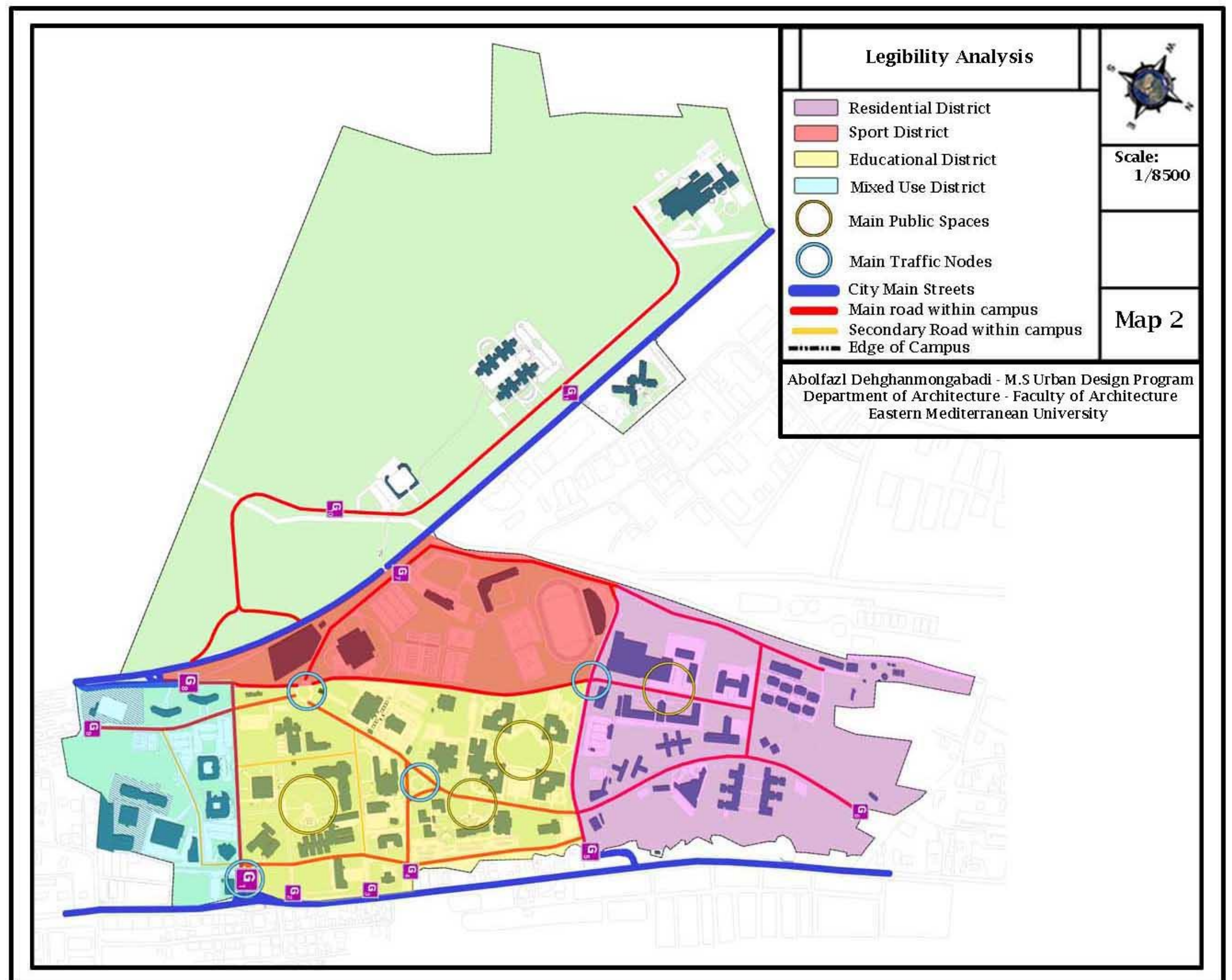


Map 1: Location of EMU campus (Source: <http://www.Google.com>)

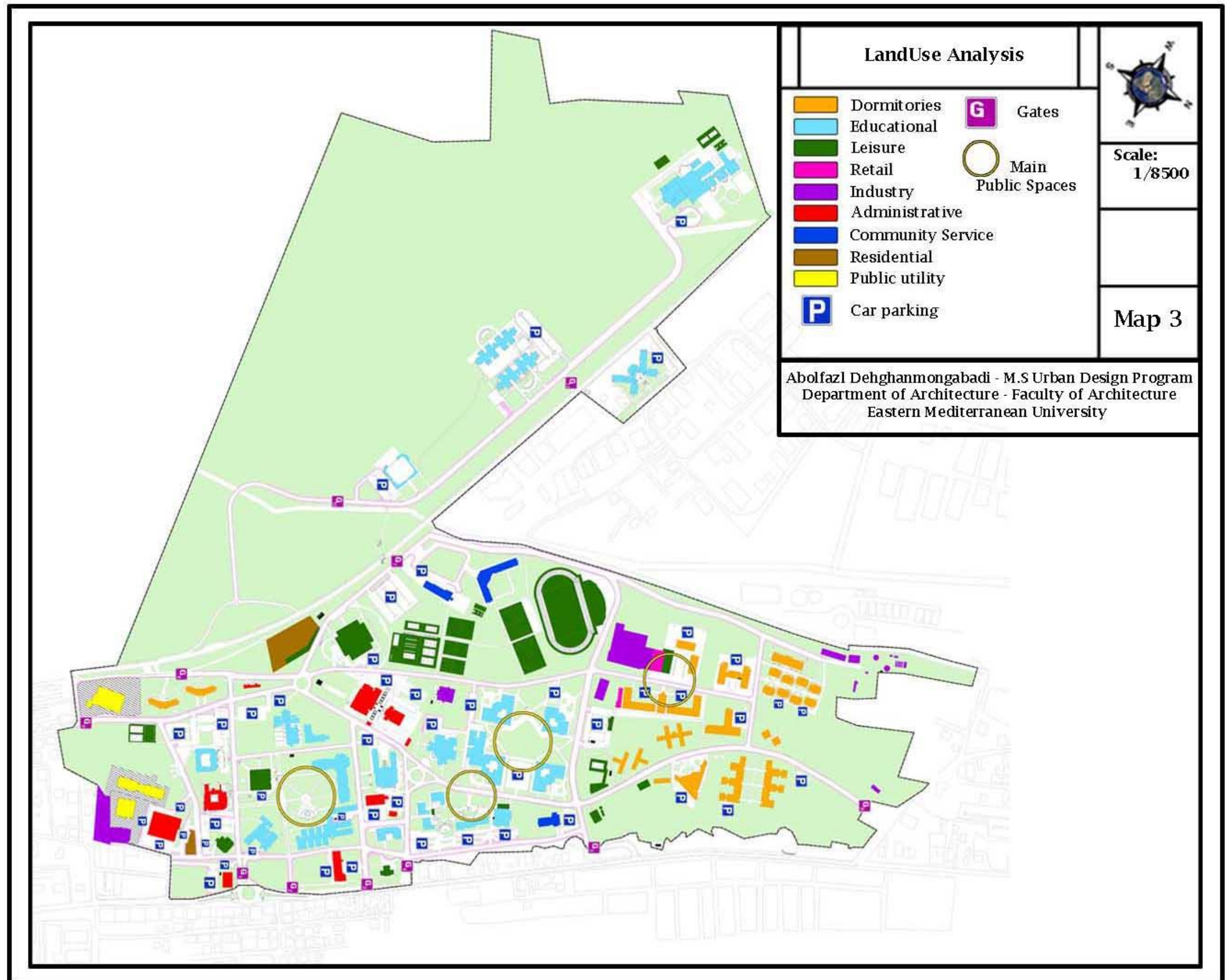
4.2.4 Functional Characteristics

As has been stated before, the EMU campus is divided to two parts. The north part that is main part consists of 4 districts due to dispersion of buildings within campus environment pursuant to their functions (Map 2). Hence, these 4 districts include Educational district, Sport district, Residential district and Mix Use district which involve Administrative buildings, Educational Buildings, Dormitory buildings and infrastructure facilities at a time. The south part of the campus in which there are only two faculties, is not as active as the north campus due to lack of social facilities. The location of the districts in the north part have particular role in the legibility of the campus environment. Furthermore, the positions of main and secondary roads within EMU campus and their connection to the main streets of city as well as the location of 4 main traffic nodes which play a crucial role in vehicle accessibility along campus also help the legibility of EMU campus environment.

The location and connection of all physical elements and facilities within EMU campus including a mixture of educational, residential and administrative buildings, streets, public spaces; community services, leisure, retail and public utilities are illustrating a good condition of legibility at EMU campus environment (Map 3). In this regards, there are 4 main public spaces, three of which are located in the educational district and one of them is in the dormitory district. These public spaces help EMU members to have easy pedestrian accessibility to all part of campus and provide a quiet place for taking a rest along the way.



Map 2: Legibility Analysis of EMU campus (Source: author)



Map 3: LandUse Analysis of EMU campus (Source: author)

4.3 Transportation and Accessibility in/around EMU Campus

As has been stated in previous sections, transportation is a key factor in university campus environments which has direct and indirect impacts on social, economic and environmental quality as well as sustainability of university campus environments and surrounding communities. Hence, in this part, all dimensions of existing transportation modes at EMU campus including walking, bicycling, public transportation and private cars which are used by EMU's members for commuting to campus from city as well as moving within campus, will be examine through the selected indicators at the first part of this chapter based on the findings of the qualitative and quantitative research contacted throughout the case study survey.

4.3.1 Transportation and Accessibility to/from City from/to EMU Campus

As mentioned before two main streets of Famagusta city, Salamis road and Lefkosa road are adjacent to EMU campus; therefore, these two roads provide accessibility to/from campus from/to the city. Moreover, EMU campus has 11 gates providing access to and from the city 9 of which are used for access to the north part of the campus and two of them for access to the south part of the campus (Map 4). In the north part of the campus, 4 gates are open for vehicles, pedestrian and bicycles include gates number 1, 5, 8, and 9, two of them include gates number 1 and 5 provide access from Salamis road which one of them is main entrance to campus environment which is gate number 1(Figure 9), and the other two gates involve gates number 8 and 9 have access from Lefkosa road (Figure 10).



Figure 8: The Main Entrance of EMU, Gate Number 1 (Source: author)



Figure 9: The Entrance of Lefkosa Road, Gate Number 8 (Source: author)

However, the other gates of the north part are closed to cars, just used by pedestrian and cyclists (Figure 11). In the south part of campus, the both gates are open for vehicles, pedestrian and bicycles and are accessible from Lefkosa road.



Figure 10: The Close Gates for Vehicles (Source: author)

Due to four main existing transportation modes and questionnaire survey results, 47 percent of respondents commute to and from campus from city by walking, 29 percent by public transportation, 16 percent by private cars, and 8 percent by bicycle (Figure 12).

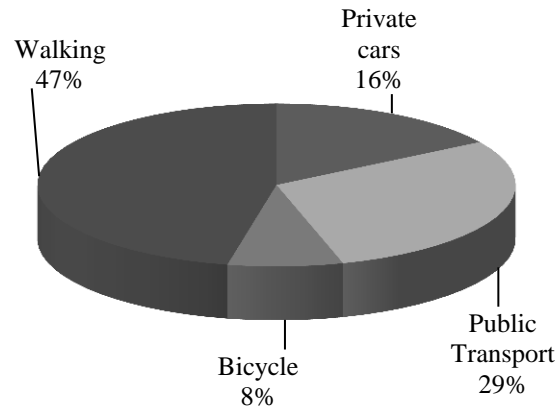


Figure 11: The Percentage of Used of Transportation Modes by University's Members for Commuting to cCampus from City (Source: author)

The commuters who commute by public transport according to the existing public transportation modes are divided to 2 groups: commuters by university's bus service and commuters by taxis. According to the questionnaire survey result, 62 % of travelers by public transport to/from city/campus, commute by bus and 38 % commute by taxis (Figure 13).

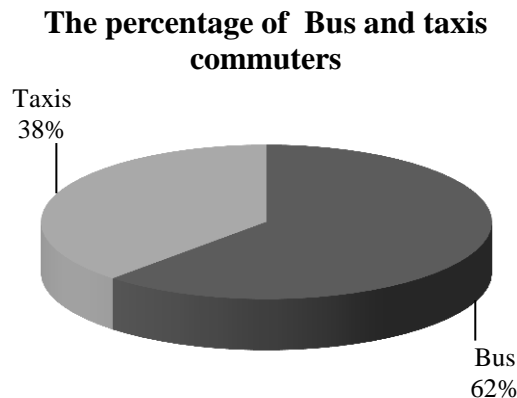
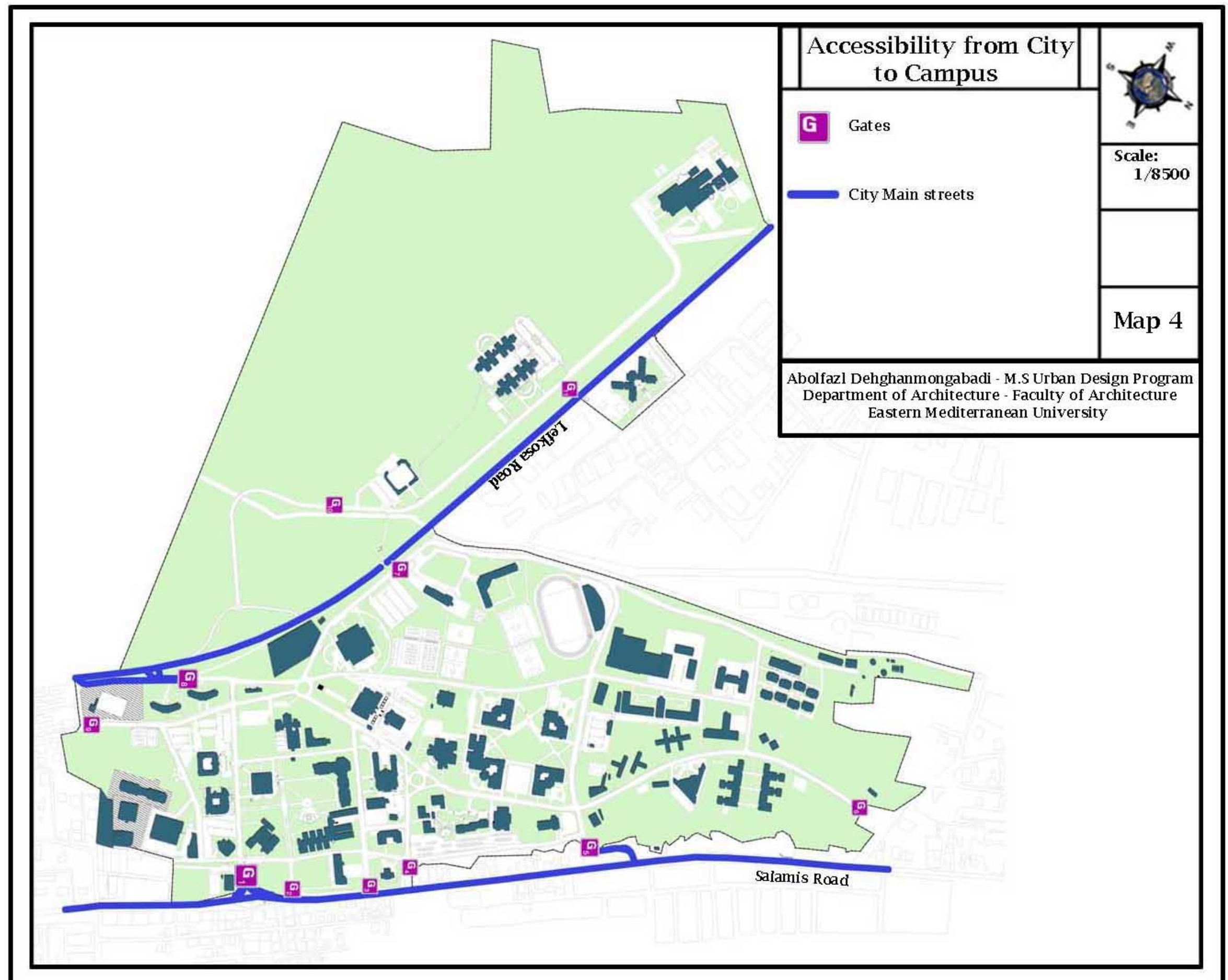


Figure 12: The Percentage of Commuter by University's Bus Service and Taxis (Source: author)

Consequently, most of the commuters of walking are students because they mainly live (prefer living) in the residential districts (such as Karakol, Yenişehir-Social Housing) which are in walking distance and/or close proximity to the university campus. However, unfortunately, most of the staff commutes to campus by private cars. Besides, most of the commuters by public transportation modes use university's

bus service because it is free for EMU members as taxis price is expensive. It is essential to mention here that, taxis price is not under control of university management system but instead government agencies are responsible to determine all taxis prices in the country.



Map 4: Accessibility of EMU campus from Famagusta City (Source: author)

4.3.2 Transportation within EMU campus environment

As has been mentioned in previous parts, there are four modes of transportation systems at EMU campus including walking, cycling, private cars, and public transportation which are used by university's members within campus environment for moving from one place to another place. Besides, due to questionnaire survey results, 73 % of respondents move from one place to another place within campus environment by walking, 11 % by private cars, 5 % by bicycles and 11 % by public transportation (Figure 14). Yet, most of the staff move within campus by their own private cars; sometimes, if the distance be short, move by walking. Hence, in this part, these four modes of transportation systems and their related facilities within campus environment will be examined and explained.

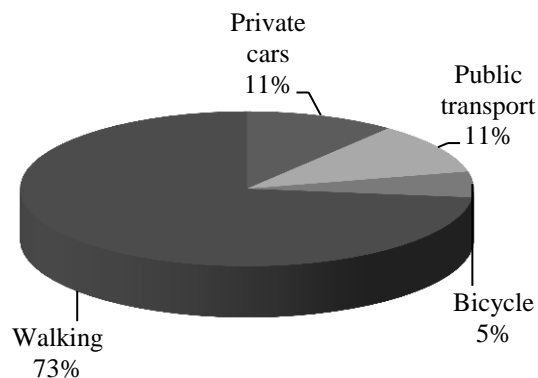


Figure 13: The Percentage of Existing Transportation Modes which Use by University's Members within Campus (Source: author)

4.3.2.1 Walking

As has been mentioned in previous chapter, walking is the basic mode of sustainable non-motorized transportation mode which is suitable for short distance in all human communities particularly in universities campuses. Besides, walking has many social, economic and environmental benefits. Hence, in this part the efficiency, continuity, safety, and physical conditions of pedestrian routes including pavement, lighting, and shading elements along EMU campus (Map 5) will be examined toward

improving the quality of walking facilities for encouraging EMU members to commute by walking to campus from city as well as moving by walking within the campus.

According to the questionnaire results, 66 % of respondents indicated that existing sidewalks and pedestrian paths along campus environment are efficient and 50 % of them think that continuity along existing pedestrian paths and sidewalks is in a good condition (Figure 15).

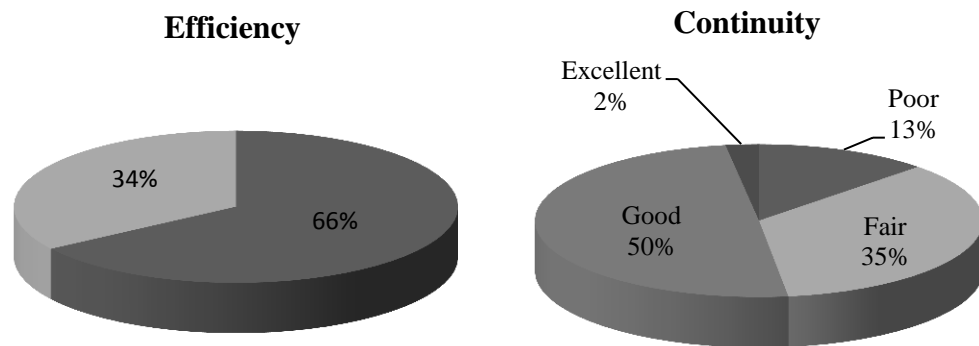


Figure 14: Efficiency and Continuity along Pedestrian Paths and Sidewalks within Campus (Source: author)

Furthermore, 53 % of respondents have agreed that safety along pedestrian paths and sidewalks is good (Figure 16), yet 39 % think that safety at interaction points between pedestrians and vehicles is fair (Figure 17).

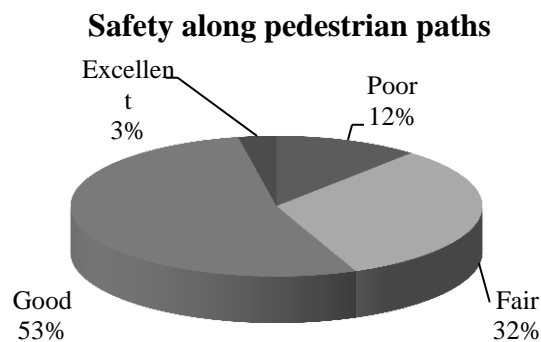


Figure 15: Safety along Pedestrian Paths and Sidewalks (Source: author)

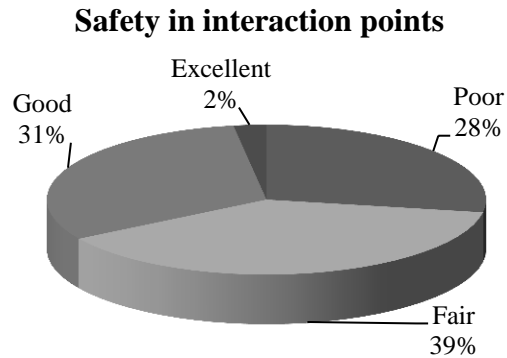


Figure 16: Safety in Interaction Points between Pedestrian and Vehicles (Source: author)

The questionnaire results about physical condition of pedestrian paths and sidewalks showed, 47 % of respondents think that pavements conditions are fair (Figure 18), on the quality of lighting at night 38 % (Figure 19) and on the quality of shading elements 42 % mentioned that they are fair (Figure 20).

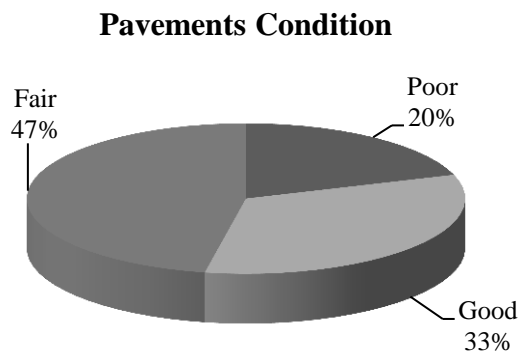


Figure 17: Pavement Condition along Pedestrian Paths and Sidewalks (Source: author)

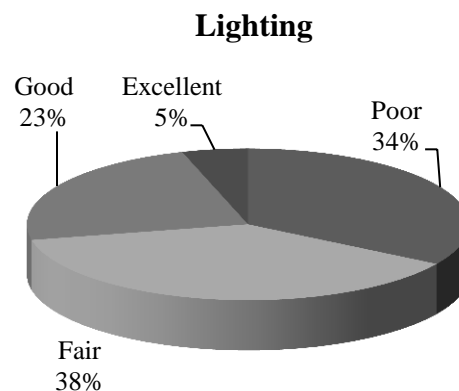


Figure 18: The quality of Lighting along Pedestrian Paths and Sidewalks (Source: author)

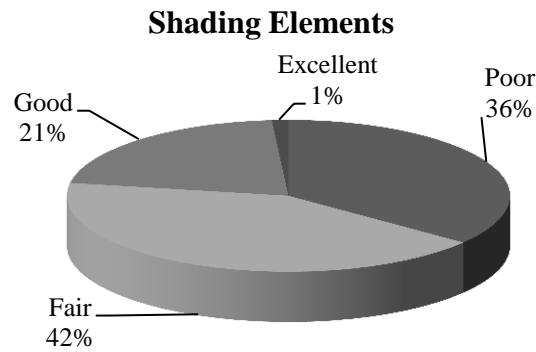


Figure 19: The Condition of Shading Elements along Pedestrian Paths and Sidewalks
(Source: author)

As consequent, due to physical layout of EMU campus environment and proximity of existing districts to each other as well as residing of 35 % of students on campus and site survey results, walking is the best mode for moving within campus for EMU members for moving from a place to another place. According to site survey results about walking facilities at EMU campus environment, continuity and safety along pedestrian routes are in good condition but there is lack of safety at interaction points of pedestrians with vehicles. Besides, the quality of pavement, lighting and shading elements along pedestrian routes are in fair condition. The existing shading elements are consisted of trees only and there are no other kinds of shading elements along pedestrian paths and sidewalks (Figures 21and 22).

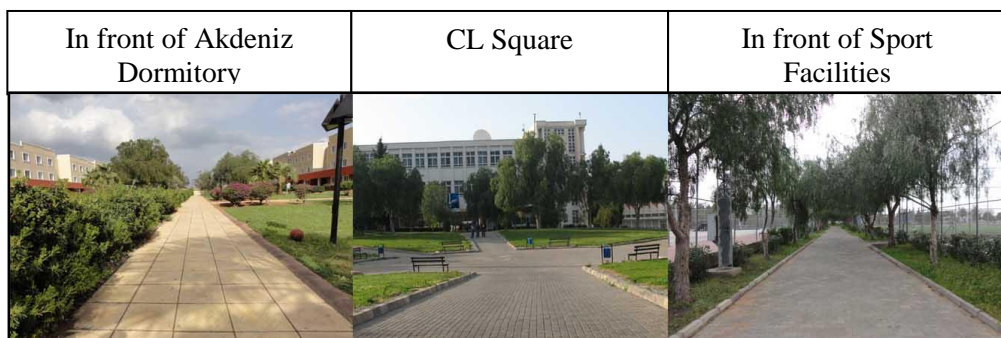
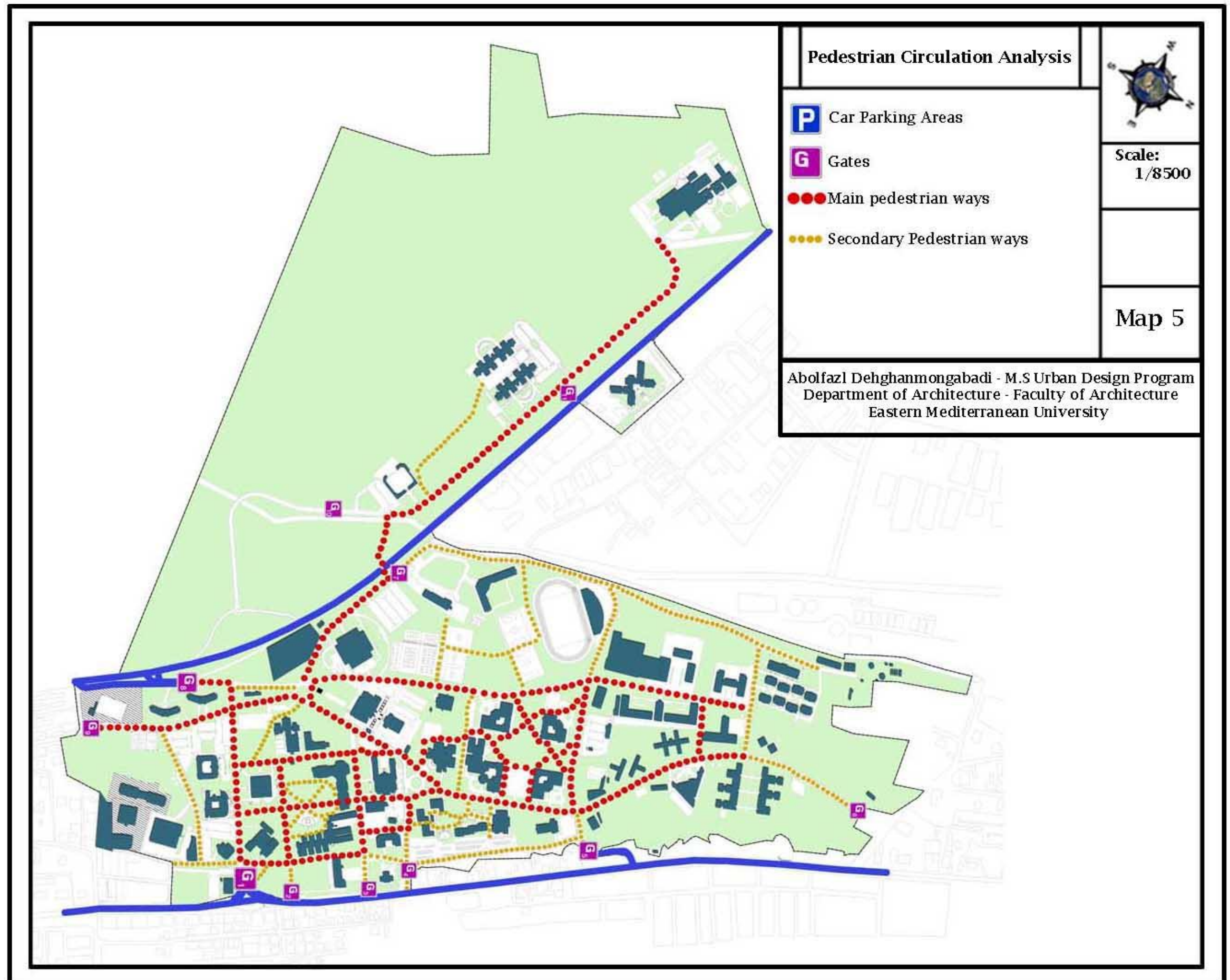


Figure 20: The Condition of Pavements and Shading Elements in pedestrian paths along EMU Campus (Source: author)



Figure 21: The Condition of Pavements and Shading Elements in sidewalks along EMU Campus (Source: author)

Thus, walking facilities within EMU campus due to main aim of this study need special consideration and should be improved. Since, the physical condition of pedestrian paths and sidewalks as well as continuity and safety along pedestrian routes play important roles to encourage EMU members to commute by walking.



Map 5: Pedestrian Circulation Analysis at EMU campus (Source: author)

4.3.2.2 Cycling

Due to the previous sections, bicycle is active mode of sustainable non-motorized transportation systems which is faster than walking so this mode can be better method for medium trip distances. Besides, cycling has a direct effect to improve health of EMU members and environmental health condition. Thus, bicycle also is a choice to EMU members for commuting to campus and moving within campus. Hence, in this part the efficiency of the existing bike lines and situations of bicycle facilities include quality of bike lines and bike stands as well as safety along bike line within EMU campus will be examined.

According to questionnaire survey results, 74 % mentioned that existing bike lines at EMU campus are not efficient (Figure 23) , 52 % stated safety along bike lines is poor (Figure 24) and 41 % declared that quality of bicycle parking is poor as well (Figure 25).

Efficiency of bike lines

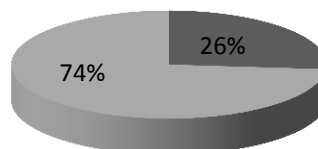


Figure 22: The Efficiency of Bike Lines along EMU Campus
(Source: author)

Safety along bike lines

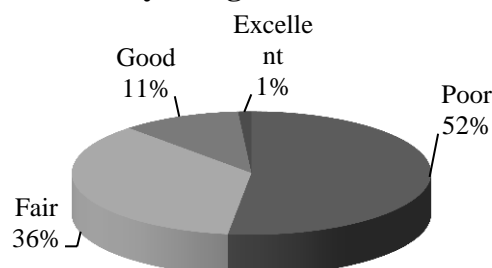


Figure 23: The Safety of Bike Lines along EMU Campus
(Source: author)

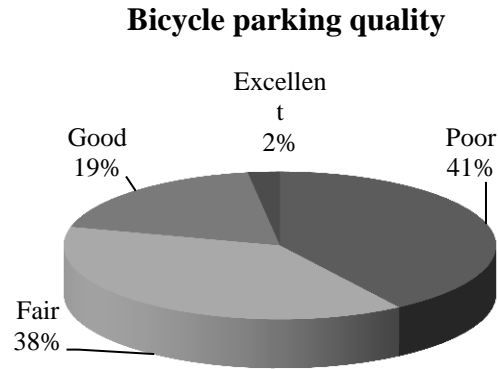


Figure 24: The Quality of Bike Lines along EMU Campus
(Source: author)

Consequently, based on the site survey findings, unfortunately there is not an appropriate separate bike lane along EMU campus and bike lines are shared with vehicle roads (Figure 26). Besides, bicycle parking around campus are not efficient and they are not in favorable conditions for users as well as there is lack of security in bike stations (Figure 27). Furthermore, there are not signage and any ancillary services for cyclists such as repair and accessories shop.



Figure 25: Existing Bike Lines at EMU Campus (Source: author)

As a final point, based on the questionnaire survey results, only 8 % of respondents use bicycle for commuting to campus from city and 5 % used bicycle within the campus (Figures 12 and 14). Hence, these percentages show that EMU members are not satisfied with existing bicycle facilities within campus and also Famagusta city; therefore, they are not enthusiastic to commute by bike within the existing conditions.



Figure 26: The Quality of Existing Bike Parking at EMU Campus
(Source: author)

4.3.2.3 Public Transportation

There are two modes of public transportation systems within EMU campus include university's bus services and taxis services. Hence, in this part quality of bus services, bus stations and bus timing as well as quality of taxis services will be discussed.

Based on the questionnaire survey results, 29 % of commuter from the city to/from campus used public transportation and 11 % of EMU members used public transport for moving within campus (Figures 12 and 14). Thus, public transportation mode after walking is the second main mode of transportation for commuting to campus.

4.3.2.3.1 The EMU Bus Services

According to the statement mentioned above, 62 % of public transportation users commute by university's bus service to campus (Figure 13). Hence, paying attention to quality of bus services and related facilities have direct effects on the numbers of users.

Furthermore, due to the questionnaire survey result, 41 % of respondents mentioned that the quality of bus services is fair (Figure 28), 42 % of respondents mentioned the quality of bus stations is poor (Figure 29) and 57 % of them mentioned that the timing of bus is poor and most of the time bus is full (Figure 30).

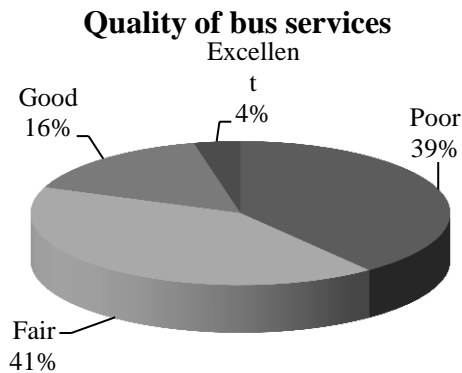


Figure 27: The Quality of Bus Services (Source: author)

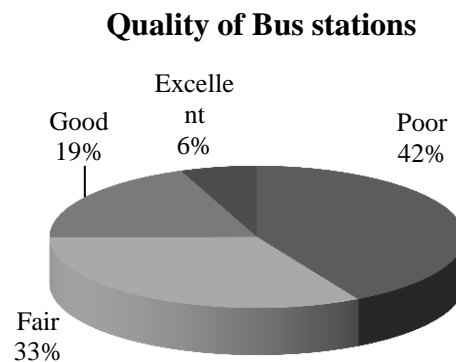


Figure 28: The Quality of Bus Stations (Source: author)

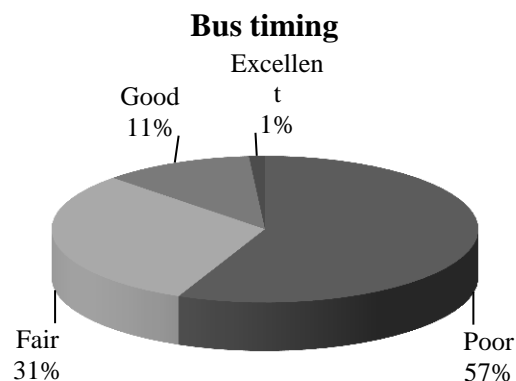


Figure 29: The Quality of Bus Timing (Source: author)

Finally, due to site survey result, the main problems of users of EMU bus services is about bus timing, the numbers and quality of buses (Figure 31) as well as the quality and numbers of bus stations (Figure 32). Besides, the bus circulation within EMU campus should be improved because of lack of support in some parts especially in sport district (Map 6). The university's bus services are covered all destinations within the Famagusta city but there is lack of bus service for EMU members who live in the suburbs (Figure 33). Thus, special consideration to this kind of public

transportation mode which is free of charge for EMU members is essential to more encourage them to commute by public transportation and reducing the number of private cars usage.



Figure 30: The Quality of Buses (Source: author)



Figure 31: The Quality of Existing Bus Stations within EMU Campus (Source: author)

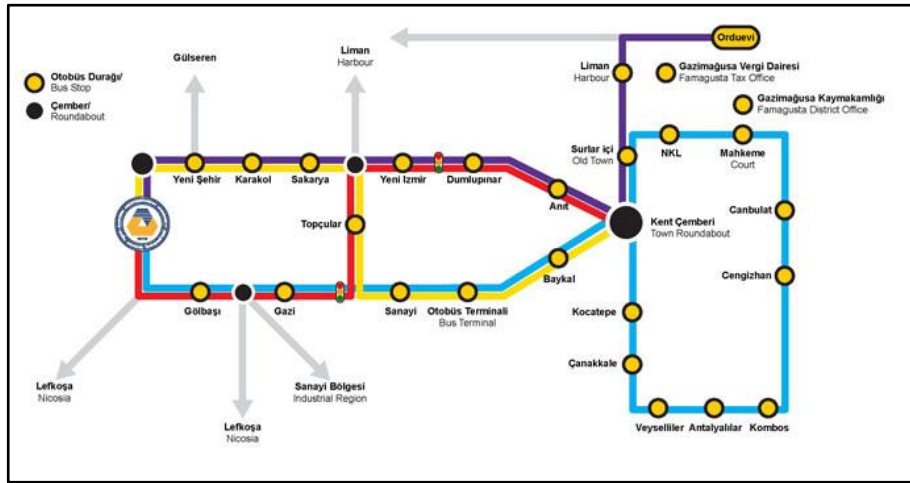
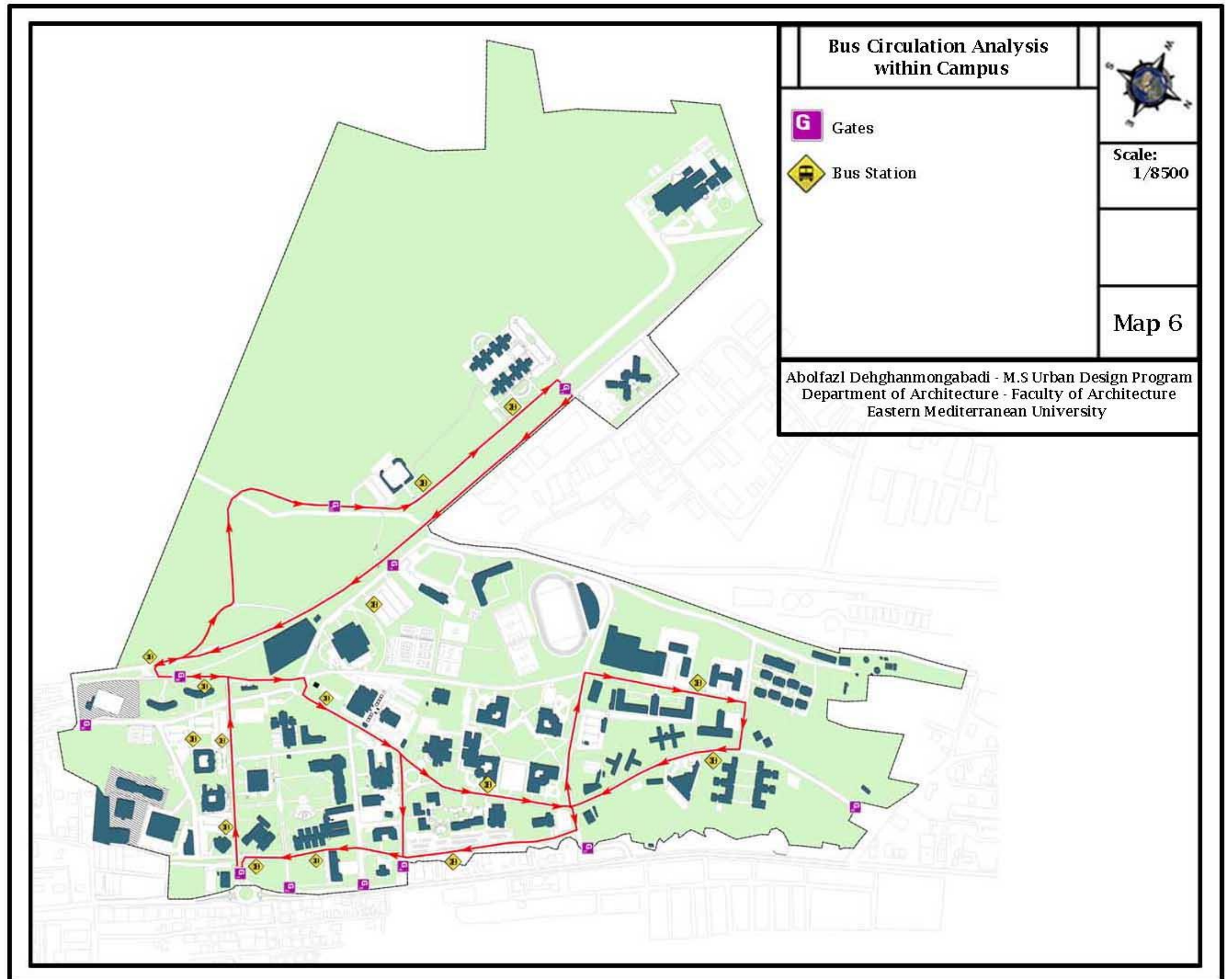


Figure 32: The EMU bus services circulation within the Famagusta City (Source: http://www.emu.edu.tr/ulasim/transportation/bus_services.htm)



Map 6: Bus Circulation Analysis at EMU campus (Source: author)

4.3.2.3.2 Taxis services

Second mode of public transportation which is used at EMU campus is taxis. Based on the questionnaire survey results, 32 % of public transportation users commute by taxis to and from campus (Figure 13). According to questionnaire survey results, 51 % of respondents mentioned that the quality of taxis services along campus is good (Figure 34), but the high price of taxis and also lack of taxi-stations within campus have been their problems about this mode of public transportation.

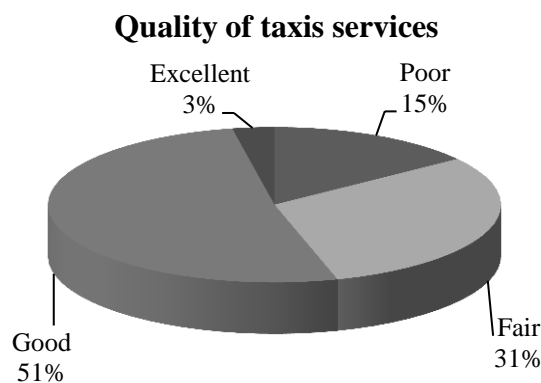


Figure 33: The Quality of Taxis Services (Source: author)

4.3.2.4 Private cars

In this part, the quality of vehicle roads and car parking areas, numbers and locations of car parking areas, and as well as safety and lighting in car parking areas will be analyzed.

According to the information gathered from the Security Unit of EMU which has control on vehicular traffics and facilities, there are about 2000 parking places for cars in the north part and about 150 parking places for cars in the south part of EMU campus. Meanwhile, half of these car parking areas are reserved for students, including the parking lots at the edges; however, students prefer parking their cars in the central car parking areas and this creates a lack of car parking within the campus.

Again, based on the information gathered from the Security Unit of EMU, everyday about 4000 cars including taxis, visitor cars and members' cars are commuting to/from EMU campus and during the day, about 3000 cars are parking within the campus, either in the car parking areas or along the vehicle roads. This information indicates that, there is lack of parking areas at EMU campus due to the high number of private car commuters.

Based on the results of the questionnaire survey, 16 % of EMU members commute by private cars to and from campus and also 11 % of them use private cars for moving within campus environment (Figures 12, 14). Hence, according to the site survey, 56 % of respondents stated that the numbers of car parking areas are not adequate (Figure 35).

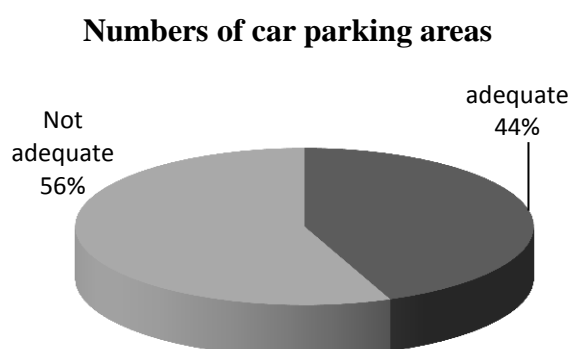


Figure 34: The Number of Car Parking Areas at EMU Campus (Source: author)

About the quality of vehicle roads (Figure 36) and quality of car parking areas (Figure 37) inside EMU campus, 43% of respondents think that they are in good quality.

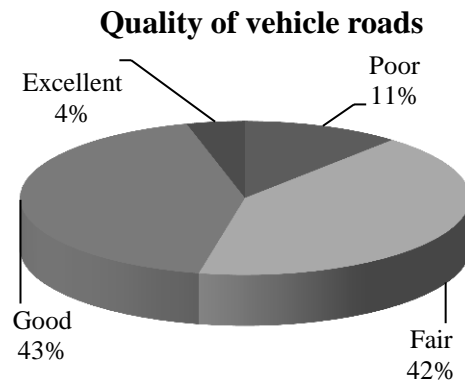


Figure 35: The Quality of Vehicle Roads at EMU Campus (Source: author)

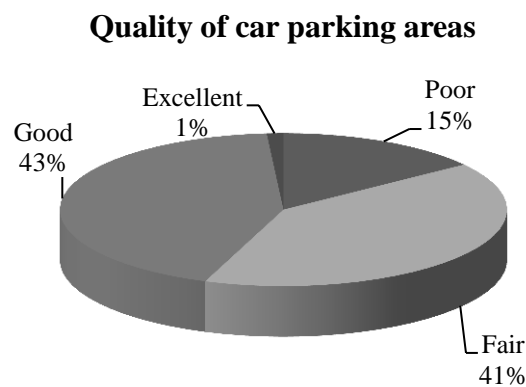


Figure 36: The Quality of Car Parking Areas at EMU Campus (Source: author)

Furthermore, 48 % of respondents stated that the location of car parking areas are good (Figure 38) ; 54 % mentioned that safety in car parking areas are good (Figure 39) and on quality of lighting at night in car parking areas 45 % mentioned that they are fair (Figure 40).

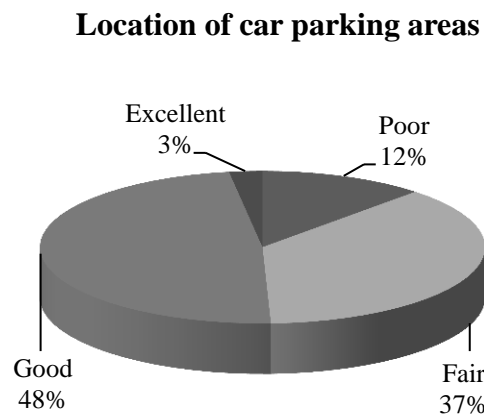


Figure 37: The Location of Car Parking Areas at EMU Campus (Source: author)

Safety in car parking areas

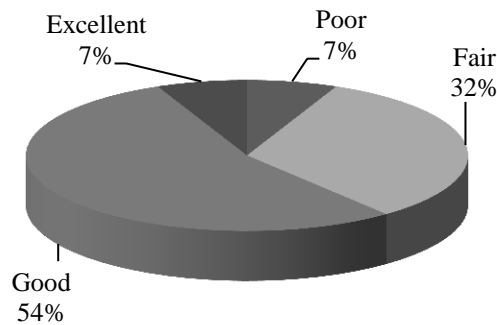


Figure 38: The Safety in Car Parking Areas at EMU Campus (Source: author)

Lighting of car parking areas

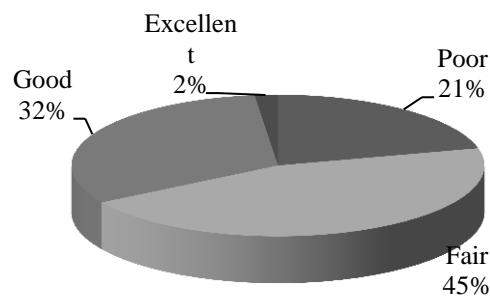


Figure 39: The Quality of Lighting in Car Parking Areas at EMU Campus (Source: author)

As conclusion, according to the site survey results, the vehicle roads within EMU campus which are divided into two categories including main roads and secondary roads, are in good condition (Figure 41); however, the traffic calming ramps and mechanisms are not proper.



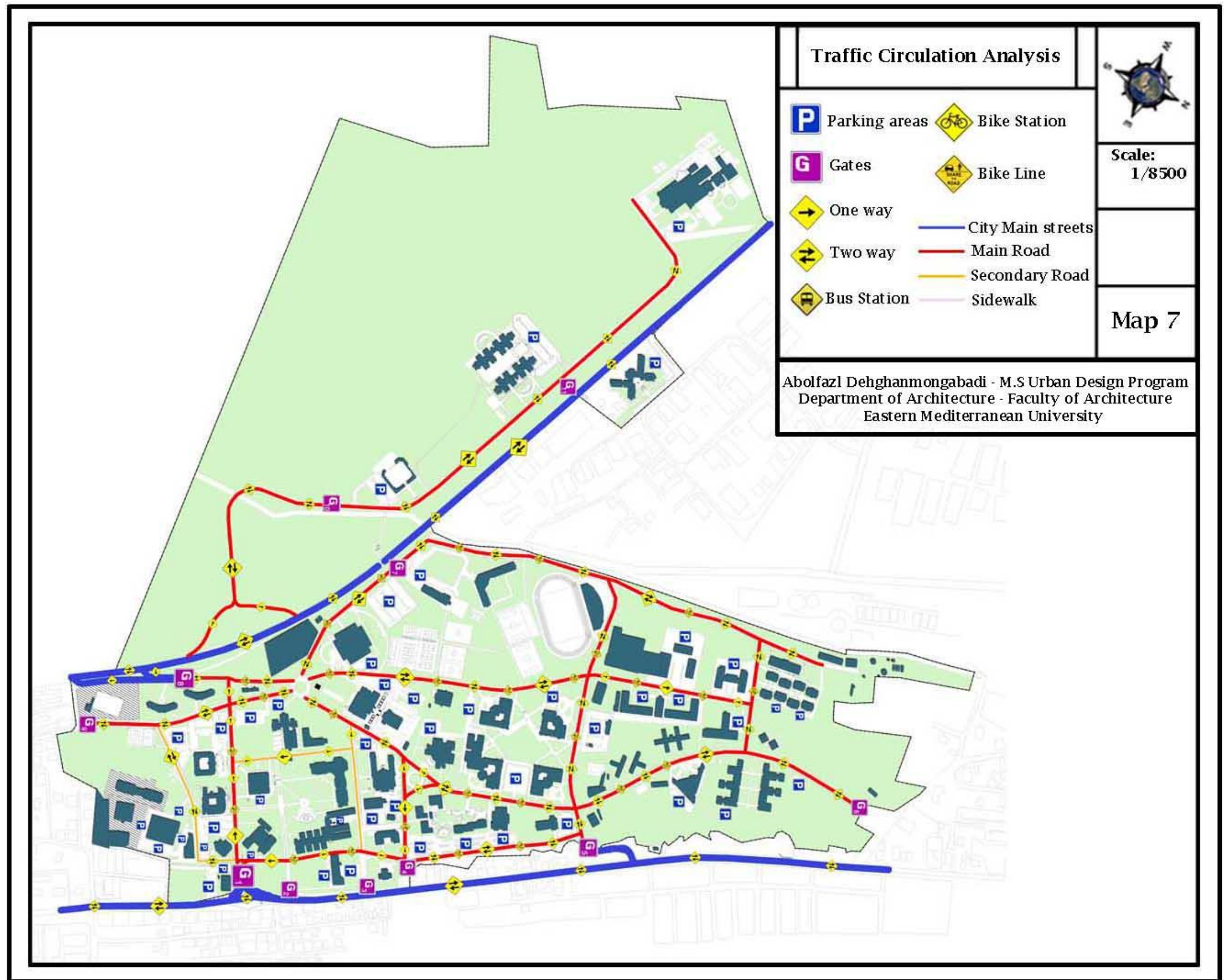
Figure 40: The Quality of Vehicle Roads at EMU Campus (Source: author)

Besides, the parking areas inside EMU campus are in good conditions (Figure 42) but there is a big problem about the numbers of car parking areas especially near the central library and CL square which is main public space at EMU campus because

most of the students like to park their cars in the parking areas in the central part of the campus. The other problem is the lighting of the parking areas at nights. In Map 7, all vehicle roads and parking areas as well as circulations of vehicles at EMU campus are illustrated.



Figure 41: The Quality of Car Parking Areas at EMU Campus (Source: author)



Map 7: Traffic Circulation Analysis at EMU campus (Source: author)

4.3.3 Transportation Management at EMU Campus

The interviews which have been conducted with the Environmental Affairs Administration and Campus Services Coordinator as well as the Rector's Office Coordinator for understanding the university strategies and future plans in transportation sector have clarified that, there are no efficient strategies and plans towards the future of transportation within the campus; the decisions are taken on a daily basis. Besides, there is no special committee or administrative unit to manage and take decisions about the campus, nor to define transportation strategies at EMU campus with full awareness on existing conditions of transportation and problems in this sector. The only authority regarding the decisions / proposals for the vehicular traffic and the car parking areas is the Security Department, which is also responsible for the maintenance and security of car parking areas. There is also a Traffic Education and Research Center within the academic body of the university. This center was established in 1998 by the University Board of Executives with the following mission:

- "Assist the foreign EMU students, academic and administrative staff to adapt to the traffic rules and regulations in the Turkish Republic of Northern Cyprus (TRNC) by offering educational seminars;
- Conduct research, organize symposium, congress and conferences on traffic problems;
- Increase the awareness of people living in North Cyprus about the importance of traffic;
- Establish links with organizations working on traffic safety, both in North Cyprus and abroad" (URL 1).

However, the center does not have the chance to contribute to the development of transportation and traffic management of the campus somehow. To summarize, it can be argued that in EMU, a sufficient transportation management does not exist; the future of the physical development of the campus including its traffic and transportation development is based on daily decisions of the ruling bodies. This may be regarded as the basic problem of transportation sector at EMU.

4.3.4 Putting It All-together: Strengths and Weaknesses of Transportation and Accessibility in/around EMU Campus

Based on the survey results which have been presented in detail above, the strengths and weaknesses of transportation sector in EMU campus will be summarized in this section.

4.3.4.1 Strengths of Transportation in EMU

Although the survey results show that transportation and traffic circulation at EMU campus has many problems, we may list a number of positive qualities regarding transportation sector in EMU. These are:

- **Walking**
 1. Efficiency of pedestrian routes (with lacking shading elements)
 2. Safety along pedestrian routes
 3. The quality of pavements along pedestrian paths and sidewalks
 4. Continuity along pedestrian paths and sidewalks
- **Public Transportation**
 5. The quality of taxi services to/from the campus
 6. Existence of free bus services to/from city/campus
- **Private cars**
 7. The quality of vehicle roads

8. The quality of car parking areas
9. The safety of car parking areas

4.3.4.2 Weaknesses of Transportation in EMU

The questionnaire survey, behavior observation and site survey show that there are too many problems and weaknesses regarding transportation sector at EMU campus. Hence, they can be summarized as following:

- **Walking**

1. Lack of safety in interaction points
2. Lack of appropriate shading elements along pedestrian routes
3. Lack of appropriate lighting at night along pedestrian routes
4. Lack of signage along pedestrian routes
5. Lack of paying attention to pedestrians with disability
6. Lack of facilities and infrastructure for disabled along the pedestrian routes
7. Lack of main/legible pedestrian paths along the campus
8. Lack of a pedestrian zone to provide a safer area for pedestrians
9. Lack of control on walking facilities along the campus

- **Cycling**

10. Low number of bicycle commuters for mobility
11. Lack of efficiency of existing bike lines along the campus
12. Lack of separate bike lines along the campus
13. Lack of safety along existing bike lines
14. Lack of appropriate bike stations along the campus
15. Lack of security in bike stations along the campus (including inappropriate locking / security systems)

16. Lack of appropriate signage along the campus
17. Lack of ancillary services for cyclists such as repair and accessories shop
18. Lack of control on bike facilities along the campus

- **Public Transportation**

19. Lack of appropriate and sufficient bus services
20. Lack of proper bus stations along the campus
21. Inappropriate timing of the existing bus services (not fitting the existing time-table)
22. Lack of the bus / shuttle services to all parts of the campus
23. Lack of taxi stations within the campus
24. Lack of control on public transportation activities and facilities

- **Private cars**

25. Dependency on private car usage
26. Lack of parking areas in some parts due to the increasing number of cars
27. Lack of appropriate lighting at night in parking areas
28. Lack of suitable signage along vehicle roads
29. Lack of control on vehicles facilities
30. Inappropriate infrastructure (ramps and other mechanic systems) for traffic-calming

4.4 Summary of the Chapter

This chapter analyzed all dimensions of transportation sector in/around EMU campus based on the general information about EMU campus by using qualitative and quantitative methods. In this regard, all existing transportation modes at EMU

campus include walking, cycling, public transportation and private cars which is used by EMU members to commute from the city to/from the campus and within the campus have been analyzed. The analysis results show that the transportation sector at EMU campus has many problems and weaknesses. According to the problems and weaknesses of transportation sector at EMU campus, a set of proposals as a comprehensive guideline will be provided in the following chapter for achieving sustainable transportation at EMU campus.

Chapter 5

CONCLUSION: PROPOSALS FOR ACHIEVING SUSTAINABLE TRANSPORTATION AT EMU CAMPUS

5.1 Introduction

Transportation sector is one of the main issues to be considered for the sustainability in living environments, and university campuses are one of the main physical and social environments in which transportation plays a crucial role for environmental, social and physical sustainability. Accordingly, the focus of this research has been the means of sustainable transportation planning on university campus environments. The problem area, and thus the field study in this research has been selected as the Eastern Mediterranean University (EMU) campus in Famagusta, North Cyprus. Thus, the main aim of the research has been defined as setting up a guideline to have a sustainable transportation system and a pedestrian friendly environment at EMU campus, with the intention of improving the quality of the campus environment.

The Eastern Mediterranean University (EMU) campus in Famagusta city in North Cyprus, is the home for approximately 14,000 students and about 1000 staff. The EMU campus is undergoing development and changes; therefore, it is essential to look to the future of the campus in a strategic perspective. In this regard, promoting sustainability at EMU campus by rely on teaching, planning and moving toward an environmental, social and cultural as well as economic sustainable development

manner is indispensable. Accordingly, creating a master plan for EMU campus to achieve a sustainable campus environment is also vital.

With this intention in mind, this research has initially provided a comprehensive review on sustainable campus environments with the focus on sustainable transportation planning in university campuses. Accordingly, definition and aims of sustainable transportation, indicators and impacts of sustainable transportation planning, need for sustainable transportation in university campus environments and kinds of sustainable transportation systems and strategies in university campus environments have been studied and some examples of implementations of sustainable transportation management strategies in university campus environments have been reviewed. Then based on a thorough analysis, transportation and accessibility in/around EMU campus have been examined in detailed.

As has been mentioned in previous chapters, transportation sector plays a crucial role in the concept of sustainability at university campuses. Thus, providing a smart master plan for transportation at EMU campus has been found to be necessary for taking a wide-ranging look at transportation issues to explicitly address the sustainable transportation for EMU campus. Based on the findings of the research, it can be argued that, a smart transportation master plan which focuses on multi-modal circulation on EMU campus including pedestrian, bicycle and motorized circulations as well as appropriate car parking and better public transportation services to decrease reliance on private car usage and demand for parking is needed.

In this final chapter, following the main aim of this study and opportunity of EMU campus to have sustainable transportation inside its own campus to provide

appropriate and comfortable accessibility to its members in an environmentally responsible approaches; first of all proposals for vehicular, pedestrian and cycling movement / mobility will be presented. These proposals are based on the vision and objectives of the “Improvement Project for EMU Campus: Designing a Pedestrian/Student Friendly Campus” presented in the report of Urban Design Studio I (UDES 501) the Spring Semester of 2010-2011 Academic Year (Please see page 64 of this thesis and Appendix C for details). These proposals are also supported with proposals for improvements for walking, cycling, public transportation and private cars. Secondly, a set of recommendations to achieve sustainable transportation at EMU campus by focusing on a more efficient use of existing transportation modes at EMU campus is provided. Thus, these recommendations will be presented in two sets:

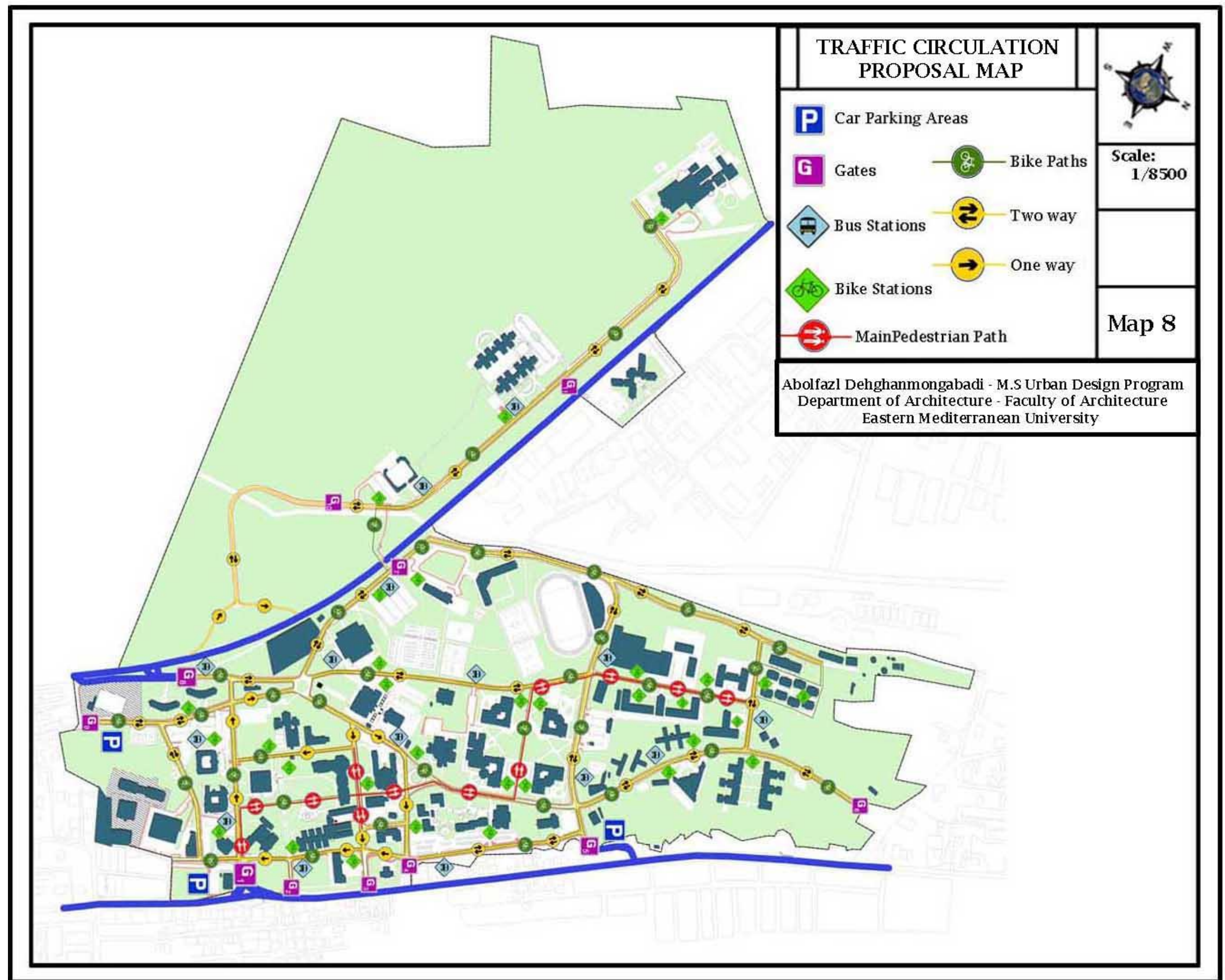
- (i) General Recommendations: The recommendations which focus on the role and effects of university management system in achieving sustainable transportation at EMU campus.
- (ii) Particular Recommendations: The recommendations which focus on specific strategies for promoting sustainable transportation systems at EMU campus.

5.2 Proposals for Pedestrian, Vehicular and Cycling Circulation at EMU Campus

In this part, based on the results have been achieved during UDES 501 project and also based on the findings of this research a “Traffic Circulation Proposal Map” as a Traffic Master Plan has been provided (Map 8). The Traffic Master Plan shows all the following items:

- A main pedestrian path that has continued along the campus from main Gate (Gate number 1) to residential district.

- Separate bike lines throughout the campus
- Location of 30 new bike stations throughout the campus
- New Traffic circulations along the campus
- Location of 3 multi-storey car parking near the main Gates
- Location of 15 new bus stations throughout the campus



Map 8: Traffic Circulation Proposal map for EMU Campus (Sources: UDES 501 and author)

Based on the traffic circulation proposal, in the following, a set of proposals for each kind of existing transportation modes at EMU campus including walking, cycling, public transportation and private cars, are provided in separate sections, with the consideration of achieving a sustainable transportation system within in EMU campus.

5.2.1 Proposals for Improvements in Walking

As has been stated in previous sections, walking is one of the main modes of transportation which used by EMU's members for commuting to campus from city as well as for moving within campus from a place to another place. Consequently, improving the quality of walking facilities due to the weaknesses and problems in this sector is essential, for providing more comfortable and safer pedestrian ways within EMU campus to encourage EMU members to commute by walking to campus from city and moving by walking within campus. Accordingly, the following are the proposals for improving walking facilities in EMU campus:

- Improving the quality of building's facades and creating a charming environment to encourage people walking.
- Increasing the quality of public spaces.
- Increasing the quality of pedestrian ways by providing shading elements, appropriate street furniture and lighting elements along the pedestrian routes.
- Defining a major pedestrian zone in central part of campus to provide a safer area for pedestrians and cyclists.
- Defining a main pedestrian path along EMU campus without any conflict with motorized traffic.

- Set back the pedestrian ways from vehicle roads to decrease the negative impacts of vehicle traffic on quality of walkways.
- Improving the connectivity of pedestrian paths and sidewalks.
- Improving the linkage between pedestrian ways and bus and taxis stations.
- Improving the quality of pavements of pedestrian ways.
- Using different paving material to emphasize pedestrian ways.
- Decreasing the intersection points and crosswalks for improving the safety along pedestrian ways.
- Using flashing yellow lights and different texture pavement in the intersection points to stop the motorists for pedestrians.
- Providing excellent lighting on pedestrian ways to increase the safety at night.
- Special paying attention to pedestrians with disability by color-coded walkways and curb cut.
- Increasing the shading elements as well as archways and canopies along pedestrian ways for protecting pedestrians from extreme summer sun and rain.
- Improving the quality of signage and maps to show direct route to pedestrians.
- Maintaining all pedestrian ways and facilities at all seasons.
- Assigning a full-time pedestrian facilities director on campus to have control on all dimensions of pedestrian facilities within EMU campus.

5.2.2 Proposals for Improvements in Cycling

As has been mentioned in the previous chapter, the EMU members are not satisfied with the existing bicycle facilities and they are not enthusiastic to commute by bike.

Hence, bicycle facilities and strategies need to be improved for encouraging the EMU members to use bike for commuting. Accordingly, based on the weaknesses and problems of this sector, the following proposals have been provided:

- Creating appropriate separate bike lanes along EMU campus.
- Having attractive scenery around bike paths and being far away from vehicle traffic and noise pollution.
- Providing good connection between main parts of campus by bike paths.
- Improving the quality of bike stations and covering them.
- Increasing the number of bike stations.
- Increasing the security of bike stations.
- Providing full services to cyclists such as repair services, tire pumps and showers facilities.
- Providing safety along bike paths with appropriate lighting.
- Improving the quality of signage and maps to show direct routes to bicyclists.
- Providing a strategy of bike-renting to students and staff for a semester.
- Providing the bike storage to keep students and staff bicycles during the summers.
- Maintaining all bicycle facilities at all seasons.
- Assigning a full-time bicycle director on campus to have control on all dimensions of bicycle facilities and strategies within EMU campus.
- Increasing the level of collaboration among the university and municipality of Famagusta city to improve the cycling facilities within the city.
- Encouraging the Traffic Education and Research Center of EMU to develop a master plan for cycling in Famagusta city.

It should be noted that, even if the best facilities for cycling is provided for the EMU campus, if the city of Famagusta does not have a proper cycling conditions, these facilities would not work as efficient as they could be.

5.2.3 Proposals for Improvements in Public Transportation

Due to statements which have been mentioned in previous chapter, public transportation is the second important mode of transportation system at EMU campus. This mode has the opportunity to be a convenient alternative for private car usage at EMU campus. Hence, according to problems and weaknesses of this transport mode, the following proposals for improving the quality and attractiveness of this mode have been provided:

- Improving the quality of bus services by use of new buses and high enough service for support all parts of city.
- Designing new bus shelters/stops which have harmony with campus environment and be more comfortable and safer for bus users.
- Increasing the numbers of bus stations along the EMU campus.
- Providing good location for bus shelters so that they can be accessible by pedestrians and bicyclists to combine these modes and bus transit.
- Improving the bus timing to comfort the bus users which need increasing the level of collaboration among the university and city as well as the numbers of buses due to the numbers of users.
- Improving the bus circulation within campus to support all parts of EMU campus.
- Providing shuttle services which only run within the campus.
- Defining appropriate taxi stations within EMU campus.

- Decreasing the taxis prices for students which need collaboration among the university and municipality of Famagusta city.
- Giving license to the specified numbers of taxis to commute to EMU campus for improving the safety of users.
- Maintaining all public transportation facilities at all seasons.
- Better coordination of the university administration with the related government agencies for the betterment of the taxi prices.
- Assigning a full-time public transport director on campus to have control on all dimension of public transportation facilities and strategies to increase the appeal of this form of transportation within EMU campus

5.2.4 Proposals for Improvements in Private Cars

As has been stated in previous part of this chapter, the respondents are satisfied about the quality of vehicle roads and parking areas within EMU campus. However, based on the weaknesses and problems identified in this sector, the following proposals have been provided:

- Discouraging private car usage within the campus by providing better facilities for walking and cycling.
- Providing more car parking facilities at the edges / near the gates of the campus and providing bicycles and shuttle serviced from these points to the central locations.
- Eliminating all side car parking facilities in the central zones.
- Providing the appropriate strategies to use of car parking areas for decreasing the numbers of private car usage and efficient use of vehicles.
- Improving the lighting of parking areas to increase the safety of them at night.

- Assigning a full-time director on campus to have control on all dimensions of vehicles facilities and strategies within campus.

5.3 Set of Recommendations for Achieving a Sustainable

Transportation System at EMU Campus

The following recommendations have been made based on the theory about sustainable transportation in university campuses as well as considering the local characteristics of EMU.

5.3.1 General Recommendations for Achieving a Sustainable Transportation System in EMU

The EMU management system has direct effects in achieving a successful and comprehensive sustainable transportation system at the campus. Since, the commitment of university management system in reducing the use of single-occupancy vehicle and declining its negative impacts on environment as well as promoting a comprehensive and more comfortable transportation system for its student, faculty and staff is starting point to improve the quality of their campus and achieve a sustainable transportation. In this regard, the following recommendations have been provided:

- Creating a stable sustainable transportation committee (STC) to have control and take decision on all dimension of transportation at EMU campus as well as to have constant efforts to promote sustainable transportation strategies.
- Providing a comprehensive master plan for transportation sector at EMU campus, based on the strategies and polices which are confirmed by the proposed sustainable transportation committee (STC).
- Increasing the level of collaboration among the university sustainable transportation committee (STC) and local organizations especially the

municipality of Famagusta city to take decisions towards promoting successful sustainable transportation strategies along EMU campus and city.

- Increasing the level of collaboration among the university administration, the university sustainable transportation committee (STC) and the government agencies for creating a control mechanism for taxi prices or providing reduced prices for students.
- Developing partnership of students in the EMU sustainable transportation committee to take better decisions and provide efficient sustainable transportation strategies due to students' demands.

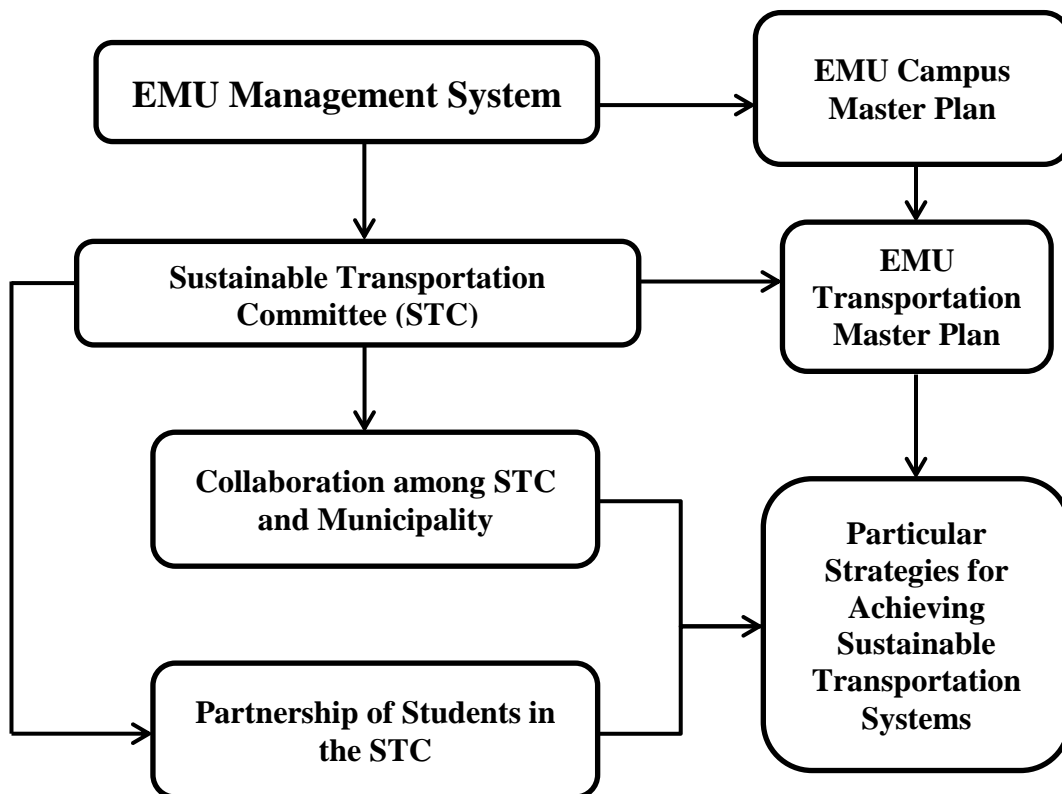


Figure 42: Recommended approach for achieving a sustainable transportation system at EMU campus (Source: author)

5.3.2 Particular Recommendations for Achieving a Sustainable Transportation System at EMU

Establishing successful sustainable transportation strategies for EMU campus is achievable by a right and comprehensive university management structure. Hence, the following particular recommendations have been provided to have great efforts for decreasing the single-occupancy vehicles and their negative impacts on EMU campus environment and surrounding environment as well as improving the quality of alternative transportation modes to providing a fair sustainable transportation system at EMU campus.

5.3.2.1 Parking Management

As has been stated in literature review and case study, parking demands in university campuses is one of the most important problems. Thus, parking management plays a significant role to decrease single-occupancy car journeys and improve the sustainability of transportation at EMU campus.

- The most effective strategy in parking management is parking pricing which has direct effects on decreasing single-occupancy car journeys and encourages private car users to use alternative modes.
- Restriction of parking is the other main strategy because fewer available parking areas in university campuses encourage commuters by single-occupancy car to use alternative modes.

5.3.2.2 Alternative Transportation Systems

EMU needs to provide a variety of alternative transportation modes on its campus to decrease the commute of single-occupancy cars to campus and achieve sustainable transportation in its campus. Hence, the following recommendations are supported strategies which are linked to these alternative modes.

- The U-Pass strategy has long term effects on the use of public transportation which can be one of the main alternative transportation modes in EMU campus. Promoting this mode of transportation would encourage all EMU members to commute by public transportation and active modes rather than private vehicles. This strategy would be successful at EMU campus base on proposals which are mentioned in the previous lines of this chapter.
- Promoting a carpooling strategy through transportation services in EMU to encourage EMU members to shift their demand away from personal car trips to campus.
- Providing a bike and pedestrian strategy through transportation services at EMU campus and improving the quality and quantity of bicycle and pedestrian facilities at EMU campus base on proposals which are mentioned in the previous lines of this chapter.

5.3.2.3 Educational Strategies

As mentioned in previous chapters, the multiple roles of universities in communities are including research, teaching, providing new knowledge, skills and technologies as well as prepare their graduates as effective and responsible citizens. Hence, EMU must use this specialty and its powerful tools to promote concept of sustainable transportation between its members by implementing in its campus and its curriculums. The following recommendations will be supporting educational strategies for promoting use of sustainable transportation by EMU members.

- Providing a series of educational programs by focusing on environmental, social and cultural as well as economic benefits of promoting sustainable

transportation and choice alternative transportation modes at EMU campus and its relative communities.

- Providing a series of educational programs by focusing on use of bicycle and its benefits as well as educating students and staff how they can repair their bicycles and keep them.
- Designing several workshops to inform students and staff about negative impacts of increase in the use of single-occupancy private cars.

5.4 Last Words

It is hoped, this research will be a base and an initial starting point for achieving sustainable transportation at EMU campus in the not-too-distant future. It is believed that, if considered well by the related administrators, the proposals in this research could guide the decision-makers for the future of the EMU campus as well as for the future of the transportation facilities in Famagusta, as a university town. This thesis could also be useful for the future researchers who are willing to study on sustainable transportation issues.

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APPENDICES

Appendix A: Sample of Questionnaire

There have been various researches along sustainable transportation in university campus environments. The purpose of this research is to try to understand the needs and problems of EMU's members along transportation for creating a sustainable transportation system and a pedestrian friendly environment in EMU campus, with the intention of improving the quality of the campus environment.

This questionnaire survey is conducted by Abolfazl Dehghanmongabadi Master candidate of M.S in Urban Design program, in the Department of Architecture, Faculty of Architecture, Eastern Mediterranean University, Famagusta, North Cyprus, as a part of his Master studies under the supervision by Prof. Dr. Şebnem Onal Hoskara. Furthermore, all collected data will be analyzed by Abolfazl Dehghanmongabadi under the guidance of Prof. Dr. Şebnem Onal Hoskara.

If you want any extra information about this project, please send an e-mail to: Abolfazl.dehghanm@gmail.com or call +90 533 8861449.

Direction:

- Put a check (✓) to your corresponding answer.

Thank you in advance for your time and support.

A- Section one: Personal Information

1- Gender: ☐ Male ☐ Female

2- What is your age group?

☐ 18 to 22 ☐ 23 to 29

☐ 30 to 39 ☐ 40 to 49

☐ 50 to 60 ☐ Over 60

3- Country: Nationality:

4- Are you a

☐ Student ☐ Academic staff ☐ Administrative staff

5- Which faculty/department are you studying at or a member of?

6- What is your field of study? (If you are a student)

7- What is your highest degree or level of study? (If you are a student)

☐ Undergraduate student ☐ Master ☐ PHD

8- How long have you been studying or working in EMU?

☐ Less than 1 year ☐ 1 to 2 year ☐ 3 to 4 year ☐ More than 4 years

9- Where do you live?

☐ Inside campus ☐ Outside campus

10- What kinds of accommodation are you living in?

☐ Dormitory ☐ Shared flat ☐ Apartment ☐ Villa ☐ Other

(Please specify)

11- What kind of transportation systems do you use for commute to campus from city?

☐ Private car ☐ Public transportation ☐ Bicycle ☐ Walking

12- What kind of transportation systems do you use to move from one place to another within the campus?

☐ Private car ☐ Public transportation ☐ Bicycle ☐ Walking

B- Section Two: View about Transportation systems conditions in EMU Campus

i. About Walking Facilities:

1- Do you think the existing pedestrian pathways and sidewalks within EMU campus are efficient?

☐ Yes ☐ No

2- How do you see the continuity between pedestrian pathways within the campus?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

3- What do you think about safety along the pedestrian paths?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

4- How do you see the safety in interaction points between pedestrians and vehicles within the campus?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

5- What do you think about the condition of pavements of pedestrian paths?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

6- What do you think about lighting of pedestrian paths at nights?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

7- How do you see the condition of shadings elements along the pedestrian paths?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

ii. About Cycling Facilities:

1- Do you think the existing bike lines within EMU campus are efficient?

☐ Yes ☐ No

2- What do you think about safety along the bike lines?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

3- How do you see the quality of bicycle facilities?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

4- What do you think about efficiency of bicycle parking?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

iii. Public Transportation to/From city & Public Transportation within Campus

1- What kind of existing public transportation systems do you use for commute to campus from city? Why?

☐ Bus ☐ Taxis

Because.....

2- What kind of existing public transportation systems do you use to move from a place to another place within campus? Why?

☐ Bus ☐ Taxis ☐ None

Because.....

iii-1- Bus Facilities

3- What do you think about quality of university's bus services to/from city?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

4- What do you think about quality of university's bus services within campus?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

5- How do you see the quality of stations of buses within campus?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

6- What do you think about bus timing?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

iii-2- Taxis Facilities

1- Do you use specific Taxis?

☐ Yes ☐ No

- 2- What do you think about quality of Taxis services to/from city?
☐ Poor ☐ Fair ☐ Good ☐ Excellent
- 3- What do you think about quality of Taxis services within campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent

C- Private car Usage:

- 1- Do you think the numbers of car parking areas within EMU campus are sufficient enough?
☐ Yes ☐ No
- 2- How do you see the quality of vehicle roads within EMU campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent
- 3- What do you think about quality of car parking areas within EMU campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent
- 4- How do you see the location of car parking areas within EMU campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent
- 5- How do you see the safety of car parking areas within EMU campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent
- 6- How do you see the lighting of car parking areas within EMU campus?
☐ Poor ☐ Fair ☐ Good ☐ Excellent

D- Section Three: Expectations

- 1- Which kind of existing transportation modes do you prefer to use if all facilities about it be in a good condition?
☐ Private car ☐ Public transportation ☐ Bicycle ☐ Walking
- 2- In your opinion EMU campus must have specific Taxis with Taxis stations within campus?
☐ Yes ☐ No
- 3- What is the main problem that you are facing according to mode of transportation systems which you are using?
- 4- What is your opinion or your suggestion to improve the quality of transportation in EMU campus?

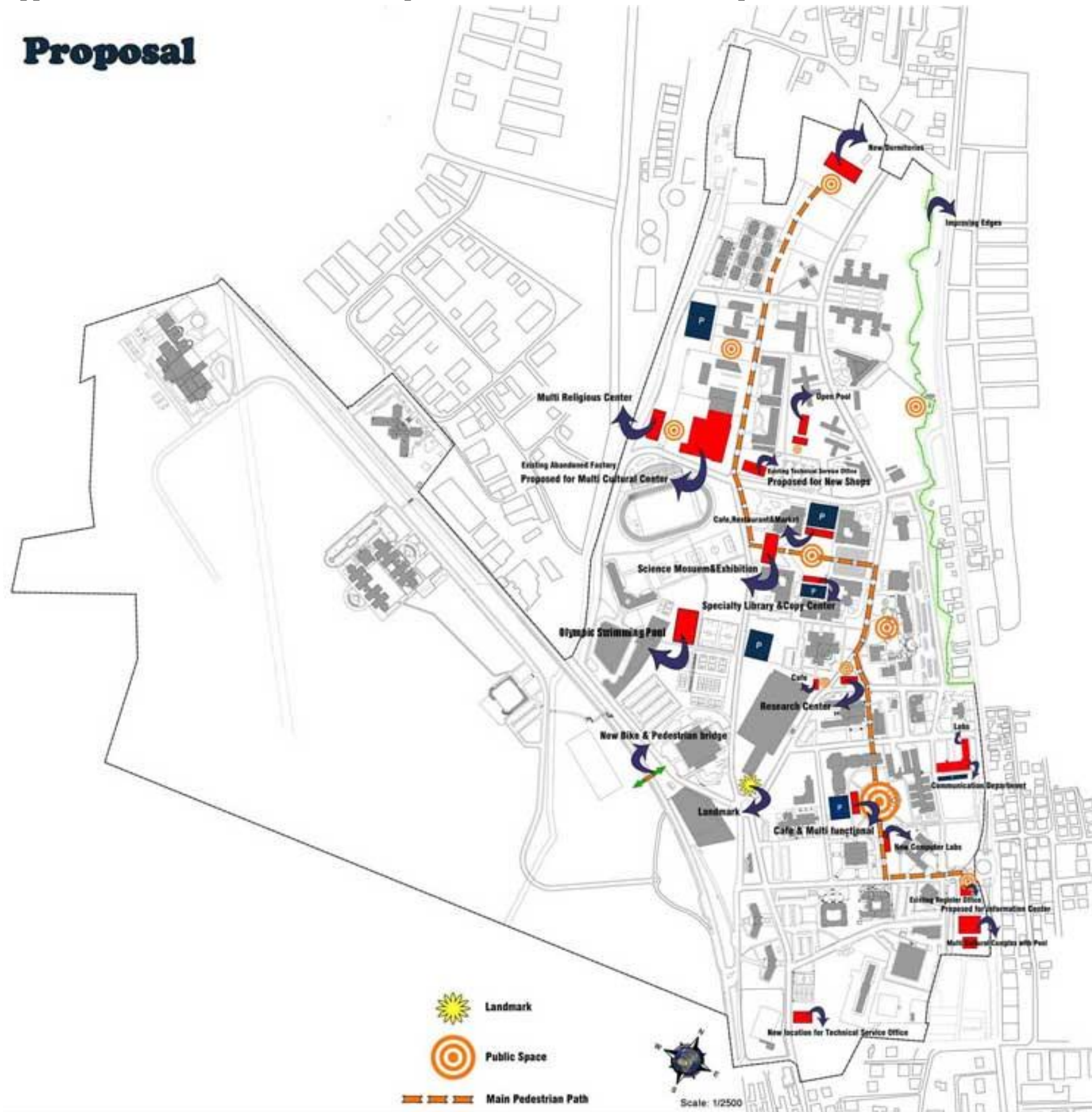
Thanks for your time and support 😊😊😊😊

Appendix B: Sample of Interview

1. Do you have any program to improve the quality of all existing kinds of transportation systems within campus and to/from city?
2. Do you have any idea to add a new transport system to existing transportation systems within campus?
3. Do you have any program to create separate bike lane within campus in future?
4. Do you have any project to create vehicle, pedestrian and bicycle connection between two parts of campus?
5. Do you have any future idea to decrease commute to campus by private car?
6. Do you have any plan to create a main pedestrian way along the campus and also create a pedestrian zone within center of campus?
7. Is there a *Campus Planning Unit* in the University?
8. How are the decisions about any development in Campus being taken?

Appendix C: Master Plan for EMU Campus to Achieve a Sustainable Campus Environment

Proposal



Urban Design Studio 1 (UDES 501) spring 2011



Course Instructors: Prof. Dr. Salim Chal Haskani
Assoc. Prof. Dr. Basim Chirar Yehia
Students: Abdulaziz Daghlas, Nima Housni, Sara Housni, Amir Radwan

Vision

Having a pedestrian and student friendly campus for Eastern Mediterranean University with well-defined and well-functioning public spaces, lively qualified and aesthetic environment.

Aims and objectives based on UD Objectives:

Character

- To improve the gates/entrances of the campus.
- To improve the functional and aesthetic qualities of educational buildings.

Quality of Public Realm

- To have a clear public space strategy for pedestrians.
- To improve the quality of pedestrian paths. (EoM)
- To improve the quality of public open spaces.
- To improve the number and the quality of furnishing elements.
- To enhance gathering areas for students.

Ease of Movement

- To create an efficient and well-designed bike lane circulation.
- To reorganize the traffic circulation.
- To improve the design of existing car parking.
- To propose new car parking areas.
- To re-arrange the existing gates to the campus.
- To propose a an over-bridge between the east and west parts of the campus.

Legibility

- To propose a landmark to increase legibility.
- To create strong edges.
- To design a signage system for whole campus to increase legibility.

Adaptability

- To improve social interaction by creating new function.
- To re-function the existing buildings according to the changing requirements.

Diversity

- To increase functional diversity for public purposes (for students).
- To develop vacant lands for further development.