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Master plan compliance of turkish university campuses: a functional land use assessment via satellite ımagery

Türk üniversite kampüslerinin master plan uyumluluğu: uydu görüntüleri aracılığıyla işlevsel arazi kullanım değerlendirmesi

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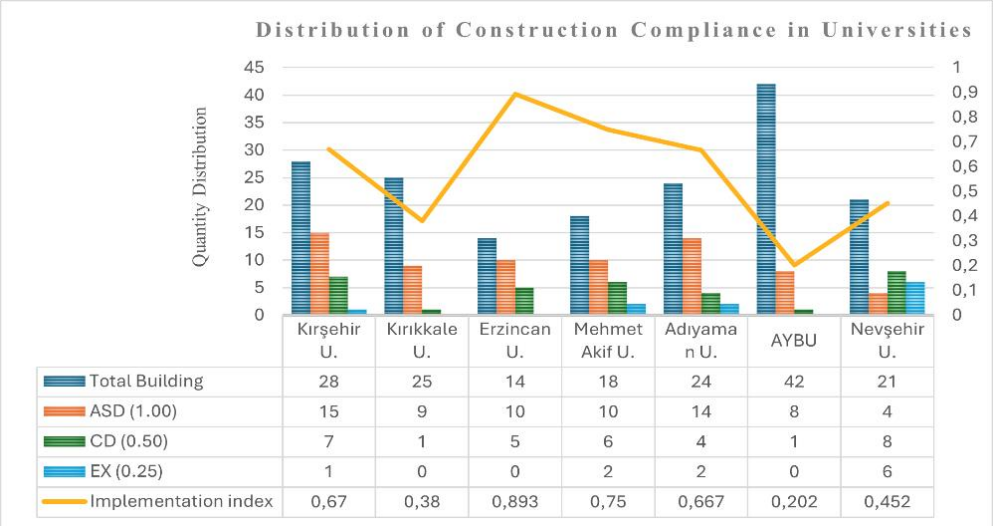
Master Plan Compliance of Turkish University Campuses: A Functional Land Use Assessment via Satellite Imagery

Highlights

- *The study evaluates master plan compliance in seven Turkish university campuses established after 2006.*
- *A functional land-use classification and building coding system were developed for comparative analysis.*
- *Satellite imagery and master plans were overlaid to identify spatial and functional deviations.*
- *A weighted Implementation Index was proposed to quantify plan realization performance.*
- *Results reveal significant differences among universities, highlighting issues in campus development*

Graphical Abstract

This study compares the functional and spatial development of seven Turkish university campuses with their original master plans by integrating satellite imagery, functional classification, and a novel Implementation Index.



	Kırşehir U.	Kırıkkale U.	Erzincan U.	Mehmet Akif U.	Adıyaman U.	AYBU	Nevşehir U.
Total Building	28	25	14	18	24	42	21
ASD (1.00)	15	9	10	10	14	8	4
CD (0.50)	7	1	5	6	4	1	8
EX (0.25)	1	0	0	2	2	0	6
Implementation index	0,67	0,38	0,893	0,75	0,667	0,202	0,452

Figure. Distribution of Construction Compliance in Universities

Aim

The aim of this study is to evaluate how closely the spatial and functional development of post-2006 Turkish university campuses align with their master plans by analysing compliance at the building scale.

Design & Methodology

The study evaluates campus master plan compliance by classifying functional units, comparing master plans with satellite imagery, and calculating a weighted Implementation Index using data derived from Google Earth, AutoCAD overlays, and official planning documents.

Originality

This research introduces a systematic and replicable plan-implementation assessment method that integrates functional land-use classification with satellite-based spatial verification and proposes a novel Implementation Index specifically designed for campus master plan evaluation.

Findings

The findings reveal significant variation among universities: some campuses closely follow their master plans, while others show major spatial and functional deviations.

Conclusion

The author(s) of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

Etik Standartların Beyanı (*Declaration of Ethical Standards*)

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Master Plan Compliance of Turkish University Campuses: A Functional Land Use Assessment via Satellite Imagery

Araştırma Makalesi / Research Article

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ABSTRACT

Universities build their campuses based on master plans and strategic development plans. These plans are crucial as they define circulation systems, allocate functional building zones, and outline the relationships between buildings and open spaces at an urban design scale. The expectation is that buildings and open spaces will be developed under these guidelines over time. However, discrepancies between actual campus development and the original master plans are frequently observed, often accompanied by functional changes to the built environment. In Turkey, a significant expansion in higher education took place post-2006, marked by the establishment of around 140 universities. This growth emphasized the importance of master planning in ensuring functional and spatial coherence in campus design. Despite this, variations in adherence to master plans have been widely observed, leading to questions about the effectiveness and flexibility of these plans in addressing evolving needs. This study aims to compare campus developments with their respective master plans and focuses on a group of universities established in the same region and period. By analysing this compliance, the research identifies differences or similarities in campus development based on functional groups of buildings. Data from seven universities, including master plans and satellite imagery from different regions of Turkey where master plans are available, are examined using an index system. This analysis shows current challenges and gaps in campus planning to contribute to the development of more effective strategies. It ultimately aims to evaluate the elements of success and failure in campus planning and to provide recommendations to improve future planning processes.

Keywords: Master plan compliance, university development, functional classification, remote sensing, spatial planning.

Türk Üniversite Kampüslerinin Master Plan Uyumluluğu: Uydu Görüntüleri Aracılığıyla İşlevsel Arazi Kullanım Değerlendirmesi

ÖZ

Üniversiteler kampüslerini ana planlar ve stratejik gelişim planları temelinde inşa ederler. Bu planlar, ulaşım sistemlerini tanımladıkları, işlevsel bina bölgelerini tahsis ettikleri ve kentsel tasarım ölçeğinde binalar ile açık alanlar arasındaki ilişkileri özetledikleri için kritik öneme sahiptir. Binaların ve açık alanların zaman içinde bu yönergeler doğrultusunda geliştirileceği beklenmektedir. Ancak, gerçek kampüs gelişimi ile orijinal ana planlar arasında sıklıkla tutarsızlıklar gözlemlenmekte ve bu tutarsızlıklara genellikle inşa edilmiş çevrede işlevsel değişiklikler eşlik etmektedir. Türkiye'de, 2006 sonrası dönemde yaklaşık 140 üniversitenin kurulmasıyla belirginleşen yükseköğretimde önemli bir büyüme yaşanmıştır. Bu büyüme, kampüs tasarımında işlevsel ve mekânsal tutarlılığın sağlanmasında ana planın önemini vurgulamıştır. Buna rağmen, ana planlara uyumda yaygın olarak farklılıklar gözlemlenmiş ve bu durum, bu planların değişen ihtiyaçları karşılamadaki etkinliği ve esnekliği hakkında sorulara yol açmıştır. Bu çalışma, kampüs gelişimlerini ilgili ana planlarıyla karşılaştırmayı amaçlamakta ve aynı bölge ve dönemde kurulmuş bir grup üniversiteye odaklanmaktadır. Bu uyumu analiz ederek araştırma, binaların işlevsel gruplarına göre kampüs gelişimindeki farklılıkları veya benzerlikleri belirlemektedir. Master planların mevcut olduğu Türkiye'nin farklı bölgelerine ait master planları ve uydu görüntüleri de dahil olmak üzere yedi üniversitenin verileri, bir endeks sistemi belirlenerek incelenmektedir. Bu analiz, kampüs planlamasındaki zorlukları ve eksiklikleri ortaya koyarak daha etkili stratejilerin geliştirilmesine katkıda bulunmaktadır. Sonuç olarak, kampüs planlamasındaki başarı ve başarısızlık unsurlarını değerlendirmeyi ve gelecekteki planlama süreçlerini iyileştirmek için önerilerde bulunmayı amaçlamaktadır.

Anahtar Kelimeler: Master plan uyumu, üniversite gelişimi, fonksiyonel sınıflandırma, uzaktan algılama, mekânsal planlama.

1. INTRODUCTION

Universities are considered institutions that cultivate qualified individuals who will shape society in the future. In addition to education and research, they are institutions that provide a wide range of needs, including study spaces, dining options, sports and entertainment facilities, and healthcare services, all of which will make daily life easier for students. These complementary

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facilities ensure that campuses can function as integrated living environments. Given that campuses host diverse functions organized into distinct units, it is essential to plan them in a way that allows these units to operate as a coherent whole. This requirement has led to the emergence of university settlement systems designed according to specific principles, creating an orderly structure for campus development [1].

University master plans address a range of goals, including site selection, integration with the urban context, transportation networks, capacity planning, and spatial organization. Understanding different settlement systems, their interaction with physical planning, and the conditions under which they should be applied is vital for both current and future planning success [2]. As [3] notes, campus design is the art of shaping the physical environment in ways that convey form, meaning, and identity elements that reflect an institution's mission and values. These designs also communicate the university's presence and role to its users. They consist of structures, activity zones, and green spaces that support the university's vision and mission while accommodating evolving priorities. Functional groups typically include: educational facilities (faculties, classrooms, laboratories), research facilities (labs, libraries), administrative units (rectorate, dean's offices), housing (student dormitories, staff residences), social and cultural spaces (conference centers, cafeterias, sports facilities, entertainment areas), health facilities, and auxiliary infrastructure (technical services, energy systems). Together, these form comprehensive environments integrating education, research, social life, recreation, and administration [4].

Universities also play a transformative role in their host cities. They stimulate local economies, expand cultural and artistic activities, influence the built environment, and positively affect demographics [5]. In Turkey, policies since the 1960s have aimed to distribute higher education evenly across the country, using universities as tools for regional development and reducing disparities between regions [6]. From 1992 onward, Turkey experienced rapid expansion in higher education. The "one university for each province" policy, adopted in 2002, culminated in significant growth: from only 77 universities in 2006 to 179 by 2014, an increase of 132% within eight years. By the end of 2008, every province had at least one university, and 41 cities that had never hosted one before saw the establishment of their first institutions.

Before detailing the scope of this study, it is important to note the relevance of land use and land cover (LULC) analysis in campus planning. LULC refers to the physical surface features (e.g., vegetation, built-up areas, water bodies) and their functional uses (e.g., education, recreation, residential) [7] Although LULC is obtained through traditional inventories or surveys, satellite remote sensing saves time and reduces costs in determining the geographical distribution of temporal changes in LULC on a regional scale [8]. Remote sensing technologies based on satellite imagery allow consistent monitoring of these elements over time, making them invaluable for assessing whether spatial development aligns with planned designs [9], [10]. In the context of university campuses, integrating Geographic Information Systems (GIS) with remote sensing offers precise detection of deviations between master plans and actual construction, supporting both compliance assessment and long-term sustainability planning.

In spatial planning theory, the relationship between the planned and the implemented area has long been a key subject of discussion. Previous studies show that their implementation often diverges from original proposals due to institutional priorities, financial constraints, and phased development processes [3]. Recent research has increasingly employed GIS and remote sensing techniques to analyse campus growth, land-use change, and spatial transformation using satellite imagery [11]. Despite these contributions, most studies focus on land-use or sustainability indicators rather than directly evaluating compliance between proposed campus master plans and realized development, indicating a need for systematic assessment approaches such as the one proposed in this study.

In this study, the extent to which campus developments in state universities established in Turkey after 2006 have been implemented by the initially prepared master plans is investigated. The rapidly increasing number of universities in recent years, along with the spatial planning needs it has generated and the deviations encountered in practice, shape the main research problem of this study. The study aims to examine the consistency between the functional structure groups that took part in campus planning and the actual physical development, and to draw inferences regarding the causes of any inconsistencies.

Google Earth receives data from satellites stationed in space to study the Earth and then processes it through the program's software to make it usable [12]. The functional classification of campus areas is evaluated through a comparison between the master plans and current satellite images based on this classification. The study focuses on 7 state universities selected from different regions, for the master plans were accessible As Designed. The methodology is based on identifying functional groups at the building scale and evaluating compliance to describe the degree to which the physical development of university campuses corresponds with the objectives, spatial arrangements, and functional distributions set out in their original master plans. Compliance refers to the extent of alignment between planned and actual campus layouts, encompassing the location, function, and scale of constructed facilities, and provides a constructive framework for assessing the effectiveness of campus planning. The data were manually analysed using Google Earth satellite imagery, AutoCAD drawings, and official planning documents from the universities.

The article first explains the planning principles and functional groups of university campuses, then presents the data collection and analysis process in the methodology and materials section. In the findings section, the planned and actual conditions of each university are comparatively discussed.

1.1. University Functional Groups and Classification Studies

In order to systematically evaluate the spatial development of university campuses, this study adopts a functional classification framework based on academic literature. The functional grouping system applied here aligns with the inventory-based classification used in previous spatial analyses of university settlements [4] while also being cross-referenced with institutional standards such as the MEKSİS (Spatial Database Management System). MEKSİS is the official spatial database infrastructure managed by the Republic of Turkey's Ministry of Environment, Urbanization, and Climate Change. Within this system, buildings are categorized by specific function codes (e.g., educational facilities, social-cultural structures, dormitories), which allow for standardized geospatial analyses across public institutions.

In addition to this national database, the grouping methodology also reflects widely accepted academic typologies in campus planning literature. Earlier studies have emphasized the multi-functional nature of modern university campuses, advocating for classification systems that separate educational, administrative, recreational, residential, and support functions [1], [13]. These categorizations not only serve architectural and planning purposes but also improve analytical clarity. For instance, understanding the spatial distribution of "Work and Study" buildings versus "Recreation and Socialization" facilities provides valuable insight into institutional priorities and construction tendencies.

In this context, classification studies facilitate the analysis of functional groups and allow for the systematic monitoring of the spatial transformation of campus layouts over time. In particular, buildings such as faculties, laboratories, dormitories, sports facilities, and administrative offices are evaluated in the planning process by being grouped according to their location within the campus and their frequency of use.

1.2. Land Cover, Land Use, and Remote Sensing

Land cover refers to the physical and biological material on the surface of the Earth, such as vegetation, urban infrastructure, water bodies, and bare soil. Land use, meanwhile, describes how these surfaces are utilized by humans—whether for agriculture, residential settlement, industry, transportation, or recreation [14], [15]. The distinction between these two concepts is essential for analysing urban growth, environmental change, and spatial development patterns. Monitoring their change over time provides critical input for effective urban and regional planning.

One of the most significant applications of satellite imagery is the determination of land use and land cover (LULC). Land Use and Land Cover (LULC) maps are important geospatial information sources for different applications such as city planning, vegetation analysis, natural resource management, natural disaster analysis, and land change determination [16]. The analysis of satellite imagery offers an effective means to identify trends, changes, and developments over time [17].

Much work has been done on monitoring land cover changes in the field of remote sensing, and methods and tools have continuously improved to determine the changes on Earth with the most accurate results [18]. By using satellite imagery and aerial photography, remote sensing enables consistent and repeatable assessments of spatial dynamics without the need for ground-level observation [9]. Modern remote sensing systems provide multispectral and temporal datasets that allow researchers to track development, deforestation, urban sprawl, and infrastructure growth over decades [10]. For instance, one of the most important advantages of the GEE platform, one of the remote sensing technologies, is that it provides full and complete access to remote sensing products and can process these products very quickly [19]. Algorithms such as Support Vector Machines, Random Forest, and Convolutional Neural Networks are widely used to classify complex landscapes with high accuracy accuracy [20], [21].The Random Forest algorithm has garnered considerable attention within the ML community and is frequently favored for its effectiveness in addressing classification and regression challenges [22]. Geographic Information Systems (GIS) are powerful tools that contribute significantly to decision-making processes by documenting, storing, evaluating, and presenting spatial data [23], [24]. Determining the built-up areas of buildings using unmanned aerial vehicles [25] and vegetation analysis [26] are applications of these technologies.

The integration of GIS and remote sensing has proven effective in urban planning by supporting land suitability analysis, environmental impact assessments, and infrastructure monitoring [27]. In the context of university campus development, remote sensing offers data for assessing the consistency between spatial plans and actual land use. Particularly in newly established institutions such as those in Turkey after 2006, remote sensing allows researchers to detect whether construction has followed the approved master plan, or whether deviations and unplanned developments have occurred.

In the literature, a wide range of studies can be found, such as LULC analyses in urban areas to evaluate different scenarios and monitoring changes assessing the potential impacts of sea level rise on land cover [28]. Many remote sensing applications rely on the investigation of land use and land cover, which are generally obtained through classification of imagery [29]. Furthermore, artificial neural networks in deep learning can process large amounts of data by learning

from their representations [30]. Future studies could incorporate spectral indices or supervised classification methods to improve the quantitative evaluation of campus ecological conditions. Remote sensing-based multi-temporal satellite image analysis has increasingly become a fundamental method for quantitatively monitoring the spatial growth processes of campuses and assessing their compliance with master plans. In previous studies, the use of data sources such as Copernicus and the classification of impervious–built-up–vegetation have enabled detailed identification of construction trends and green space losses [31]. In addition, the study conducted by [32] demonstrated that AI-supported approaches can accelerate the analysis process.

2. METHOD

Campus buildings, the elements that make up the buildings, parking lots, recreation, and accommodation areas should be designed by considering all aspects, from the frequency of use to the point of intersection with transportation networks. In addition, the purchases of goods and services made by the academic and administrative staff of the universities and the students to meet their nutrition, clothing, accommodation, entertainment, and other personal needs will positively affect the income and employment status of the city. This situation will also provide positive changes in the economic and morphological structure of the cities through the university [33]. Campuses are expected to have seven basic functions: (i) education and training functions (classrooms), (ii) research functions (laboratory, library), (iii) management function, (iv) accommodation functions (student dormitories, academic and administrative staff housing), (v) sports and recreation functions, (vi) socio-cultural activities functions (congress center, dining hall, recreational facilities), (vii) security and support units (garage, installation workshops, warehouses, service, etc.) [34]. As a result of the implementation of these functions, not only will successful campus planning and sustainability be achieved, but also the way will be opened for universities to positively affect cities [35].

Since the concept of planning includes many elements, from the design of a single building to the creation of a master plan for many structures, the environment surrounding the structure and the gradual implementation of the plan, site selection is of great importance in planning and has a direct impact on the elements affecting planning [15].

This study utilizes a systematic, three-step method (Figure 1) to evaluate how closely the spatial development of selected university campuses in Turkey, established after 2006, aligns with their original master plans. Both qualitative (descriptive spatial interpretation) and quantitative (implementation index-based) approaches were used to analyse deviations and patterns of implementation.

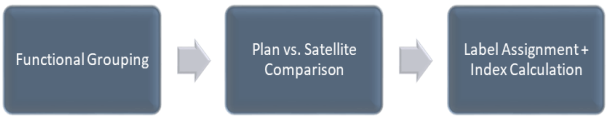


Figure 1: Overview of the Three-Step Methodology

Each step builds upon the last to provide a complete spatial implementation assessment.

a. Functional group classification

Based on the literature [4], [34], each campus component was classified into seven functional groups. This classification allows for a standardized, building-scale comparison of planned and constructed spaces:

W – Work/Study: Faculties, classrooms, laboratories

A – Accommodation: Dormitories, guesthouses, staff housing

R – Recreation and Socialization: Sports areas, cafeterias, social centers

D – Administrative Departments and Centers: Rectorates, administration units, research centers

S – Service Roads: Roads for vehicles

P – Pedestrian Roads: Walkways and pathways

C – Campus Area: Open areas, green space, unbuilt areas

Each structure was labelled using a coding scheme based on university ID, function code, and sequence. For example, the label “3W2” refers to the second building under the Work/Study group (W) for university 3. Similarly, “5A1” indicates the first accommodation building for university 5. This structure enabled a uniform dataset architecture across seven universities and allowed functional comparisons to be performed with minimal ambiguity.

b. Comparison of master plans and satellite images

Original master plans were obtained from the web and the authors’ archive and refined for study. Then, 2025 satellite images from [36] were overlaid in AutoCAD [37] software. This alignment allowed for a visual and spatial comparison between planned and constructed elements. Differences in position, absence of planned buildings, or emergence of unplanned structures were manually annotated. All built structures were visually identified, and their functions were matched with master plan intentions. These results were numerically and color-coded in Excel for each university.

c. Compliance labels and index calculation

The Implementation Index (I) proposed in this study was conceptually adapted from performance and compliance measurement methods frequently used in spatial planning and environmental assessment literature [e.g.,[38], [39]]. Although various indices such as the Plan Implementation Performance Index and the Land Use Efficiency Index have been used in spatial planning and environmental assessment studies, there is no index

specifically designed to evaluate the implementation performance of university campus master plans at the building scale. The Implementation Index proposed in this study conceptually builds upon these existing approaches but differs in its functional categorization, weighting system, and direct application to campus-scale master plan compliance. By integrating functional building groups with spatial conformity levels, the index offers a tailored and replicable tool for evaluating campus plan implementation.

Similar to the Plan Implementation Performance Index and Land Use Efficiency Index, it quantifies the degree of correspondence between planned and actual spatial development using weighted categorical values. The weighting scheme (1.0, 0.5, 0.25) reflects the relative conformity of each category to the original master plan: structures built "As Designed" (ASD) are fully compliant; those "Constructed Differently" (CD) partially comply due to locational or functional deviation; and "Existed" (EX) structures predate the plan but remain operational within the campus. This proportional system allows the index to summarize both the quantity and quality of implementation in a single comparable value.

To assess the overall implementation level, an Implementation Index (I) was calculated as follows:

I = ((1.0 ×N_ASD)+(0.5 ×N_CD)+(0.25 ×N_EX)) / N_Total

In this formula, each implementation label is assigned a weight based on its degree of conformity to the original master plan. Structures categorized as "As Designed" (ASD) are considered fully aligned and receive a full score (1.0). "Constructed Differently" (CD) buildings, which were built with deviations in location or function, are partially compliant and thus assigned a moderate weight (0.5). "Existed" (EX) buildings, which predated the master plan but are functionally integrated into the campus, are given a minimal contribution score (0.25). This weighting system ensures that the index reflects not only the quantity of completed structures but also their spatial and functional fidelity to the original campus vision. N_ASD represents the number of structures that were constructed exactly as shown in the master plan, while N_CD refers to buildings that were realized with spatial or functional deviations. N_EX indicates pre-existing structures that were already on site before the master plan but are still functionally active. N_Total is the total number of structures that were originally planned, serving as the denominator in the index calculation.

- N_ASD: Number of structures built as designed
- N_CD: Number of structures constructed differently
- N_EX: Number of pre-existing structures
- N_Total: Total number of planned structures

This index was calculated for each campus, and the results were visualized in the findings section with color-coded tables and figures. Each table (Table 1) reflects the coding logic and the implementation status.

Table 1. Sample Code Schema for University Buildings

Code	Meaning	Implementation Assessment
1W3	University 1, Work function, Building 3	**ASD (As Designed)**
2A1	University 2, Accommodation, Building 1	**CD (Constructed Differently)**
3R4	University 3, Recreation and Socialization, Building 4	**NC (None Constructed)**
4D2	University 4, Administrative Unit 2	**EX (Existed)**

These codes were used consistently across all visual and tabular representations in the results section. This integrated method ensures both analytical rigor and transparency in evaluating the campus implementation performance.

The categorization of campus facilities in this study is based on their alignment with the original master plans and their presence in satellite imagery. Facilities that were designed in the master plan and constructed accordingly, as seen in satellite photographs, are labeled as " As Designed " This label also covers buildings constructed in the same location but of different sizes. If one facility is included in the master plan but constructed in a different location, and the other is a structure that was not originally planned but is visible in satellite imagery, these two situations fall into the " Constructed Differently " category. Buildings that were planned in the master plan but never constructed and do not appear in satellite imagery are classified as "None Constructed." Lastly, structures that already existed in the area before being incorporated into the master plan are categorized as "Existed." This classification system provides a structured way to assess how closely university campus developments adhere to their initial plans.

As a result of the examined criteria, implementation labels were examined under the functional relationships of the units. The percentage of implementation of each university and the changes in the function groups within the whole group were discussed.

2.1. Material

The years 1981 and later marked a period of significant numerical change in the Turkish higher education system. Although the spatial distribution of higher education institutions across the country began much earlier, major quantitative transformations occurred with the enactment of Law No. 2547 [40]. Since 2006, Turkey has witnessed a significant expansion in its higher education landscape, marked by the establishment of several notable universities. Alongside this growth, regulatory frameworks governing higher education have undergone adaptations to accommodate evolving educational needs and international standards. Reforms, including amendments to the Higher Education Law, have aimed to enhance the quality assurance mechanisms through the establishment of the Turkish Higher Education Quality Assurance Agency (YÖKAK).

Furthermore, efforts to encourage private sector participation in higher education, promote internationalization through partnerships with foreign universities, and grant universities more autonomy in administrative and academic matters have been prominent features of post-2006 regulations. These changes reflect Turkey's commitment to fostering a dynamic and globally competitive higher education sector that meets the needs of its diverse student population while contributing to research and innovation on both national and international scales [41]. With the Law No. 5467 dated 01.03.2006, a total of fifteen new state universities were established in different cities. Table 2 shows the list of all universities established after 2006.

Table 2. Universities in Turkey established after 2006

	University Name	City	Year
1.	Adıyaman University	Adıyaman	2006
2.	Aksaray University	Aksaray	2006
3.	Amasya University	Amasya	2006
4.	Burdur Mehmet Akif Ersoy University	Burdur	2006
5.	Duzce University	Düzce	2006
6.	Erzincan Binali Yıldırım University	Erzincan	2006
7.	Giresun University	Giresun	2006
8.	Kastamonu University	Kastamonu	2006
9.	Kırşehir Ahi Evran University	Kırşehir	2006
10.	Ordu University	Ordu	2006
11.	Recep Tayyip Erdogan University	Rize	2006
12.	Tekirdağ Namık Kemal University	Tekirdağ	2006
13.	Uşak University	Uşak	2006
14.	Yozgat Bozok University	Yozgat	2006
15.	Rize University	Rize	2006
16.	Ağrı İbrahim Çeçen University	Ağrı	2007
17.	Artvin Çoruh University	Artvin	2007
18.	Batman University	Batman	2007
19.	Bilecik Şeyh Edebali University	Bilecik	2007
20.	Bingöl University	Bingöl	2007
21.	Bitlis Eren University	Bitlis	2007
22.	Çankırı Karatekin University	Çankırı	2007
23.	Karabuk University	Karabük	2007
24.	Karamanoğlu Mehmetbey University	Karaman	2007
25.	Kırklareli University	Kırklareli	2007
26.	Kilis 7 Aralik University	Kilis	2007
27.	Mardin Artuklu University	Mardin	2007
28.	Muş Alparslan University	Muş	2007
29.	Nevşehir Hacı Bektaş Veli University	Nevşehir	2007
30.	Osmaniye Korkut Ata University	Osmaniye	2007
31.	Siirt University	Siirt	2007
32.	Sinop University	Sinop	2007
33.	Ardahan University	Ardahan	2008
34.	Bartin University	Bartın	2008
35.	Bayburt University	Bayburt	2008
36.	Gumushane University	Gümüşhane	2008
37.	Hakkari University	Hakkari	2008
38.	Iğdır University	Iğdır	2008
39.	Munzur University	Tunceli	2008
40.	Şırnak University	Şırnak	2008
41.	Yalova University	Yalova	2008
42.	Abdullah Gül University	Kayseri	2010
43.	Ankara Yıldırım Beyazıt University	Ankara	2010
44.	Bursa Technical University	Bursa	2010
45.	Erzurum Technical University	Erzurum	2010
46.	Istanbul Medeniyet University	İstanbul	2010
47.	Izmir Kâtip Çelebi University	İzmir	2010
48.	Necmettin Erbakan University	Konya	2010
49.	Adana Alparslan Türkeş Science and Technology University	Adana	2011
50.	Ankara Social Sciences University	Ankara	2013
51.	Alanya Alaaddin Keykubat University	Antalya	2015
52.	Bandırma Onyedi Eylül University	Balıkesir	2015
53.	Izmir Bakırçay University	İzmir	2016
54.	Izmir Democracy University	İzmir	2016
55.	Ankara Music and Fine Arts University	Ankara	2017
56.	Ankara Hacı Bayram Veli University	Ankara	2018
57.	Eskisehir Technical University	Eskişehir	2018
58.	Isparta University of Applied Sciences	Isparta	2018
59.	Kütahya Health Sciences University	Kütahya	2018
60.	Tarsus University	Mersin	2018

The period between 2006 and 2008 corresponds to a phase during which a large number of universities were established. During this time, universities spread across various cities in Anatolia, many of which were relatively small urban centers. The period from 2010 to 2018, on the other hand, reflects the increasing integration of science and technology into higher education, driven by factors such as digitalization, transformations in knowledge production, and market-oriented approaches. As a result, universities during this period became more responsive to market demands, and scientific knowledge increasingly gained commercial value [42]. Within the scope of this study, seven universities established after 2006—during a phase of rapid expansion in Anatolia—were selected for analysis. Although Table 2 lists all universities founded after 2006 in Türkiye, the selected case studies represent different regions and, importantly, institutions for which master plans were accessible. The universities examined in this study are Kırşehir Ahi Evran University (2006), Kırklareli University (2007),

Erzincan Binali Yıldırım University (2006), Burdur Mehmet Akif Ersoy University (2006), Adıyaman University (2006), Ankara Yıldırım Beyazıt University (2010), Nevşehir Hacı Bektaş Veli University (2007) (Figure 2).

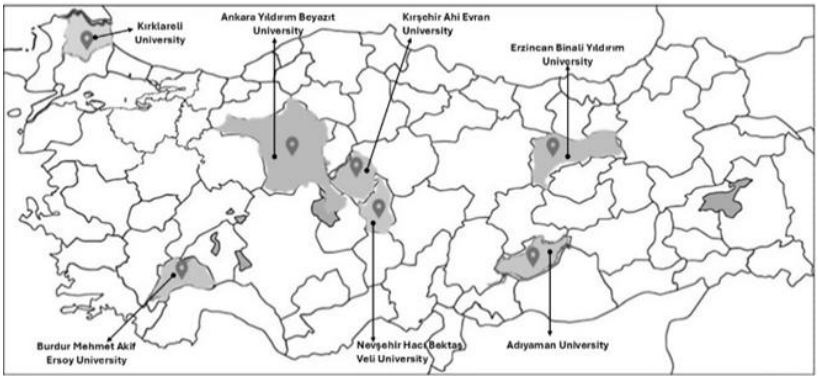


Figure 2. Selected Universities shown on the map

3. RESULT

This research focused on the development of seven public universities that were founded after 2006. Each case was studied by comparing the current physical layout of the campus with the proposals outlined in its original master plan, supported by recent satellite imagery. The purpose was not only to measure whether the campuses had expanded as intended, but also to understand how faithfully the built environment reflected the vision set out at the beginning.

To carry out this comparison, the study grouped the planned facilities into four functional categories: "Work and Study," "Accommodation," "Recreation and Socialization," and "Administrative Units and Centers." For each category, individual buildings were labelled with compliance codes (ASD, CD, NC, EX), which made it possible to track the level of completion and the degree of adherence to the original design. This method allowed a structured yet flexible way to evaluate a wide range of facilities, from dormitories and classrooms to mosques, cafés, and administrative offices.

The findings were then organized into a series of tables and figures. These visual tools helped clarify how closely—or how loosely—different universities followed their plans and also highlighted patterns that might not be immediately visible in the raw data. In some cases, the constructed buildings were almost identical to what had been envisioned, while in others, delays, omissions, or significant changes were evident. Such variations made it possible to see not just the outcome but also the underlying priorities and constraints of each institution.

Taken together, these evaluations provide a comparative picture of campus growth strategies. They show which types of facilities were prioritized, which were delayed, and how different universities balanced ambition with available resources. In short, the analysis captures both the progress achieved and the compromises made, offering a realistic view of how institutional visions have been translated into built form.

3.1. Kırşehir Ahi Evran University

Although some structures in this group (Faculty of Dentistry, Faculty of Health Sciences, Faculty of Pharmacy, Conservatory, and School of Foreign Languages) were defined in the master plan, they have not been constructed in the current situation. However, a mosque was built in place of the Faculty of Engineering and Architecture; in addition, some structures, such as the Faculty of Islamic Sciences and the Faculty of Fine Arts, were included in the campus outside the master plan (Table 3, Figure 3). It was observed that the student dormitories planned in the accommodation function group were largely constructed, but the male and female dormitories were outside the master plan. The vast majority of the structures in the Recreation and Socialization group (stadium, swimming pool, indoor sports hall, cultural center, library) were built; only the student community center remained incomplete. In the administrative units and centers group, structures such as the Central Research Laboratory, Rectorate building, and Student Affairs were completed, while the Technopolis and Hospital were none constructed.

As a result, while the groups with the highest rate of implementation among the planned structures on the campus were work-learning and recreation-socialization, deviations, and developments outside the master plan were also observed in some structures.

3.2. Kırklareli University

It is observed that, among the 14 faculties categorized under the "working and learning" function group on the Kırklareli University campus, only four have been constructed, while the remaining faculties have not yet been realized. A mosque has been built in the area designated for the Faculty of Technology, and this deviation has been noted with the label "constructed differently" (Table 4, Figure 4). None of the guesthouses planned under the "accommodation" function group has been constructed, and no developments have been observed in this category.

Within the "recreation and socialization" function group, several structures such as the social facility building, library, indoor sports hall, and stadium have been completed. However, other planned structures, including the congress center, health facility, and swimming pool, have not been constructed. Thus, the implementation rate in this category is approximately fifty percent (Figure 4). In the "administrative units" group, only the central research laboratory has been built, while the rectorate building, although planned, has not been realized.

In conclusion, apart from a mosque that was constructed outside of the master plan, the overall implementation rate of the planned buildings on the campus remains considerably low.

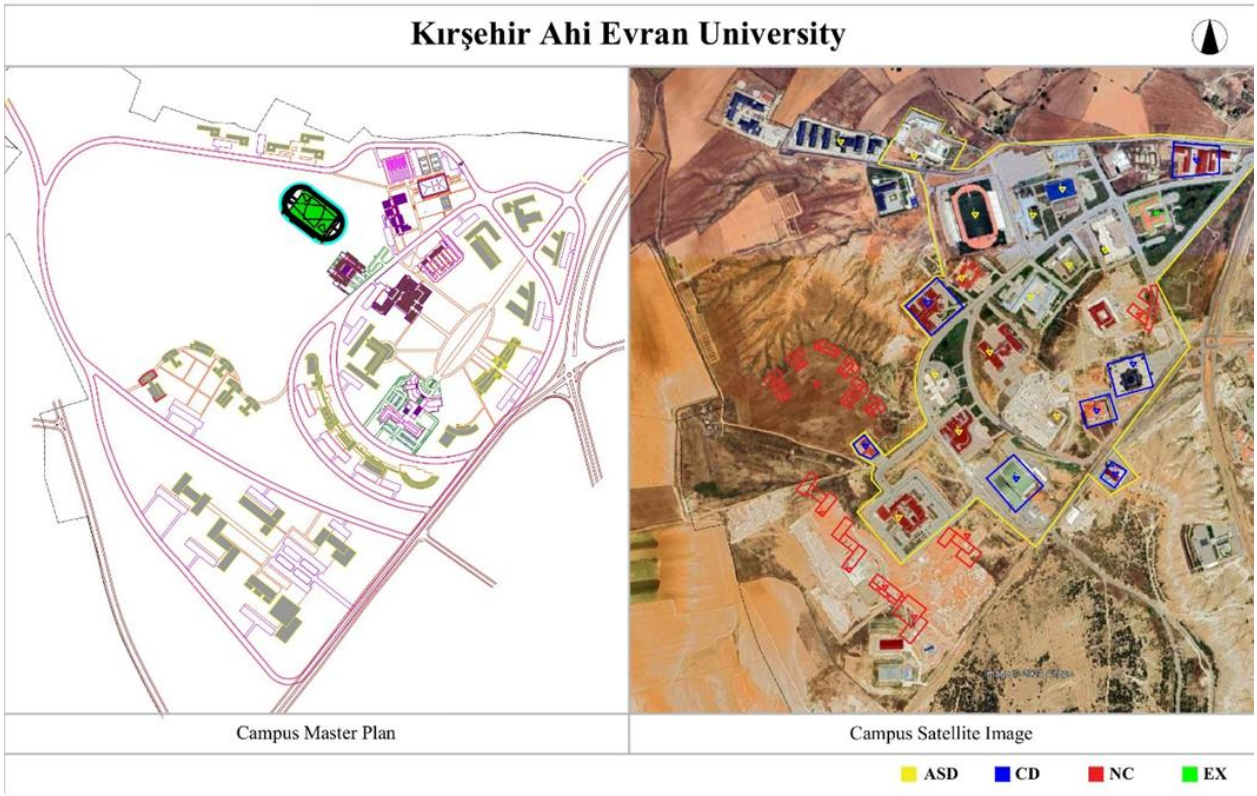


Figure 3. Implementation labels of Kırşehir Ahi Evran University

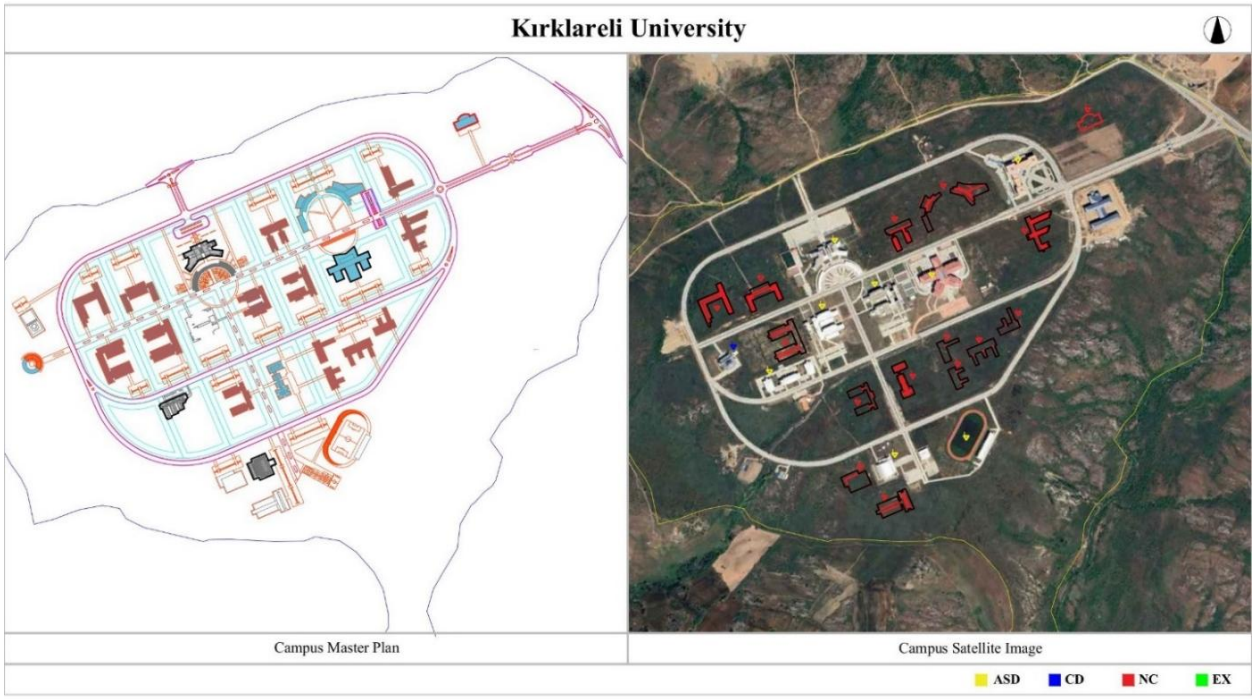


Figure 3. Implementation labels of Kırklareli University

Table 3. Comparison of Units for Kırşehir Ahi Evran University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
1W1	Faculty of Economics and Administrative Sciences	4.050 m2		4.050 m2	1W1	Faculty of Economics and Administrative Sciences	EX
1W2	Faculty of Arts and Sciences	8.320 m2		8.320 m2	1W2	Faculty of Arts and Sciences	ASD
1W3	Faculty of Engineering and Architecture	5.400 m2		1.800 m2	1D6	Mosque	CD
1W4	Faculty of Law	5.210 m2		4.700 m2	1W4	Faculty	ASD
1W5	Faculty of Education	7.255 m2		4.200 m2	1W5	Faculty of Education	ASD
1W6	Faculty of Agriculture	5.600 m2		5.600 m2	1W6	Faculty of Agriculture	ASD
1W7	Faculty of Medicine	3.020 m2		5.200 m2	1W7	Faculty of Medicine	ASD
1W8	Faculty of Dentistry	4.320 m2					NC
1W9	Faculty of Health Sciences	4.320 m2					NC
1W10	Pharmacy	4.032 m2					NC
1W11	Conservatory	2.890 m2					NC
1W12	School of Foreign Languages	4.000 m2					NC
1W13	High School of Physical Education and Sports	3.800 m2		3.800 m2	1W13	High School of Physical Education and Sports	ASD
1W14	Vocational School of Health Services	4.020 m2					NC
1W15	School of Physical Therapy and Rehabilitation	1.700 m2		1.200 m2	1W15	School of Physical Therapy and Rehabilitation	CD
1A1	Student Dormitory	4.900 m2		4.000 m2	1A1	Student Dormitory	ASD
1A2	Guesthouse and Social Facility	1.060 m2					NC
1R1	Stadium	18.000 m2		18.000 m2	1R1	Stadium	ASD
1R2	Indoor swimming pool	4.400 m2		4.400 m2	1R2	Indoor swimming pool	ASD
1R3	Indoor Gym	3.340 m2		3.340 m2	1R3	Indoor Gym	ASD
1R4	Student Community Center	2.120 m2					NC
1R5	Culture-Congress Center	2.000 m2		5.500 m2	1R5	Culture-Congress Center	ASD
1R6	Library	1.800 m2		1.800 m2	1R6	Library	ASD
1D1	Central Research Laboratory	6.700 m2		6.700 m2	1D1	Central Research Laboratory	ASD
1D2	Rectorate	2.300 m2		2.800 m2	1D2	Rectorate	ASD
1D3	Student Affairs Department	1.700 m2		1.700 m2	1D3	Student Affairs Department	ASD
1D4	Technopark	10.300 m2					NC
1D5	Hospital	5.760 m2					NC
1S	Service Road	145.100 m2		93.500 m2	1S	Service Road	CD
1P	Pedestrian Road	14.000 m2		8.000 m2	1P	Pedestrian Road	CD
1C	Campus Area	1.928.000 m2		346.000 m2	1C	Campus Area	CD
NA				2.000 m2	1W16	Faculty of Islamic Sciences	CD
NA				4.900 m2	1W3	Faculty of Engineering and Architecture	CD
NA				950 m2	1W17	Faculty of Fine Arts	CD
NA				2.200 m2	1A3	Higher Education Male Dormitory	CD
NA				3.500 m2	1A4	Female dormitory	CD

Table 4. Comparison of Units for Kırklareli University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
2W1	Faculty of Science	5.250 m2					NC
2W2	Faculty of Literature	4.800 m2					NC
2W3	Faculty of Technology	7.440 m2		1.900 m2	2D3	Mosque	CD
2W4	Engineering faculty	7.440 m2			2W4	Engineering faculty	ASD
2W5	Faculty of Education	3.850 m2					NC
2W6	Tourism Faculty	4.080 m2		5.000 m2	2W10	School of Health	ASD
2W7	Faculty of Law	4.800 m2					NC
2W8	Faculty of Economics and Administrative Sciences	3.800 m2		9.200 m2	2W16	Faculty of Theology	ASD
2W9	Vocational School of Health Services	2.600 m2					NC
2W10	School of Health	3.400 m2					NC
2W11	School of Technical Sciences	2.300 m2					NC
2W12	School of Social Sciences	2.300 m2					NC
2W13	School of Foreign Languages	3.900 m2					NC
2W14	High School of Physical Education and Sports	5.760 m2					NC
2W15	Central Classroom	6.500 m2		3.250 m2	2W15	Faculty of Arts and Sciences	ASD
2A1	Guesthouse	2.500 m2					NC
2R1	Social Building	5.800 m2		5.800 m2	2R1	Social Building	ASD
2R2	Library	4.700 m2		4.700 m2	2R2	Library	ASD
2R3	Culture Congress Center	9.000 m2					NC
2R4	Medico and Student Center Building	3.600 m2					NC
2R5	Indoor swimming pool	4.460 m2					NC
2R6	Indoor Gym	5.250 m2		5.250 m2	2R6	Indoor Gym	ASD
2R7	Stadium	18.000 m2		18.000 m2	2R7	Stadium	ASD
2D1	Central Research Laboratory	4.080 m2		3.600 m2	2D1	Central Research Laboratory	ASD
2D2	Rectorate	3.070 m2					NC
2S	Service Road	84.600 m2		84.600 m2	2S	Service Road	ASD
2P	Pedestrian Road	31.600 m2		31.600 m2	2P	Pedestrian Road	ASD
2C	Campus Area	2.533.320 m2		2.533.320 m2	2C	Campus Area	ASD

3.3. Erzincan Binali Yıldırım University

On the Erzincan University campus, several faculties within the “working and learning” function group have been constructed, while others remain unrealized. Additionally, an open social area has been built within a zone allocated to this group, and this deviation has been categorized under the label “constructed differently” (Table 5, Figure 5). The student dormitory and guesthouse designed under the “accommodation” function group have been constructed following the master plan. Most of the structures under the “recreation and socialization” group—such as the stadium, cafeteria, outdoor sports areas, and amphitheatre—have been largely completed. Nevertheless, the library and congress center were built even though they were not in the main plan and were therefore evaluated under a different label (Table 5). Within the “administrative units and centers” group, the mosque is the only structure included in the master plan. However, buildings such as the rectorate and kindergarten were constructed independently of the master plan.

In general, while the proportion of structures constructed outside the master plan is relatively high, the rate of unrealized structures is considerably low.

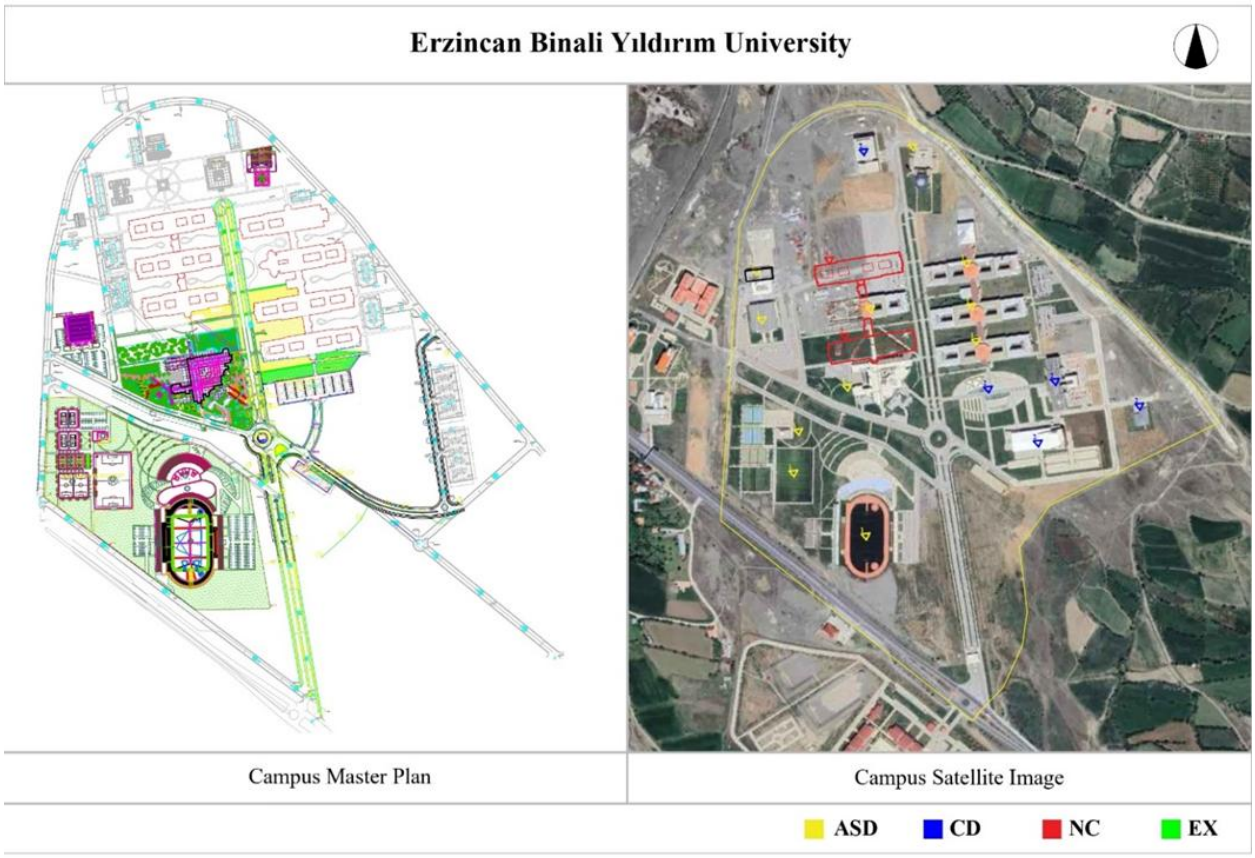


Figure 5. Implementation labels of Erzincan University

Table 5. Comparison of Units for Erzincan University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
3W1	Academic Building A	8.200 m2					NC
3W2	Academic Building B	8.200 m2		7.200 m2	3W2	Academic Building B	ASD
3W3	Academic Building C	8.200 m2					NC
3W4	Academic Building D	9.000 m2		9.100 m2	3W4	Academic Building D	ASD
3W5	Academic Building E	9.000 m2		9.100 m2	3W5	Academic Building E	ASD
3W6	Academic Building F	9.000 m2		9.100 m2	3W6	Academic Building F	ASD
3W7	Academic Building G	9.000 m2		10.700 m2	3R5	Open Social Area	CD
3A1	Student Dormitory	4.500 m2		5.700 m2	3A1	Student Dormitory	ASD
3A2	Guesthouse & Bazaar	6.400 m2		6.400 m2	3A2	Konukevi	ASD
3R1	Stadium	18.000 m2		18.000 m2	3R1	Stadyum	ASD
3R2	Cafeteria	560 m2		560 m2	3R2	Cafeteria	ASD
3R3	Outdoor sports fields	21.350 m2		21.350 m2	3R3	Outdoor sports fields	ASD
3R4	Amphitheatre	4.700 m2		4.700 m2	3R4	Amphitheatre	ASD
3D1	Mosque	2.000 m2		2.000 m2	3D1	Mosque	ASD
3S	Service Road	72.000 m2		72.000 m2	3S	Service Road	ASD
3P	Pedestrian Road	20.000 m2		20.000 m2	3P	Pedestrian Road	ASD
3C	Campus Area	820.000 m2		740.000 m2	3C	Campus Area	CD
NA				5.500 m2	3R6	Congress and Culture Center	CD
NA				4.200 m2	3D2	Rectorate	CD
NA				950 m2	3D3	Kindergarten	CD
NA				3.160 m2	3R7	Library	CD

3.4. Burdur Mehmet Akif Ersoy University

Structures within the "working and learning" function group at Burdur Mehmet Akif Ersoy University have been largely constructed; however, some have been realized in different locations or with different functions. (Table 6, Figure 6). Although the student dormitory under the "accommodation" function group was not defined in the master plan, it has been constructed and positioned in the area originally designated for the research center.

Approximately 80% of the structures planned within the "recreation and socialization" function group have been realized. Only the cultural and congress center remains unbuilt, indicating a high completion rate within this group. In the "administrative units and centers" group, many of the structures outlined in the master plan have been constructed, although some have been located in different areas. The labels "as planned" and "constructed differently" are distributed in a balanced manner within this group.

In conclusion, the master plan at Burdur Mehmet Akif Ersoy University has been largely implemented, with deviations occurring primarily due to student needs or local requirements.

3.5. Adıyaman University

Several structures within the "working and learning" function group at Adıyaman University have been constructed as planned, while others have either been relocated or not realized at all. For instance, Block B of the Faculty of Education was built in place of the Cultural and Congress Center and has therefore been classified under the label "constructed differently" (Table 7, Figure 7). All structures under the "accommodation" function group—including the student dormitory, guesthouse, and staff housing—have been built either as planned or with minor deviations, resulting in a 100% implementation rate for this group. Within the "recreation and socialization" group, all planned structures except the library have been constructed. The congress center, however, has been repurposed into a different facility. This indicates a generally high implementation rate within the group. In the "administrative units and centers" category, all planned buildings have been completed except for the mosque and kindergarten. On the other hand, a student center, which was not included in the original master plan, has been constructed.

Overall, Adıyaman University has largely adhered to its master plan and achieved particularly high implementation rates in the accommodation and social infrastructure categories. Deviations from the plan have remained limited.

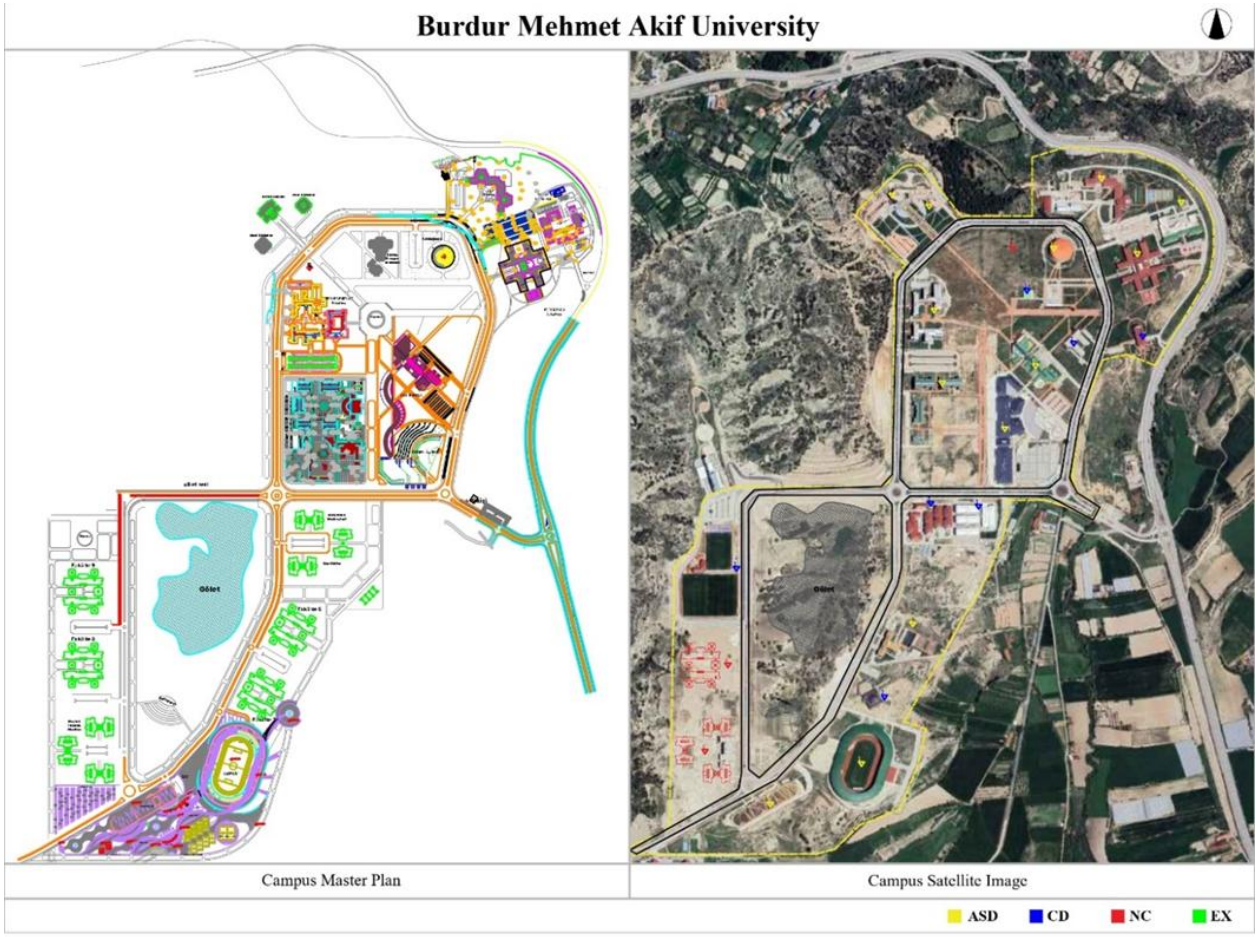


Figure 6. Implementation labels of Burdur Mehmet Akif Ersoy University

Table 6. Comparison of Units for Burdur Mehmet Akif Ersoy University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
4W1	Faculty of Economics and Administrative Sciences	5.000 m2		5.000 m2	4W1	Faculty of Economics and Administrative Sciences	EX
4W2	Faculty of Veterinary Medicine	12.500 m2		12.500 m2	4W2	Faculty of Veterinary Medicine	EX
4W3	Faculty of Arts and Sciences	11.700 m2		7.200 m2	4W3	Faculty of Arts and Sciences	ASD
4W4	Faculty of Education	11.200 m2		5.400 m2	4W4	Faculty of Education	ASD
4W5	Faculty 6	8.175 m2		2.800 m2	4W5	Faculty 6	ASD
4W6	Faculty 7	8.175 m2		2.500 m2	4D5	Mosque	CD
4W7	Faculty 8	8.175 m2					NC
4W8	Faculty 9	8.175 m2		27.000 m2	4R6	Outdoor sports fields	CD
4W9	Vocational School	9.000 m2					NC
4R1	Library	3.450 m2		3.450 m2	4R1	Library	ASD
4R2	Culture Congress Center	4.300 m2					NC
4R3	SKS Menza	10.400 m2		25.000 m2	4R3	SKS Menza	ASD
4R4	Sport complex	8.300 m2		8.300 m2	4R4	Sport complex	ASD
4R5	Stadium	18.000 m2		18.000 m2	4R5	Stadium	ASD
4D1	Rectorate	2.360 m2		2.500 m2	4D1	Rectorate	ASD
4D2	Administrative Units	2.800 m2		1.600 m2	4D2	Administrative Units	ASD
4D3	Animal Hospital	5.000 m2		6.200 m2	4D3	Animal Hospital	ASD
4D4	Research Center	9.000 m2		13.400 m2	4A1	Student Dormitory	CD
4S	Service Road	137.500 m2		137.500 m2	4S	Service Road	ASD
4P	Pedestrian Road	42.500 m2		18.750 m2	4P	Pedestrian Road	CD
4C	Campus Area	1.607.750 m2		1.607.750 m2	4C	Campus Area	ASD
NA				2.500 m2	4D4	Central Research Laboratory	CD
NA				500 m2	4R7	Cafe	CD
NA				1.500 m2	4W10	Faculty of Health Sciences	CD

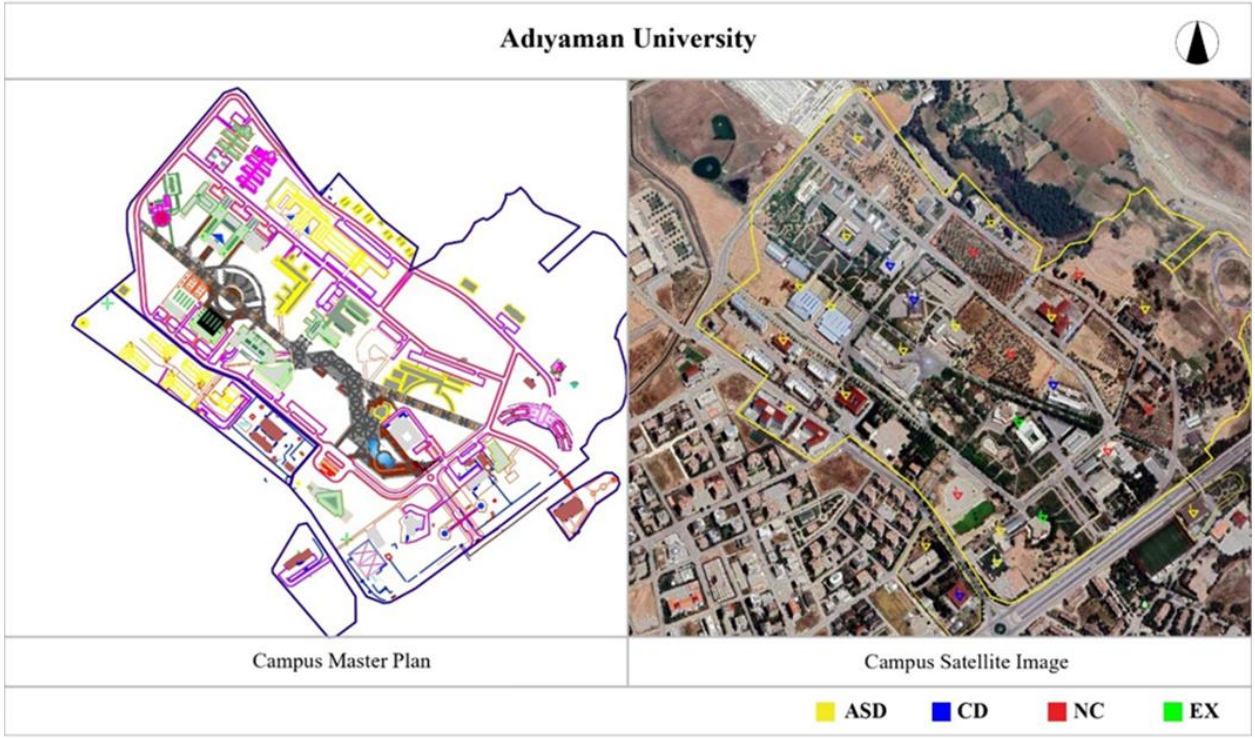


Figure 7. Implementation labels of Adıyaman University

Table 7. Comparison of Units for Adıyaman University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
5W1	Faculty of Arts and Sciences	10.480 m2		10.480 m2	5W11	High School of Physical Education and Sports	ASD
5W2	Faculty of Arts and Sciences Available	880 m2		880 m2	5W2	Faculty of Arts and Sciences Available	EX
5W3	Faculty of Education	5.600 m2		1.200 m2	5D5	Mosque	CD
5W4	Faculty of Education Available	2.000 m2		2.000 m2	5W4	Faculty of Education Available	EX
5W5	Faculty of Engineering	9.000 m2					NC
5W6	Faculty of Economics and Administrative Sciences	7.500 m2		3.300 m2	5W6	Faculty of Economics and Administrative Sciences	ASD
5W7	Faculty of Fine Arts	4.000 m2					NC
5W8	School of Health	900 m2		900 m2	5W8	School of Health	ASD
5W9	Vocational School	1.200 m2					NC
5W10	Faculty Reserve Area	17.100 m2		2.600 m2	5W11	Faculty of Islamic Sciences	ASD
5A1	Student Dormitory	9.500 m2		12.700 m2	5A1	Student Dormitory	ASD
5A2	Lojman	2.040 m2		900 m2	5A2	Lojman	ASD
5A3	Guesthouse	854 m2		854 m2	5A3	Misafirhane	ASD
5R1	Library	2.850 m2					NC
5R2	Cafeteria	1.370 m2		1.370 m2	5R2	Cafeteria	ASD
5R3	Indoor Gym	5.000 m2		5.000 m2	5R3	Indoor Gym	ASD
5R4	Medico Social Building	4.800 m2		4.800 m2	5R4	Medico Social Building	ASD
5R5	Culture Congress Center	6.670 m2		2.200 m2	5W12	Faculty of Education B Block	CD
5R6	Outdoor sports fields	3.000 m2		3.000 m2	5R6	Outdoor sports fields	ASD
5D1	Rectorate	1.800 m2		1.800 m2	5D1	Rectorate	ASD
5D2	Research Center	2.100 m2		2.100 m2	5D2	Research Center	ASD
5D3	Student Affairs Department	700 m2		700 m2	5D3	Student Affairs Department	ASD
5D4	Kindergarten	700 m2					NC
5D5	Mosque	1.600 m2					NC
5S	Service Road	84.000 m2		84.000 m2	5S	Service Road	ASD
5P	Pedestrian Road	34.300 m2		34.300 m2	5P	Pedestrian Road	ASD
5C	Campus Area	708.300 m2		725.000 m2	5C	Campus Area	CD
NA					5D6	Student Center	CD

3.6. Ankara Yıldırım Beyazıt University

Ankara Yıldırım Beyazıt University possesses a considerably large campus area, with numerous faculties planned under its master plan. However, the current state reveals that only the Faculties of Humanities and Social Sciences and Business have been constructed, while the remaining faculties have yet to be realized. Furthermore, the Faculty of Architecture was constructed in place of a planned laboratory area, and this deviation has been categorized under the label "constructed differently" (Table 8, Figure 8).

Only one of the planned dormitories has been completed under the "accommodation" group, while the rest of the dorms and staff housing have not materialized. This shows that progress in this category has been very limited. In terms of "recreation and socialization," certain elements like sports facilities, cafés, and restaurants are in place, yet many other planned amenities are still missing. As a result, the group as a whole remains only partially implemented. A similar situation is seen with the "administrative units and centers." Although a mosque and a bus garage were built, most of the other administrative buildings have not moved forward despite being included in the master plan.

Overall, Ankara Yıldırım Beyazıt University's campus reflects a rather low realization of the master plan. This outcome is likely tied to the early stage of development, the large area reserved for expansion, and the extensive list of facilities that are still on hold.

3.7. Nevşehir Hacı Bektaş Veli University

Within the "working and learning" function group at Nevşehir Hacı Bektaş Veli University, several faculties are already present, some of which were constructed before the development of the master plan. In the zones designated for new faculties, only a limited number of buildings have been realized. Additionally, certain structures, such as the Faculty of Technology, have been constructed outside the scope of the master plan (Table 9, Figure 9).

In the "accommodation" function group, there are no dormitories or guesthouses, neither in the current campus layout nor in the master plan. No development has been observed in this category. Regarding the "recreation and socialization" function group, most of the planned structures have been implemented in locations different from those originally proposed and are thus categorized as "constructed differently." Notably, the sports hall, stadium, and library have been constructed in alternative areas. In the "administrative units and centers" group, several buildings have been constructed outside the master plan. Prominent examples include the Career Planning and Research Center and the Technopark.

Furthermore, buildings such as a mosque and a kindergarten have also been established in unplanned locations. In conclusion, the implementation of the campus at Nevşehir University is predominantly concentrated in the "constructed differently" (CD) category. This pattern indicates that the reassignment of existing buildings and developments outside the master plan has significantly influenced the spatial coherence of the campus.

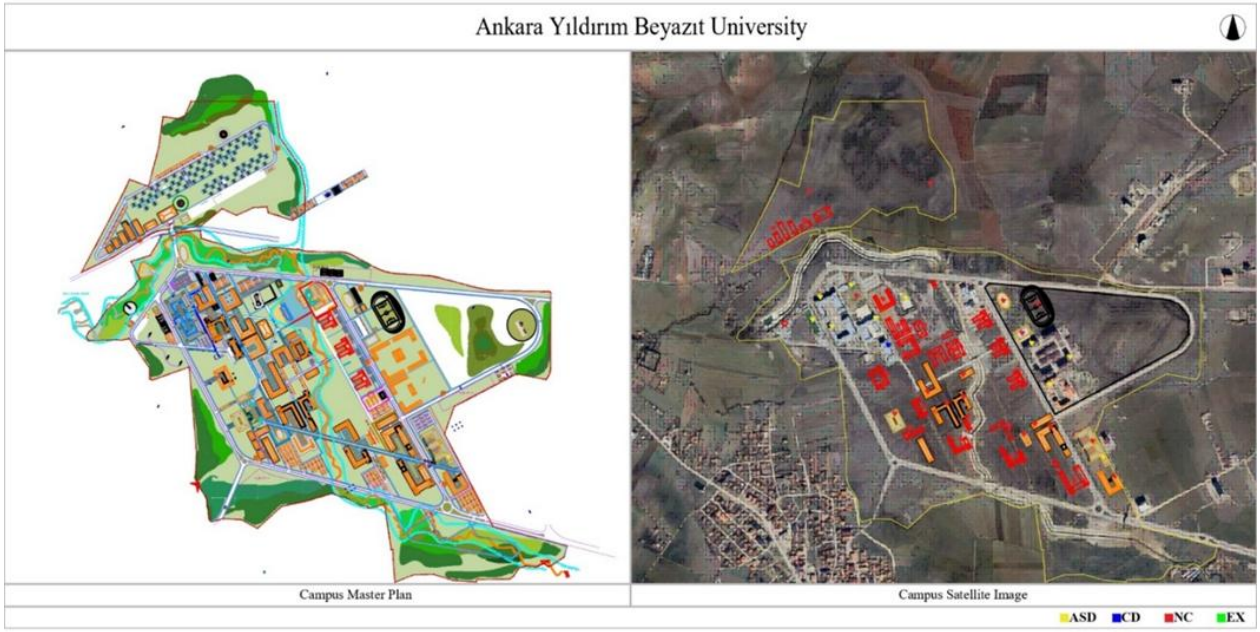


Figure 8. Implementation labels of Ankara Yıldırım Beyazıt University

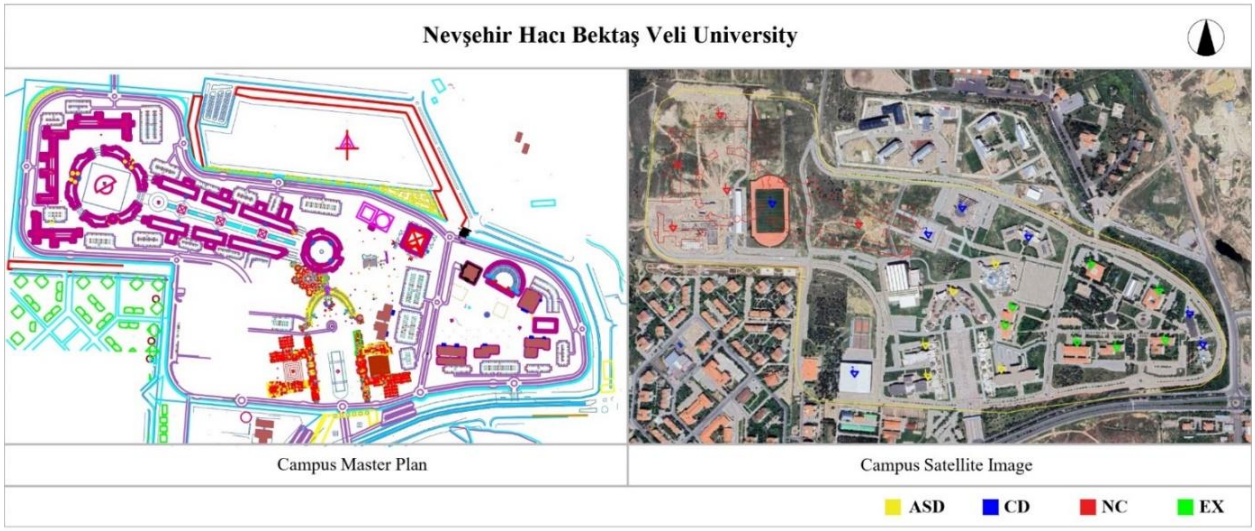


Figure 9. Implementation labels of Nevşehir Hacı Bektaş Veli University

Table 8. Comparison of Units for Ankara Yıldırım Beyazıt University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
6W1	Faculty of Humanities and Social Sciences	46.893 m2		46.893 m2	6W1	Faculty of Humanities and Social Sciences	ASD
6W2	Faculty of Law	15.157 m2		15.157 m2	6W4	Faculty of Management	ASD
6W3	Faculty of Political Sciences	34.801 m2					NC
6W4	Faculty of Management	18.521 m2					NC
6W5	Faculty of Architecture	32.010 m2					NC
6W6	Faculty of Engineering and Natural Sciences	34.801 m2					NC
6W7	Faculty of Islamic Sciences	13.166 m2					NC
6W8	Conservatory	14.987 m2					NC
6W9	Faculty of Fine Arts	22.963 m2					NC
6W10	Faculty of Medicine	56.868 m2					NC
6W11	Faculty of Dentistry	25.520 m2					NC
6W12	Faculty of Health Sciences	10.872 m2					NC
6W13	School of Foreign Languages	34.894 m2					NC
6W14	Institute of Science and Technology	17.520 m2					NC
6W15	Central Classrooms	16.436 m2					NC
6W16	Amplifier	2.821 m2					NC
6A1	Student Dormitory	56.496 m2		24.340 m2	6A1	Student Dormitory	ASD
6A2	Student Dormitory (Private)	36.472 m2					NC
6A3	Guesthouse	19.884 m2					NC
6A4	Rector's House	294 m2					NC
6A5	Lojman	38.719 m2					NC
6R1	Library & Technology, Science Research M.	17.228 m2					NC
6R2	Culture Congress Center	16.875 m2					NC
6R3	Museum	1.007 m2					NC
6R4	Sports Facilities	32.047 m2		5.000 m2	6R4	Sports Facilities	ASD
6R5	Workshop	2.512 m2					NC
6R6	Bazaar	12.241 m2					NC
6R7	Social Building	3.882 m2					NC
6R8	dining halls	4.836 m2					NC
6R9	Cafeteria	450 m2		200 m2	6R9	Cafeteria	ASD
6R10	Restaurant	3.886 m2		650 m2	6R10	Restaurant	ASD
6D1	Rectorate	6.246 m2					NC
6D2	Central Archive Building	6.808 m2					NC
6D3	Medical Center	2.418 m2					NC
6D4	Hospital	67.912 m2					NC
6D5	Nursery-Kindergarten Building	2.792 m2					NC
6D6	Primary school	7.800 m2					NC
6D7	Central Research Laboratory	11.979 m2		3.180 m2	6W5	Faculty of Architecture	CD
6D8	Civil Engineering Laboratories	10.832 m2					NC
6D9	Mosque	1.913 m2		1.913 m2	6D9	Mosque	ASD
6D10	Bus Garage and Repair Shop	4.457 m2		4.457 m2	6D10	Bus Garage and Repair Shop	ASD
6D11	Water Purification Plant	2.850 m2					NC
6S	Service Road	212.435 m2		170.435 m2	6S	Service Road	CD
6P	Pedestrian Road	120.000 m2		18.000 m2	6P	Pedestrian Road	CD
6C	Campus Area	2.429.280 m2		2.030.000 m2	6C	Campus Area	CD

Table 9. Comparison of Units for Nevşehir Hacı Bektaş Veli University

ID	Building Name (in Master plan)	Area		Constructed Area	ID	Building Name (in place)	Implementation Tag
7W1	Faculty of Engineering	7.800 m2		7.800 m2	7W2	Faculty of Education	ASD
7W2	Faculty of Education	7.200 m2		7.200 m2	7W11	Faculty of Arts and Sciences	ASD
7W3	Faculty of Fine Arts	900 m2		900 m2	7W3	Faculty of Fine Arts	EX
7W4	Faculty of Engineering and Architecture	880 m2		880 m2	7W4	Faculty of Engineering and Architecture	EX
7W5	Faculty of Commerce and Tourism Education	1.410 m2		1.410 m2	7W5	Faculty of Commerce and Tourism Education	EX
7W6	Faculty of Arts and Sciences	2.100 m2		2.100 m2	7W6	Faculty of Arts and Sciences	EX
7W7	Faculty of Economics and Administrative Sciences	1.400 m2		1.400 m2	7W7	Faculty of Economics and Administrative Sciences	EX
7W8	Vocational School	1.540 m2		1.540 m2	7W8	Vocational School	EX
7W9	Tourism Faculty	4.150 m2					NC
7W10	Faculty of Economics and Administrative Sciences	2.970 m2					NC
7W11	Faculty of Arts and Sciences	2.620 m2					NC
7W12	Faculty of Fine Arts	2.090 m2					NC
7W13	Conservatory	2.090 m2					NC
7W14	Development Areas	11.560 m2					NC
7R1	Library	5.100 m2		3.400 m2	7D4	Technopark	CD
7R2	Dining hall	10.200 m2		10.200 m2	7R2	Dining hall	ASD
7R3	Amphitheatre	5.400 m2					NC
7R4	Cafe						NC
7D1	Rectorate	3.600 m2		3.600 m2	7D1	Rectorate	ASD
7D2	Mosque	3.520 m2		5.100 m2	7R1	Library	CD
7D3	Clock tower	4.000 m2		3.960 m2	7D5	Career Planning Application and Research Center	CD
7S	Service Road	80.518 m2		80.518 m2	7S	Service Road	ASD
7P	Pedestrian Road	7.900 m2		7.900 m2	7P	Pedestrian Road	ASD
7C	Campus Area	66.270 m2		66.270 m2	7C	Campus Area	ASD
NA				620 m2	7D2	Mosque	CD
NA				5.720 m2	7R5	Indoor Gym	CD
NA				980 m2	7W15	Faculty of Theology	CD
NA				18.000 m2	7R6	Stadium	CD
NA				1.860 m2	7D6	Kindergarten	CD

4. DISCUSSION

4.1. Descriptive Evaluations

Kırşehir Ahi Evran University's master plan included several faculties such as Dentistry, Pharmacy, and Health Sciences that were never built. In their place, a number of alternative structures have appeared. Student dormitories were constructed outside the plan, suggesting that priorities shifted over time or that resources were reassigned. While most recreational and social facilities were eventually realized, the absence of central elements like the Technopark and the hospital is striking. This uneven outcome indicates that some functional groups advanced smoothly, whereas others stalled—likely due to funding limitations or changing institutional strategies.

Kırklareli University has made only limited progress toward its original scheme. Out of the fourteen faculties envisioned, just four have materialized. A mosque was erected on the site reserved for the Faculty of Technology, and none of the planned guesthouses have been built. Recreational and sports areas were only partially delivered, covering roughly half of what was proposed. Social facilities, in particular, fall short of meeting student demand. Among the administrative units, the central research laboratory exists, but the rectorate remains absent. These deviations appear tied to

shifting priorities and assessments of urgency. The mosque—introduced outside the plan—likely reflects community expectations rather than institutional design.

Erzincan Binali Yıldırım University left a number of planned work and study buildings unbuilt. This choice may reflect a greater focus on student social life. In contrast, the accommodation group is complete: all dormitories and guesthouses have been delivered. Recreational and social facilities are also largely present, though a few—like the library and congress center—took on forms different from what the plan originally envisioned.

Mehmet Akif Ersoy University displays a relatively balanced picture. Most of the work and study group was constructed as intended, although a student dormitory replaced the planned research center. About 80% of recreational and social facilities have been finished, but the culture and congress center is still missing. On the administrative side, nearly all planned structures are in place. Overall, the campus matches the master plan fairly closely, with deviations likely tied to budget pressures or shifting student needs.

Adıyaman University also shows a strong level of completion. Within the faculties, some buildings were delivered, some adjusted, and a few omitted, giving a mixed but balanced outcome. The accommodation group achieved full completion, covering dormitories, guesthouses, and staff housing. In the recreational and social group, one building originally intended for academic use was repurposed as the culture and congress center, but overall implementation remains high. Most administrative units were built, with the exception of the preschool and mosque. A student center was also added independently of the plan. Taken together, the university's development shows a high level of adherence, particularly in housing and social facilities.

Ankara Yıldırım Beyazıt University occupies a very large site, but the pace of construction has been slow. So far, only the Faculties of Humanities and Social Sciences and of Business have been completed. The Faculty of Architecture and Fine Arts was built on land initially allocated for a laboratory. Student dormitories exist, but other accommodation structures are missing. Some sports fields, cafes, and restaurants are in place, yet many of the planned recreational and social facilities remain unrealized. Administrative and central units show very low delivery. Overall, the university lags behind in implementation, but given the campus scale, more construction may be expected in the coming years.

Nevşehir Hacı Bektaş Veli University presents a campus divided between existing and projected faculties. Only two of the planned faculties have been realized, while a Faculty of Technology was introduced outside the scheme. The accommodation group remains empty, with no dormitories or housing constructed. Recreational and social structures—such as the indoor sports hall, stadium, and library—were built, but not always in the zones foreseen by the plan. Several administrative units were also delivered outside the framework, including a career planning and research center and a Technopark. A preschool and mosque were likewise added independently. The campus contains many cases of "built differently," pointing to either the adaptation of existing facilities or a rethinking of institutional needs.

4.2. Implementation Index Results

The validity of the proposed Implementation Index was assessed through cross-case comparison among the selected universities. Index values were evaluated together with detailed qualitative descriptions of campus development patterns. Campuses with high index scores consistently exhibited strong spatial and functional conformity to their master plans, whereas lower scores corresponded to campuses with significant deviations or unimplemented facilities. This consistency between quantitative index results and qualitative spatial observations supports the internal validity of the index and demonstrates its capacity to reliably reflect implementation performance.

Figure 10 shows the implementation index values calculated for the seven universities in the study. The index (Ɪ) measures how many of the planned buildings were actually realized and places them into four groups: As Designed (ASD), Constructed Differently (CD), None Constructed (NC), and Existed (EX). This scoring method, developed specifically for this research, makes it possible to compare how closely each campus followed its original plan. (Table 10)

When the results are compared, Erzincan Binali Yıldırım University (Ɪ = 0.893) comes forward with the highest level of compliance. Most of its planned functions have been built as intended, which suggests a strong adherence to the original master plan. At the opposite end, Ankara Yıldırım Beyazıt University shows the lowest ratio of buildings constructed exactly as planned; many of its facilities fell into the "None Constructed" group.

Table 10. Implementation Index Formula and Scoring Criteria

Implementation Label	**Description**	**Weight**
ASD – As Designed	The structure was built exactly as in the master plan	1.0
CD – Constructed Differently	Built, but with altered form or location	0.5
EX – Existed	Already present before the plan	0.25
NC – None Constructed	Planned but not built	0

Formula used:

Ɪ= ((1.0·N_ASD) +(0.5·N_CD) +(0.25·N_EX))/N_TOTAL

Applying this formula gives a wide spread of results:

• Ɪ3 – Erzincan Binali Yıldırım University (0.893): The strongest example of compliance. The university's campus development has stayed very close to the original vision.

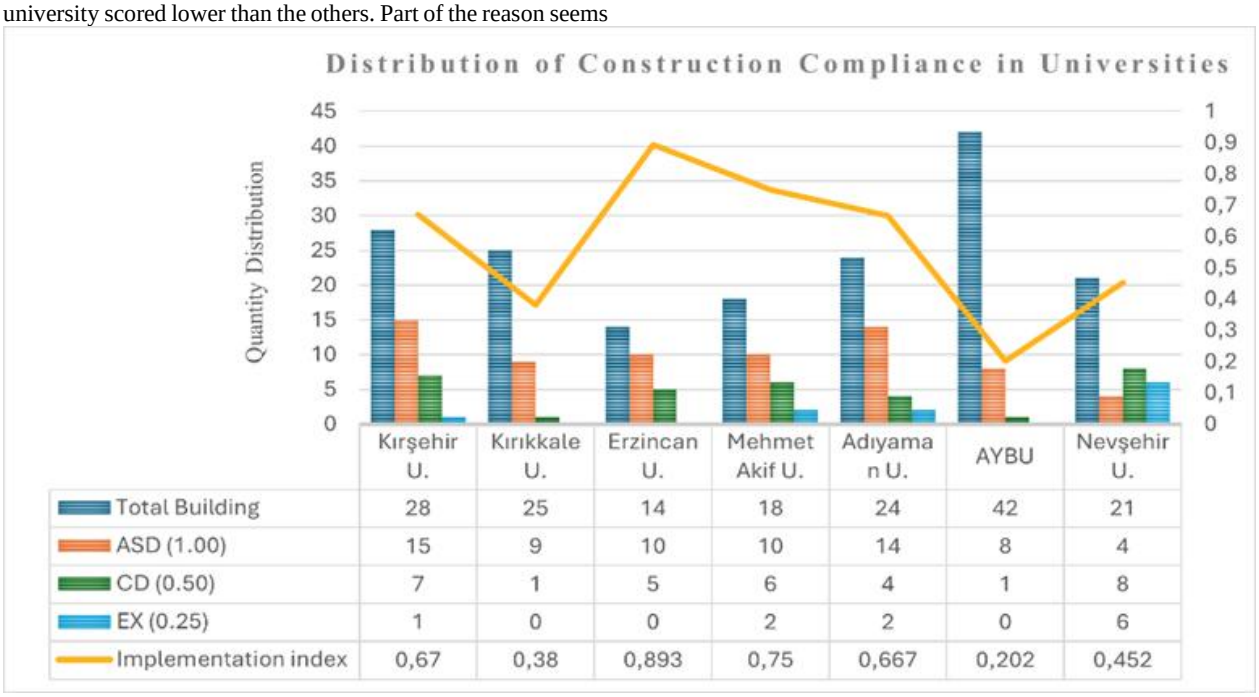
• Ƭ4 – Mehmet Akif Ersoy University (0.750): This institution ranks second. Many of the buildings in the plan were actually built, but a couple of them turned out a bit different from what had been drawn up.

• Ƭ1 – Kırşehir Ahi Evran University (0.670) & Ƭ5 – Adıyaman University (0.667): Their results sit in the middle range. A good number of the planned buildings were actually constructed, though not all. Some never moved forward at all, and a few ended up quite different from what the plan had described.

• Ƭ7 – Nevşehir Hacı Bektaş Veli University (0.452): This university scored lower than the others. Part of the reason seems to be delays in building, and in some cases the plan was altered so much that the outcome no longer matched the original design.

• Ƭ2 – Kırklareli University (0.380): Only a small portion of the planned campus was built. The difference between the intended layout and the final result is quite clear.

• Ƭ6 – Ankara Yıldırım Beyazıt University (0.202): At the bottom of the list. The score points to serious struggles in translating the plan into practice.



	Kırşehir U.	Kırıkkale U.	Erzincan U.	Mehmet Akif U.	Adıyaman U.	AYBU	Nevşehir U.
Total Building	28	25	14	18	24	42	21
ASD (1.00)	15	9	10	10	14	8	4
CD (0.50)	7	1	5	6	4	1	8
EX (0.25)	1	0	0	2	2	0	6
Implementation index	0,67	0,38	0,893	0,75	0,667	0,202	0,452

Figure 10. Distribution of Construction Compliance in Universities

When looking across all universities, the contrast becomes obvious. Erzincan Binali Yıldırım (Ƭ3) and Mehmet Akif Ersoy (Ƭ4) managed to follow their plans fairly well, while Ankara Yıldırım Beyazıt (Ƭ6) fell far behind. The reasons are not identical everywhere, but things like available funds, shifting needs, administrative capacity, and even timing of construction likely played a role. The situation is not uniform across functions. Spaces for work, study, and recreation were generally completed more successfully, while accommodation units and administrative buildings showed greater inconsistency. These differences may reflect changes in institutional priorities, limited budgets, or new needs that emerged after the plans were drawn.

Looking at Figure 11, it can be seen that universities with higher implementation scores tended to follow their master plans more closely. Their focus on urgent needs—such as teaching spaces and essential student facilities—helped them meet expectations. The success of these campuses seems to rest on a combination of sound planning, adequate financial resources, and effective project execution. When assessed in relation to their host cities, deviations from campus master plans can also be interpreted as adaptive responses to urban growth, accessibility conditions, land availability, and socio-economic pressures. Particularly in newly established universities located in small and medium-sized cities, campus development appears to be closely intertwined with patterns of urban expansion. Incorporating this perspective enhances the theoretical depth of the study by situating campus plan implementation within the wider framework of city–university interaction.

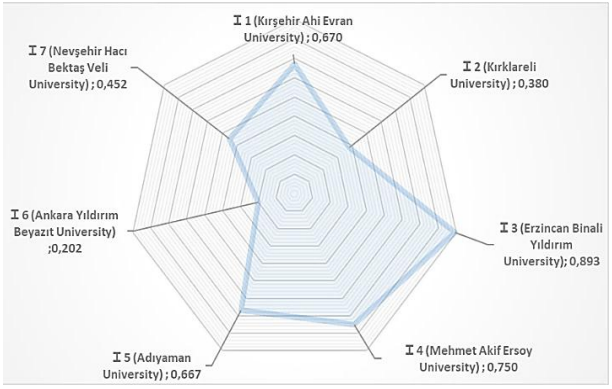


Figure 11. Implementation index report

5. CONCLUSION

Universities hold a central place in shaping the future of societies, not only by providing education but also by producing knowledge and fostering social development. In recent decades, these institutions have moved far beyond being simple teaching spaces. They are now conceived as wide-ranging campus environments that bring together social, cultural, health, housing, and recreational facilities alongside classrooms and laboratories. For such diverse settings to function well, campuses require careful planning and design. Education, research, and cultural needs must remain at the core, but resources also have to be managed efficiently. For a campus to grow in a healthy way, planning must look ahead and tie the university's aims to the city context. Whether this vision is fulfilled, however, depends on local factors, the funds at hand, and the leadership of the institution. Examining campus master plans and measuring the degree to which they are followed offers a practical way to monitor this development.

This study presents an index-based method for assessing how well university campuses comply with their master plans. By integrating both qualitative and quantitative observations into a single metric, the index provides a repeatable and transparent way to assess the congruence between planned and realized spatial structures. Furthermore, the use of satellite imagery has enabled objective observation of physical development and the detection of changes without field surveys. These tools offer a practical approach for monitoring campus growth and assessing planning performance. The analysis shows that adherence to master plans differs greatly. For instance, universities Ü3 and Ü4 achieved high levels of compliance (0.893 and 0.750). They succeeded in constructing most of the facilities foreseen in their plans, paying attention to architectural principles. Importantly, their completion of educational as well as social spaces has created a more balanced campus life for students. On the other hand, universities with very low compliance, such as Ü6 (0.202), face significant obstacles. In some places, rapid growth in student numbers and the creation of new academic departments have outpaced available infrastructure, pushing institutions toward unplanned and ad hoc building projects. Explaining the full reasons behind these results lies outside the scope of this paper; the aim here is limited to introducing a method for assessing plan compliance.

By reviewing more than 300 buildings across seven new Turkish university campuses, this research puts forward a systematic approach to evaluate spatial and functional development. The main contribution of this research lies in its systematic approach that combines visual analysis with a quantitative compliance index. This framework provides a repeatable way to measure how master plans are translated into built environments by using accessible data sources such as satellite imagery. The proposed methodology offers a structured and comparable basis for evaluating planning performance across different campuses. The resulting Compliance Index provides a useful metric, but it is not without limitations. The analysis relies on satellite imagery and manually performed measurements, which may result in lower measurement precision compared to automated or machine-learning-based techniques. In addition, the evaluation was limited to universities for which master plans were accessible, and on-site observations could not be conducted. A further step could involve automation: high-resolution satellite imagery, analyzed through remote sensing or supervised classification, offers a way to reduce manual mapping and to refresh the index periodically. Future studies may benefit from automated image processing methods and a broader dataset to enhance accuracy and comparability.

DECLARATION OF ETHICAL STANDARDS

The author(s) of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

AUTHOR CONTRIBUTIONS

Şevval Ezgi TOPAL: Conceptualization, Data curation, Writing-Original draft preparation, Methodology

Ekrem Bahadır ÇALIŞKAN: Methodology, Data curation, Writing-Reviewing and Editing, Validation.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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