Acta
Technica
Jaurinensis

Vol. 13, No. 1, pp. 25-41, 2020
DOI: 10.14513/actatechjaur.v13.n1.537
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Study on Relationship between Roles of Public Open Spaces and Pedestrians Inside Campus: Case Studies from Universities in Thailand and Hungary

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Abstract: Public open spaces in campuses are social places for students and staffs. Convenient accessibility both physical and visual is the main factor that attracts people to use these spaces. This article analyses the physical layout of public open spaces through their relationship with the surrounding. The purpose of this study is to compare the relationship between public open spaces and pedestrians in the campuses. The case study conducted in four campuses located in Thailand and Hungary. In order to get the required data, spatial analysis from Geographic Information System and observation survey was employed as qualitative techniques. The study revealed that pedestrian facilities are the most important accessibility types in public open spaces in each campus. The different lengths of pedestrian facilities are related with three factors of campuses' layout. They are the size, surrounding and design elements of the campuses and their public open spaces.

Keywords: *public open space; pedestrian facilities; campus*

1. Introduction

Campuses were defined as both public and semi-public spaces depending on campus access control policy. Campuses have the main role for educating and training students. There are many places inside campuses which are used not only by students and staff but also by the general public, such as a library, cafeteria, gymnasium, public open space, and so on. In any campus, its public open space is a social space with many types and functions. Public open spaces in campus are places for several activities that users can choose by themselves (for example reading, sitting, standing around, chatting, social gathering, waiting, and passing-by). In addition, there are many design elements in the spaces for promoting more convenient, safe, aesthetic, and attractive use by people. Landscapes and streetscapes design are used for developing public open spaces such as trees, fountains, lawns, planting, colourful plants, facilities)for example, benches, bins, lamps, structures and monuments(, natural views, and pedestrian facilities.

Public open space is a necessary component of campuses, but poor access to public open spaces can lead to unused areas, undesirable behaviour, strain on management, and other difficulties. In the following pages, this study analyses the relationship between roles of public open spaces and pedestrians inside campuses and their public open spaces. We analyse four campuses; they are Széchenyi István University in Gyor, Budapest University of Technology and Economics, University of Debrecen, and Thammasat University as case studies of public open spaces in campuses. First, we define the difference of layouts of the campuses. Second, we examine how to get spatial layouts and connections of open public space in the campuses. We also look at basic considerations for designing open public spaces, including comfort and convenience, visual quality, safety, and access. Much of spatial and accessible data is based on Geographic Information System)GIS(and Open Street Map)OSM(because they were the richest information available and up to date. The data from the tools is integrated with the data from sites surveying. We hope to discern the relationship between roles of public open spaces and pedestrians. There are two goals in this study stated as follows; to compare the physical layout of public spaces in the university and to compare the relationship between roles and pedestrian facilities inside the campus.

This study is a part of the doctoral thesis which topic is “An Approach to Promote Creative Urban Public Space for Sustaining Social Identity”. Of course, no town is the same as another, but many share similarities. Since this research is a comparative research between Asia and Europe, the results of the study will be compared the relationship between roles of public open spaces and pedestrians inside campus with case studies from universities in Thailand and Hungary. We should identify the differences in geographical conditions, context and culture, and other situations.

These factors are causing variations of user behaviour and design of public spaces. Ultimately, the goal is to integrate knowledge and to establish recommendations for suitable public spaces in Thailand. Guidelines to build aesthetic urban environment, agreeable with urban lifestyles, will be mentioned and established. These will be recommended for implementation in the relevant sectors of urban spatial usage.

1.1. Public open spaces in campuses

Campuses can be roughly classified in two types: closed and open campus. Both are different for accessibility. Closed campuses always have office hours and the area is surrounded by fence. It is for protection and safety including a definition of the public and private zone [1][2]. Notwithstanding, building the best academic facilities is not enough to foster a well-rounded educational experience. Comfortable and lively public spaces provide informal places in and near campuses that can bring students, faculty, staff, visitors, and the community together [3]. However, public open spaces have no exact function [4][5]. They are adjustable by users. Mostly public open spaces are social places where people interact with each other [6]. They can influence physical activity in at least three ways [7]. First, public open space can be a setting where people engage in physical activities. Second, public open space can be a destination to which people actively travel either to be active or simply to socialize. Finally, public open space can be used as part of a route to pass through to reach another destination (for example, passing through a greenway to reach a shop) or as part of a recreational walk or running route. Hence public open spaces can contribute to different types of physical activities. For example, public open space as a thoroughfare is related to active travel, as a destination to either active travel or recreational physical activity, or public open space as a setting might be related to recreational walking or cycling, running, dog walking, formal or informal sport, or children's active play [7].

1.2. Pedestrian facilities and public open spaces

Access and linkages are the most important factors that make public spaces to be a great place [8]. A good public space network connects the different functions and public spaces of the city and invites people to walk. An attractive pedestrian network offers good climatic conditions and interesting things to look at, inviting people to walk. A comfortable pedestrian landscape has wide sidewalks of high-quality materials. Sidewalks should follow pedestrian desire lines and provide direct routes and direct access to buildings, open spaces and destinations. Sidewalks should be designed so that street furniture, trees, bicycle parking, signage, public transit stops, outdoor servings etc. do not block the area designated for walking. Streetscapes should be thoughtfully and artistically designed to draw more people to walk for both utility and pleasure [9].

Walking is a physical activity in public open spaces [10] [11]. Walking distance standards vary around the world. An individual's willingness to walk varies greatly depending on age, health, time availability, quality of surroundings, safety, climate, and many other factors. The majority of walking studies are for and about commuters. Most people are only willing to walk a quarter mile as part of a commute or approximate 400 meters in a single walking distance [12] [13]. Streets were once a place where people stopped for conversation. In the same time, pedestrian facilities are not only the ways for walking through but also, they are public open spaces. In addition, pedestrian facilities with streetscapes are design elements in public open spaces. These promote to attract people to use public open spaces [14]. They are easy to get to and get through; they are visible both from a distance and up close [14]. Moreover, walking is a green travel mode that is beneficial to the environment and the economy and can promote the health of campus users [15]. Previous research has mostly focused on using pedestrian facilities in campuses. Planners and designers are concerned with walking conditions to solve many problems (for example, global warming, health problems, energy consumption, air pollution, etc.). For instance, in Kasetsart University, walking is the third most frequent travel mode after private cars and public transport [16].

Pedestrian facilities in public open spaces are the basic tools of accessibility. Walking is the suitable type of connections for campuses because it makes no cost, promotes safety, leads to healthier life, and makes more communities. Paths are the elements that can help people to get the most sense of places [17].

2. Material and Methods

This study is a qualitative research by site surveying in four campuses which are located in Thailand and Hungary. Széchenyi István University, Gyor; Budapest University of Technology and Economics, Budapest; and University of Debrecen, Debrecen are three case studies in Hungary. Thammasat University is the one case study in Thailand. The methods of this study are divided into five steps leading to the result. They are: Subject specification, Literature review, Data collection, Data analysis, and Conclusion. The framework of the research is shown in Figure 1.

a(The study on the relationship between roles of public open spaces and its connections inside campus: The case study of the universities in Thailand and Hungary. There are two goals in this study as follows:

- To compare physical layouts of the campuses
- To compare relationship between roles and pedestrian facilities inside the campus

b(Literature review collects secondary data relating to concepts and theories concerning public open spaces and connections in campuses. The data come from many sources and features; they are editorial online papers, maps, pictures, spatial analysis from Geographic Information System)GIS(and Open Street Map)OSM(.

- Public open spaces, assessing the importance of public open spaces in the campus, character, pattern, size, shape, and type of public open spaces.
- Connections, consisting of roads for vehicles and pedestrian facilities in the campus and public open spaces, and the relationship between public spaces' layout and its pedestrian facilities.

c(Data are collected from site observations; the data are related to connections and convenience in public open spaces. Dependent variables are the layouts of the campuses and their public open spaces, surrounding, size, types of connections, and length of connections.

d(The analysis uses illustration by sketching and plotting zones, including analysis tools. They are Geographic Information System (GIS) and Open Street Map)OSM(.

- Illustration: This research applies this method for describing space from site observations. All primary data are managed by sketching and plotting on maps for easy clarification of the space.
- Spatial analysis: This research applies GIS (Geographic Information System) and Open Street Map)OSM(for spatial analyses to define types of connections. Furthermore, land use, roads for vehicles, and other characteristics of space are analysed.
- From section 3, we will get layouts of the campuses with spatial and accessibility details. They are location and surrounding, areas, the length of roads for vehicles and the length of pedestrian facilities.

e(Verification of this research is comparing the ratio of the length of connections per area in four campuses. They are the ratio of the length of road for vehicles per campus areas, the length of roads for vehicles per public open space areas, the length of pedestrian facilities per campus areas, and length of pedestrian facilities per public open space areas.

f(The conclusion of this research will be representing the relationship between roles and pedestrian facilities inside the campuses.

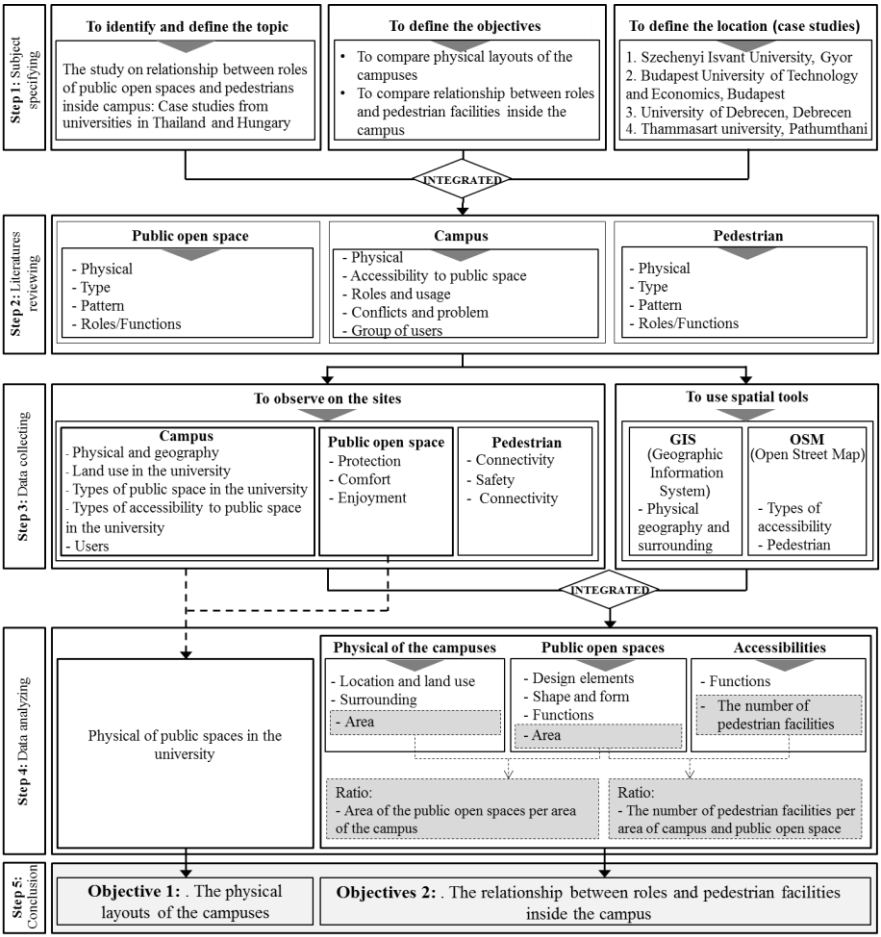


Figure 1. The framework of the study

3. Results and Discussion

3.1. Physical layouts of the campuses

The layouts of the campuses can be divided into two types by their location. In the first group, campuses were located in or near the city are Széchenyi István University and Budapest University of Technology and Economics. In the second group, the campuses were located far from the city with the cloistered environment like

Thammasat University and the University of Debrecen. Moreover, the campuses are different in size of the area and in the character of planning.

Referring to the following layouts of the campuses in Figure 2., it is visible that Széchenyi University and Budapest University of Technology and Economics are small and medium size of campuses. Both are located within a kilometre radius of the city. The campuses are surrounded by groups of residential and commercial land use with dense buildings. On the other hand, Thammasat University and the University of Debrecen are the two with the largest area, with big public open spaces. They are located far away from the city and surrounded by big open space. Both campuses have the character of a small town with facilities such as shops, banks, etc.

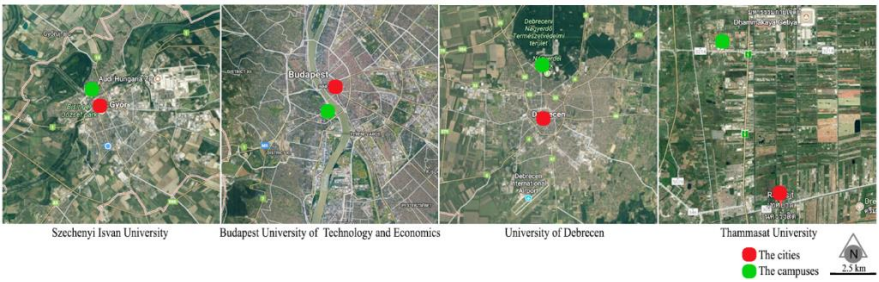


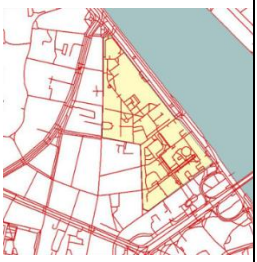
Figure 2. The layouts of the campuses

In terms of publicness and privacy, Széchenyi István University is the only one campus in the study that is a fully public space because it has no fences. Public open spaces inside the campus are always open. In addition, the campus connects to Mosoni Danube River on the West side. It is a big recreation park and beach where people can walk through from the public open space into the campus. On the other hand, Thammasat University, The University of Debrecen, and Budapest University of Technology and Economics are semi-public spaces or closed campuses. They are surrounded by fences and they are opened or closed by official hours. The main user of the campuses and their public open spaces are students and staff.

The layouts of the campuses containing the different connections and public open spaces are shown in Table 1.

The public open spaces in each campus have different physical outlines. They are distributed in many locations in campuses and they have also many shapes. For instance, there are big public open spaces connecting academic buildings, some are small and are surrounded by other places, or they are green areas as a greenbelt boundary. The differences of these public open spaces are various the identities or characters of the spaces.

Table 1. Layout and plans of the campuses

	Layouts	Connections	Public open spaces
Széchenyi István University Gyor			
Budapest University of Technology and Economics			
University of Debrecen			
Thammasat university (Rangsit campus), Pathumthani			

Public open spaces in Thammasat University and the University of Debrecen are big open spaces. They are located at the edge of the campus and they are separated from the building zones by roads for vehicles which is the main accessibility to the

public open space. Public open spaces in Széchenyi István University and Budapest University of Technology and Economics are located in the center of the campus areas. The public open spaces are surrounded by groups of buildings and also connected to the buildings by pedestrian facilities. The design elements are related with the use of these public open spaces. They are street furniture in public open spaces and landscape design for promoting comfort and convenience for users. There are trees, lawn, planting, colorful plants, facilities, natural views, pond, and so on. The main activities here are reading, sitting, standing around, chatting, social gathering, waiting, and passing by. The design elements in public open spaces and activities in each public open space are rather similar in the four campuses as shown in Table 2.

3.2. Relationship between roles and pedestrian facilities inside the campus

3.2.1. Pedestrian facilities in the campuses and their public open spaces

- Road for vehicles in the campuses

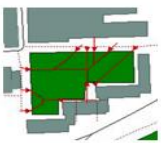
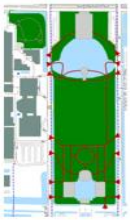
The lengths of the road for vehicles in Széchenyi István University, Budapest University of Technology and Economics, University of Debrecen, and Thammasat University are 1,518 m., 1,564 m., 10,996 m., and 44,609 m. respectively. Széchenyi István University and Budapest University of Technology and Economics have no roads for vehicles in their public open spaces. The lengths of the roads for vehicles in public open spaces in University of Debrecen and Thammasat University are 799 m. and 682 m. respectively.

Thammasat University has the highest ratio of the length of road for vehicles per square meter. It is 0.036)m./sq. m.(. Széchenyi István University and the University of Debrecen have approximate ratios. They are 0.017)m./sq. m.(and 0.015)m./sq. m.(respectively. Budapest University of Technology and Economics has the lowest ratio of the length of roads for vehicles per square meter. It is 0.005)m. /sq. m.(.

- Pedestrian facilities in the public open spaces

The lengths of pedestrian facilities in Széchenyi István University, Budapest University of Technology and Economics, University of Debrecen, and Thammasat University are 1,469 m., 5,141 m., 4,179 m., and 26,013 m. respectively. The lengths of pedestrian facilities in their public open spaces are 297 m., 667 m., 1,784 m., and 3,061 m. respectively.

Table 2. The environment and functions of the campuses

	Public Open Spaces	Surroundings and shape	Public open spaces and its connections	Design elements	Main activities
Széchenyi István university, Gyor				Trees Lawn Planting Colourful plants Facilities Natural views	Reading Sitting Standing around Chatting Social gathering Waiting Passing – by
Budapest University of Technology and Economics, Budapest				Trees Fountain Lawn Planting Colourful plants Facilities Natural views	Reading Sitting Standing around Chatting Enjoying scenery Social gathering Waiting Passing – by
University of Debrecen, Debrecen				Trees Fountain Lawn Planting Colourful plants Facilities Natural views	Reading Sitting Chatting Enjoying scenery Social gathering Waiting Passing – by
Thammasat university, Pathumthani				Trees Ponds Lawn Planting Colourful plants Natural views	Sitting Standing around Chatting Enjoying scenery Social gathering Waiting

- Ratio of length per area

The ratios of the length of roads for vehicles per campus areas of Széchenyi István University, Budapest University of Technology and Economics, University of Debrecen, and Thammasat University are 0.017 m., 0.005 m., 0.006 m., and 0.036 m. respectively.

The ratios of the length of roads for vehicles per public open space areas in University of Debrecen and Thammasat University are 0.004 m., and 0.003 m. respectively. Széchenyi István University and Budapest University of Technology and Economics have no this ratios because they have no roads for vehicles in their open spaces.

The ratios of the length of pedestrian facilities per campus areas are 0.016 m., 0.016 m., 0.006 m., and 0.021 m. respectively. And the ratios of the length of pedestrian facilities per public of open space areas are 0.057 m., and 0.053 m., 0.009 m., and 0.016 m. respectively (Table 3.).

3.2.2. The comparison of length and ratio of connections in the campuses.

Referring to Table 3, the comparison of spatial and accessibility details of the campuses are as follows:

- Széchenyi István University has the smallest areas, related both the campus and its public open space. Moreover, the campus has the shortest connections both road for vehicles and pedestrian facilities. On the other hand, the campus has the highest ratio of the length of pedestrian facilities in public open space per public open space area.
- Budapest University of Technology and Economics has the second smallest areas both the campus and its public open space. At the same time, the campus has the lowest ratio of the length of road for vehicles in the campus per campus area.
- University of Debrecen has the longest roads for vehicles in the public open spaces. Consequently, the campus has the highest ratio of the length of roads for vehicles in the public open space per public open space area. It has also the lowest ratio of pedestrian facilities per area related both the campus and the public open space area
- Thammasat University has the biggest area, related both the campus and its public open space. The campus has the longest roads for vehicles in the campus area. It has also the longest pedestrian facilities in the campus and in public open space areas. Moreover, the campus has the highest ratio of the length of roads for vehicles in the campus per campus area including the ratio of pedestrian facilities in the campus per campus area.

Table 3. Length and ratio of connections in the campuses

Campus	Area (sq. m.)		Length (m.)				Ratio (m. / sq. m.)			
			Road for vehicles		Pedestrian facilities					
	(A) Campus	(B) Public open space	(C) In the campus	(D) In the public open space	(E) In the campus	(F) In the public open space	(C)/(A)	(D)/(B)	(E)/(A)	(F)/(B)
Széchenyi István University, Győr	**90,297***	**5,255***	**1,518***	**0***	**1,469***	**297***	0.017	**0***	0.016	**0.057****
Budapest University of Technology and Economics	315,000	12,647	1,564	**0***	5,141	667	**0.005***	**0***	0.016	0.053
University of Debrecen	739,232	189,480	10,996	**779****	4,179	1,784	0.015	**0.004****	**0.006***	**0.009***
Thammasat University, Pathumthani	**1,225,235 ****	**196,027****	**44,609****	682	**26,013****	**3,061****	**0.036****	0.003	**0.021****	0.016

Note: X* = the lowest number, X** = the highest number

In conclusion, each public open space has pedestrian facilities longer than the road for vehicles. Széchenyi István University has the most pedestrian facilities in public open space. Following the forerunner, the ranking is: Budapest University of Technology and Economics, Thammasat University, and University of Debrecen. We can notice that the length of road for vehicles is related to the layouts of the campuses. Several campuses have long roads for vehicles, as seen in Thammasat University and University of Debrecen. Moreover, the character of building location is one of the factors that affects the length of roads for vehicles. If buildings or public open spaces in the campuses are connected with each other, the length of roads for vehicles will be small. On the other hand, the length of pedestrian facilities will be high. As shown in this study, Budapest University of Technology and Economics has many groups of buildings. They are located close to each other; some are even connected to each other. The lengths of roads for vehicles in the campus and in its public open space are shorter than in the other campuses. Therefore, the ratios of the roads for vehicles per the campus area and its public open space area are the lowest. They are only 0.005)m./sq. m.(and 0)m./sq. m.(respectively as shown in Table 3. Particularly, Széchenyi István University has only pedestrian facilities in its public open space. In addition, Széchenyi István University has the highest ratio of pedestrian facilities in public open space per public open space area. It is 0.057)m. /sq. m.(as shown in Table 3.

It was found that the different lengths of pedestrian facilities are related to the layout of the campuses and the functions of their public open spaces. Pedestrian facilities are the main connections to public open spaces. The spatial arrangement of pedestrian facilities is influenced by the following three factors (Figure 3).

a) The size of the campus and its public open space: Pedestrian facilities are good for connecting buildings and public open spaces in acceptable distance for humans. Because a single walking distance standard for all situations is 400 meters, thus the smaller the areas, the closer the distance the pedestrians are using. On the other hand, the bigger the areas, the longer are the distances. In this case, the road for vehicles is important to connect buildings and public open spaces.

b) Surrounding of the campus and its public open space: Design and planning zones, groups of buildings, and public open spaces in the surrounding are affecting the types of connections. If the surrounding it built-in, pedestrian facilities will be created. Furthermore, a short distance between buildings and public open spaces is attracting people to walk because of building shadow.

c) Design elements: All four public open spaces in the campuses have elements of landscape designs. They promote safety, comfort, and convenience to users for using the spaces including supporting the aesthetic in public open spaces.

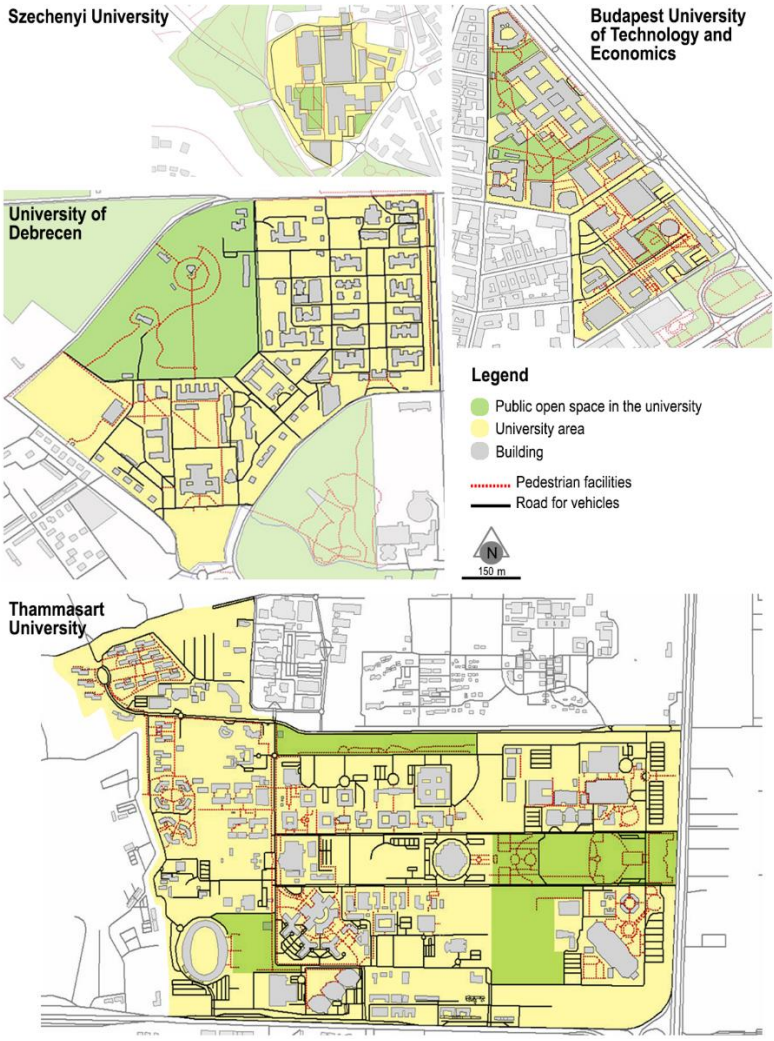


Figure 3. Land use and connections in the campuses

4. Conclusions

Campuses are important places to students and staff, including the community around the campuses. Consequently, layout and planning of campuses should match with the context and the surrounding. The open space also creates a pedestrian precinct that is connected by circulation pathways through which the students and staff pass in their movement from parking, walkways, and buildings. Pedestrian facilities are the main means of mobility to public open spaces in the campuses. These facilities are related to the different layouts of the campuses including the size of the campus and its public open space, the surrounding the campus and its public open space, and its design elements.

This study only used site surveying and spatial analysis data from Geographic Information System)GIS(and Open Street Map)OSM(. For future study, questionnaires will be used for collecting information about user's behaviors and preferences. The relationship between the layout and the usage will add more value to the study.

Acknowledgement

This study was supported by Erasmus+ student mobility between Programme and Partner Countries grant)16/1/KA107/022781-4(. We thank our colleagues from Széchenyi István University who provided insight and expertise that greatly assisted the research.

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