Legibility and Connectivity in Campus Areas: Case of Karadeniz Technical University

Doç.Dr. Yelda Aydın TÜRK

Karadeniz Technical University, Department of City and Regional Planning, Trabzon, Turkey
aydinturkyelda@gmail.com

Arş.Gör. Beyza KARADENİZ

Karadeniz Technical University, Department of City and Regional Planning, Trabzon, Turkey
senbeyazz@gmail.com

Öğr.Gör. Ayşegül ÖZYAVUZ

Karadeniz Technical University, Department of Architecture, Trabzon, Turkey
ahanedan@yahoo.com

ABSTRACT

Successfully designed campuses help to balance university's academic, research and service missions with its educational services and raise learning performances. High level of design and planning service has close relation with campus legibility. Kevin Lynch, one of the leading theorists, did several research on legibility used cognitive mapping as a tool and defined five fundamental legibility elements, has been widely used in design research.

In this study, Black Sea Technical University is selected as the research area and its legibility level has determined. Aim of this study is to define the legibility level of the campus by students' perceptions. In this context, Lynch's five fundamental legibility elements directed students to generate cognitive maps of the campus, and each student's perception level on campus area is determined. Additionally, integration levels of the areas in the campus will b

Respondent group include students from Architecture, and Urban and Regional Planning departments. End product is the analysis of the cognitive maps, produced by each student, based on legibility elements. Cognitive map of the campus has created, and the legibility level of the campus is determined. Following, the results are classified as the areas with high, medium and low cognition. Furthermore, depth maps and integration levels of the Campus will be analyzed in depthmapX application to compare the results

with the cognitive maps. Finally, possibility of raising university's educational and research activities through design are discussed.

Keywords: Campus Planning and Design, Legibility, Cognitive Maps, Space Syntax, Connectivity Analysis

ÖZET

İyi tasarlanmış kampüsler, üniversitenin akademik, araştırma ve hizmet misyonunu destekler ve eğitim hizmetlerini ve öğrenme performanslarını artırmaya yardımcı niteliktedirler. İyi bir tasarım ve planlama hizmeti alan kampüs alanları ile bu alanlarının algılanabilirliği /okunabilirliği yakından ilişkilidir. Okunabilirlik çalışmalarının başında gelen teorisyenlerden Kevin Lynch, kentlerde algı haritaları yöntemi ile pek çok çalışmalar gerçekleştirmiş ve beş temel okunabilirlik elemanı tanımlamıştır.

Bu çalışmada, Karadeniz Teknik Üniversitesi Kampüsü çalışma alanı olarak belirlenmiştir. Çalışmanın amacı kampüsün okunabilirlik düzeyini öğrencilere çizdirilen algı haritaları üzerinden saptanmasıdır. Bu bağlamda, Lynch'in tanımladığı beş temel okunabilirlik elemanı kullanılarak öğrencilere bireysel algı haritaları çizdirilmiştir. İmaj haritaları analizine Mimarlık ve Şehir ve Bölge planlama bölümlerinden toplam 299 öğrenci katılmıştır. Öğrencilerden derlenen algı haritaları analiz edilerek bir sentez harita geliştirilmiştir. İmaj haritalarına ek olarak, mekan dizimi analizi de kullanılmıştır. Bu bağlamda, kampüsün erişilebilirlik analizleri yapılarak, yol sisteminin bağlantı düzeyleri saptanarak elde edilen veriler kampüs geneli bağlamında değerlendirilmiştir. Elde edilen sonuçlar neticesinde kampüste yüksek, orta ve düşük düzeylerde algılanan alanlar belirlenmiştir. Erişilebilirlik analizleri de incelenerek algı haritaları ile karşılaştırılmıştır. Sonuç olarak, üniversite genelinde daha yaşanabilir ve okunabilir alanların oluşumuna yönelik tasarım önerileri geliştirilmiştir.

Anahtar Kelimeler; Kampüs Planlaması ve Tasarımı, Okunabilirlik, Algı Haritaları, Mekan dizimi, Erişilebilirlik Analizi

1. INTRODUCTION

The environmental quality and livability of the campus areas, where college students with diverse cultural, ethnic and social backgrounds live and study, are significant facts as they contribute to students academic and social activities. Thus, well designed and planned campus areas may raise awareness among faculty, student body and employees. Universities hold an important role for its surroundings. Environmental quality and livability factors of a place affect individual's level of perception of that place.

Knowing the facts how people perceive physical environment, helps the designers to understand user habits and helps to create more perceptible and memorable places. Initial perception and image mapping studies are done by architect Kevin Lynch in 1960.

Lynch observed environment and the habitual properties of the user and defined five elements that people mainly observe. He outlines roads, nodes, edges, landmarks and district as the elements that people store in their minds, then created cognitive maps. Others, as Erickson and Moughtin, agreed that cognitive maps are powerful tools to understand the place through inhabitants' minds. By using various methods for generating cognitive maps, researchers studies perception and representations of places. For instance, Lynch explores the cities of Boston, New Jersey and Los Angles, asks residents (different age, gender...) to draw the city map, and generated cognitive maps of these cities.

Observers draw the paths based on their cognition of different roads, footpaths, railways and walkways. Paths can often be the strongest cognition elements in people's mental maps. Landmarks are usually defined as a simple physical object, such as a church spire, a tower, a dome or a hill (Lynch, 1960). Landmarks are generally point of references that are tall and visible. They can either be local or distant. The more familiar a journey is, the more frequent local landmarks are noticed and used.

Edges are linear elements not used or thought as of routes. They may either join two recognizable areas as a seam, or may act as a barrier between recognizable area. Edges may take the form of intensely busy roads, routes, cuttings
and streams (Figure 1).

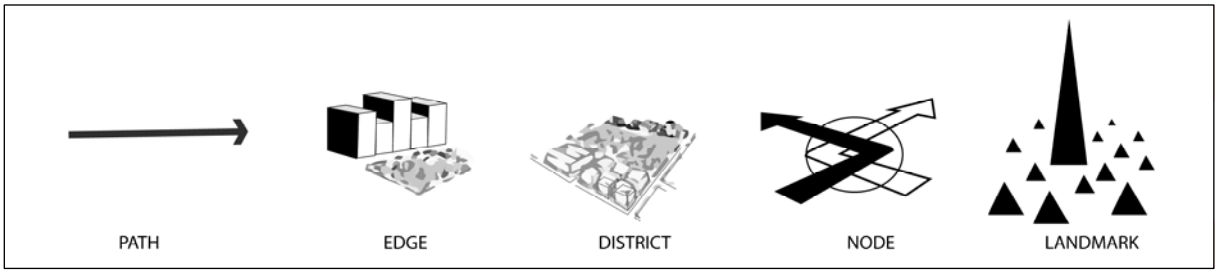

Figure 1. Elements of urban image (Lynch, 1960)

Districts are medium to large areas of a city which the observer walks into and have an identifiable set of characteristics. These might be related to use or architectural style. A district can be defined by its limits. Some people organize their mental maps around districts rather than nodes. A node is a point to or from which an observer might be travelling. Nodes are generally places of some type of activity. They can characteristically

be a major junction or gathering places. In some districts a node can provides a concentration of activities, so that the node becomes the core of that district (Figure 1).

It is not easy to distinctly separate each of these defined elements. Districts accommodate nodes, defined with the edges, divided with the roads and attract with the landmarks. In order one to locate himself in a place and develop a sense of belonging, he should identify the edge, the roads and connections, signs and nodes of the area. This method can be applied in different scales to various urban areas, such as University Campuses. In the recent years, use of computer aided applications become a common method. Space syntax, developed by Bill Hillier in 1970, presents a overall theory of how people relate to space in built environments. This method is also a powerful tool for studying use and legibility of spaces. In this study, legibility level of Karadeniz Technical University Campus is determined and the image of campus is produced by the students. In addition to image maps, space syntax analysis used in this study. The Connectivity analysis is produced to understand the accessibility level of the road system. As a result, the image maps, that created by students and the connectivity maps are compared and discussed.

2. METHOD

Mental and cognitive mapping is a widely used method by various disciplines. Cognitive map is defined as, true values that individuals observe and a series of stored hypothesis array in their surroundings (Lyoyd, 1997).

The study area is the Kanuni Campus of Karadeniz Technical University (KTU). 299 students from Architecture and City and Regional Planning Departments participated in the study. Fundamental legibility principles and elements established by Kevin Lynch (1960) are used to determine how the selected students generate cognitive maps of the campus. Students are asked to draw and mark the edges, districts, roads, nodes and landmarks on the plan, based on their personal perceptions. An overall image map of the campus is generated as the result of the analyses of students' cognitive maps. In addition, outcomes of space syntax analyses represents the accessibility level of the paths in the Campus. The result of connectivity analyses and the students' interpretations are compared in terms of accordance and relations.

3. FINDINGS

This part is a summary of the findings. Each of students results analyzed individually in terms of Lynchian legibility elements. Student's cognitive maps are collected and the outcomes combined into individual maps and graphs.

3.1. Edges

There are various number of edges defined by students. The results shows that some edges are more recognizable than other edges. As shown in Figure 2, four edges identified the most among students. The highest rated *Edge 6*, recognized by %39 (n=117) and consist of departments, dormitories and housing units (Figure 2, 3).

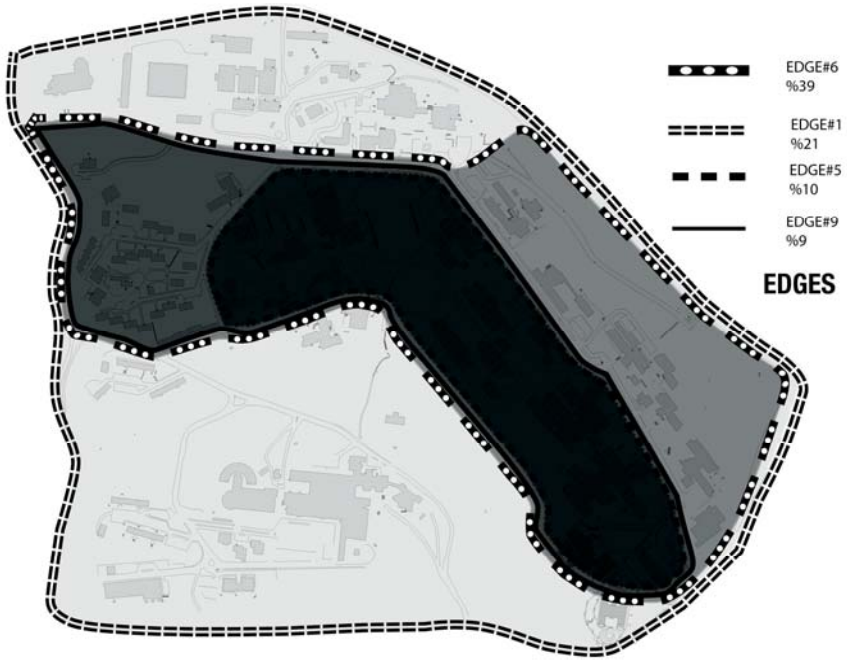

Figure 2. Map Showing the Edges Defined By Students

The second most recognized edge is the *Edge 1*, drawn by %21 (n=62) that overlaps the Campus property. Edge 5, is the south part of the campus that covers the engineering and architecture departments, the business school and the dormitories and recognized by %10 (n=30) of the students. Additionally, Edge 9 is drawn by the %9 (n=27) and includes the housing area, departments, and dormitories (Figure 2, 3).

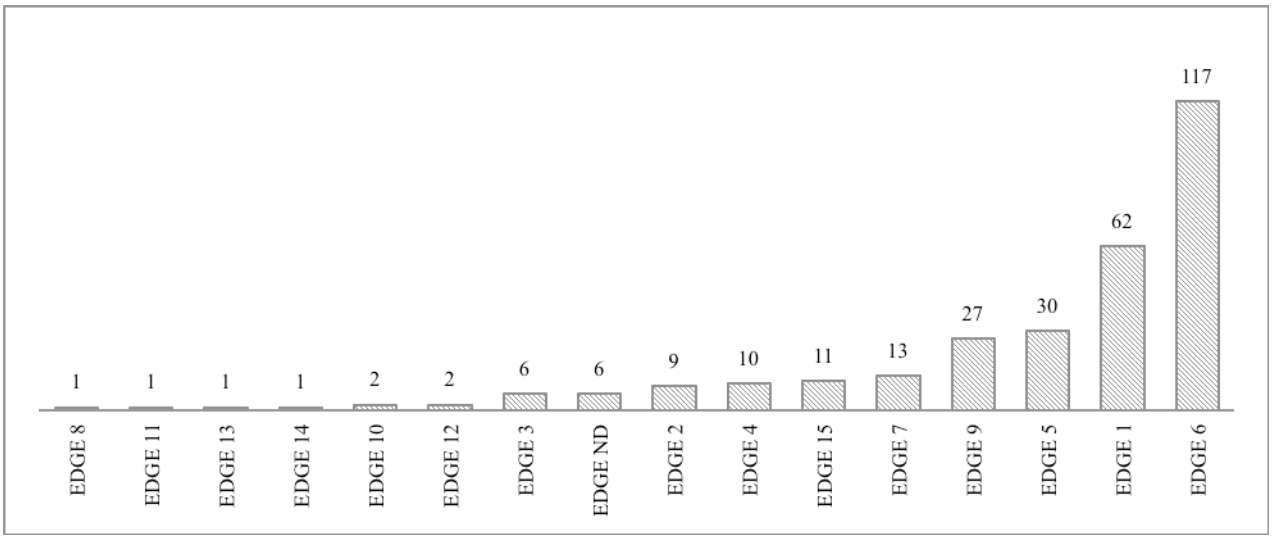

Figure 3. Frequency of Edges

As it is shown in Figure 2 almost one fifth of students can define Edge 1, the true campus property. Accordingly, Edge 6, which includes schools, commercial areas, dormitories and housing for faculty is the most recognized edge. These are the busiest places of the campus, therefore, Edge 6 is highly perceived and used area in the campus. The areas outside of Edge 6 are either not easily accessible as medical campus due to harsh topography or areas serve no daily activity.

3.2. Districts

12 main districts are defined based on collected data. These districts are; trails & green areas, architecture & engineering departments, business school, medical school, housing areas, dormitories, sports and recreational areas, commercial areas, convention center, social areas, administrative and cultural amenities, college of geography, department of science and department of letters. The most recognized districts among given list of areas are; dormitories %51 (n=151), housing %43 (n=130) and, administrative and cultural amenities %39 (n=117) which are highly used by the student body (Figure 5).

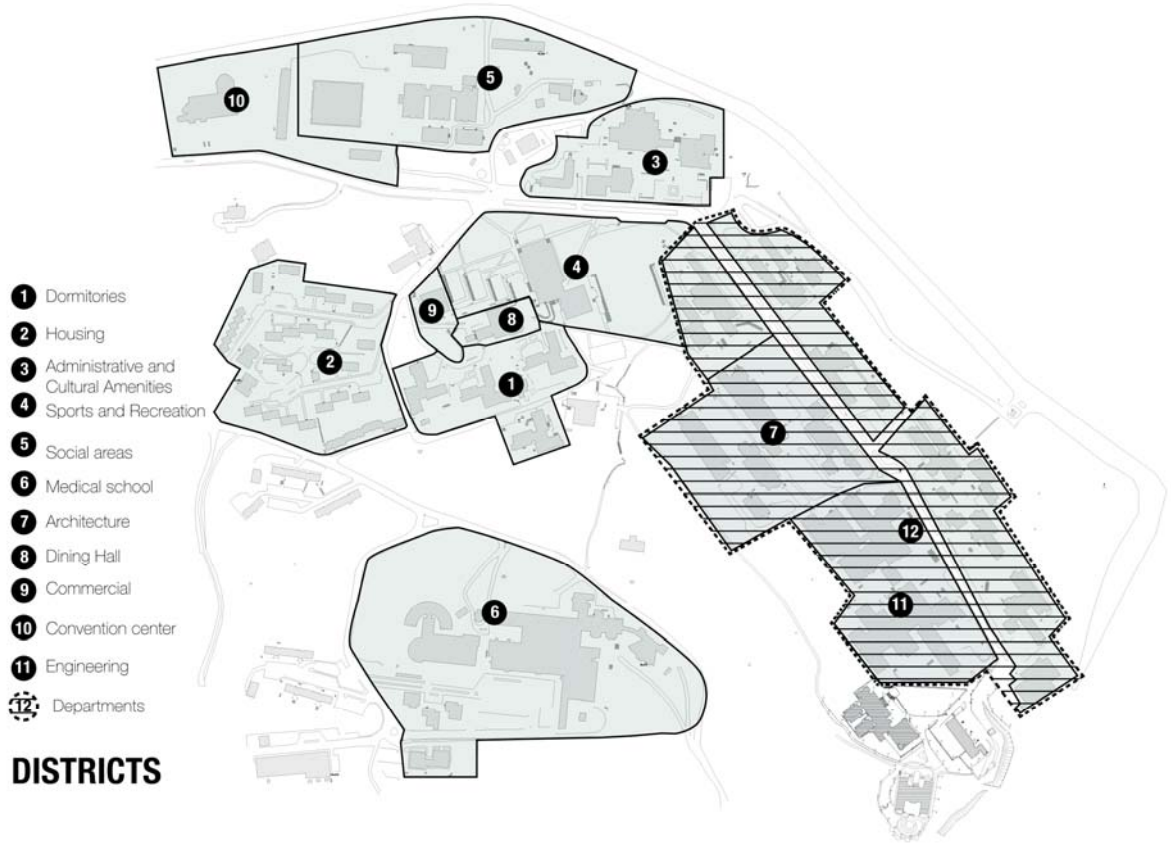

Figure 4. Map Showing the Districts

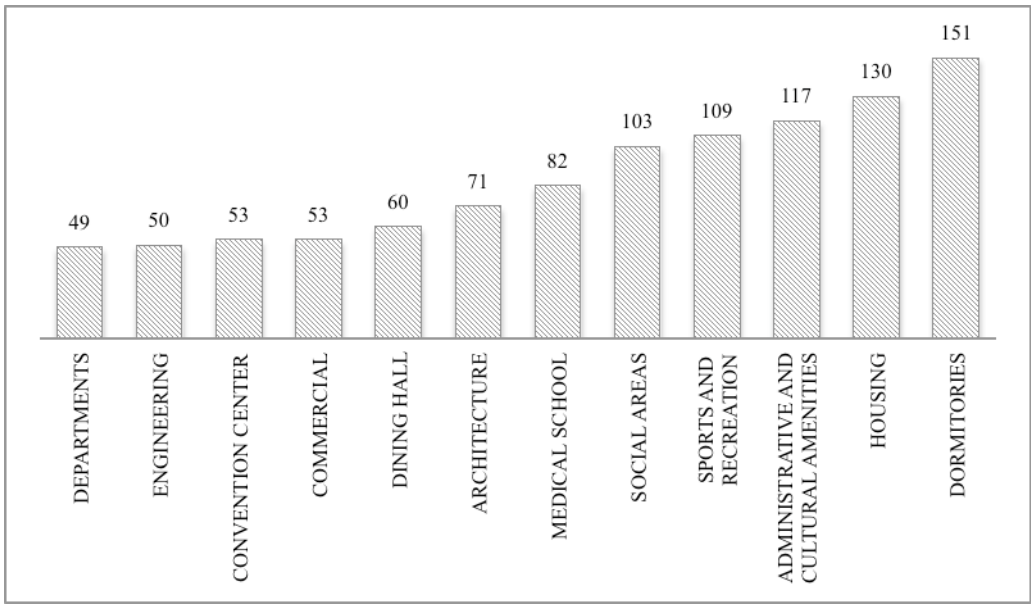

Figure 5. Frequency of Districts Defined by Students

As it is shown in Figure 4, students defined various districts. However, the districts do not cover homogenous areas. Particularly, edge 12 is a good example to this situation. This district contains dissimilar departments such as architecture, engineering and school of

social affairs. Accordingly, students define subareas within these districts. In contrary, the area where dormitories and other social and commercial units located, is defined as a well-defined district

As a result, small areas that contain various functions are better clarified by students (Figure 5).

3.3. Nodes

22 Nodes are identified by students. Results show that courtyards of significant buildings (library, school of architecture,) stops (shuttle and bus stops), gates (gate a and gate b) and social areas are defined as the most recognized nodes. Library courtyard %54 (n=161), architecture courtyard %40 (n=120) shuttle stop %40 (n=119), and social area %37 (n=111) are the highly defined by the students among the 22 nodes (Figure 6). Nodes are mainly located on the main arterials. There are also small nodes identified in front of the institutional buildings for public use such as mosque, stadium, (Figure 7, 12).

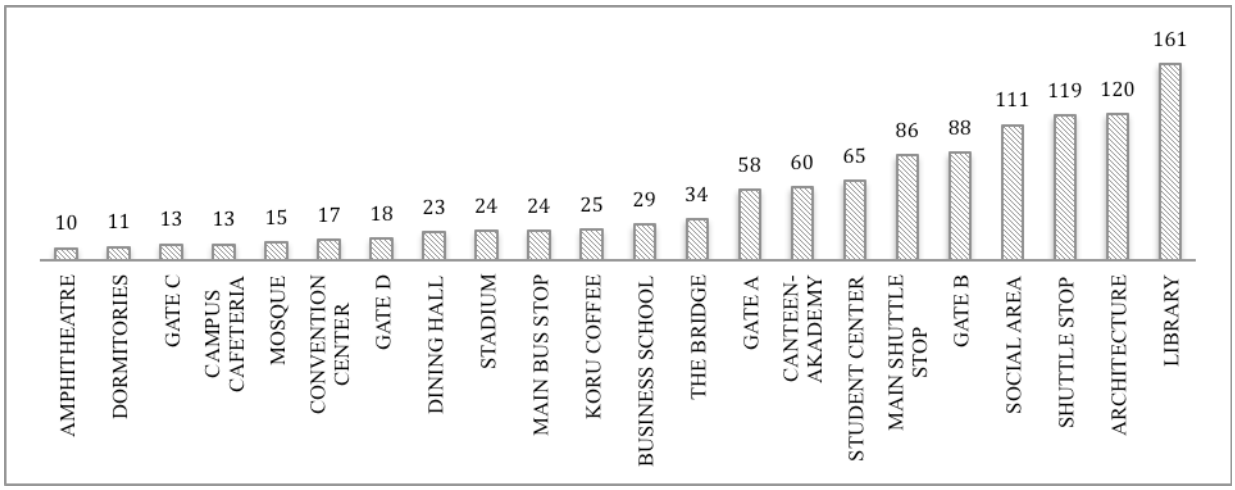

Figure 6. Frequency of Nodes

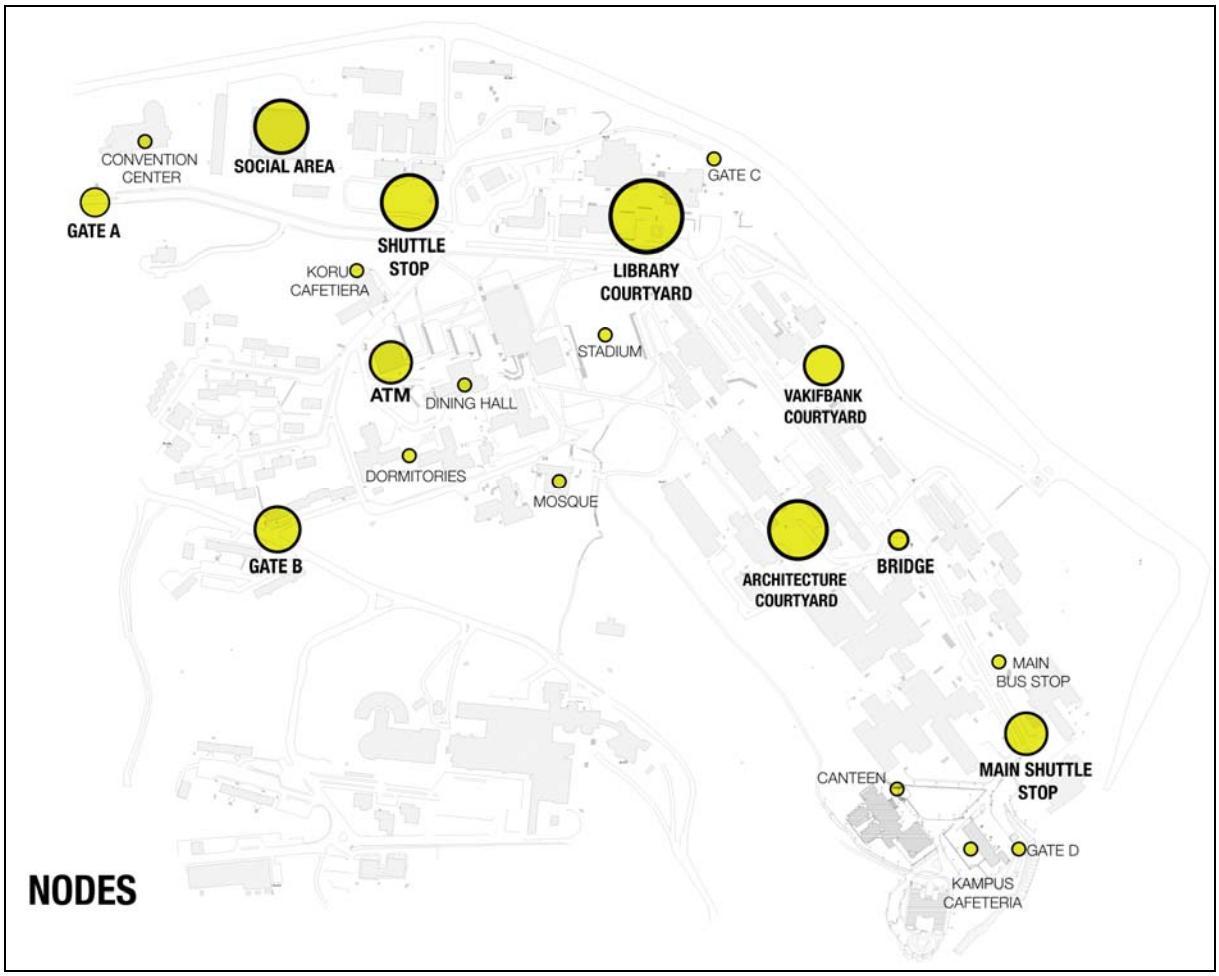

Figure 7. Map Showing the Highly Recognized Nodes

3.4. Landmark

Based on the analysis 19 landmarks are defined. Most marked landmarks are significant buildings (library) monuments, social areas, gates and landscape features (Figure 8, 9). The most important landmarks are the monuments; monument at the library courtyard %58 (n=173) and monument by the shuttle stop %32 (n=96). Additionally, social area is recognized by 111 students (%37) as an important landmark and bridge on the main arterial %33 (n=99) (fig 8).

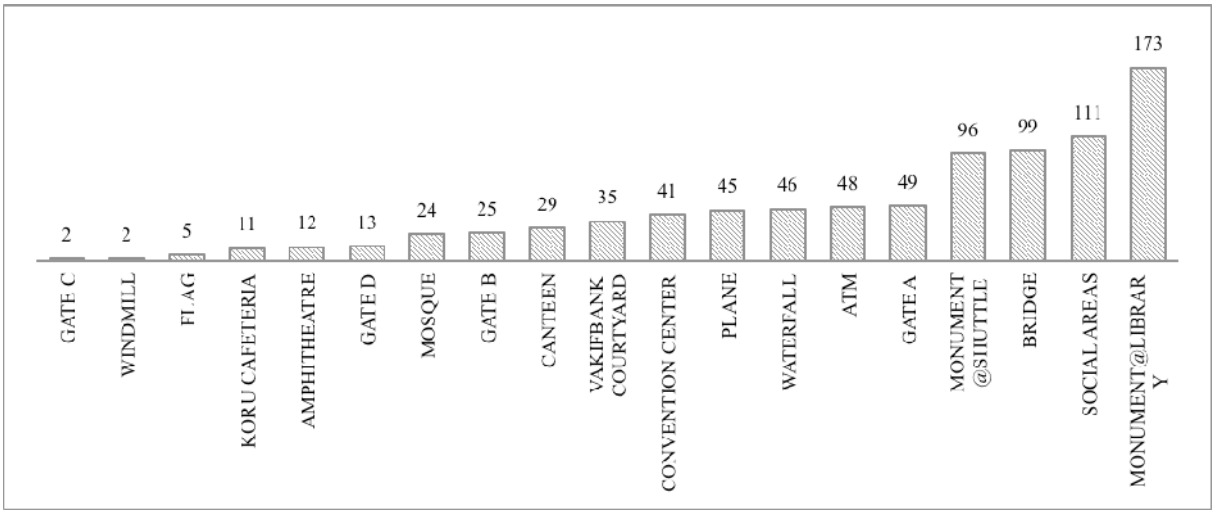

Figure 8. Frequency of Landmarks

As shown on the map below, majority of the landmarks are located on the main arterial (Figure 9). Similar to Nodes, landmarks are also located on the main arterials and overlap with the significant Nodes (Figure 7, 13).

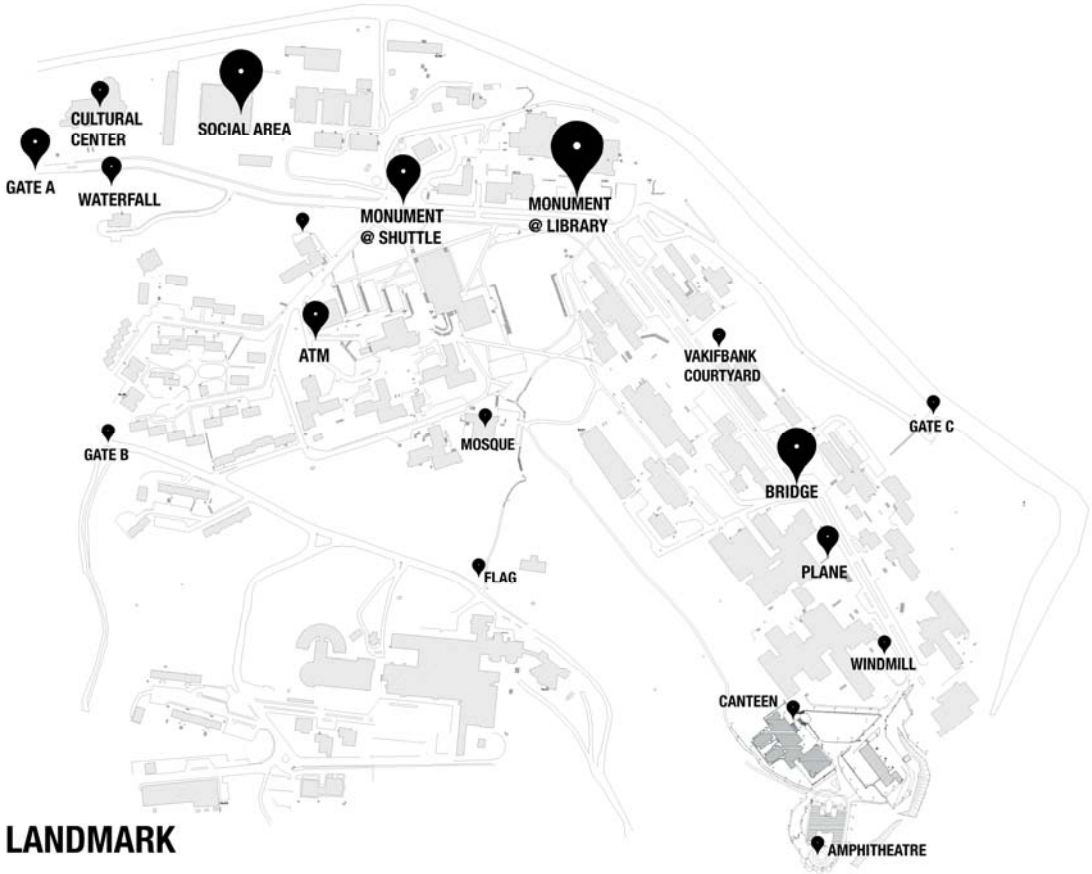

Figure 9. Map Showing the Locations Of Perceived Landmarks

Figure 10. Landmarks (URL 1-2, 2015)

3.5. Paths

The Figure 11 is a summary map of collected data from student cognitive maps, showing the important and less important roads and connections in KTU Campus. The map represents the primary roads with a thick continuous line. Gradually the secondary roads are drawn with thin and dashed lines. According to students, primary roads of the campus that carry the most vehicular and pedestrian traffic have the highest degree of perception (Figure 11). Additionally, some pedestrian streets are highly recognizable. Because they provide easy access and shortcuts to distribution points (gates, bus stops and exits).

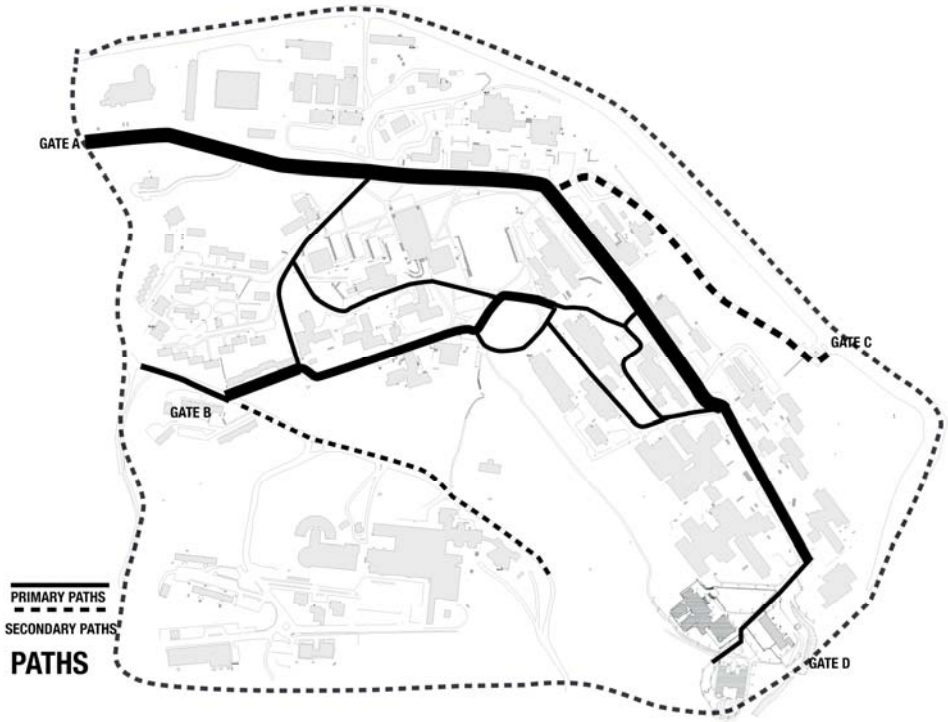

Figure 11. Map Showing the Perceived Paths

The connectivity analyses processed in Space syntax also represents similar results as students cognitive maps. According to the analysis, main arterial, which carry the most vehicular and pedestrian traffic, is the primary path (Figure 12). Because main arterial is the widest road in the campus that has a linear geometry and multiple junctions.

Figure 12. Connectivity Analysis of Campus

On the other hand, based on connectivity analysis produced in space syntax, pedestrian ways drawn by students that provide short cut access to departments and dormitories are not syntactically accessible. The software overlook these features since it bases analysis to the geometry and functional formulas. The user preferences and opinions should be considered, thus these paths are important in the sense of campus accessibility and pedestrian connections. It is important to improve the accessibility of the roads that has high level of perception. Thus, better access to departments and other facilities can be provided. The results support that, while designing and planning urban areas such as campuses, spatial analysis should be intensified with such studies.

4. DISCUSSION AND CONCLUSION

Figure 13 displays the produced campus image map as the study of student's drawings. Campus has a certain level of perception. Different students perceive edges, districts,

important nodes and landmarks differently. Edges could not be defined clearly, therefore some unidentifiable areas left empty. The important landmarks and nodes are located on the main arterials where both students' drawings and connectivity analysis reveal as primary paths. Additionally, it is clear that significant nodes accommodate highly perceived landmarks (Figure 13).

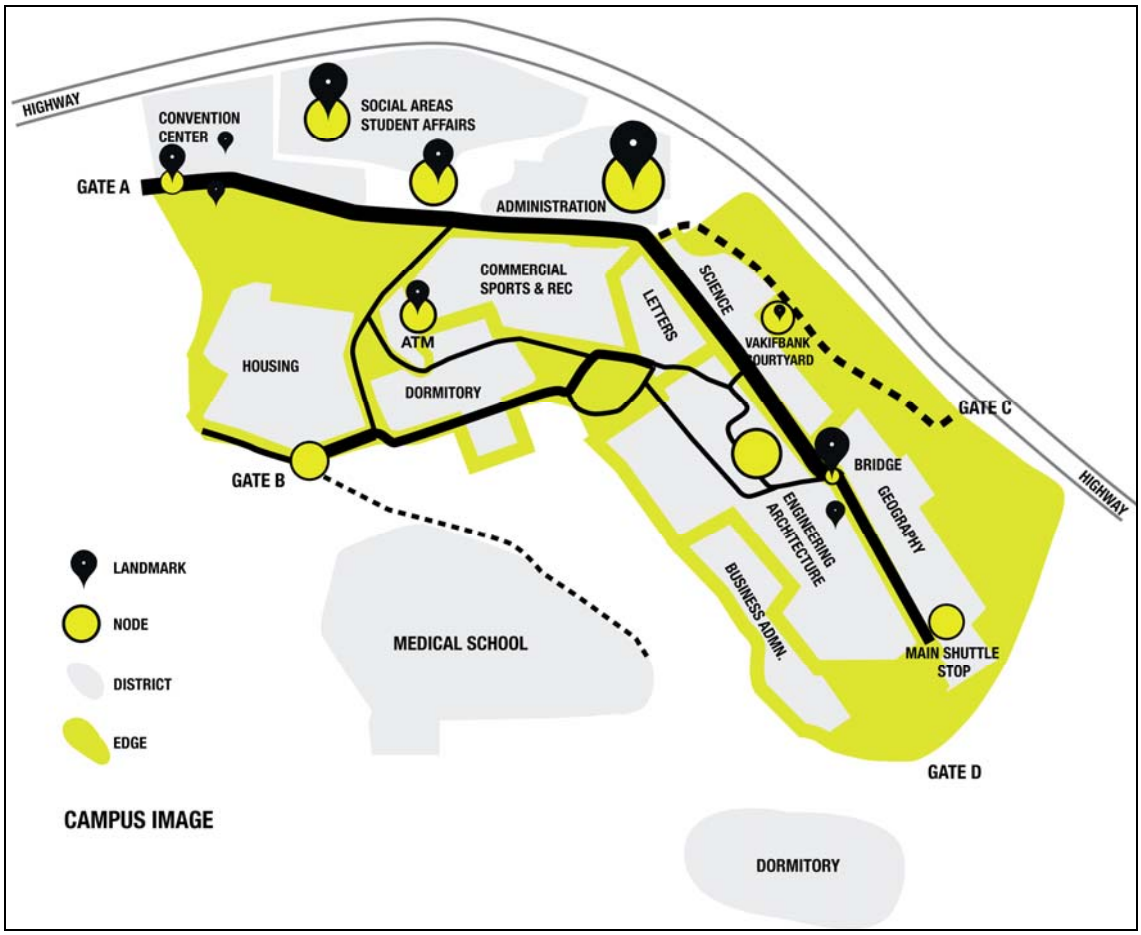

Figure 13. Final Image Map of Campus

It is vital to test the legibility level of the campuses periodically in order to understand the current potentials and limitations and the tendency for future expansions. So, important landmarks, paths and nodes that add value to campus legibility should be protected. Also, the districts with low perception level and the paths that ease the access should be strengthened. Because, these elements (roads, nodes, landmarks, districts) contribute to awareness level and improves student's sense of belonging and ownership. KTU will eventually expand into new areas and built new facilities and services. Accordingly, a master plan is being developed by the University. The outcomes of this study can be beneficial for master plan and design process of the campus.

5. REFERENCES

Ericson, B. (2001) The Armature and Fabric as A Model for Understanding Spatial Organisation, Aproaching Urban Desing The Design Process, Edt: Roberts, M., Greed, C., Longman, England, pp. 21-38.

Göregenli, M. (2013) Çevre Psikolojisi İnsan-Mekan İlişkileri [Environmental Psychology, Human-Spaca Relations]. İstanbul Bilgi Üniversitesi Yayınları (2rd ed.). Istanbul

Hillier,B.,&Hanson,J.(1984) The Social Logic of Space:. Retrieved from https://www.cambridge.org/core/books/the-social-logic-of space/6B0A078C79A74F0CC615ACD8B250A985

Lynch, K. (1960) The Image of The City. Cambridge MA: MIT Press.

Lloyd, R. (1997) Spatial Cognition: Geographic Environments. Dordrecht: Kluwer Academic

Moughtin, C. (1999), Urban Design Street and Square. Butterworth Architecture, Oxford

URL-1, Probeklein, (2011) Ktu_Foto_2 .Retrieved June 15, 2016 from http://upload.wikimedia.prg/wikipedia/en/3/3c/Ktu_foto_2.jpg

URL-2, Probeklein, (2011) Ktu_Foto_3 .Retrieved June 15, 2016 from http://upload.wikimedia.prg/wikipedia/en/3/3c/Ktu_foto_3.jpg