A GIS-BASED CAMPUS INFORMATION SYSTEM: IZMIR INSTITUTE OF TECHNOLOGY

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ABSTRACT

In the 21st century, GIS based Campus Information Systems (CIS) have been used by many universities for different aims and become an effective tool. CIS is a wholeness and integrity that is formed by hardware, software, data and users in order to collect spatial and non-spatial data about the university and its sub-units (both academic and administrative), transfer them to computer, store, query, analyze and present the result reports as graphics or non-graphics.

In general, the goal of this study is to prepare a GIS-based Izmir Institute of Technology (IIT) CIS. Moreover, after preparing maps of campus area in desired formats, the objectives of the project are to store the maps to plan or update, to provide rapid and easy access to personal and sharable information about campus, to prepare the databases about each department, and to use them for administrative purposes.

Therefore, it would have been achieved two main objectives in terms of planning and interactive access for students and staff. At first, by this system, it has been achieved more scientific spatial analyses about land use decisions depending on the natural capacities of the campus site. Then, some negative sides and impacts have been determined relating to the physical developments proposed by the existing campus plan. Thus, it has been achieved crucial results about these defects supporting our initial observations about campus. Secondly, to achieve all information about campus referring spatial or non-spatial by students, academic & administrative staff, and inter-active information access would be created.

In order to create CIS for IIT, the spatial and non-spatial data about campus including maps, attribute data were collected; maps, databases, spatial analyses and queries were produced via ArcGIS.

At the end of the study, site location of IIT, 1/50000 environmental plan, 1/5000 IIT Master Plan, existing map of campus area, proposed implementation plan of campus area, thematic maps & spatial analyses about topography, geology, soil capability and vegetation and other natural features and suitability analysis for campus site were produced as result productions.

1. INTRODUCTION

As be known that, GIS use has become widespread in diverse disciplines such as urban and regional planning, cartography, tourism sector, local governments and private sector. In general meaning, GIS is a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating and presenting spatial and non-spatial information about areas of the earth (Chrisman, 2002).

In this project, the goal is to create a GIS Based Campus Information System for Izmir Institute of Technology, in order to increase the efficiency of planning in campus and campus management within an effective data storing, analyzing, querying system.

Depending on these stored data it was produced maps listed below for presentation and tried some queries. The maps are:
- Site Location of IYTE in Izmir
- 1/50000 Environmental Plan of Karaburun Peninsula- IYTE Campus
- 1/5000 IYTE Master Plan,
- Existing Situation Map of Campus Area,
- Existing Infrastructure of Campus,
- 3D Campus Views,
- 3D Analyses

At last, the completion of this project in the following term is planned as:

- creating building information system for the Faculty of Architecture as a pilot project and

- creating interactive access system about the activities, programmes, staff information in buildings for all people.

2. CAMPUS INFORMATION SYSTEM

Today, Campus Information Systems is a GIS-based system, has been used by many universities for different aims and become an effective tool. It is a wholeness and integrity that is formed by hardware, software, data and users in order to collect spatial and non-spatial data about the university and its sub-units (both academic and administrative), transfer them to computer, store, query, analyze and present the result reports as graphics or non-graphics.

Here, all data belonged to the university campuses including topographical features, land use and natural conditions of the region where the campus is located, building information, student, academic and administrative staff information. These are organized under this structure aiming to reach data easier involving internet based information access and also for rapid and right decision making for all kinds of planning services such as land-use functions, construction decisions, health facilities, distribution rates of students to different units of the university, statistical data on educational activities and education, staff and plant management.

3. IZMIR INSTITUTE OF TECHNOLOGY CAMPUS INFORMATION SYSTEM

3.1. Need of CIS for IYTE

In IYTE, planning, construction, and technical infrastructure works are applied by Yapı İşleri Daire Başkanlığı and Proje Yönetim Merkezi. However, it was seemed that the information were not consistent with each other. Moreover, the information about administrative and academic staff is saved in Personel Daire Başkanlığı. Here again, these information are inadequate and face with problems in updating particularly after the earthquake.

The major reason of these deficiencies is the absence of a database management system. There should be a single database management system which sheltering all integrated data for more efficient arrangements, planning works and campus management.

Second, as it is witnessed that, depending on the geographic features, campus site has vulnerabilities about geological features, rivers, and topographic limitations. Relating to these some problems were happen in built-up area. For example, it was observed that, there were natural riverbeds close to the Science and Engineering Faculties, also the inadequate precautions in Architecture Faculty for the slope and the damages caused by earthquakes. Thus, in order to see the possible hazards, the geography of campus site should be analyzed within such as complex information system.

Lastly, there is needed an interactive campus information system in order to provide rapid and easy access to personal and sharable information about the placeses of classes, activities, programmes, staff information etc for the students, academic and administrative staff.

3.2. The Goals and Objectives

In general, the goal of this project is to prepare IYTE Campus Information System that involves all spatial and non-spatial data. Parallel to the existing situation and deficiencies of campus told above, the objectives were defined:

- To store all spatial and non-spatial information about campus in order to plan or update and to use in administrative purposes.
- To prepare possible hazard analysis in order to understand the limits of the geography of campus site.
- To create interactive information access in campus to provide rapid and easy access for personal and sharable information about campus within in an effective building information system.

3.3. A GIS Based Campus Information System for IYTE

3.3.1. Site Location of IYTE in Izmir

1/250000 scale map shows, the location of Izmir Institute of Technology in Izmir. Also, surrounding settlements and the distances between IYTE is displayed. IYTE boundaries are limited with Urla Municipality Boundary at the east, Barbaros Village road at the west, Izmir-Cesme Highway at the south, Bozburun at the north. The total campus area is 3500 ha. Izmir-

Cesme Highway passes in IYTE Campus boundaries. Figure 1 presents that the location of IYTE from a point of Izmir.

Figure 1: Site Location of IYTE in Izmir

3.3.2. 1/25000 Environmental Plan of Karaburun Peninsula- IYTE Campus

In Environmental Plan, after determination of natural and archaeological site areas in the campus area, the area which takes part between proposed Karaburun Road and Campus area was defined as "Macekia- Brushwood" area. The total construction need for the Campus is 461826 m². Figure 2 shows 1/25000 Environmental Plan of Karaburun Peninsula and IYTE Campus.

KARABURUN PENINSULA ENVIRONMENTAL PLAN - IIT CAMPUS

KARABURUN YARIMADASI ÇEVRE DÜZENİ PLANI - İYTE KAMPÜSÜ

KARABURUN PENINSULA PLANNING PROJECT
KARABURUN YARIMADASI PLANLAMA PROJESİ
KARABURUN ENVIRONMENTAL PLAN
KARABURUN ÇEVRE DÜZENİ PLANI

Scale :

500 m. 0 m. 1000 m. 2500 m.

LEGEND / GÖSTERİM

Symbol	Description
Province Boundary / *İl Sınırı*	
District Boundary / *İlçe Sınırı*	
Municipal Boundary / *Belediye Sınırı*	
Adjacent Area Boundary / *Mücavir Alan Sınırı*	
Environmental Planning Boundary / *Çevre Düzeni Planlama Sınırı*	
Approved Master Plan Boundary / *Onanlı İmar Planı Sınırı*	
1st Degree Natural Conservation Area Boundary / *1. Derece Doğal Sit Alan Sınırı*	
2nd Degree Natural Conservation Area Boundary / *2. Derece Doğal Sit Alan Sınırı*	
3rd Degree Natural Conservation Area Boundary / *3. Derece Doğal Sit Alan Sınırı*	
Existing Settlement Area (GAR:0,40-FAR:0,80) / *Meskun Konut Alanı (TAKS:0,40-KAKS:0,80)*	
Proposed Housing Development Area (GAR:0,20-FAR:0,40) / *Orta Yoğunluklu Gelişme Konut Alanı (TAKS:0,20-KAKS:0,40)*	
Proposed Housing Development Area (GAR:0,15-FAR:0,30) / *Seyrek Yoğunluklu Gelişme Konut Alanı (TAKS:0,15-KAKS:0,30)*	
University Campus Area / *Üniversite Kampüs Alanı*	
Tourism Settlement Area / *Turizm Tesis Alanı*	
Tourism Settlement/Vacation Houses Area / *Tercihli Kullanım Alanı*	
Tourism Settlement/Camp Area (Official) / *Kamu Kurumları Sosyal Tesis Alanı*	
Daily Use Area / *Günübirlik Kullanım Alanı*	
Picnic Area / *Orman İçi Dinlenme Alanı*	
Industrial Zone / *Organize Sanayi Bölgesi*	
1st Degree Natural Conservation Area / *1. Derece Doğal Sit Alanı*	
2nd Degree Natural Conservation Area / *2. Derece Doğal Sit Alanı*	
3rd Degree Natural Conservation Area / *3. Derece Doğal Sit Alanı*	
1st Degree Archeological Conservation Area / *1. Derece Arkeolojik Sit Alanı*	
Forest Area / *Orman Alanı*	
Park / *Kentsel Yeşil Alanlar*	
Agricultural Preservation Area / *Tarımsal Niteliği Korunacak Alan*	
Special Agricultural Production Preservation Area / *Tarımsal Niteliği Korunacak Özel Mahsul Alanı*	
Macekia/Brushwood / *Makilik/Fundalık*	
1st Degree Roads / *1. Derece Yollar*	
2nd Degree Roads / *2. Derece Yollar*	

ADVISORS

PREPARED BY

Source: CP 301 Planning Studio - 2005

Figure 2: 1/25000 Environmental Plan of Karaburun Peninsula- IYTE Campus

Source: CP 301 Karaburun Peninsula Planning Project Analytical Research Report, IYTE, 2005, p. 128

3.3.3. 1/5000 IYTE Master Plan

According to the plan which was approved in 1994, some part of the proposal Karaburun road, separates from Izmir-Cesme Motorway, from inside the campus area. Proposed Karaburun road passes from the Campus area and Gulbahce settlement. 1/25000 scaled Environmental Revision of Master Plan of Cesme- Karaburun and the master plan was approved by Public works. Izmir Instıtute of Technology Campus Area is a 2. degree Site and the value for the construction is 0.002. Table 1 shows the total construction area needed for uses in Master Plan. Additionally, Figure 3 displays IYTE campus area as master plan.

Table 1: Total Construction Area needed for uses in Master Plan

Function		Emsal	Total Construction Area needed (m²)
Academic and Administrative building areas	Rector's office	0.02	83.596
	Scie		34.964
	Engineerinf Fac.		89.039
	Architecture Fac.		25.546
Sport facilities		0.02	57.928
Staff Houses		0.02	49.531
Dormitories		0.02	106.698
Izmır Technology Improvement Addition Area		0.35	14.524
TOTAL			461826

Source: CP 301 Karaburun Peninsula Planning Project Analytical Research Report, 2005

GULBAHCE BAY

Legend

Boundaries
- ◁━▷ IIT Ownership Boundary
- ━━━ Approved Master Plan Boundary
- ┄┄┄ Approved Master Plan Change Boundary
- ┄┄┄ Municipal Boundary

Roads
Degree
- ━━ 1
- ━━ 2
- ━━ 3
- ━━ 4

Zones
- 1st Degree Natural Conservation Area
- 3rd Degree Natural Conservation Area
- Forestry

- Academic& Administrative Units
- Academic& Administrative Development Area
- 3rd Degree Archeological Consevation Area
- Gas station
- Technopark
- Sea
- Natural Environment Park
- Education
- Electric& Energy
- Laboratory
- Personnel Houses
- Macekia& Brushwood
- Guesthouse
- Recreation Area
- Sports Area
- Sea Sports& Marina

- Thermal Recration& Energy Research Center
- Production Units
- Satellite Communication Center
- Existing Settement Arrea
- Dormitories& Service Units
- 3rd Degree Archeological Consevation Area
- Electric Energy Station
- Agricultural Production

Figure 3: 1/5000 IYTE Master Plan

3.3.4. Existing Situation Map of Campus Area

1/5000 scale map, shows build-up area of campus as plan views presented in Figure 4. This map was obtained by coinciding the satellite view and drawings which contains Buildings and Infrastructure System in Arcmap programme.
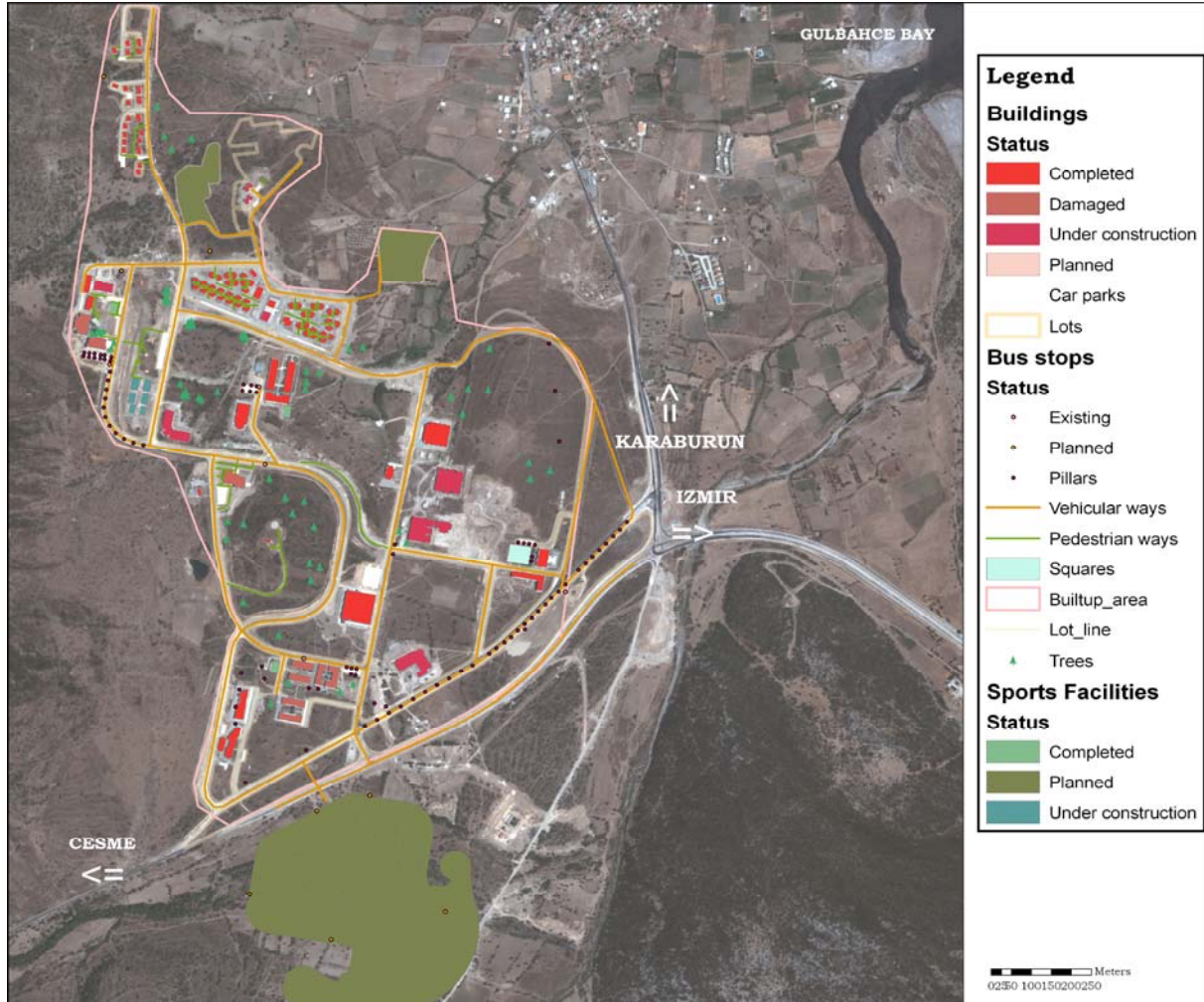
Figure 4: Existing Situation Map of Campus

3.3.5. Existing Infrastructure System of Campus

Existing Infrastructure System Map shows existing High Voltage Line, Telephone and Network System, Water System, Electric Line, Sewage Pipes, Canals, Pillars, Canal Elements, Valves, Sewage Elements, Water Purification Buildings. The map represents in Figure5.
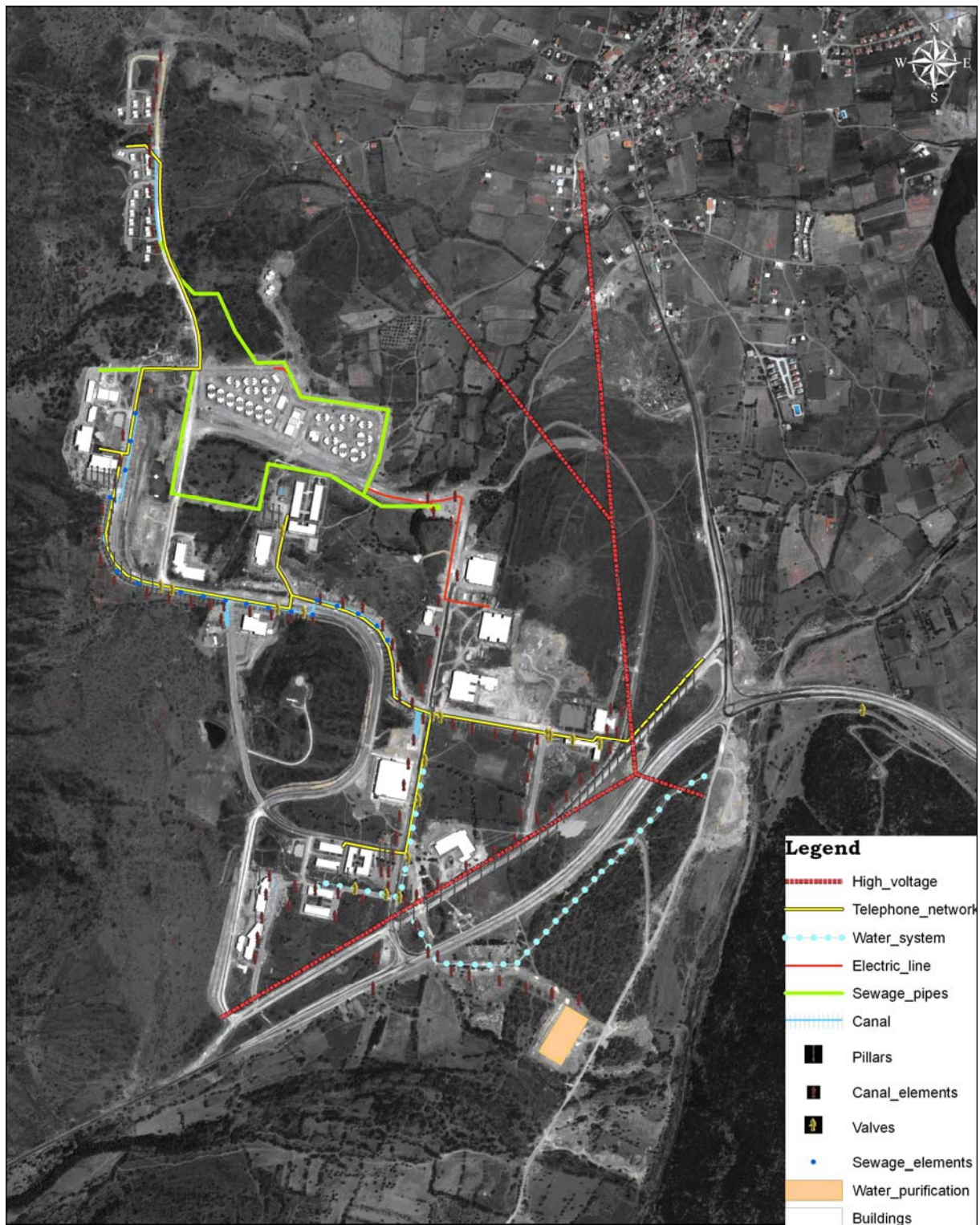
Figure 5: Existing Infrastructure System of Campus

3.3.6. 3D Campus Views

3D Views of IYTE Campus Map shows build-up area of Campus as 2D and 3D perspectives obtained from Figure6. Buildings, distance of the buildings and relations between them is

shown. This map can be useful for planning of other addition units of campus area after that time. Figure shows 3D view of Faculty of Architecture in IYTE.

Figure 6: 3D Campus Views
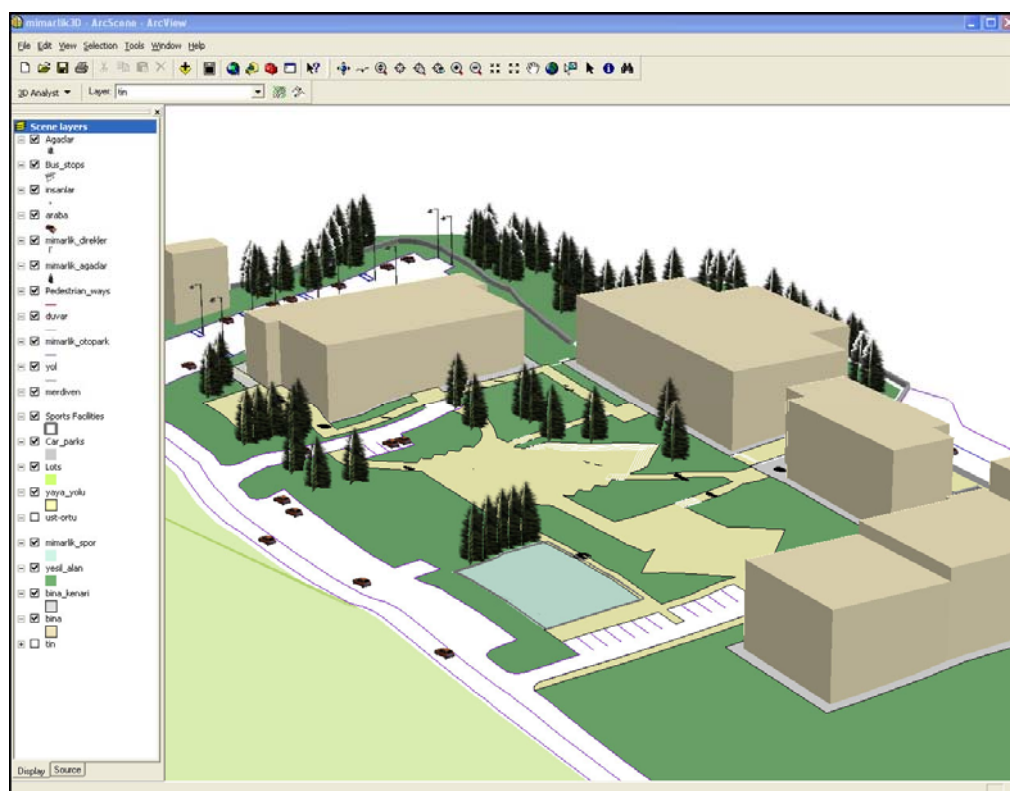
Figure 7: 3D view of Architecture

3.3.7. 3D Analyses

- Topography:

Levelization for the stability of the slopes excavation around the Architecture Faculty and the Cafeteria building must be done. If don't landslides will occur. Levelization of the slopes excavation and the retaining wall must be constructed due to the ground search reports.For example the retaining wall around the Architecture Faculty do not obey the report (Yüksek Teknoloji Enst. Mevcut Yerleşim Alanının Jeolojik Etüd Raporu, MTA Genel Müd., 1999).

Firstly, the slope percentages of the site were defined in spatial analyst in ArcView. Also a section is produced along the site. Then, to determine the unsuitable areas for construction, the areas over the slope of 25 and 30 percents are queried by raster calculator in spatial analyst and compared with the existing buildings. Figure 8,9,10 show the results of topographical analyses.
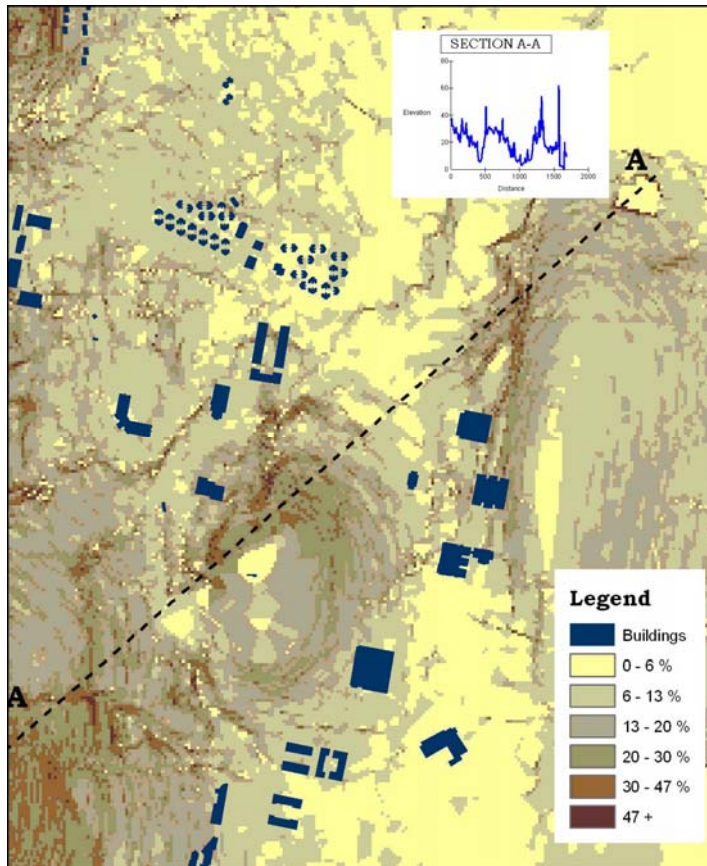
Figure 8: Section of topography
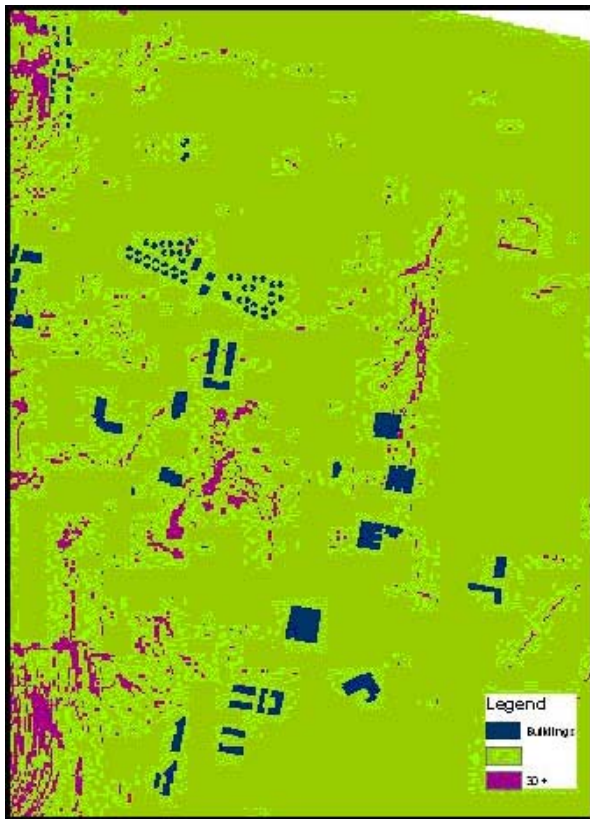
Figure 9: Slope over 30+
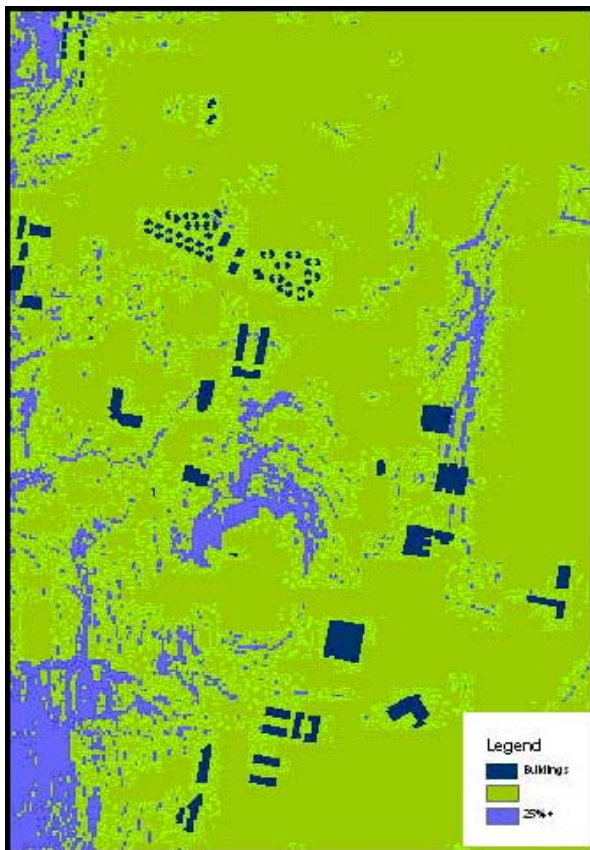
Figure 10: Slope over 25+

- Geology:

Because of the inadequate information about geological structure, the analysis is not satisfactory enough. According to these reports, there are no big faults in the campus area. Detailed ground investigations must be applied before a construction. (Jeoloji ve Jeofizik Raporu Hk MTA, 2001). Also, in the campus area, construction must not be done on the faults since the area is in the fist earthquake zone. Additionally, the building must not be high floor and the ground researches must be done properly before construction (Yüksek Teknoloji Enst. Mevcut Yerleşim Alanının Jeolojik Etüd Raporu, MTA Genel Müd., 1999). Figure11 presents the fault and buildings location relation.
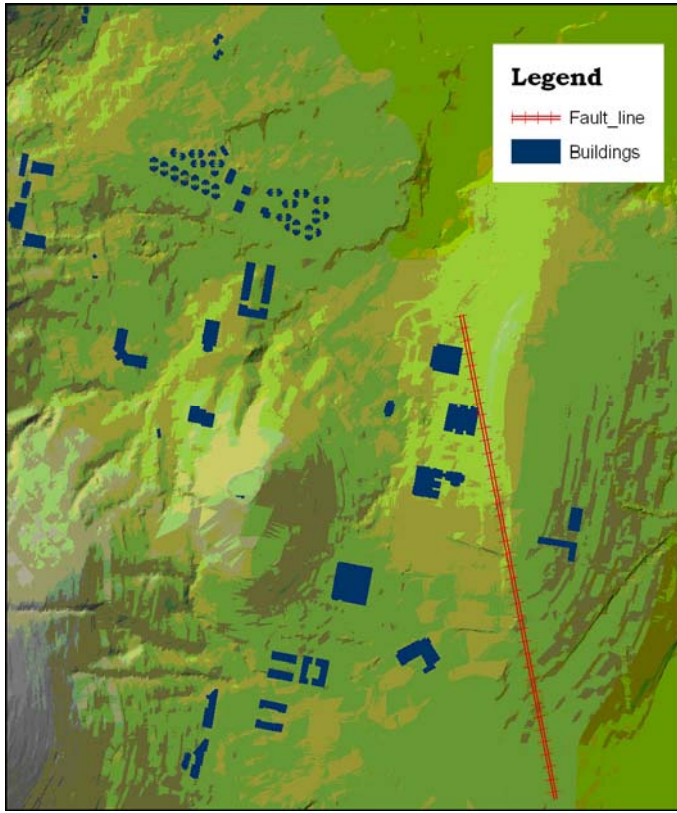
Figure 11: Fault Line in IYTE

- Rivers:

The rivers of Tatar, Sirin, and Kavaklı must be improved before construction around. The other riverbeds are sufficently improved so protection will be enough (İzmir-Urla-Gülbahçe-İYTE Kampus Alanının İmar Planı ile İlgili Taşkın Etütleri) and in the campus area, construction must not be done on the riverbelts since the area (Yüksek Teknoloji Enst. Mevcut Yerleşim Alanının Jeolojik Etüd Raporu, MTA Genel Müd., 1999).

The Science Faculty constructed over a riverbelt. For these reasons, the drenage systems must be constructed around and ground constructed buildings and planned buildings (İzmir Yüksek Teknoloji Enst. Mevcut Yerleşim Alanının Jeolojik Etüd Raporu, MTA Genel Müd., 1999).

In the analyses, the rivers were displayed and applied 25 meters buffer zone for each, then coincided with existing buildings. Figure 12 displays that, the parts of Science Faculty; Engineering Faculty and Library buildings are located under the buffer zone.
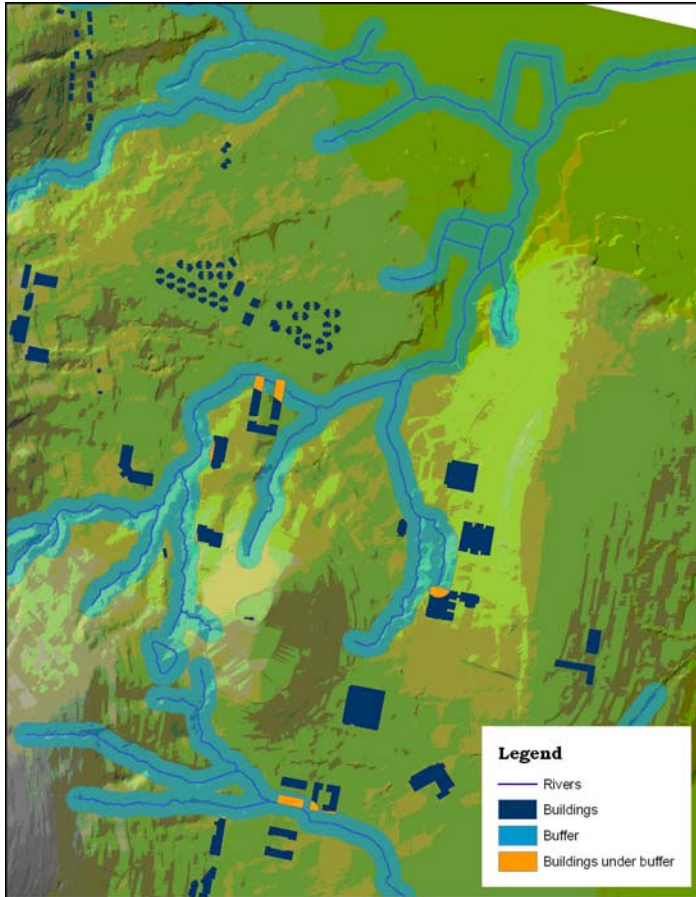
Figure 12: Rivers and 25 m buffer zone in IYTE

- High voltage:

50 m buffer was preferred in for the high voltage line in the site. The result is represents that in Figure13. According to the analysis the Mechanical Engineering building is located under the high voltage buffer.
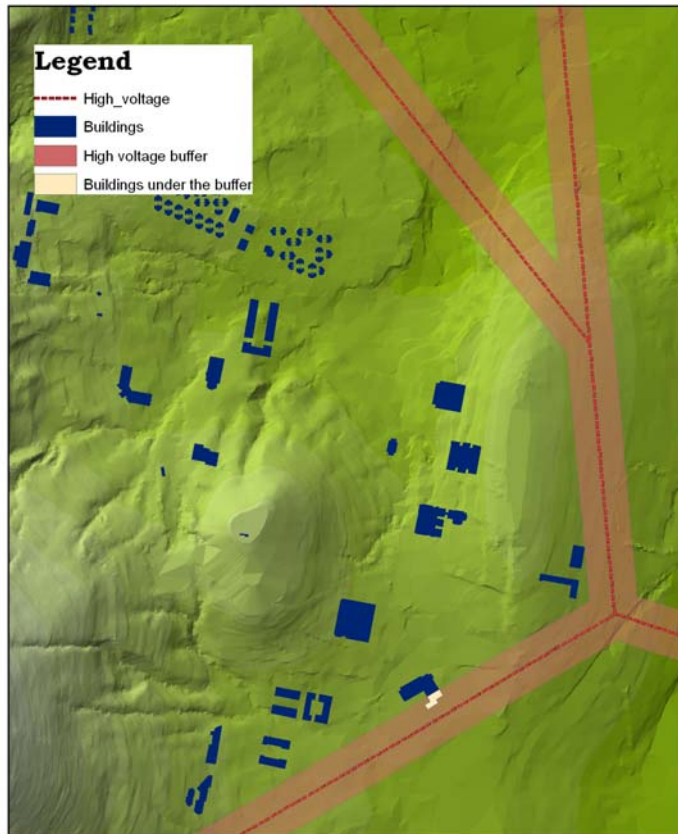
Figure13: High Voltage Line and 50 m buffer zone in IYTE

4. CONCLUSION

In this study, it has been aimed to obtain integration between spatial and non-spatial data via creating a GIS based campus information system for IYTE. Moreover, interactive access to them has been the other objective for this study. This is an important point for urban planners in order to create new settlement areas for people. As, geological, topographical, soil capabilities and natural structures affect the potential area selection whatever its role is, a campus or a housing area. This point of view requires a serious data collection, processing, analyzing and synthesis. Therefore, GIS provides efficiency and easiness for these steps for planning studies. Moreover, its spatial and non-spatial data integration capability makes it understandable easily.

IYTE is still a growing campus area with new faculty buildings, sport areas and dormitories. The campus's topographical, geological and soil capabilities require to be worked on them carefully; because of this, a GIS based CIS helps for the new decisions. At first, whole spatial and non-spatial information about IYTE campus have stored in Arc GIS, they have been

updated and used for administrative purposes. Then, analyzes have been performed in case a possible hazard occurrence. What the limitations of this campus are and where the new axis is are the some examples of tried to be answered. At the end of study, it is observed that the most suitable areas for IYTE are placed between faculty of architecture and dormitories. The results are shown in Figure.14. The red areas are not suitable for settlement. The greens are suitable for settlement.
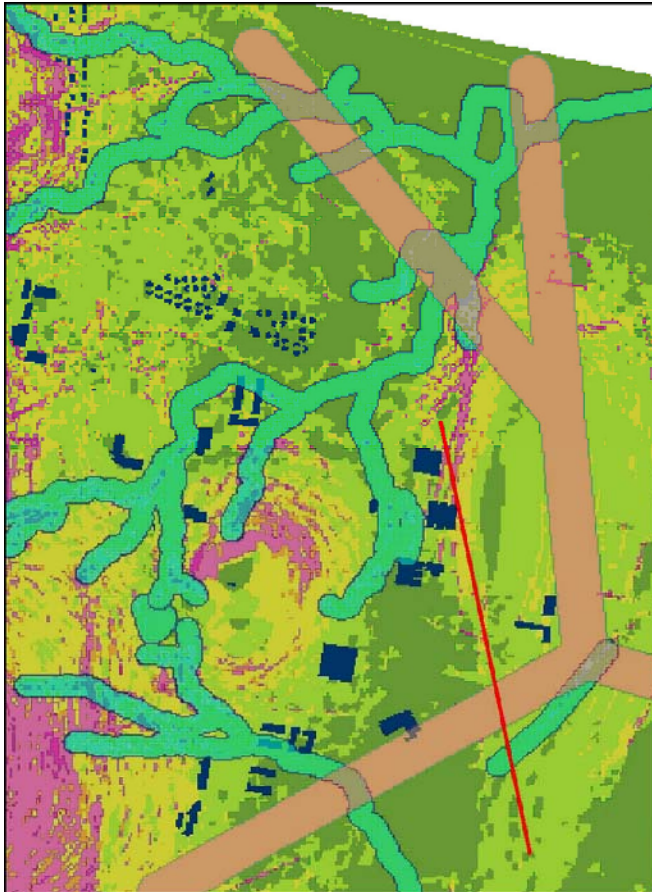

Figure 14 : The result of the suitability analyzes

This study is not a completely finished study. Its databases, type of analyze, settlement criteria specifications etc. could be changed easily depends on necessities. Moreover, a web based analyzes and queries could be the next step of this study. In addition to these, staff information system could be integrated to this GIS-based campus information system. This system will provide students, academic and administrative staff and other exterior users to access necessary but limited information just about campus location, transportation to

campus, general campus uses and also campus activities, programs and personal staff and student information.

As a result, a GIS based campus information system provides more secure areas for the students, academic and administrative staff; because, it is the fact that more accurate information leads to get more effective decisions.

5. REFERENCES

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