ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

BIM INTEGRATION APPROACH TO ARCHITECTURE UNDERGRADUATE EDUCATION: THE CASE OF ITU

M.Sc. THESIS

Fulden YILMAZ

Department of Informatics

Architectural Design Computing Program

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MİMARLIK LİSANS EĞİTİMİNE BİM ENTEGRASYONU YAKLAŞIMI: İTÜ ÖRNEĞİ

YÜKSEK LİSANS TEZİ

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Fulden YILMAZ, a M.Sc. student of ITU Graduate School of Science Engineering and Technology student ID 523171002, successfully defended the thesis entitled "BIM INTEGRATION APPROACH TO ARCHITECTURE UNDERGRADUATE EDUCATION: THE CASE OF ITU", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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To my father,

FOREWORD

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June 2020

Fulden YILMAZ
Architect

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ABBREVIATIONS

ACSA	:	Association of Collegiate Schools of Architecture
AEC	:	Architecture Engineering Construction
AGC	:	Associated General Contractors of America
AIA	:	American Institute of Architects
AIC	:	Academic Interoperability Coalition
AIM	:	Asset Information Management
AIR	:	Asset Information Requirements
AFNOR	:	French Standardization Association
ANSI	:	The American National Standards Institute
BAC	:	BIM Acceleration Committee
BCA	:	Building and Construction Authority
BCF	:	BIM Collaboration Format
BDS	:	Building Definition System
BEIIC	:	Built Environment Industry Innovation Council
BEP	:	Building Execution Plan
BIM	:	Building Information Modelling
BMP	:	BIM Management Plan
BPEB	:	BIM Project Execution Plan
BS	:	British Standards
BSI	:	British Standards Institute
CAD	:	Computer-aided Design
CAM	:	Computer-aided Manufacturing
CAPEX	:	Capital Expenditures
CDE	:	Common Data Environment
CIC	:	Construction Industry Council
COBie	:	Construction Operations Building Information Exchange
CORONET	:	Construction and Real Estate Network
DIN	:	German Industry Standards Association
DAC	:	Design Automated by Computer
EAAE	:	European Association for Architectural Education
ECTS	:	European Credit Transfer System
EIR	:	Exchange Information Requirements
ENHSA	:	European Network of Heads of Schools of Architecture
GPS	:	Geometric Product Specifications
GSA	:	Geological Society of America
IFC	:	The Industry Foundation Class
IMSAD	:	Association of Turkish Construction Material Producers
IPD	:	Integrated Project Delivery
ISO	:	International Standards Organization
IT	:	Information Technology
ITU	:	Istanbul Technical University

LOD	**:**	Level of Development (in United Stade)
LOD	**:**	Level of Model Detail (in United Kingdom)
LOI	**:**	Level of Model Information
LOIN	**:**	Level of Information Need
LOM	**:**	Level of Model Definition
MIAK	**:**	Department of Architectural Accrediting Board
MIPD	**:**	Master Information Delivery Plan
NAAB	**:**	National Architectural Accrediting Board
NATSPEC	**:**	National Building Specification (in Australia)
NBIM	**:**	National Institute of Building Sciences
NBIMS	**:**	National Building Modelling Information Standards
NCARB	**:**	National Council of Architectural Registration Boards
OIR	**:**	Organization Information Requirements
OPEX	**:**	Operational Expenditures
PAS	**:**	Publicly Available Specifications
PDP	**:**	Project Delivery Procedures
PIM	**:**	Project Information Management
PIP	**:**	Project Implementation Plan
PIR	**:**	Project Information Requirements
SIS	**:**	The Swedish Standards Commission
SSI	**:**	Semi-Structural Interview
TSE	**:**	Turkish Standards Institute
WIP	**:**	Work in Progress

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BIM INTEGRATION APPROACH TO ARCHITECTURE UNDERGRADUATE EDUCATION: THE CASE OF ITU

SUMMARY

The 4th Industrial Revolution, which started in 2011 with the development of technology, directs the world to technology-oriented production and management strategies. This revolution demonstrates the importance of digitalization in all sectors and the need to mature business strategies with international perspectives. Considering the labour productivity indexes tables that continued until 2010, especially the construction sector experiences a serious loss of productivity compared to other sectors until the digitalization era. For reducing this loss, in the last decade, the sector focuses itself on BIM systems which propose a digital infrastructure that allows the construction industry to control building construction processes from the design phase to the operational phase, based on data. In the same aim, the use of BIM systems in many countries has started to be mandatory on a public occasion. Although this requirement remained within the scope of national standards and BIM specifications in project requirements until 2018, the presence of international BIM standards clearly shows the necessity of using BIM systems worldwide.

BIM systems are a useful process for facilitating construction management and reducing cost losses in construction processes. Notably, the systems gather the multidisciplinary structure of the construction sector on project process, and it aims to digitize and manage buildings, complexes or facilities as a whole, from the design stage to the operational processes. In this context, digitization can be considered as the process of transferring and managing any information related to building construction processes to object-oriented digital media in a way that can be recognized by the computer. This goal means changing the project processes involving all stakeholders in the construction industry and managing the projects from a different perspective.

The use of BIM systems in leading countries such as the United States and the United Kingdom has been developed by supporting public standards. The publications made by the BIM committees established in these countries regulate works of all stakeholders who will be involved in the project process. For this reason, the presence of standards in the process of getting used to the use of BIM systems enables the projects to proceed with more distinct lines. When looking at Turkey, many stakeholders in the construction sector is faced with BIM specification when they need to be involved in international projects. However, there is not a state-supported, standard process for the use and implementation of BIM systems. Therefore, this change and development are proceeding by the companies' efforts.

Dodge Data & Analytics, one of the leading intelligence providers in the North American construction industry, publishes SmartMarket Reports for the use of BIM systems for various regions around the world in specific years to evaluate the use of the BIM system (McGraw Hill Construction, 2012; McGraw Hill Construction, 2013; Harvey & Stephen, 2015; McGraw Hill, 2017). When these reports are analysed, some problems that construction companies face in system integration come to the fore. They are the

integration problems of BIM tools with each other, procedures that are not very clear in project submissions and the fact that the production sector in the construction does not yet integrate into this system. Among these problems, the lack of qualified personnel specialised in BIM systems is also noteworthy. The leading countries try to solve the problem with some education reforms such as adding new BIM courses to the current curriculum, opening new BIM programs in üniversities.

The efficiency of BIM systems is monitored by taking into consideration the gains in the cost flows of the trio of design-construction and operation. Entering correct and regular information in the design stage affects the financial benefits in the construction and operation stages is significant. For this reason, the primary group that should specialize in construction management systems is architects. However, when university education related to architecture is examined, courses related to construction management and BIM systems are not covered in detail in undergraduate education. The lack of knowledge shows that architects should receive additional training to specialize after university education to take part in new generation construction projects. On the other hand, many architects who have completed their undergraduate education face BIM systems in the market due to new business strategies. For the system to function efficiently and for the architect to exist in this system, BIM systems education must be included in architecture undergraduate education.

In this context, within the scope of the thesis, it is aimed to put forward a proposal on how to integrate the BIM system into undergraduate education and this proposal will be structured on ITU architectural undergraduate education. Firstly, the main subjects to be addressed in the evaluation of the BIM background are revealed through the analysis of BIM standards in various regions. These topics are basic BIM knowledge, project life cycle, roles and responsibilities, BIM model dimensions, BIM model development levels (Level of Development, LOD), common data environment (CDE) and project delivery procedures, and lastly collaboration, respectively. Afterwards, the gains (skills and knowledge) related to the main topics are questioned. These gains can be listed as follows: theoretical the knowledge of the BIM systems, the knowledge of project stages, the skill of teamwork and work-sharing, the skill of modelling, various management and computational skills related to these, building elements and material knowledge, the skill of the working with common data platform, and interdisciplinary systematic teamwork skills. The gains are analysed for preparing questions to evaluate the level of support the BIM system of the courses in the undergraduate program.

In the second part of the study, various approaches and proposals focused on integrating BIM education to the universities are analysed by reviewing the current academic sources. Theses and researches in the literature revealed the importance of Bloom Taxonomy, which is one of the frequently encountered pedagogical approaches to integrating BIM systems into education, and the necessity of analysis of knowledge and skills in this context. In the analysis, these knowledge and skills emerge as theoretical BIM knowledge, modelling skill, skill to analyse the BIM model, interdisciplinary collaboration skills, and management and computational skills. In addition to the gradual learning approach, also these knowledge and skills are evaluated as a parallel structure that will support each other continuously. The evaluation emphasises the importance of continuing BIM theoretical knowledge throughout the process and the awareness of management and computational skills at the beginning of the system. With these proposals, a general learning model is put forward. This model is the basic approach of the integration process that will be

introduced within the scope of the curriculum after evaluating the level of supporting the BIM system of the courses in the undergraduate program.

Recommended BIM learning model is configured on the undergraduate education of Istanbul Technical University Department of Architecture. For this purpose, the content of the compulsory courses in the curriculum are evaluated, and it is envisaged that 29 from the 44 compulsory courses in the curriculum can provide the necessary infrastructure for BIM learning. The background of these courses by using BIM subjects revealed from BIM standards are evaluated through a semi-structural interview with the instructors of the courses.

As a result of these interviews, it is reached that the basic BIM knowledge and collaboration issues have not yet matured for education within the scope of the compulsory courses at the university. Also, training focused on BIM learning is not yet included in the curriculum. However, students' homework and project delivery process in the single common digital storage is positive in terms of BIM learning process. Moreover, the existence of some critical courses such as building elements and materials courses and building management and economy course is valuable for the BIM learning model stages. These courses provide infrastructure in the curriculum for BIM learning model stages. However, it is not considered to acquire BIM knowledge and skills directly through these courses. For the implementation of this learning model stages, it is first envisaged that the curriculum should be integrated with architectural project and construction project courses, and then the knowledge and skills of the stages should be gained within the scope of project courses by supporting with digital learning tools. It is hoped that the BIM learning model and structuring process proposed in the study will provide an infrastructure for BIM learning setup on undergraduate education at the department of architecture at universities.

MİMARLIK LİSANS EĞİTİMİNE BİM ENTEGRASYONU YAKLAŞIMI: İTÜ ÖRNEĞİ

ÖZET

Teknolojinin gelişimi ile 2011 yılında baş gösteren 4. Sanayi Devrimi dünyayı teknoloji odaklı üretim ve yönetim stratejilerine yönlendirmiştir. Bu devrim, tüm sektörlerde dijitalleşmenin önemini ve iş yapış stratejilerinin uluslararası bakış açıları ile olgunlaştırılmasının gerekliliğini göstermiştir. 2010 yılına kadar süregelen iş gücü verim endeksleri tabloları göz önüne alındığında ise özellikle inşaat sektörü, dijitalleşme çağına kadar diğer sektörlere oranla ciddi bir verim kaybı yaşamıştır. Kaybın geri kazanılması için son on yıl içerisinde sektör kendini BIM sistemlerine odaklamıştır. BIM sistemleri inşaat sektörünün verilere dayalı bir şekilde bina yapım süreçlerinin tasarım aşamasından işletme aşamasına kadar kontrol edilmesine olanak tanıyan bir altyapı önermektedir. Verim kayıplarının azaltılması amacı ile birçok ülkede BIM sistemlerinin kullanımı kamu vesilesi ile zorunluluk teşkil etmeye başlamıştır. Bu zorunluluk 2018 yılına kadar ulusal standartlar ve proje gereksinimlerindeki BIM şartnameleri özelinde kalmış olsa da artık uluslararası BIM standartlarının varlığı BIM sistemlerinin dünya çapında kullanılmasının gerekliliğini açıkça göstermektedir.

BIM sistemleri, inşaat yönetimini kolaylaştırmak ve inşaat süreçlerindeki maliyet kayıplarını azaltmak için faydalı bir süreçtir. Özellikle inşaat sektörünün çok disiplinli ve dağınık yapısını projeler özelinde toparlayarak; bina, kompleks veya tesislerin tasarım aşamasından işletme süreçlerine kadar bir bütün halinde dijitalleşmesini ve tek merkezli yönetilmesini hedefler. Dijitalleşme bu kapsamda bina yapım süreçleri ile ilgili her bilginin bilgisayar tarafından tanınabilecek şekilde nesne tabanlı dijital ortama aktarılması ve bu ortamda yönetilmesi süreci olarak düşünülebilir. Bu hedef, inşaat sektöründeki tüm paydaşların dahil oldukları proje süreçlerinin değişmesi ve projelerin farklı bir bakış açısıyla yönetilmesi anlamına gelmektedir.

Amerika ve İngiltere gibi öncü ülkelerde BIM sistemlerinin kullanımı kamusal standartlar ile desteklenerek geliştirilmiştir. Bu ülkelerde kurulan BIM komiteleri ile yapılan yayınlar proje sürecine dahil olacak tüm paydaşlara öğreti niteliğindedir. Bu nedenle BIM sistemlerinin kullanımına alışma sürecinde standartların varlığı projelerin daha belirgin hatlarla ilerlemesini sağlamaktadır. Türkiye için bu değişime bakıldığında, inşaat sektöründeki birçok paydaş uluslararası projelere dahil olmak istediğinde BIM şartnameleri ile karşı karşıya kalmaktadır. Ayrıca bu değişim ve gelişim firmaların kendi çabaları ile ilerlemektedir. Bunun nedeni BIM sistemlerinin kullanımına ve uygulanasına yönelik devlet bazında desteklenen stratejik standart bir sürecin mevcut olmamasıdır.

Kuzey Amerika inşaat endüstrisinin önde gelen istihbarat sağlayıcılarından Dodge Data & Analytics, BIM sisteminin kullanımını değerlendirmek amacıyla belirli yıllarda dünyadaki çeşitli bölgeler için BIM sistemlerinin kullanımına yönelik SmartMarket Raporları yayınlamaktadır (McGraw Hill Construction, 2012; McGraw Hill Construction, 2013; Harvey & Stephen, 2015; McGraw Hill, 2017). Bu raporlar incelendiğinde, inşaat firmalarının sisteme entegrasyonda karşılaştıkları bazı sorunlar göze çarpar. Bu sorunların

başında BIM araçlarının birbirleri ile entegrasyon problemleri, proje teslimlerindeki çok açık olmayan prosedürler, inşaat tedarik sürecindeki üretim sektörünün henüz bu sisteme entegre olmayışı gibi konu başlıkları yer alır. Bu konu başlıkları içerisinde BIM sistemlerinde uzmanlaşmış kalifiye elemanların azlığı da dikkat çekmektedir. Bu durum öncü ülkelerde bazı eğitim reformları ile geliştirilmeye çalışılmaktadır.

BIM sistemlerinin verimliliği tasarım-inşa ve işletme üçlüsünün maliyet akışlarındaki kazanımları göz önüne alınarak takip edilmektedir. Tasarım etabındaki doğru ve düzenli bilgi girişlerinin inşa ve işletme etabındaki mali kazançlara etkisi oldukça önemlidir. Bu nedenle inşaat yönetimi sistemleri ile ilgili uzmanlaşması gereken temel meslek gruplarından biri mimarlardır. Ancak mimarlık ile ilgili üniversite eğitimleri incelendiğinde inşaat yönetimi ve BIM sistemleri ile alakalı dersler lisans eğitimde detaylı bir şekilde ele alınmamaktadır. Bu durum mimarların yeni nesil inşaat projelerinde yer alması açısından üniversite eğitimi sonrası uzmanlaşmak için ek eğitimler alması gerektiğini göstermektedir. Öte yandan, lisans eğitimini tamamlamış birçok mimar gelişen teknoloji ve yeni iş yapış stratejilerinin gerekliliği nedeni ile piyasada BIM sistemleri ile karşı karşıya gelmektedir. Sistemin verimli işleyebilmesi ve mimarın bu sistemde var olabilmesi için, BIM sistemleri öğreniminin özellikle mimari lisans eğitimine dahil olması önem arz etmektedir.

Bu bağlamda tez kapsamında BIM sisteminin lisans eğitimine nasıl entegre edileceğine dair bir öneri sunulması amaçlanmaktadır ve bu öneri İTÜ mimari lisans eğitimi üzerine yapılandırılacaktır. İlk olarak, BIM arka planının değerlendirilmesinde ele alınacak ana konular, çeşitli bölgelerdeki BIM standartlarının analizi ile ortaya konulmuştur. Bu konular sırasıyla temel BIM bilgisi, proje yaşam döngüsü, roller ve sorumluluklar, BIM model boyutları, BIM modeli gelişim seviyeleri (Level of Development, LOD), ortak veri ortamı (Common Data Environment, CDE) ve proje teslim prosedürleri ile iş birliği stratejileridir. Daha sonra ana konularla ilgili kazanımlar (beceri ve bilgi) sorgulanmış ve BIM öğreniminin lisans eğitiminde karşılık bulacağı kavramlar sorgulanmıştır. Bu kavramlar şu şekilde sıralanabilir: teorik BIM sistemleri bilgisi, proje aşamaları bilgisi, ekip çalışması ve iş paylaşımı becerisi, modelleme becerisi, bunlarla ilgili çeşitli yönetim ve hesaplama becerileri, yapı elemanları ve malzeme bilgisi, ortak veri platformu ile çalışma becerisi ve disiplinler arası sistematik ekip çalışması becerileri. Bu kavramların ortaya çıkarılmasının temel amacı lisans programındaki derslerin BIM sistemini destekleme düzeyini değerlendirmek için hazırlanacak soruların arka planının oluşturulmasıdır.

Çalışmanın ikinci bölümünde BIM eğitiminin üniversitelere entegre edilmesine odaklanan çeşitli yaklaşımlar ve öneriler mevcut akademik kaynaklar taranarak gözden geçirilmiştir. Literatürdeki tezler ve araştırmalar BIM sistemlerinin eğitime entegre edilmesi üzerine sıklıkla karşılaşılan pedagojik yaklaşımlardan biri olan Bloom Taksonomisinin önemini ve bu kapsamdaki bilgi ve becerilerin analizinin gerekliliğini ortaya çıkarmıştır. Literatürde ele alınan bilgi ve beceriler Bloom Taksonomisindeki aşamalı öğrenme modeli üzerinden düşünüldüğünde sırasıyla teorik BIM bilgisi, bilgi modelleme becerisi, BIM modelini analiz edebilme becerisi, disiplinler arası iş birliği becerisi ile yönetim ve hesaplama becerileri olarak ortaya çıkmaktadır. Bu bilgi ve beceriler çalışma kapsamında sentezlenmiş ve birbirlerini sürekli destekleyecek paralel bir yapı ile değerlendirilmesi önerilmiştir. Bu değerlendirme kapsamında genel bir öğrenme modeli ortaya konmuştur. Bu model lisans programındaki derslerin BIM sistemini destekleme düzeyini değerlendirdikten sonra müfredat kapsamında ortaya koyulacak entegrasyon sürecinin temel yaklaşımını oluşturmaktadır.

Önerilen BIM öğrenme modeli, İstanbul Teknik Üniversitesi Mimarlık Bölümü lisans eğitimi üzerine yapılandırılmıştır. Bu amaçla, müfredattaki zorunlu derslerin içeriği değerlendirilmiş ve müfredattaki 44 zorunlu dersten 29'unun BIM öğrenimi için gerekli altyapıyı sağlayabileceği öngörülmüştür. Bu derslerin yukarıda belirtilen, standartlara dayalı BIM temel konularındaki kazanımları, derslerin öğretim elemanları ile soru-cevap şeklinde yarı yapısal bir görüşme ile değerlendirilmiştir.

Bu görüşmeler sonucunda temel BIM bilgisi ve iş birliği stratejileri konularının üniversitedeki zorunlu dersler kapsamındaki eğitim için henüz olgunlaşmadığına ve BIM öğrenimi odaklı bir eğitimin henüz müfredata dahil edilmediğine ulaşılmıştır. Ancak, derslerde öğrencilerin ortak veri ortamının tek ortak dijital depo yapısına uygun ödev ve proje teslim süreci geçirmeleri BIM öğrenim süreci açısından olumlu karşılanmıştır. Ayrıca bu süreçte BIM öğrenim modeli aşamaları için bina yapı elemanları ve malzemeleri dersleri ile bina yönetim ve ekonomisi dersi gibi bazı kritik derslerin de varlığı ortaya çıkarılmıştır. Bu dersler öğrenme modeli aşamaları için müfredata bir altyapı sunmaktadır. Ancak BIM bilgi ve becerilerinin direkt bu dersler vasıtası ile kazandırılması düşünülmemektedir. Bu öğretim modülünün uygulanması için ilk olarak müfredatın mimari proje ve uygulama projesi dersleri ile entegre bir şekilde bütünleşmesinin gerekliliği öngörülmekte, daha sonra dijital kaynaklar ile desteklenerek bu bilgi ve becerilerin proje dersleri kapsamında kazandırılması önerilmektedir. Çalışma içerisinde önerilen BIM öğrenme modeli ve yapılandırma sürecinin üniversitelerdeki mimarlık bölümü lisans eğitimleri üzerinde BIM öğrenimi kurgusu için bir altyapı oluşturması umut edilmektedir.

1. INTRODUCTION

To keep pace with the changing market conditions after the 4th Industrial Revolution, business processes in the construction sector have undergone a change and development with Building Information Modelling (BIM) systems. The systems are in theory old but used in the last twenty years at the Architecture, Engineering and Construction (AEC) market. It is important to note that BIM is not only a transition in technology but also a change in operation. It allows a building to be represented by smart objects that carry detailed information about itself and even understand their relationship with other objects in the building model.

The BIM is not only changes the way building drawings and visualizations are created but also significantly changes all building processes (Eastman, 2011). The process of accepting this change by the market starts with some critical data in 2004. As seen Figure 1.1, data from The United States' productivity reviews between 1964-2004 show that productivity for all other sectors increased by about eighty per cent (80%), while the construction industry suffered a twenty per cent (20%) loss (Gilbertet al, 2012).

In the same years, the construction cost curve published by BuildingSMART International's founding president Patrick Macleamy also reveals a critical rate that will guide the solution of yield losses (Figure 1.2). The main issue to be considered in the curve is the raise of the equivalent of one dollar lost in the design phase, about sixty times during the operational phase (MacLeamy, 2004).

As a result of these two statistical data, the idea that BIM systems carry out building construction processes with a holistic and controllable digital model is the main reason for change for the market. This change provides advances such as reduced construction costs in the market, increasing the quality of production, and completing projects with fewer errors in less time (Young et al, 2008).

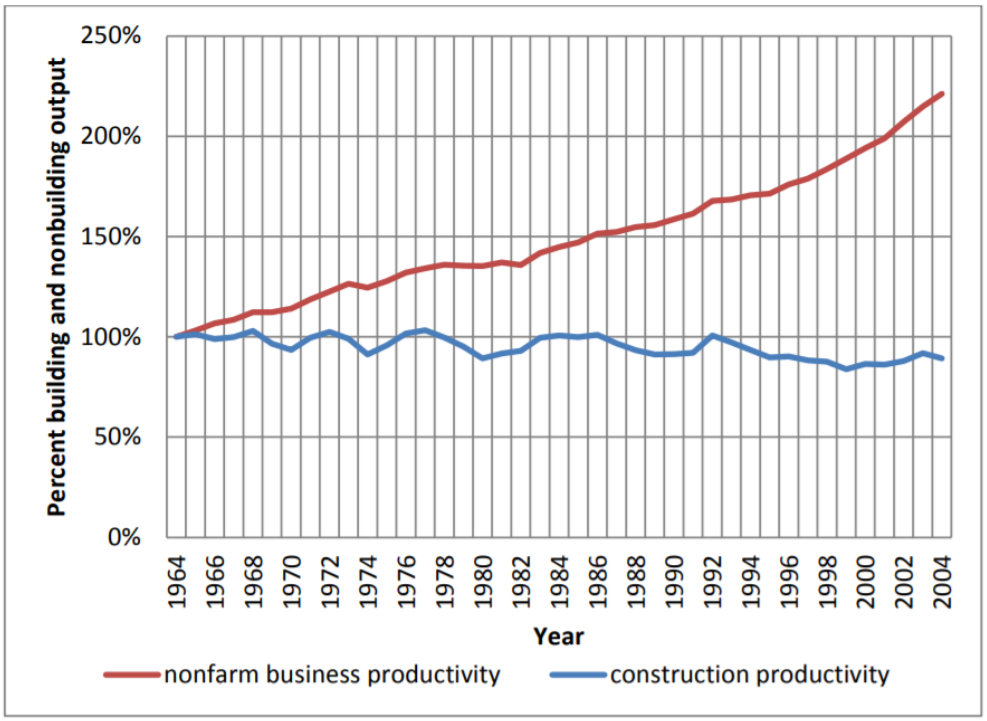


Figure 1.1 : Comparison between The United State construction labour productivity and non-farm labour productivity (image – (Teicholz, 2004) is revised by Gilbert et al, 2012).

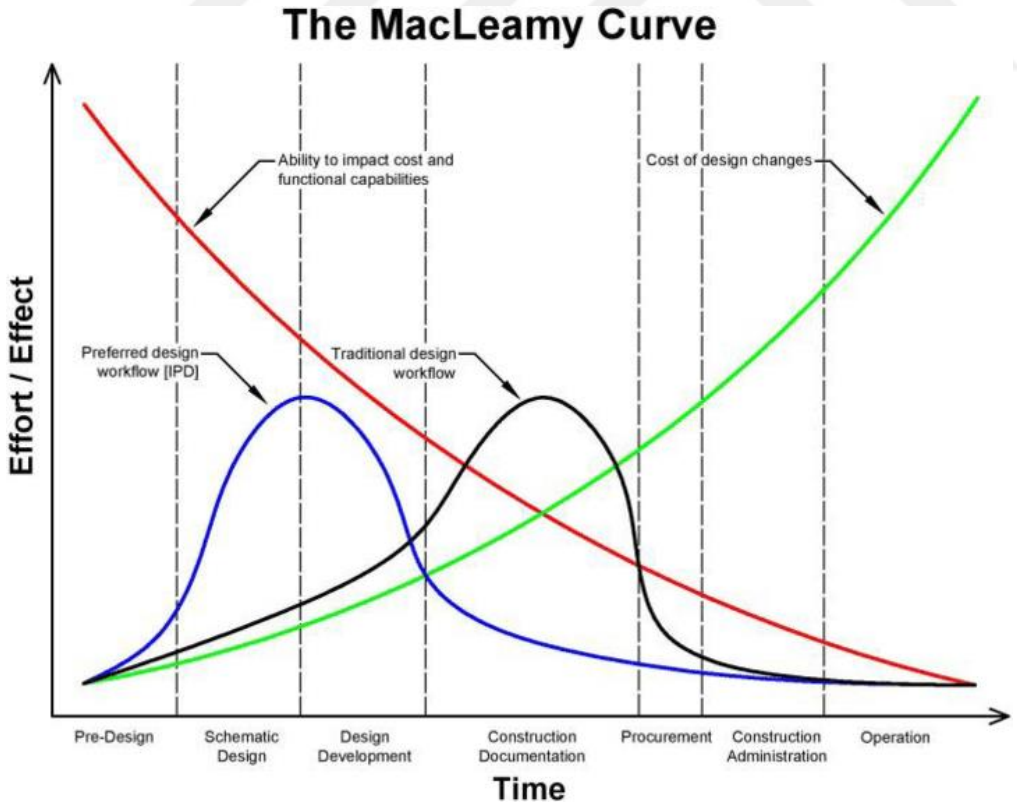


Figure 1.2 : The Macleamy Curve (CURT, 2004, p.4).

The primary purpose of using BIM is to benefit the construction industry, so it is essential to manage the process effectively. There are many BIM guidelines for the use of the systems in various countries of the world for the management of BIM processes that have positive effects on market efficiency. Moreover, the use of BIM is compulsory for some countries, and the government provides details for expectations and planning of the process with the national BIM standard. Also, in 2018, the first two documents of international BIM standards were published under the leadership of The United Kingdom, and the BIM process was handled at the international level (Url 1). When BIM process in Turkey is examined, Any BIM guidance documents are not prepared yet. However, founded in 2018 under the leadership of IMSAD, Building Smart Turkey works on the management of the BIM process for nearly two years. It carries out these works with the leading companies and the public in the market. As a result of the team's cooperation with the Turkish Standards Institute (TSE) in 2019, the BIM mirror committee is established within the TSE body. Thus, the first steps for the Turkish BIM standards are taken (URL 2).

Considering the impact of the BIM process on the market, it is unthinkable for the universities that make up the infrastructure of the construction sector experts working in the market to fall behind this situation. At leading universities in the world such as Georgia Institute of Technology and Penn State University, these systems were studies as theoretical approaches before market requirements. Therefore, the developments should be considered for encompassing other universities. Also, considering the studies for the standardization process in Turkey, after a short time, qualified staff and experts who will guide this development will be sought for BIM systems using in local projects. For this reason, universities that aim to train students at the international level must strengthen themselves in BIM systems. This development is inevitable for ITU Architecture Faculty, one of the institutions that form the architects' background at the international level for the AEC sector.

1.1 Motivation

Based on lack of qualified staff in BIM systems, the value of establishing an infrastructure that can achieve the learning of BIM systems within the scope of university undergraduate education for architects who are in the fundamental

processes of the construction sector is the primary motivation of the study. This motivation reveals a basic research question:

- How to be integrated BIM systems to architecture undergraduate education?

Considering that the architecture undergraduate programs have different curriculum infrastructures, it is the value to design an integration process according to suggested the current curriculum analysis and to reveal the general BIM learning model. The research aims to reveal an analysis process for architecture undergraduate education in terms of BIM systems integration to education.

In the scope of this aim; two basic data are a necessity to continue the research. One of them is identifying the basic subjects of BIM systems for evaluating the current curriculum. That the BIM systems are evaluated with BIM standards in public processes is led to the approach that basic subjects to be learned in this context can be handled within the framework of the standards. The reality that BIM standards are not formed yet in Turkey and the works developed for international BIM standards reveal the value of identifying basic subjects within most comprehensive BIM standards in the world. Another data is which types proposals are in the literature related to the integration of the BIM systems to the current education. After reaching the data, it is predicted that a more general learning model can be reached by examining and synthesizing the models proposed for BIM learning.

In the final of the thesis, it is predicted that the analysis of the basic curriculum structure of architecture undergraduate program can present a background for integrated with the general model for BIM education proposals in the current literature.

1.2 Scope of Thesis

In the scope of this thesis, three main studies are conducted to the research question raised within the process.

In the first study (Figure 1.4) , the BIM standards of the leading countries for four basic regions are examined for obtaining BIM basic subjects. For this analysis, a manual content analysis method is used. In the last of the study, the basic subjects of BIM are found out. Then, the subjects are re-interpreted in terms of learning gains for the current curriculum analysis.

In the second study (Figure 1.4), for reaching a general BIM learning model, the BIM learning approaches and proposes are examined with the literature review method. For supporting this analysis, firstly the theoretical and technological process on the development of the BIM systems are explained, and the BIM learning requirements are revealed. Then, proposals for the BIM integration process to universities are examined. In the result of the part, bloom taxonomy, which is a taxonomic and gradual pedagogical approach, is preferred as the most common approach on integrating with the curriculum. In order for this pedagogic approach to be transformed into a BIM learning model, it is necessary to gradually address the knowledge and skills of BIM learning in the basics. Therefore, in the last of the study, BIM knowledge and skills are discussed to put forward a general infrastructure of BIM learning. A general model proposes that BIM learning has been put forward with the applied approaches and the data obtained.

In the last study (Figure 1.4), the architectural education curriculum in terms of BIM integration is analysed. For the analyse, the undergraduate curriculum of Istanbul Technical University (ITU) Architecture Department, which is one of Turkey's leading architecture schools and has the first international NAAB certification is preferred. Firstly, the current status of the ITU architecture undergraduate program is analysed, and the courses in the curriculum are classified by examining the current contents reached from the ITU web site. Afterwards, courses that may be related to basic BIM subjects are filtered according to these classes. Then, whether the filtered courses give a background for gains of the basic BIM subjects is examined with the semi-structural interviews (SSI). In the process, The gains are revealed from the first study and provide forming the questions of the SSI. In the last section of the title, gaps and potentials in the system are revealed in terms of BIM integration process by discussing the results of the instructor comments.

In the last part of the thesis, proposals for BIM integration process from the literature review and new strategies reached from interview outputs are evaluated for the solutions of the gaps discussed. Result of the evaluations, curriculum-specific proposes are put forward, and the BIM learning model concluded from the second study is configured according to the current curriculum.

In general evaluation, many proposals and analysis methodology for BIM integration to the architecture of undergraduate education can also be used other undergraduate

educations. The current curriculum analysis and that the proposed general BIM learning model is configured according to the results of the study is the main approach of the thesis.

1.3 Methodology

The main method preferred in the thesis is the qualitative research method (Figure 1.3). The reason for choosing this method is that the thesis starts with a research question and an inductive process is suggested for accessing this research question. The basic cause in the preference for the inductive process is the lack of a structured training BIM context of the architecture undergraduate education in Turkey. Therefore, the process of integrating BIM systems to the formal education and drawing a learning model in this context is open to interpretation and needs to be experienced with proposals revealed. Analysis and synthesis of current data are of great importance for the structuring of this process.

In scope of the methodology, it is decided to carry out an analysis of the current architecture undergraduate education as to whether the educational approach to be designed is in a structure that can progress in integration with formal education. In the realization of this analysis, firstly, it is aimed to reveal the basic subjects related to BIM and to create a background on which gains will be evaluated in education. BIM standards, which can reach common information at both national and international levels, are used for the selection of the main subjects. Therefore, in the first section, the most comprehensive BIM standards on four continents are examined to identify common subjects. Each document is read first in the review, and common topics are identified. Then, the topics are collected and classified in the common BIM subjects. Each class is explained in detail by sources and common keywords. In the continuation of each statement, he takes part in personal comments on educational gains based on the subjects and their content in available resources. In this context, the scanning and classification of the contents are done manually.

Another required process within the scope of the methodology is to examine the world approaches to the integration of BIM to University. Therefore, the literature review is used for revealing the integration approaches and proposals in various academic research. Within the scope of the comments obtained, approaches to the formal education model on the need and implementation of BIM integration are reached. It is

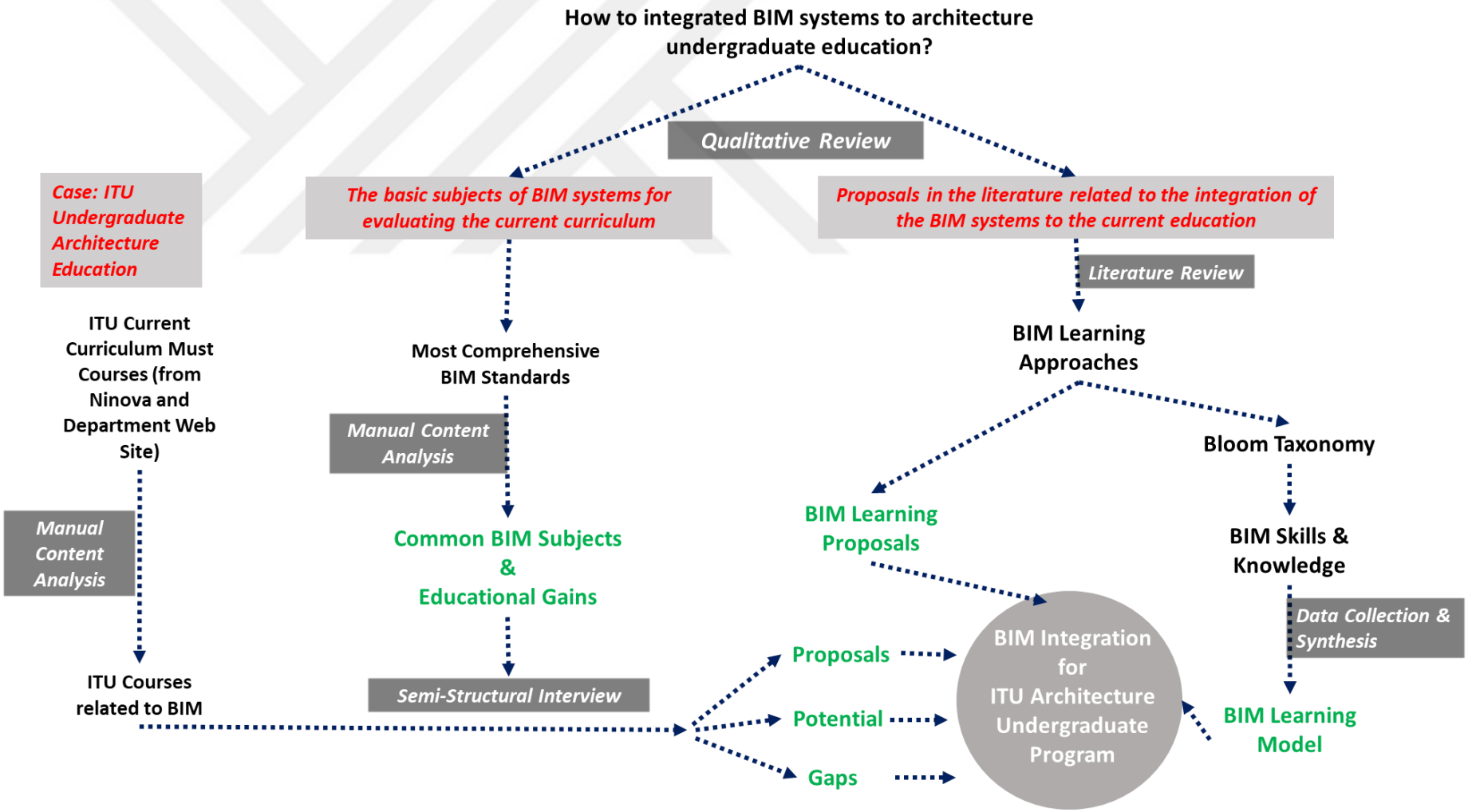


Figure 1.3 : Methodology of Thesis

determined that the most frequently used approach was Bloom Taxonomy. On the basis of this method, knowledge and skills related to BIM learning are classified with data taken in literature reviews. A general BIM learning model is created by synthesizing the classified comments.

The current curriculum for ITU research is analysed in the light of BIM subjects and learning outcomes obtained in the first study and data from semi-structured interviews. Firstly, the must courses are manually classified with the content analysis method. The courses are filtered as related or not related to BIM. Then, in order to analyse the education in the courses that can be questioned within the scope of BIM integration, the data are collected by semi-structured interview method. This method is carried out in the form of mutual question and answer conversation with the instructors of the courses. The interview questions are prepared both as open and closed questions. Thus, deeper data about the courses and formal curriculum are obtained. While the collected data question the existence of BIM subjects within the scope of the courses, they also reveal the potential and gaps of the existing curriculum for BIM education integration. In addition, the data obtained from the interviews provide discovering some proposals on the infrastructure to be implemented during the integration process.

With the data obtained in the results section of the thesis, multiple proposals regarding the ITU curriculum could be put forward and an infrastructure for the application of the general BIM learning model obtained in the second part could be presented with this method implemented on the curriculum. In the last chapter on the implementation of this infrastructure, the comments of the head of the department are also taken by conducting a semi-structured interview and positive approaches to the BIM integration proposals are encountered.

1.4 Outline of Thesis

The thesis occurs three main study (Figure 1.4):

In the first study, the main subjects of the BIM are determined and explained by examining the most comprehensive BIM standards in the world for the aim to evaluate the current curriculum.

In the second study, the theoretical and technological development of the term BIM is revealed, and the BIM learning requirements in the academy, proposals in education

integration, and the information and skills discussed in this context are analysed by the literature review method. In the last of this study, a hybrid BIM learning model is reached by synthesising the literature comments.

In the third study, firstly, the current status of the ITU architecture undergraduate education curriculum is analysed and the courses in the curriculum are classified by analysing their content. Classified courses are examined and evaluated with SSI, which are realised with instructors of the courses by using common BIM subjects obtained from the first study.

After the three studies, the proposals are revealed with approaches obtained from the second study and the potentials, gaps and specific proposals obtained from the results of the SSI.

In the conclusion of the thesis, the integration proposal of the hybrid BIM learning model obtained from the second study to the current ITU architecture undergraduate curriculum and analytic process for BIM learning model integration to the curriculum are reached.

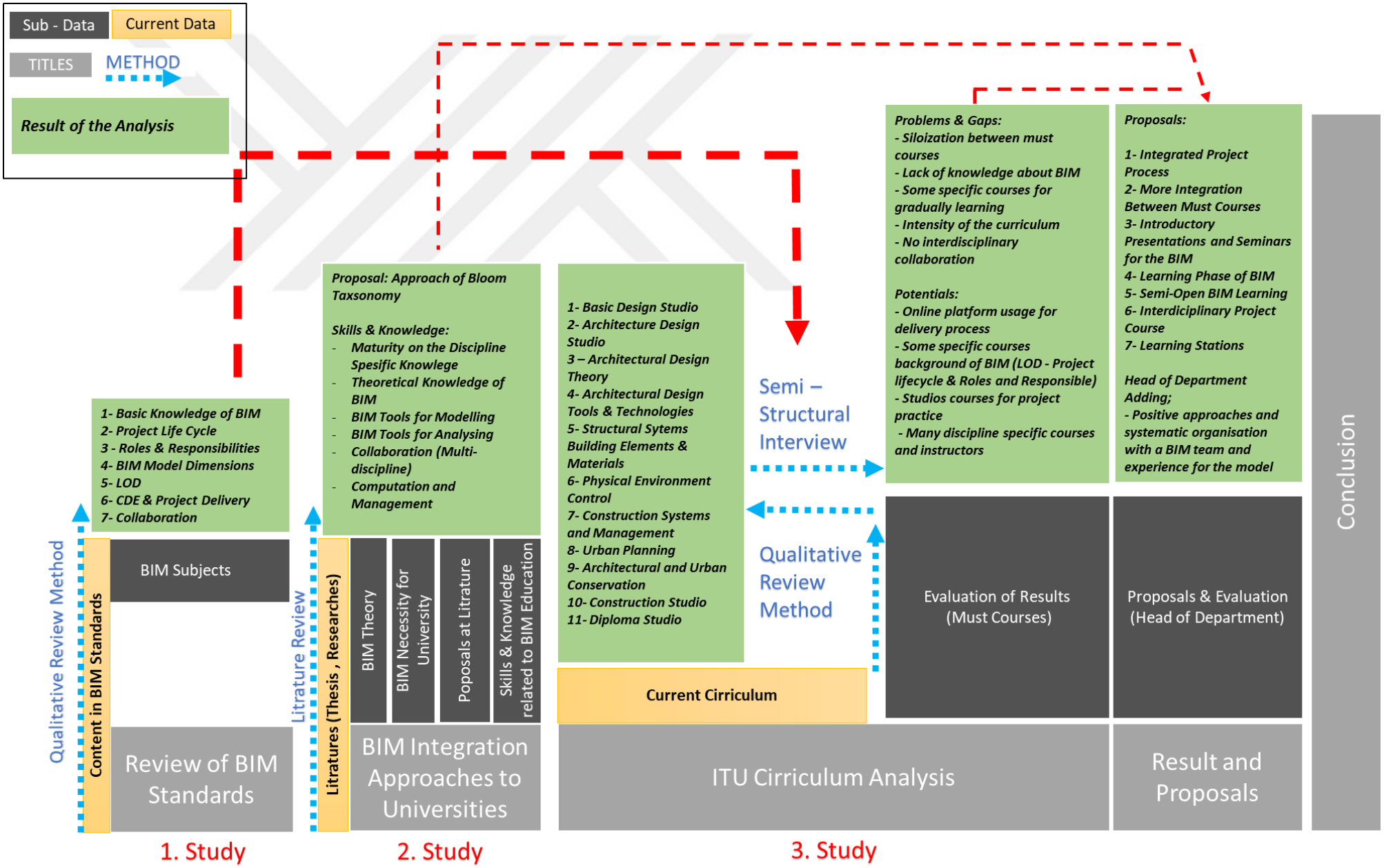


Figure 1.4 : Outline of Thesis .

2. REVIEW OF BIM STANDARDS TO REVEAL BASIC SUBJECTS FOR EVALUATING BIM BACKGROUND IN EDUCATION

Various reference documents and BIM standards are used in various countries where BIM use becomes a government obligation to align BIM awareness within projects. The primary aim in the thesis process is to evaluate the current curriculum in architecture undergraduate education within the scope of BIM and to measure whether they have the necessary background for BIM integration. For this purpose, the selection of which BIM subjects for the evaluation process will be examined is the most critical issue.

The basic documents that enable BIM-competency to be measured at the national and international level are BIM standards. This situation reveals the approach that the subjects to be analysed for the curriculum evaluation can be addressed within the scope of the common subjects within the most comprehensive and current BIM standards.

In the first part, the necessity of the standards is mentioned. Therefore, the reason for the existence of international BIM standards is revealed. Then, the most comprehensive and up-to-date documents in four regions around the world are determined based on various academic studies. Then, the contents of the documents are examined and presented as a summary, and their main topics are tabulated. The main subjects listed are summarised with common topic titles at the end of the section, and basic BIM topics are revealed. Then, each subject is discussed in detail with the document resources and interpreted within the scope of educational earnings and contents.

At the end of the department, seven basic BIM subjects to be evaluated for the current curriculum are reached. Moreover, within the scope of these subjects, the gains to be evaluated on the education side are revealed.

2.1 The Standardization from Yesterday to Today

Standardization is defined as the process of implementing and developing technical standards based on the consensus of different parties, including firms, users, standard

organizations and governments (Xie et al, 2016). The first standardization processes in history are considered to begin with the efforts to standardize weight and measurement units in Indus Valley Civilization (Kenoyer, 2010). On the national scale, the thread sizes used in the screw-cutting lathes produced by Henry Maudslay after the industrial revolution have been used by various companies, and standard dimensions have been determined and the thread measurements of Joseph Whitworth have been used as the first unofficial national standard among the companies (Gilbert et al, 1966). Official national standards start to be developed with the Engineering Standards Committee established in London in the early 1900s (McWilliam, 2001). The committee has worked on the development of standards for railway lines and engines, steam engines, telegraph and telephone materials, electrical cables and accessories within the first five years after its establishment. The committee was then developed and renamed the British Standards Institute (BSI) in 1938. After the United Kingdom, national standardization processes have also been developed in several countries (Herold and Rogers 2010). German Industry Standards Association (DIN), founded in Germany in 1917; The American National Standards Institute (ANSI), founded in The United States in 1918; The Swedish Standards Commission (SIS), established in Sweden in 1922; and the 1926 French Standardization Association (AFNOR) are other leading organizations established to carry out national standardization efforts.

In the post-World War II period in 1947, British Standards (BS) 5750 quality standards gain popularity, national standardization associations establish the International Standards Organization (ISO) to develop international quality standards (Boli and Thomas, 1999). The organization forms the Geometric Product Specifications (GPS), the first publication of which was presented as sectoral length measurements in 1951. In 1960, the International System of Units called ISO 31 is published. Then, in 1987, the first international quality management standard ISO 9000 is published.

In 1962, McLuhan et al. lay the foundation for the idea that the world will be the only economic global market with the concept of "Global Village" (Mc Luhan, 1962). The discussion of the concept of standardization in the global market starts in the 1980s with Theodore Levitt's article titled "Globalization of Markets". Levitt argues in the article that the world market will be irreversibly homogeneous; demands of people will become more similar and will be market segmentation with the same quality values. In contrast to the article, in the same years, it is assumed that the increasing perception

of globalization is due to the spread of several brands (Rosen et al, 1989). There are also some suggestions that some cultural norms can prevent the homogeneous situation (Still and Hill, 1985). Such similar arguments cause Levitt's views to be ignored in those years.

However, Levitt (1983) bases his defence on the development of technology. He argues that developments in the media, especially on television, enable people, even from the most isolated places, to learn about the culture of others, to absorb their culture, and to learn about the latest products, features and brands. If the products of these brands have the best quality and the lowest price, they argue that consumers will give up local preferences based on cultural differences and accept the standard product. In fact, an essential issue is that Levitt (1983) discusses standardization as a phenomenon rather than a requirement here.

Today, the accessibility brought by television has left itself to the information density that is much more transparent with the internet. This supports Levitt's idea that globalizing demands will affect standards and that everything will look alike after a while. Moreover, according to Levitt (1983), this uniformity will spread not only to the production process and various products but also to marketing and working strategies. However, the reality of this situation is still controversial because the demands of consumers can also become increasingly complex.

In order to keep this entire process under control, some minimum laws can be determined by standardization processes and subjectivity can be maintained in the company. New issues may also arise that need to be controlled during this process. For example, the reliability of information was needed due to the increased information pollution. Therefore, in 2005, a family of standards for information technology was introduced by ISO as ISO 27001 in order to increase information security and protect company assets. In addition, due to the excessive energy consumption problem, ISO 50001 Energy Management standards were published in 2011. It is evident that international standards are needed to achieve the right balance in terms of efficiency and quality in a globalizing world. ISO serves this purpose with sustainable development goals. As seen in Figure 2.1, approximately 2300 standards have been published for various sustainability targets since its establishment of ISO.

Figure 2.1 : ISO standards according to sustainability targets (ISO, 2019).

The efficiency of today's construction projects requires the cooperation of multicultural and geographically dispersed teams that will take part in the same implementation process in various time periods. 4. The Industrial Revolution and afterward many sectors leave themselves to technology-oriented production and management strategies. The construction sector, on the other hand, is unable to detach the construction management process from traditionalism for a long time, although this development needed it. However, globalization is becoming an inevitable phenomenon. The results of the yield indexes in 2010 reveal that this sector has lost a lot of blood, and it is emphasized that the sector should standardize its business strategy. The purpose of standardization is to create an optimum way in terms of time, cost and quality to achieve the goal of the business process (Muenstermann et al, 2010). With this awareness, the use of BIM systems in the construction industry have started to become widespread. It is important that standards have been successfully established for the benefits expected to occur with the use of BIM. Because standards play an essential role in ensuring that BIM processes are more widely adopted and data is accessible throughout the supply chain (BSI, 2013). In order to standardize and implement BIM processes, guidance documents need to be defined (Azhar et al, 2012). From 2010 to today, guidance documents and national standard studies on BIM are carried out in many different countries. Moreover, the first parts of international BIM Standards, which are ISO 19650-1 and ISO 19650-2, were published by ISO in 2018. The history table of most widespread ISO standards and the process changes in standardization are given in Figure 2.2.

Figure 2.2 : History of ISO standards.

2.2 The Selection of The Most Comprehensive BIM Standards in the World

In n many countries of the world, it is now mandatory to complete most of the projects with BIM systems. The United State is believed to be the pioneer of this process. When the standardization processes are examined, it is seen that the most critical factor in the acquisition of BIM maturity is public institutions. Distribution of BIM usage obligation, according to countries, is given in Figure 2.3 on the map (McAuley et al, 2017). Firstly, the countries that are obliged to use BIM were determined, and then the standards in these countries are examined.

The most comprehensive and up-to-date study to examine the use of BIM worldwide belongs to Cheng and Lu (2015). After this article, some studies and guides are also published recently, such as SmartMarket Reports published by McGraw Hill Construction and BICP Global BIM Study published by Barry McAuley (2017). In these documents, the process was examined one by one in the scope of national, on the contrary Cheng and Lu. According to Cheng and Lu's comparative research, it is open that America, Europe, Asia, and Australia respectively involved in implementing BIM Systems (Cheng and Lu, 2015).

First, many public sector bodies at different levels in The United States have created BIM programs, BIM objectives and implementation roadmaps since 2003. Following these initiatives, standard studies on the BIM process started in 2007. In the same period in Europe, the British Government advocated the use of BIM systems and required the use of the system in all projects until 2016. Although Asia started this process later, Singapore and Hong Kong countries established their own BIM committees in a short time, and Singapore published the BIM Project Delivery Guide in 2008 (Cheng and Lu, 2015). Australia, on the other hand, declared that it accepted BIM nationally in 2012 and presented its objectives in this process in the BIM Initiative Report (BuildingSMART Australia, 2012).

New Zealand near to Australia has also been working on BIM systems since 2012 (Cheng and Lu, 2015). New Zealand published a comprehensive BIM document in 2019. Therefore, New Zealand is added to the research. Within the scope of the thesis, with together New Zealand Handbook and International BIM Standard, the contents of the most comprehensive and up-to-date documents of the four regions in the table will be examined.

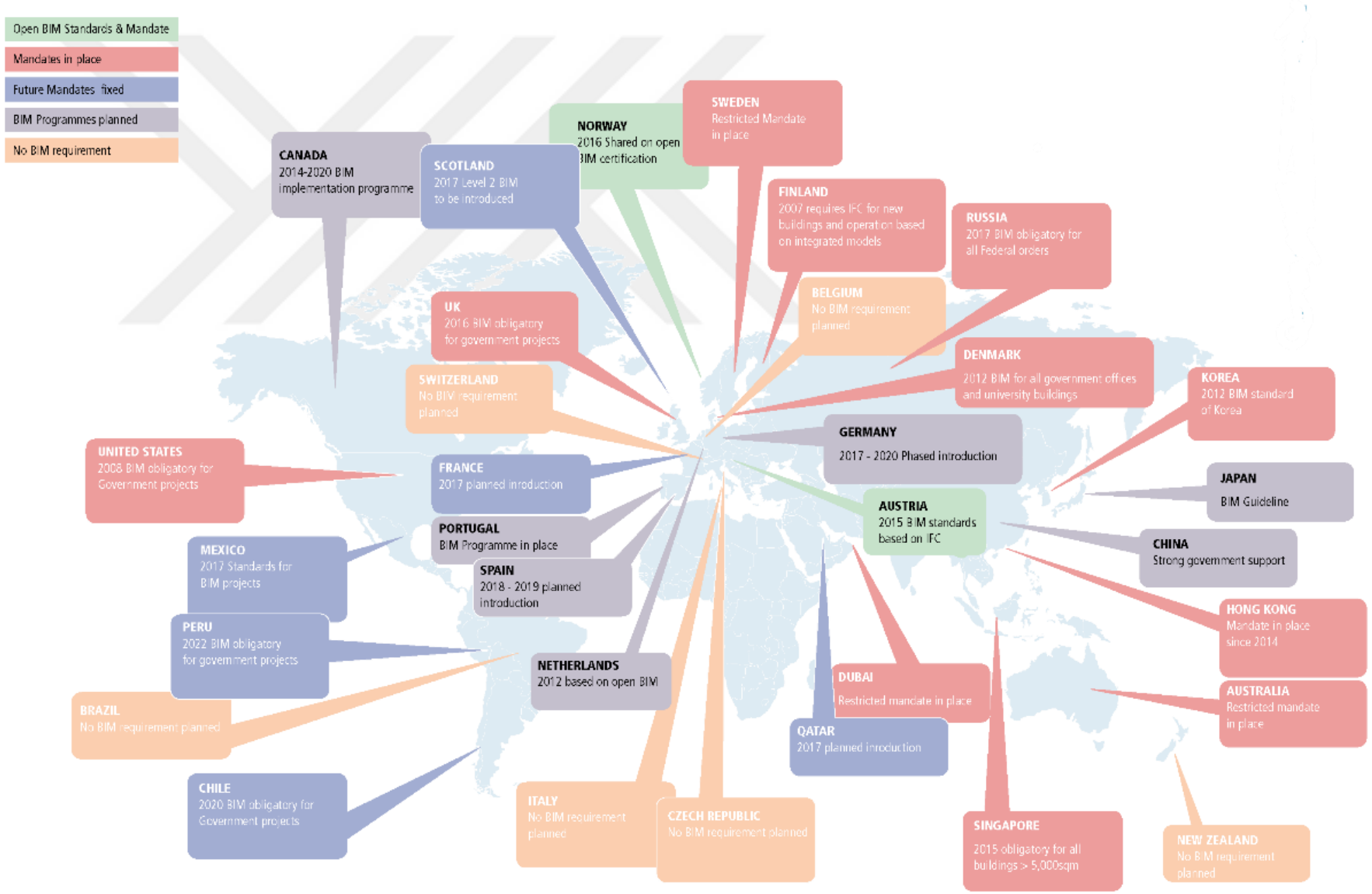


Figure 2.3 : BIM mandatory map according to countries (McAugley et al, 2017).

Table 2.1 : BIM documents according to regions (Cheng and Lu, 2015).

Region	Country/ Organization	Year Range	Quantity		
			Gov. Body	Non-profit Org.	Total
The United States	Nation-wide	2007-2015	9	15	24
	State-wide and city-wide	2009-2013	8		8
	University-wide	2009-2013		15	15
	Sub-Total		17	30	47
Europe	the United Kingdom	2007-2015	3	15	18
	Norway	2008-2013	4	2	6
	Finland	2007-2013	2	1	3
	Denmark	2007		4	4
	Sweden	2009		1	1
	Netherlands	2013	2		2
	Sub-Total		11	23	34
Asia	Singapore	2008-2013	12		12
	Korea	2009-2011	5	1	6
	Japan	2012-2013		3	3
	Mainland China	2013-2015	4		4
	Taiwan	2010-2014		4	4
	Hong Kong	2009-2014	4	2	6
	Sub-Total		25	10	35
Australasia	Australia	2009-2015	3	5	8
Total					123

The United State:

The process in The United States is started by creating prestigious public institutions such as Associated General Contractors of America (AGC), National Institute of Building Sciences (NIBS) and Geological Society of America (GSA) to work in BIM developments. The first announcement in BIM studies is three-dimensional (3D) and fourth-dimensional (4D) BIM program studies which are started by GSA in 2003. The BIM requirement was initiated in 2007 for large-scale projects that received a project draft fund, and National Building Modelling Information Standards (NBIMS) V1 has been published by NIBS. As seen in Table 2.2, there are forty-seven standards prepared in The United State until 2015. The current and most comprehensive BIM document at the moment is the NBIMS V3 document published by the same board in 2015 (Cheng and Lu, 2015).

Table 2.2 : BIM standards in The United States (Cheng and Lu, 2015).

[NIBS] NBIMS v1.0	2007
[NIBS] NBIMS v1.0	2007
[GSA] BIM Guide Series 01 v0.6	2007
[GSA] BIM Guide Series 02 v0.96	2007
[AIA] Document E201™–2007, Digital Data Protocol Exhibit	2007
[AIA] Document C106™–2007 Digital Data Licensing Agreement	2007
[AIA] Document E202-2008 BIM protocol exhibit	2008
[AGC] The Contractor's Guide to BIM v1	2008
[Wisconsin] BIM Guidelines and Standards for Arc. and Engineers	2009
[PSU] BIM PEP Guide v0.1	2009
[PSU] BIM PEP Guide v0.2	2009
[PSU] BIM PEP Guide v1.0	2009
[GSA] BIM Guide Series 03 v1.0	2009
[GSA] BIM Guide Series 04 v1.0	2009
[GSA] BIM Guide Series 05 v1.0	2009
[VA] The VA BIM Guide v1.0	2010
[LACCD] LACCD BIMS v3	2010
[PSU] BIM PEP Guide v2.0	2010
[AGC] The Contractor's Guide to BIM v2	2010
[PSU] BIM PEP Guide v2.1	2011
[UF] BIM Execution Plan v1.1	2011
[University of Connecticut] CAD Standards Guideline	2011
[GSA] BIM Guide Series 08 v1.0	2011
[Ohio] State of Ohio BIM Protocol	2011
[NIBS] NBIMS v2.0	2012
[NYC DDC] BIM Guidelines	2012
[IU] BIM Guidelines and Standards for Aec	2012
[PSU] BIM Planning Guide for Facility Owners v1.0	2012
[PSU] BIM Planning Guide for Facility Owners v1.01	2012
[PSU] BIM Planning Guide for Facility Owners v1.02	2012
[University at Albany] AECM BIM Guidelines 2012	2012
[NYC DOB] BIM Site Safety Submission Guidelines and Standards	2013
[NYC SCA] BIM Guidelines and Standards for Architects and Engineers v1.1	2013
[SPU/SDoT] CAD Manual SPU/SDoT Inter-Departmental CAD Standard	2013
[Tennessee] BIM Requirements V1.0	2013
[PSU] BIM Planning Guide for Facility Owners v2.0	2013
[PSU] The Uses of BIM v0.9	2013
[NYC DDC] Design Consultant Guide Appendix	2013
[AIA] Document E203™–2013, BIM and Digital Data Exhibit	2013
[AIA] Document G201™–2013, Project Digital Data Protocol Form	2013
[AIA] Document G202™–2013, Project BIM Protocol Form	2013
[AIA] Guide, Instructions and Commentary to the 2013 AIA	2013
[AGC, BIMForum] Level of Development Specification v2013	2013
[AGC, BIMForum] Level of Development Specification v2015	2015
[NIBS] NBIMS v3.0	2015
[GSA] BIM Guide Series 06 v1.0	2015
[GSA] BIM Guide Series 07 v1.0	2015

The United Kingdom:

The United Kingdom started its standardization process in 2007 by creating the Publicly Available Specifications (PAS). Then, in 2011, the BIM task group was established, aiming to reduce the costs of the public sector by twenty percent (20%) in The United Kingdom (PAS 1192-2, 2013). The government supported these efforts and made it mandatory to deliver construction projects as BIM level two until 2016. In the BIM integration processes, a series of PAS documents have been published starting from 2013 under the sponsorship of Construction Industry Council (CIC) by BSI. PAS documents are very comprehensive and publicly available guidance documents at the standardization stage of BIM processes. When these documents are completed by two years, it is checked whether they require revision by BSI and, if approved, they can turn into official British or International standards. In this process, two documents have been converted to international BIM standards. These are ISO 19650 1 and ISO 19650 2 documents, which are based on BSI standards. Each document focuses individually on BIM topics, and these topics are maturing on BIM levels. The list and general contents of these The United Kingdom documents are shown in Table 2.3. Since there is no comprehensive document in The United Kingdom, PAS and BSI documents as national documents and ISO 19650-1, which is more comprehensive as the international publication, will be examined.

Table 2.3 : BIM standards developed by BSI (Cheng and Lu, 2015).

TABLE 4: The current and future standards developed by BSI B/555 committee.

Year	Standard	Description
2007	BS 1192: 2007 Collaborative Production of Architectural, Engineering and Construction Information. Code of Practice	A combined data and procedure standard, applicable at level 0 and 1
2011	BS 8541-2: 2011 Library Objects for Architecture, Engineering and Construction. Recommended 2D Symbols of Building Elements for Use in Building Information Modeling	2D building information, mainly targeting at level 1
2012	BS 8541-1: 2012 Library Objects for Architecture, Engineering and Construction -- Part 1: Identification and Classification -- Code of practice	Definition and classification of Library objects, for use from level 0 to level 3
2012	BS 8541-3: 2012 Standard due: Library Objects for Architecture, Engineering and Construction: Shape and measurements	3D symbols of detail LoDs, particularly focusing on level 1 to 2
2012	BS 8541-4: 2012 Standard due: Library Objects for Architecture, Engineering and Construction: Attributes for specification and simulation	Properties for specification and simulation, essentially targeting at level 2 to 3
2013	PAS 1192-2: 2013 Specification for Information Management for the Capital/Delivery Phase of Construction Projects using BIM	Capital delivery phase, early adopter document to Gov.'s Level 2 aim
2014	PAS 1192-3: 2014 Specification management for the operational phase of assets using building information modelling	Using and maintenance of asset information model, early adopter document to Gov.'s Level 2 aim
2014	BS 1192-4: 2014 Collaborative production of information Part 4: Fulfilling employer's information exchange requirements using COBie – Code of practice	Documenting best practice recommendations for COBie implementation in Gov. pilot project
2015*	BS 7000-4: 1996 Design Management Systems. Guide to Managing Design in Construction	Documenting and managing design data

Asia:

Asian countries' integration into BIM systems dates back to 1995. In order to support the use of this system for government projects, the Construction and Real Estate Network (CORONET), which has a significant Information Technology (IT) initiative for BIM systems, was launched by the Singapore Ministry of National Development in 1995 (Wong et al, 2009). The first integration at the level of standards is the Singapore BIM Guide on the use of BIM published by the Building and Construction Authority (BCA) in 2012. As of this year, BIM has become mandatory in all public construction projects in Singapore. For this reason, Singapore is a pioneer for the Asian region in terms of using BIM systems. When the BIM guidelines of Asian countries are examined, it is seen that some countries are working for the BIM process such as Hong Kong, Taiwan, Korea, Japan, China. The timeline of BIM related publications of these countries is given in Figure 2.4 (Cheng and Lu, 2015). When the list and timeline are examined, it will be seen that most of the standards until 2015 belong to Singapore, and the last publication was made by Japan. Nevertheless, the Singapore BIM Guide V2 document was updated again in 2015. For this reason, the most comprehensive and up-to-date document in Asia was chosen as the Singapore BIM Guide V2, and it was decided to examine the content of this document.

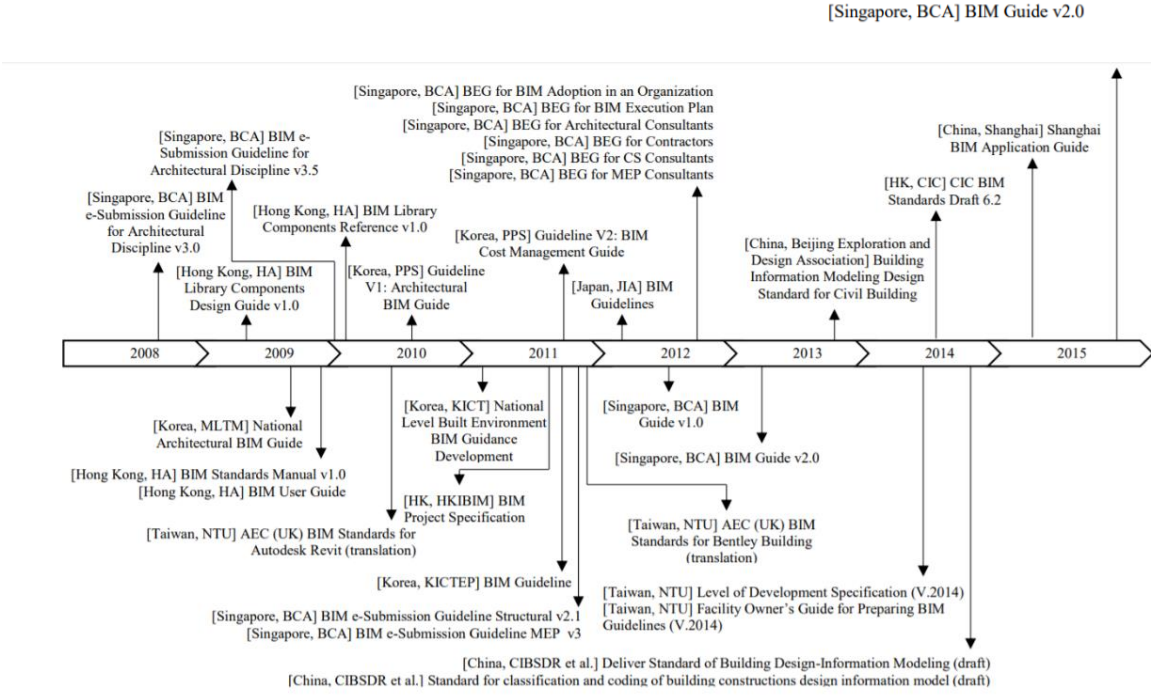


FIG. 8: BIM standards/guidelines timeline in Asian countries ("" means that the standard is under preparation).*

Figure 2.4 : The BIM standards in Asia (Cheng and Lu, 2015).

Australia and New Zealand:

Australia first published two BIM documents related to National BIM Guidelines by Cooperative Research Centre for Construction Innovation, and then the National BIM Guide was released by the National Building Specification (NATSPEC) in 2011. In 2012, with the construction of BuildingSMART Australia, the National BIM Initiative Report was published and supported by the Built Environment Industry Innovation Council (BEIIC) (BuildingSMART Australia 2012). In this report, the national action plan for Australia's BIM imperatives has been announced. As seen in Figure 2.7, Australia started working with New Zealand on the same year for BIM documentations. Moreover, Masterspec, the leading specification system in New Zealand's construction industry, published the 'New Zealand National BIM Survey 2012' to describe the current BIM development (Bolpagni, 2013, pg. 95). Later, the BIM Acceleration Committee (BAC) was established. The committee conducted BIM usage surveys since 2014 for New Zealand. Also, New Zealand reviewed the international standards published by The United Kingdom and published the New Zealand BIM Handbook in 2019. In this context, the most comprehensive national document prepared within Australia is still the NATSPEC National BIM Guide, and the document was revised in 2016. However, the New Zealand Handbook is also a very comprehensive document. Therefore, both documents will be examined separately in the scope of research.

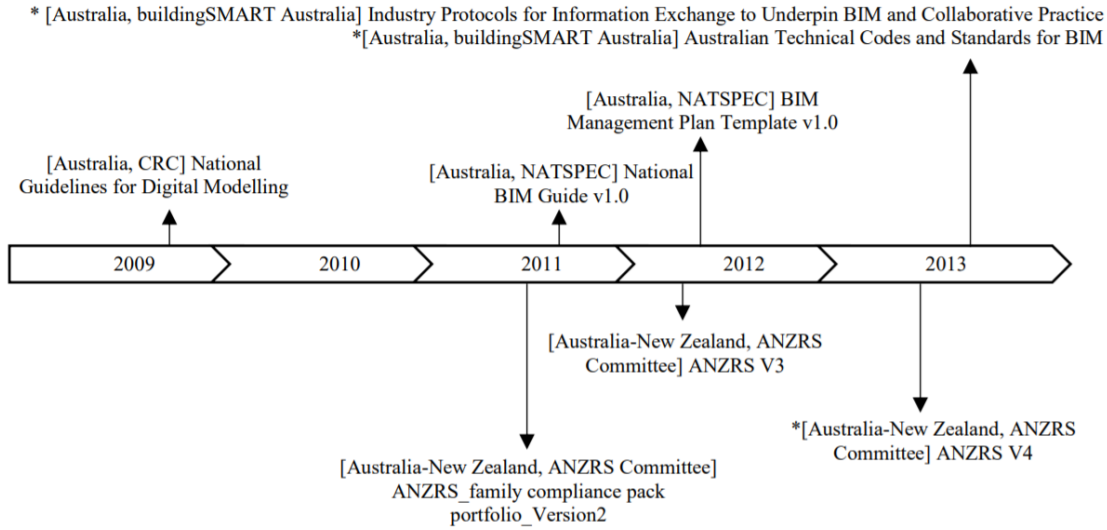


Figure 2.5 : The BIM standards in Australia (Cheng and Lu, 2015).

In this section, the most comprehensive and updated BIM documents published for BIM systems in four regions are selected. At the end of the chapter, it was decided to review NBIMS V3 for The United State, PAS-BSI-ISO documents for England, Singapore BIM Guide V2 for Asia region, and finally, NATSPEC National BIM Guide for New Zealand - New Zealand BIM Hand Book documents. The list of documents to be examined is shown in Table 2.4. The topics covered in these documents selected in the next section will be analysed, and these topics will be classified within the context of common BIM concepts. The purpose of this classification is revealing the concepts that will form the basis of the teachings about BIM.

Table 2.4 : The most comprehensive BIM standards selected within the scope of study by region.

USA - The United States	
[NIBS] NBIMS v3.0	2015
UK - The United Kingdom	
PAS 1192-2:2013	2013
PAS 1192-3:2014	2014
BS 1192-4:2014	2014
BS 1192:2007+A1:2015BS 1192:2007 - Reconfirmed	2015
PAS 1192-5:2015	2015
BS 1192:2007+A2:2016BS 1192:2007 - Reconfirmed	2016
PAS 1192-6:2018	2018
ISO 19650-1	2019
ASIA	
Singapore BIM Guide	2013
AUSTRALIA	
NATSPEC National BIM Guide: 2011 - Reconfirmed	2016
THE NEW ZEALAND BIM HANDBOOK	2019

2.3 The Analysis on BIM Standards for Revealing Basic BIM Subjects

With industry 4.0, the construction industry directs to global projects rather than national projects. This revolution expects companies in the industry to offer the best quality project using the most appropriate resources and the fastest workforce. BIM systems, which is one of the essential techniques of this process in the construction sector, make it possible to make construction management in the fastest and highest quality shape with BIM standards in the leading countries. Therefore, it is crucial to learn some basic concepts related to BIM systems that must be gained in order to exist in the global sector with architectural expertise.

The purpose of the study is to examine the most comprehensive BIM Standards of the countries in different regions of the world and to emerged common crucial concepts that should be possessed in BIM. In this section, the topics in the most current and comprehensive BIM documents determined in four regions that are selected of the previous part are scanned by the content analysis method and explained by classification.

The United State – NBIMS Version 3:

When the content of NBIMS Version 3 standards in this context in The United States is examined, the main aim of the documents is the project life cycle's smooth functioning. For this reason, it gathers the main objectives of the project processes in the focus of economic, functional and aesthetic construction aspects. It is argued that, in general, all standards related to the construction process are the cornerstone of these requirements (NBIMS V3, 2015). Topics covered in this context are BIM terms and definitions, project workflow, project execution plan, roles and responsibilities of project stakeholders, BIM usages, level of development (LOD) concept, standard data formats, classifications, project delivery procedures, interdisciplinary collaboration standards, data exchange standards and quality control procedures. All topics of the NBIMS Standards are scanned and classified with colours using the content analysis method (**Appendix A**). The main topics classified by content analysis are shown in Table 2.5.

Table 2.5 : NBIMS V3 Document Contents.

United State - NBIMS V3
BIM Terms & Definitions
BIM Project Execution Plan - Overiew, BIM Planning Guide,Practical BIM Contract Requirements
Organisational Roles - Contacts
BIM Uses, BIM process design, BIM&Facility Data Requirements, Techological Infrastructure Needs
LOD Specifications
Omniclass, Planning, Executing and Managing
IFC, XML, IFD, BCF, CAD Standards, Information Exchange Standards (COBie,Lcie,SPV,BEA,QTO,Bpie,SPARKie,HVACie,Wsie), Coordination Requirements
Quality Control

The United Kingdom – PAS and BS Documents:

The focus of the issues mentioned in PAS and BS documents is on the efficient progress of the project processes. For this purpose, the project implementation plan

(PIP), project delivery procedures (PDP), common data environment (CDE) and interdisciplinary collaboration procedures are the main topics of the documents. Each document begins with the BIM maturity levels table and BIM terms explanations. The document published in 2013 is prepared, especially for using in BIM level 2. In the documents of 2014 and after, there are some upper topics such as facility management, security management, asset management, collaborative project process, information requirements are belonged. The LOD concept that is encountered in The United States Standards comes up with the level of model detail (LOD) and level of model information (LOI) concepts created with the same purpose in The United Kingdom national BIM documents. The topics and classifications focused on the documents are shown in Table 2.6. Main topics of The United Kingdom National BIM Standards and Guides (PAS and BS) are scanned and classified with colours using the content analysis method (**Appendix A**).

Table 2.6 : PAS and BS Documents Contents.

United Kingdom - PAS + BS
BIM Maturity Level, BIM Terms & Definitions
EIR, BEP, Business Process , Project Types
Task Information Delivery Plan (TIDP), Teams Roles & Responsibilities, Roles & Responsibilities
Project Implementation Model
Level of Model Defination (LOM), Level of Model Detail (LOMD), Level of Model Information (LOMI)
Information Delivery, Master Information Delivery Plan (MIDP), Common Data Environmet(CDE), Asset Information Management (AIM),Code of Practice(Naming Procedures),
Information Exchange, Collaboration Management
Security

The United Kingdom – International – ISO 19650-1:

In ISO 19650 published in 2018, project workflows, project delivery processes and CDE concepts are focused. The document begins with BIM terms and definitions; it then addresses collaboration procedures and information requirements. In this context, the tables of the models and documents to be delivered in the project workflows are given. The most important issues are concerned with the models and information flows of the disciplines that work together. In this context, project delivery processes, the model and information details of the elements, which are identified AIR, AIM, LOI and LOD topics, the importance of the detail levels of the models, and the points to be considered in interdisciplinary information exchanges are very critical topics. The

main topics of all documents in the United Kingdom are shown in Table 2.7 (extended version is shown in **Appendix A**).

Table 2.7 : ISO 19650-1 Documents Contents.

International - ISO 19650-1
BIM Terms & Definitions
Information & Asset Life Cycle
Project and asset information management functions (Task Information Management)
Project Information Model (PIM), Project Information Management
Level of Information Need (LOIN)
Asset & Project Information, Defination of Information Requirements (Principles - Organisational Information Requirement (OIR)), Information Delivery Cycle (Principles), Information Delivery Planning, Managing Collaborative Production, CDE Workflow,Asset Information Requirement (AIR), Asset Information Model (AIM), Asset Information Management,
Exchange Information Management (EIR), Setting Information Requrements, Delivery Team Capability, ınformation Contaier-based Collaborative Working (Shared, Transitioni Publised)

Asia – Singapore BIM Guide Version 2:

When the Singapore BIM Guide is analysed, it is seen that its foundation focuses on the information model that develops throughout the project life cycle and the changing detail levels of the elements within this model. In addition, the other subject of the guide is interdisciplinary coordination and exchange of information models. It is stated that the Industry Foundation Class (IFC) format can be used for the data exchange process, and the delivery strategy it should be specified in the Building Execution Plan (BEP) document. All the topics of the document are shown in **Appendix A**. For the element detail levels; it is recommended to examine the LOD tables specified in the "bimforum". In addition, a clear example of which documents are delivered during the project life cycle in the delivery processes of the model is also included in the guide. Although the common data environment is not directly included in the document, the data be protected with the help of an easily accessible and reliable server is suggested. Besides, the responsibilities of the fundamental roles are taken part in the BIM process stated. In the content, the documents for the quality of the project model are divided according to roles simply. In general, requirements for all project stages are documented most clearly and simply in the guide. However, the document cannot be said to be sufficient for BIM use at the field and facility management level. The main topics are classified in the Singapore BIM Guide are shown in Table 2.8.

Table 2.8 : Singapore BIM Guide V2 Documents Contents.

Asia - Singapore BIM Guide V2
Introduction of Documents (BIM Deliverables,Process,Professionals)
BEP, Compensation Expectation (According to Requirements), Workflow of Design-Build Projects, Workflow of Design-Bid-Build Projects
BIM Objective & Responsibility Matrix, BIM Professionals
BIM Deliverables,Other Additional Value-added BIM Services, Modelling Guidelines for Regulatory Submission, Model Orientation,Model Division and Structure
BIM Elements, Attribute of BIM Elements, Model Progression, BIM vs 2D Practices, Modelling Guidelines for BIM Elements
Model & Documentation Production, Data Security &Saving
BIM Modelling and Collaboration Procedures, Individual Dicipline Modelling, Cross-disciplinary Model Coordination

Australia – NATSPEC:

When looking at the content of the NATSPEC document, the roles and responsibilities of the project stakeholders are first mentioned, and it is emphasized that the model sharing strategies should be followed in a common file format. It is explained that all these procedures can be gathered under a BIM execution plan document. In this context, it also mentions especially project types, project model requirements in different disciplines, detail levels of model elements (LOD) in various titles, all stages of the modelling process and coordination process. In the final stages, the importance of standardization in the document is emphasized, and details about how to transfer and manage information and project files in interdisciplinary sharing are included. The classified list of topics mentioned in the document is given in Table 2.9.

Table 2.9 : NATSPEC Documents Contents.

Australia – NATSPEC
BIM Project Requirements - Implementation - Procurement Strategies
BIM Management Plan (BMP)
Implementation(BIM Responsibilities, Terms of Use),BIM Roles and Responsibilities
Collaboration Procedures(Requirements for Using BIM),
Architecture – spatial and material design models (LOD)
Implementation (Data Reuse), Modelling Requirements(Meta Data, Space Naming and Coding, Equipment Coding, Additional Modelling Standards, Final BIM Deliverables),File Storage and Security,Requirements for 2D Drawings
Implementation (Open Standards),Software Compatibility and Data Flow Testing, Model Sharing,Collaboration Procedures
Security assessment and disaster planning

New Zealand – BIM Handbook:

The BIM handbook prepared by New Zealand starts with knowledge such as the process flow of the system, the benefits of using these systems, the purpose of the book, and how to handle it. The project life cycle is the main background for other topics. BIM systems are interpreted specially by following international standards. For this reason, its templates are very similar to the United Kingom documents. Asset Information Requirements (AIR), BIM execution plan, BIM workflows, common data environment, points to consider in modelling processes, LOD concept, model coordination and delivery processes are described in the document, respectively. Information on facility management and requirements are discussed in detail at the end of the document. The book is enriched with many additional documents that are allowed for the aforementioned subjects to be examined in a broader scope. The classified list of the mentioned topics is shown in Table 2.10.

Table 2.10 : New Zealand BIM Handbook Documents Contents.

New Zealand– BIM Handbook
Introduction of BIM Book, What is BIM?, BIM Basic, Legal Implication
Introdution(BIM and procurement), BIM Basic (BIM & Project Management), Typical BIM workflow (Projet Brief, Contract Process,Execution Plans,FM/AM Plans)
BIM Basic (Roles & Functions), Typical BIM workflow(Pre Contract Process)
Modelling and Documentation Practice
Modelling and Documentation Practice(Level of Development(LOD))
Client Information Requirements (Asset Information Requirements (AIR), Information Requirement of BIM), Information Delivery Plan, Common Data Environment
Modelling and Documentation Practice (Model Coordination , Handover)

When the contents of all documents are examined, first of all, each document proceeds by focusing on the project lifecycle. In the process, the first action to be taken to continue the project is to identify the project stakeholders and their roles. Then, the geometric and information-centred detail requirements according to the purposes of the models, which are prepared by different disciplines, are mentioned. Another common issue in the documents is the storage and delivery processes of the project documents. In addition, sharing the project documents and making them healthy throughout the project life cycle in a way that can be coordinated with each other is one of the focus areas mentioned. Finally, safety and quality concepts are also mentioned in several documents. However, since this concept is not included in all

documents, it will not be assumed as a basic BIM concept. Therefore, seven basic subjects can be mentioned about BIM according to whole analysed standards. The subjects are shown in Table 2.11.These subjects will be analysed in detail in the documents, and they will be interpreted in terms of educational gains.

Table 2.11 : Fundamentals Topics of BIM and Classification Subjects.

Included Topics	Common Topics
BIM terms, BIM maturity levels and BIM uses	Basic Knowledge of BIM
Project Phases (Stages), Project Lifecycle	Project Lifecycle
Roles of the required in the BIM process, tables of roles and responsibilities and discipline or professional codes of project members	Roles& Responsibilities
Delivery model documents (3D Model, 4D Model (time management), 5D Model (cost management), 6D Model (sustainability (in some documents: building performance)), 7D Model (facility management))	BIM Model Dimension
Required graphic details and information in model elements (Level of development - information - detail etc.)	LOD
Management process which include working, sharing, publishing and archiving progress of project documents; Naming and Classification; Common Data Storages	CDE&Project Delivery
Collaboration strategies, communication between different project members, coordination, clash detection, common data formats and information exchange procedures	Collaboration

2.3.1 Basic Knowledge of BIM

Topics covered under this subject are BIM terms, BIM maturity levels and BIM uses, as defined in the documents. The definitions of the BIM terms, the purpose of the BIM usage and explanations of the BIM maturity levels are integrated into documents to facilitate understanding of content in each document.

The United State – NBIMS Version 3:

Within the NBIMS V3 document researched in The United States Standards, BIM terms, maturity levels and BIM uses are discussed as three separate chapters. The document includes a comprehensive glossary related to BIM terms and their definitions. Besides, BIM usage purposes and definitions are explained detail in a table, as shown in Table 2.13. Finally, in order to determine the BIM maturity of the project, the BIM maturity model is shown in Table 2.13 is also specified in the document (NBIMS 2015, chp.3, chp. 5.1, chp. 5.9).

Table 2.12 : BIM Uses Purpose (NBIMS V3, 2015).

BIM Use Purpose			BIM Use Objective	Synonyms
01	**Gather**		**to collect or organize facility information**	administer, collect, manage, acquire
	01	Capture	to represent or preserve the current status of the facility and facility elements	collect
	02	Quantify	to express or measure the amount of a facility element	quantity takeoff
	03	Monitor	to collect information regarding the performance of facility elements and systems	observe, measure
	04	Qualify	to characterize or identify facility elements' status	follow, track, identify
02	**Generate**		**to create or author information about the facility**	create, author, model
	01	Prescribe	to determine the need for and select specific facility elements	program, specify
	02	Arrange	to determine location and placement of facility elements	configure, lay out, locate, place
	03	Size	to determine the magnitude and scale of facility elements	scale, engineer
03	**Analyze**		**to examine elements of the facility to gain a better understanding of it**	examine, evaluate
	01	Coordinate	to ensure the efficiency and harmony of the relationship of facility elements	detect, avoid
	02	Forecast	to predict the future performance of the facility and facility elements	simulate, predict
	03	Validate	to check or prove accuracy of facility information and that is logical and reasonable	check, confirm
04	**Communicate**		**to present information about a facility in a method in which it can be shared or exchanged**	exchange
	01	Visualize	to form a realistic representation of a facility or facility elements	review
	02	Transform	to modify information and translate it to be received by another process	translate
	03	Draw	to make a symbolic representation of the facility and facility elements	draft, annotate, detail
	04	Document	to create a record of facility information including the information necessary to precisely specify facility elements	specify, submit, schedule, report.
05	**Realize**		**to make or control a physical element using facility information**	implement, perform, execute,
	01	Fabricate	to use facility information to manufacture the elements of a facility	manufacture
	02	Assemble	to use facility information to bring together the separate elements of a facility	prefabricate
	03	Control	to use facility information to physically manipulate the operation of executing equipment	manipulate
	04	Regulate	to use facility information to inform the operation of a facility element	direct

Table 2.13 : Maturity Model (NBIMS V3, 2015).

Maturity Level	*A Data Richness*	*B Life-cycle Views*	*C Roles Or Disciplines*	*G Change Management*	*D Business process*	*F Timeliness/ Response*	*E Delivery Method*	*H Graphical Information*	*I Spatial Capability*	*J Information Accuracy*	*K Interoperability/ IFC Support*
1	Basic Core Data	No Complete Project Phase	No Single Role Fully Supported	No CM Capability	Separate Processes Not Integrated	Most Response Info manually re-collected - Slow	Single Point Access No IA	Primarily Text - No Technical Graphics	Not Spatially Located	No Ground Truth	No Interoperability
2	Expanded Data Set	Planning & Design	Only One Role Supported	Aware of CM	Few Bus Processes Collect Info	Most Response Info manually re-collected	Single Point Access w/ Limited IA	2D Non-Intelligent As Designed	Basic Spatial Location	Initial Ground Truth	Forced Interoperability
3	Enhanced Data Set	Add Construction/ Supply	Two Roles Partially Supported	Aware of CM and Root Cause Analysis	Some Bus Process Collect Info	Data Calls Not In BIM But Most Other Data Is	Network Access w/ Basic IA	NCS 2D Non-Intelligent As Designed	Spatially Located	Limited Ground Truth - Int Spaces	Limited Interoperability
4	Data Plus Some Information	Includes Construction/ Supply	Two Roles Fully Supported	Aware CM, RCA and Feedback	Most Bus Processes Collect Info	Limited Response Info Available In BIM	Network Access w/ Full IA	NCS 2D Intelligent As Designed	Located w/ Limited Info Sharing	Full Ground Truth - Int Spaces	Limited Info Transfers Between COTS
5	Data Plus Expanded Information	Includes Constr/Supply & Fabrication	Partial Plan, Design&Constr Supported	Implementing CM	All Business Process(BP) Collect Info	Most Response Info Available In BIM	Limited Web Enabled Services	NCS 2D Intelligent As-Builts	Spatially located w/Metadata	Limited Ground Truth - Int & Ext	Most Info Transfers Between COTS
6	Data w/Limited Authoritative Information	Add Limited Operations & Warranty	Plan, Design & Construction Supported	CM Capability	Few BP Collect & Maintain Info	All Response Info Available In BIM	Full Web Enabled Services	NCS 2D Intelligent And Current	Spatially located w/Full Info Share	Full Ground Truth - Int And Ext	Full Info Transfers Between COTS
7	Data w/ Mostly Authoritative Information	Includes Operations & Warranty	Partial Ops & Sustainment Supported	Implemented	Some BP Collect & Maintain Info	All Response Info From BIM & Timely	Full Web Enabled Services w/IA	3D - Intelligent Graphics	Part of a limited GIS	Limited Comp Areas & Ground Truth	Limited Info Uses IFC's For Interoperability
8	Completely Authoritative Information	Add Financial	Operations & Sustainment Supported	Implementing CM and Root Cause Analysis	All BP Collect & Maintain Info	Limited Real Time Access From BIM	Web Enabled Services - Secure	3D - Current And Intelligent	Part of a more complete GIS	Full Computed Areas & Ground Truth	Expanded Info Uses IFC's For Interoperability
9	Limited Knowledge Management	Full Facility Life-cycle Collection	All Facility Life-Cycle Roles Supported	CM and RCA capability implemented	Some BP Collect&Maint In Real Time	Full Real Time Access From BIM	Netcentric SOA Based CAC Access	4D - Add Time	Integrated into a complete GIS	Comp GT w/Limited Metrics	Most Info Uses IFC's For Interoperability
10	Full Knowledge Management	Supports External Efforts	Internal and External Roles Supported	Implementing CM & RCA and feedback	All BP Collect&Maint In Real Time	Real Time Access w/ Live Feeds	Netcentric SOA Role Based CAC	nD - Time & Cost	Integrated into GIS w/ Full Info Flow	Computed Ground Truth w/Full Metrics	All Info Uses IFC's For Interoperability

The United Kingdom – PAS and BS Documents:

When the PAS and BS documents from 2013 to 2018 are examined, they all start with BIM terms and definitions that will be mentioned in the document. Except for BS documents and PAS 1192-6 document, BIM maturity models given in Figure 2.6 are available at the entrance of each document. In this image, four BIM maturity levels are defined. These maturity levels are specific to each level; They are created in order to state the modelling dimensions to be delivered clearly, related standards, documents and their relationships with each other and how they can be applied to projects and contracts in the sector. For these purposes, it is aimed to provide a gradual integration of the use of BIM.

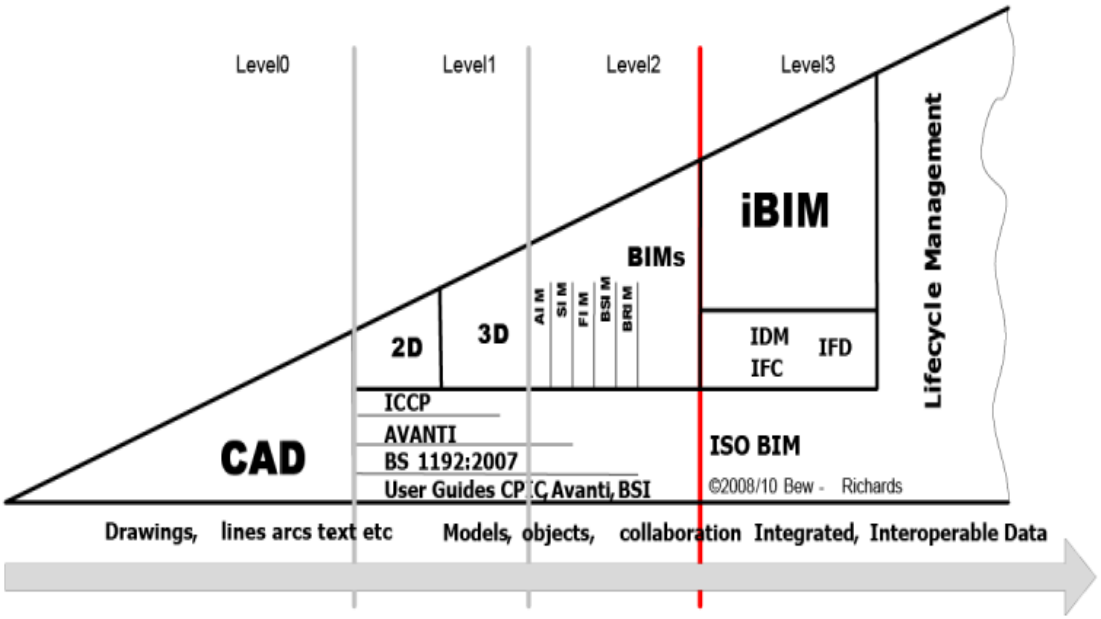


Figure 2.6 : BIM Maturity Model (Bew, 2008).

The United Kingdom – International – ISO 19650-1:

ISO 19650-1 document also starts with BIM terms and has a table as a maturity level stages for information management. In this table, as shown in Figure 2.7, it presents three main maturity levels in four layers with the aim of knowledge management. In this context, it proposes the necessity to increase the standards, information management technologies, data models and usage benefits to be handled in the BIM process.

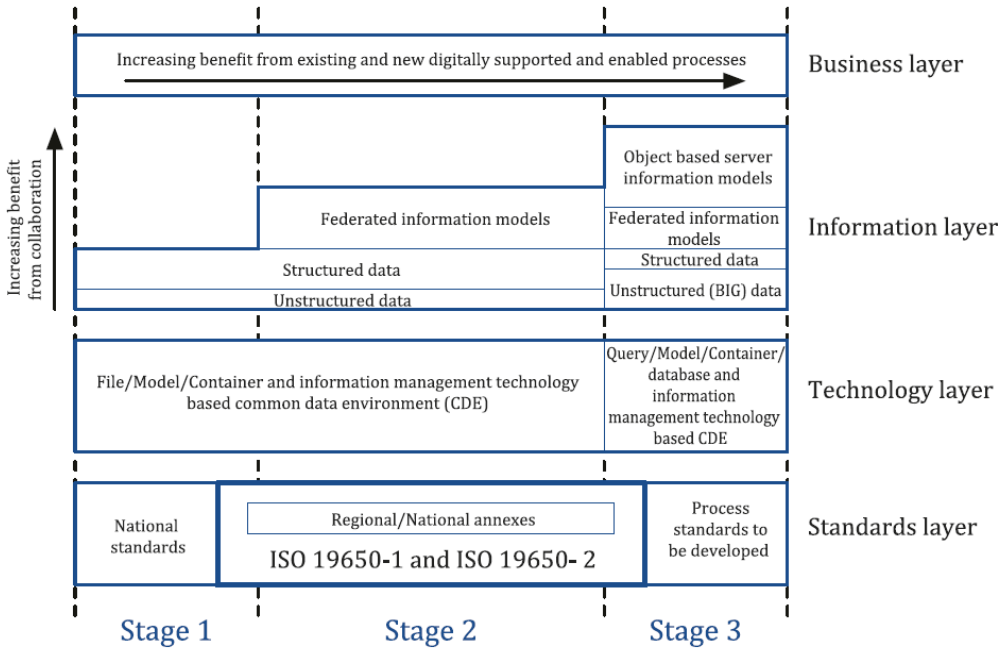


Figure 2.7 : BIM Maturity Stages of Information Management (ISO 19650-1, 2018).

Asia – Singapore BIM Guide Version 2:

In the introduction part of the Singapore BIM Guide document, it is defined how it handled the BIM process only until the application project phase. In addition, how to run the process is explained within the titles of "BIM Deliverable", "BIM Processes" and "BIM Professionals". Like other documents, there is no separate section in the document where BIM terms are defined. However, these terms and their definitions are made in detail in the supplementary document "BIM Particular Condition" of the Guide.

Australia – NATSPEC:

In Australia's NATSPEC document, BIM terms and maturity levels are not addressed as subject headings. Each section begins with the definition of the each title in the documents. In addition, all additional resources that can support the understanding of the process in the introduction are provided with a reference page. The definitions of BIM terms in the document can be found as a whole from the dictionary section of the of the "NATSPEC BIM" page in the references. For BIM maturity levels and BIM uses, when looking at the publication "NATSPEC BIM Paper 003" in the "Documents" heading within the "NATSPEC BIM" website; It is suggested to define these processes with States' "Penn State BIM Planning Guide" (NBP 003, 2014).

New Zealand – BIM Handbook:

It is stated in the BIM handbook of New Zealand that terminology and BIM uses are given in Appendix D of the document. When the Appendix D is examined, twenty-one BIM uses are classified within the specified project stages and subsequently, the definition, potential, resources and information requirements are examined in detail for each use. BIM maturity levels are not mentioned within the scope of this document.

Summary:

When looking at all the documents, it is observed that they addressed the definition and target of the BIM process at the beginning, and in this context, three main issues are mentioned. These are BIM terms, BIM uses, and BIM maturity levels. These topics are examined in detail in some documents, while in others, they are supported with reference documents and detailed here. Within the scope of BIM usage purposes and BIM maturity levels, the objectives to be addressed in the BIM process and the resources required for these targets are specified.

The Comment in terms of educational gains:

The most crucial awareness to be gained within the subject is the learning of clearly defining the BIM terms, usage purpose and maturity levels before the BIM process. Also, BIM theoretical knowledge is required for understanding the usages field, various applications purpose, BIM requirements.

2.3.2 Project Lifecycle

The project life cycle is a process that continues from the construction decision of a project to the end of the project. Within the scope of the study, the building life cycle is examined within the framework of a common concept. The process that extends from the design phase of a building to the construction and operation phase and re-start with its demolition is called the building life cycle. The cycle can be analysed mainly in three main stages: pre-construction, construction and post-construction (Talebi, 2014). In the documents reviewed, it is observed that BIM systems target the efficient operation of the entire process. This topic is taken as the basis in most of the documents and supported by the project stages. Although it is not mentioned directly in some documents, it shows itself semantically through the identification of project phases and sustainability of the information model.

The United State – NBIMS Version 3:

"Classification", "BIM Project Execution Plan", “Planning, "Executing and Managing Information Handover” and "BIM Used" topics in NBIMS include concepts related to the project lifecycle. The project stages are divided into seven stages: initial phase, conceptualization phase, criteria definition phase, design phase, coordination phase, implementation phase and transfer phase (NBIMS, 2015)

The United Kingdom – PAS and BS Documents:

When PAS and BSI documents are examined, the project life cycle is included in the document delivery plan. It is said that the project stages will be determined within the Exchange Information Requirements (EIR) and BEP topics. The importance of project stages is understood in topics of the Project Implementation Model, Business Process and Project Types.

The United Kingdom – International – ISO 19650-1:

In ISO 19650, the project life cycle is mentioned within the topics of information management and information delivery lifecycle. The document defines the project stages as design, construction, commissioning, operation and maintenance (ISO 19650-1, 2018 pg. 1).

Asia – Singapore BIM Guide Version 2:

In the Compensation Expectations section of the Singapore BIM Guide document, the project phases are mentioned in more detail until the construction phase. Then, in the Appendixes, this cycle is divided into six categories: conceptual design phase, schematic design phase, detailed design phase, construction phase, as-built phase and facility management phase. These titles are stated together with roles and responsibilities in the BEP document. The contractual flows of the project processes are also defined separately in the document.

Australia – NATSPEC:

In the NATSPEC document, the project lifecycle in BIM Management Plan heading is examined in two main phases: design and building. When we look at the whole document, while examining these stages together; the facility management phase is also discussed with other topics (NATSPEC, 2011, pg. 3 - pg5). Therefore, the stages

can be evaluated under three main topics: design, construction and facility management.

New Zealand – BIM Handbook:

NZ BIM handbook handles project phases as BIM and Procurement as design, construction and operation, where it also mentions the project flows in the context of the contract. BIM divides the CAPEX and OPEX phases defined in the project delivery documents under the title of workflow (BAC, 2019).

Summary:

The topic review shows that each project is examined in a cycle that continues from the design phase to its demolition. It is essential that the project stages are defined under the BIM purpose or that specific BIM targets are set according to the stages defined. On this occasion, considering the demands of the employer in the project, it is recommended to properly consider the project phases at the first stage, to proceed the contract process in parallel with these stages and to continue the project for specific purposes for each stage.

The Comment in terms of educational gains:

The most important subject to be learned in this topic is the existence of project processes such as design - application - building - as build and operation and their interconnected, sequential progress. Defining these stages enables the creation of documents, models and standards to be referenced for a purpose in a project process. The most critical awareness here is that each stage has a fundamental responsibility for the next stage, and the project should be created in a life cycle, to advance the life span in the most extended term in the most efficient way.

2.3.3 Project Roles and Responsibilities

Within the construction projects, many teams from different disciplines who will contribute to the project in proportion to their expertise work together. The roles and responsibilities of the teams working in BIM projects should be described before the project in order for this collaboration process to work efficiently, to arrange progress payments and to identify person-based project failures quickly. These roles and responsibilities are specified in specific codes within the standards. The fundamental

roles and responsibilities that will take place in the management of this process are explained in detail in the documents.

The United State – NBIMS Version 3:

Codes, names and responsibilities of roles that can contribute to the project are presented in a hierarchical list in the NBIMS document of The United State, primarily with the OmniClass classification system. Besides, within the BIM Collaboration Format (BCF) document, "author of the model" is defined as the real owner of the model delivered in the form of common interdisciplinary data. It is also important that these roles and responsibilities are reported at the beginning of the project in the document "BIM Project Execution Plan (BPEB)", and that the information about who is responsible on the Construction Operations Building Information Exchange (COBie) information should be also given in a COBie Responsibility Matrix. In the "Planning, Executing and Managing Information Handover" title, roles and responsibilities are re-examined for project transfer and data management. Within the scope of this issue, it is stated that the responsibility of the data to be transferred belongs to the team which deliver the project (NBIMS, 2015).

The United Kingdom – PAS and BS Documents:

When PAS and BSI documents are examined, it is important to report roles and responsibilities in the project within the BEP. The hierarchical structure of the roles is illustrated in the heading "Task Information Delivery Plan" as shown in Figure 2.8 (PAS 1192-A1, 2013). Defining two different tasks, especially for information and model control, and managing these tasks hierarchically by the task information manager reveal specific roles within BIM. Also, responsibilities and roles in document PAS 1192-3 for asset information exchange and inputs are shown in a table as owner-operator-maintainer and others (PAS 1192-3, 2014). Certain codes of all roles to be included in the project are also specified in the "Roles" heading in the BS documents.

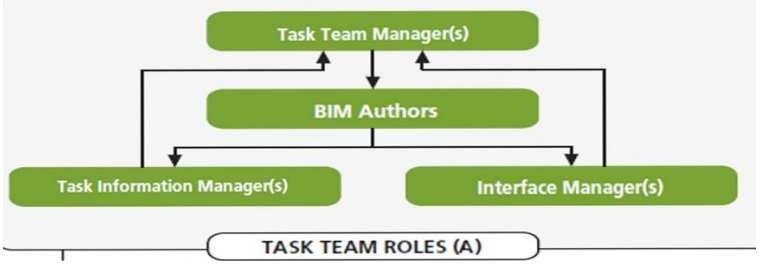


Figure 2.8 : Task Information Delivery Plan (PAS, 2013).

The United Kingdom – International – ISO 19650-1:

The ISO 19650-1 document emphasizes the need to report roles and responsibilities through a matrix of responsibilities. A responsibility matrix shows accountability, an obligation to complete deliverables of documents (ISO 19650-1, 2018).

Asia – Singapore BIM Guide Version 2:

The Singapore BIM Guide document highlighted the need to report roles and responsibilities under Model Execution Plan clearly in creation, maintenance and collaboration process of the model at different stages of the project. In addition, document submissions are requested to be presented in the "BIM Objective and Responsibility Matrix". This topic is explained in detail in the Appendix B of the document with the codes of the roles. There is also a table for the responsibilities of the Project BIM manager and BIM coordinator in the document.

Australia – NATSPEC:

In Australia's NATSPEC document, BIM responsibilities and the names of the teams are given under the title of "Implementation". In addition, there is a table in the title of “BIM Roles and Responsibilities” where the responsibilities of all roles to be included in the project are clearly stated. Responsibilities for BIM Manager and Coordinator are explained in detail outside the table. The document emphasizes the importance of developing a "BIM Management Plan (BMP)" to provide a Master information management plan and assign roles and responsibilities for model building and data integration at the start of the project (NATSPEC, 2011).

New Zealand – BIM Handbook:

In New Zealand BIM Handbook, the definition of project roles is made under the title of "BIM Roles and Function". The hierarchical structure is illustrated with the "Key Personnel and BIM Roles" graphic shown in Figure 2.9. It is emphasized that these roles and responsibilities should be stated in the BEP document. For this, Appendix H is referenced. This document describes the BEP infrastructure. In the "Key Project Contacts" title in the BEP, the roles should be defined with disciplines and the project-specific. In addition, the responsibilities regarding BIM uses and deliveries should be given in the "Client required BIM uses for the Project" table in the same document.

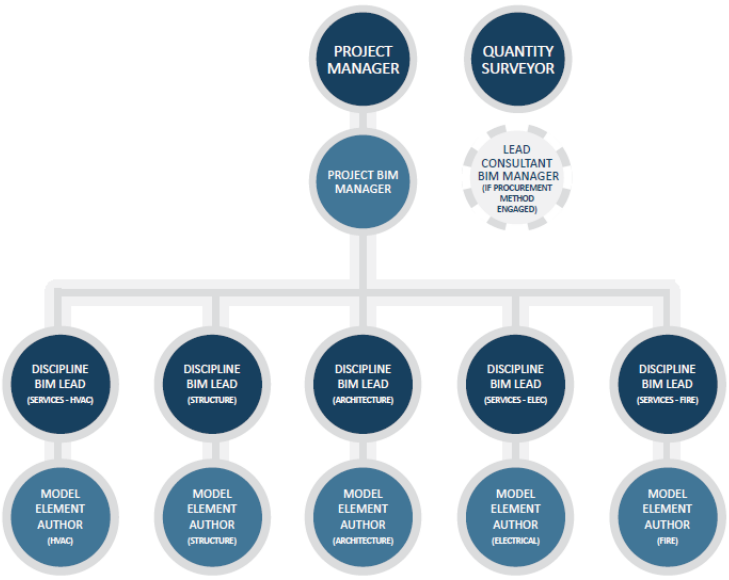


Figure 2.9 : Key Personals and BIM Roles (BAC, 2019).

Summary:

All documents reveal the existence of roles and responsibilities in the BIM process. There are roles and important responsibilities such as BIM Manager, BIM Coordinator, Task Team Manager, BIM Model Author, BIM Author, Task Information Manager, and Interface Manager specialized for BIM process management. Besides, there are specific codes that define each team and every discipline in some documents.

The Comment in terms of educational gains:

The main topic to be learned in this subject is that the BIM process is a continuing process with team-work and work sharing. Each team member in this process has to complete their tasks within the scope of specific roles. It is of utmost importance to report the roles and responsibilities of the participants in a table in order to manage the process correctly.

2.3.4 BIM Model Dimensions

Different model dimensions are available in BIM uses. These model dimensions are different from the BIM maturity levels discussed in the “Basic Knowledge of BIM” topic and are wholly related to the information model. Topics to be covered within this subject includes issues such as the separation of two-dimensional (2D) documents and

models to be delivered within the project stages in BIM systems according to their intended use and the representation tools used to create these documents.

BIM Model dimensions besides a 3D information model, it mentions customized 2D, 4D, fifth dimension (5D), sixth dimension (6D) and seventh dimension (7D) model dimensions for purposes such as presentations of project documents, cost management, time management, the building performance and how to operate the facility. Although these model dimensions are not mentioned directly within the standards, based on the goals of use, they are parallelism with the delivery model documents mentioned in the standards, so are classified into this subject. The contents of the BIM model dimensions are given in Figure 2.10.

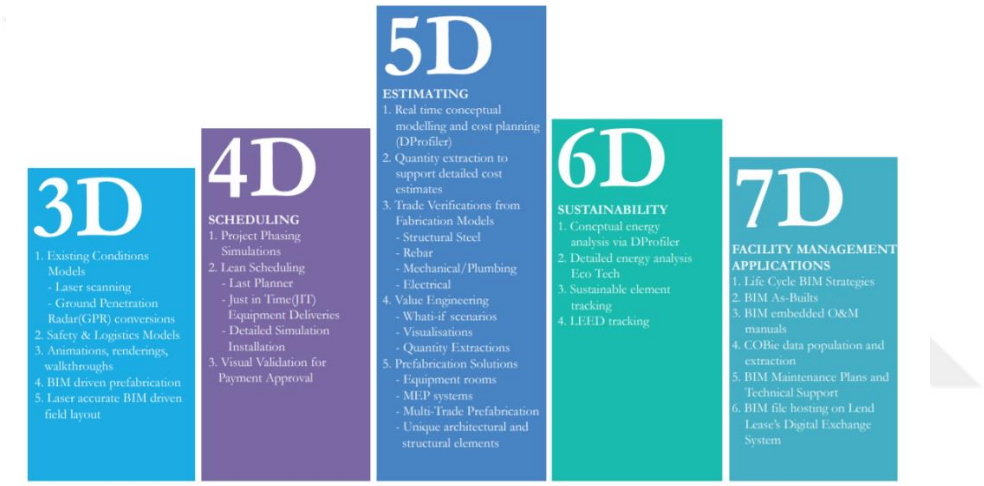


Figure 2.10 : BIM Model Dimensions (Url 3).

The United State – NBIMS Version 3:

The topic titles "Project Goals and BIM Uses", "BIM Process Design", "BIM and Facility Data Requirements" and "Technological Infrastructure Needs" in the BPEB document of the NBIMS document explain the model details and delivery schemes. Necessary models and delivery schemes are defined in the "Process Map", which is most clearly published as an Appendix of the BPEB document. The 3D BIM model and the 4D model are directly stated. While the cost plan under the 5D is under the name of "Cost Estimation". The concept of sustainability, defined by the 6D, is defined in "Building System Analysis". The model size and project delivery stages required for facility management, which defines the 7D, are covered under the headings "Record Modelling" and "Maintenance Scheduling". According to the NBIMS document, the model and program are delivered in the BIM process within the scope

of a total of sixteen topics discussed in four main project stages. Process maps defined with these topics are given in **Appendix B**.

The United Kingdom – PAS and BS Documents:

When the UK documents are examined, the model sizes are specified in the BIM levels section up to the 3-dimensional BIM model and then it is represented that it will continue with federated models. Within the scope of these federated models, in the explanations in the standard, it is stated that the 4D model, the 5D model and the operational models are not considered in level two (PAS 1192-3, 2014). However, details and delivery patterns of both graphical and graphic independent information models to be prepared by the project teams before the project should be defined within the scope of the "Master Information Delivery Plan (MIDP)". Then, each team will deliver their models and information about the project with the document "Asset Information Management (AIM)" as specified in MIDP under "Project Information Model (PIM)". These documents represent the project documents required for the design and construction phases of the project phases. Asset Information Management concept also covers time management, cost management, energy efficiency and facility management. In addition, the sections on facility management and delivery contents are detailed in the topics related to Facility Management and Cobie Data Type. Thus, it is clear that the documents containing the purposes of the 4D, 5D, 6D and 7D models are in the documents that should be delivered in the BIM process.

The United Kingdom – International – ISO 19650-1:

Considering the content of ISO 19650-1 standard, PIM and Cost Estimation topics are mentioned in the representations specified with the "Information Management Perspective" table. Apart from this table, it is required that information related to cost, energy efficiency, maintenance-repair, quality concepts to be questioned within the scope of the information model in the information requirements and management. It is also stated that the project teams will deliver their documents within the scope of the project program at the delivery times called "key decision points" (ISO 19650-1, 2018). These details in the document refer to all model dimensions in the BIM process.

Asia – Singapore BIM Guide Version 2:

In the Singapore BIM Guide document, under the heading “BIM Deliverable”, site model, massing model, discipline-specific 3D BIM models, cost estimation, time and

phase programs, As-Built models, facility management models and additional BIM services are mentioned (BCA, 2015, pg. 5). Under the title of Additional BIM services, there are also titles such as 4D models, cost analysis and energy simulations. All these mentioned topics indicate that the required model dimensions are needed directly in the BIM process.

Australia – NATSPEC:

In the NATSPEC document of Australia, the necessary models are published in more detail in title of the "Requirements of Using BIM" (NATSPEC, 2011). After site analysis and existing modelling, the project continues with the 3D architectural information model. In this process, code checking and sustainability evaluation are performed; it is then transferred to engineers. At this stage, engineers should develop their 3D BIM models with some analysis such as energy. The developed model should be turned into a coordination model and then presented with cost analysis. Finally, an As-Built model is made on the physical model in the field and Cobie data is transferred to this model and made ready for operation. In all these processes, the importance of time schedule and the 4D model requirement is mentioned. Technological infrastructure information and requirements to be used for modelling are also mentioned in the document.

New Zealand – BIM Handbook:

In New Zealand BIM Handbook, 3D, 4D and 5D model sizes are defined directly in the document. Under the heading “Modelling and Documentation Practice”, the requirements of modelling are mentioned and the details that the models should include are discussed. In this context, as-built model required for 3D BIM model, cost estimation, sustainability and facility management is mentioned. Also; A table containing project phases similar to the NBIMS document is published in Appendix B in BIM Handbook. In this table shown in **Appendix C**, the requirements of the titles containing the objectives of the model dimensions are specified through the project stages.

Summary:

Although the standards reviewed do not directly address the model sizes introduced in BIM systems, they request the required content in the BIM process in line with the descriptions of all dimensions. For this reason, it is essential to be aware of the

documents to be delivered in order through the project stages defined in BIM processes.

The Comment in terms of educational gains:

There is more than one main topic to be learned within the scope of this subject. The topics are the main purposes of the project documents within BIM systems. These are 3D information model, 4D models valid for planning program, 5D models for cost management, 6D models for building performance and 7D models for facility management. For these delivering, more than one skill should be required related to modelling skills, management skills and computational skills.

2.3.5 LOD

LOD is a concept that defines the graphical detail levels and the amount of information that the elements in the digital model should have in the required project dimensions in certain project phases during the building information modelling process. Different sub-concepts can also support this concept in each standard. For example; the term is customized in some standards such as LOI where non-graphical knowledge levels of models are defined and LOD concepts where only graphic detail levels are defined. Elements related to the limitation of the element's parameters and the details that the elements will have within the scope of the model purposes are discussed under this subject. The primary purpose of these limitations is to prevent the model from being filled with unnecessary information unless it is necessary to describe their levels clearly (Kensek and Noble, 2014).

The United State – NBIMS Version 3:

When the USA NBIMS document is examined; It uses the LOD definition by The American Institute of Architects (AIA) under the heading "LOD Specifications". AIA directly defines this concept with a geometric level of detail and information content. The defining purpose of models by model authors, according to the LOD document, allows downstream users to clearly understand the usability and limitations of the models they receive (NBIMS, 2015, chp.2.7, pg. 1). It is emphasized that the model authors and model users should decide these levels for specific purposes at the project level. In the BIM Forum LOD 2019 document attached to the document, examples are

given in term of elements are defined in classes is clearly stated. One of the examples related to the Steel Framing Column is given in Figure 2.11.

B1010.10 – Floor Structural Frame (Steel Framing Columns)

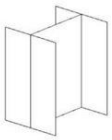
100	Generic column element. See B10.	
200	See B1010	
300	Element modeling to include: • Specific sizes of main vertical structural members modeled per defined structural grid with correct orientation Required non-graphic information associated with model elements includes: • Structural steel materials defined. • Connection details • Finishes, i.e. painted, galvanized, etc.	
350	Element modeling to include: • Actual elevations and location of member connections • Large elements of typical connections applied to all structural steel connections such as base plates, gusset plates, anchor rods, etc. • Any miscellaneous steel members with correct orientation • Any steel structure reinforcement such as web stiffeners, sleeve penetrations, etc.	
400	Element modeling to include: • Welds • Coping of members • Cap pates • Washers, nuts, etc. • All assembly elements	

Figure 2.11 : LOD Schema for Steel Framing Column (BIMForum, 2019).

The United Kingdom – PAS and BS Documents:

When the UK PAS and BS documents are examined; It is seen that the LOD concept is defined gradually within the titles of "Level of Model Definition (LOM)", LOD and LOI. Firstly, the level of knowledge and detail required by the model is defined in the form of a matrix with project phases, taking into account the information changes defined in the EIR document; it then suggests specifying the geometry and knowledge levels of its elements in the light of this model detail level (BSI 2013, pg.33).

The United Kingdom – International – ISO 19650-1:

When ISO 19650-1 document is examined; The level of detail required by the model elements and the model is explained in the concept of "Level of Information Need (LOIN)". Firstly, the geometric infrastructure of the model elements should be defined in these detail levels. Afterwards, information requirements of the model elements

should be indicated in documents such as Organization Information Requirements (OIR), Project Information Requirements (PIR), AIR and EIR documents Except for the information requirements specified in LOIN, all information entered in the model is considered as waste (ISO, 2018, pg. 23).

Asia – Singapore BIM Guide Version 2:

When the Singapore BIM Guide document is examined; First, the parameters of the model elements are exemplified under the heading "BIM Elements". It is also suggested that these parameters can be defined with the VA Object / Element Matrix and BIM Forum LOD Specification documents (BCA, 2013, pg. 6-10). The development tables of the elements are shown under the heading "Model Progression," according to the project stages. Also, in Appendix C, in a guidance document specific to Model Elements, which elements are used in the model and their definitions are given in a table (BCA, 2013, pg. 44-60).

Australia – NATSPEC:

When the NATSPEC document of Australia is examined, it suggests defining the geometrical and knowledge level of the elements together (NATSPEC, 2011, pg. 24). Within the titles of "Architecture Modelling", "Structural Modelling" and "MEP Modelling", the document advocates the need for each discipline-specific element to represent the required detail levels and develop their parameters according to the project stages in this process (NATSPEC, 2011, pg. 10-12).

New Zealand – BIM Handbook:

When the New Zealand BIM Handbook document is examined; Under the title of "Client Information Requirements", the explanations and types of information that the elements should include are mentioned. This section expresses clearly what type of information the elements should have before the knowledge levels (BAC, 2019, chp. 4.4, pg.18). In addition, under the title of "Model and Documentation Practice", the LOD concept is explained in detail by referring to the BIM Forum LOD Specification document. It even emphasizes that the Appendix C document has been prepared specifically for this topic (BAC, 2019, chp. 6.4, pg.27). When the referenced Appendix C document is examined, it is emphasized that LOD levels should be considered not for the entire model, but for model elements.

Summary:

The process that all the doctrines mentioned in common; The level of detail of the project is defined in terms of elements and the progress of the project is decided together with the model user in a table for the purpose of the project. Usually, these levels are used as described in AIA's LOD Specification documents published by BIM Forum. When looking at these documents, it has been observed that the geometrical and knowledge levels of the elements increase as the project stages progress. This situation increases the readability of necessary information by preventing excessive information pollution by keeping the information required by each project stage at a minimum rate.

The Comment in terms of educational gains:

The most important information to be learned the scope of this subject is defining the model elements according to the purpose of model, and developing the necessary parameters and geometries of these elements according to the project purpose. For this process, the background related to project elements and materials knowledge should be learned.

2.3.6 CDE and Project Delivering

Common data environment and project sharing procedures are one of the main topics covered in the BIM process. In every standard, issues related to how to share all the documents related to the project, how to access these documents, how to archive them, and the need to manage these processes with a central and protected infrastructure in many documents are included. Within the scope of this subject, document, model and employee naming procedures, classification systems, information and document management, sharing, delivery and archiving of resources related to the project are discussed.

The United State – NBIMS Version 3:

When the USA NBIMS document is examined; It primarily recommends the use of the OmniClass classification system created by the North American AEC Industry to classify the information created and used throughout the entire building life cycle and provide a standard foundation for this information. In this classification system, there are definitions and codes required for many resources used in the process. Its purpose

is to ensure that all information arrives properly with the necessary standards and facility management throughout the project (NBIMS, 2015, chp. 2.4, pg 1). Information such as naming files and delivery procedures within the scope of the project should be defined in the BPEB document content. It has been reported that the sharing of all these documents can be made on a private or public data infrastructure upon the agreement of the project parties, as well as printed documents due to legal requirements (NBIMS, 2015, chp.5.6, pg 16).

The United Kingdom – PAS and BS Documents:

When the UK PAS and BS documents are examined; it is seen that the documents are originally created for accurate and controllable information management and transfer to facility management. In this context, some topics are called attention, such as the requirements of information delivery strategies, the use of a classification system and proper information transfer. First of all, the importance of naming procedures for COBie document is emphasized in PAS documents, and naming the files by coding with specific rules is explained with examples. It also recommends the Uniclass classification system (BSI, 2015). In the process of sharing and organizing the produced information, it proposes to use CDE to manage the information in a simple and timely manner (BSI 2013, chp.9.2, pg 25). In the BS documents, the infrastructure of CDE, file naming procedures and classification systems are discussed in detail. Four stages are defined in the CDE as Work in Progress (WIP), Shared, Published and Archive. Afterwards how to transfer project documents between these stages is explained. In addition, the folders and files to be kept in this warehouse are subject to a standard naming system.

The United Kingdom – International – ISO 19650-1:

When ISO 19650-1 document is examined; There is no recommended procedure for naming and classification systems. However, it is explicitly mentioned that the common data environment and information flow must be defined. In this context, three stages are defined as WIP, Shared and Published. Information about when the information stores (project documents - delivery packages) in the BIM process should be shared should be obtained from the EIR document. All information is stored in the most recent archive folder. Figure 2.12 suggested common data environment structure and information transfer scheme are shown.

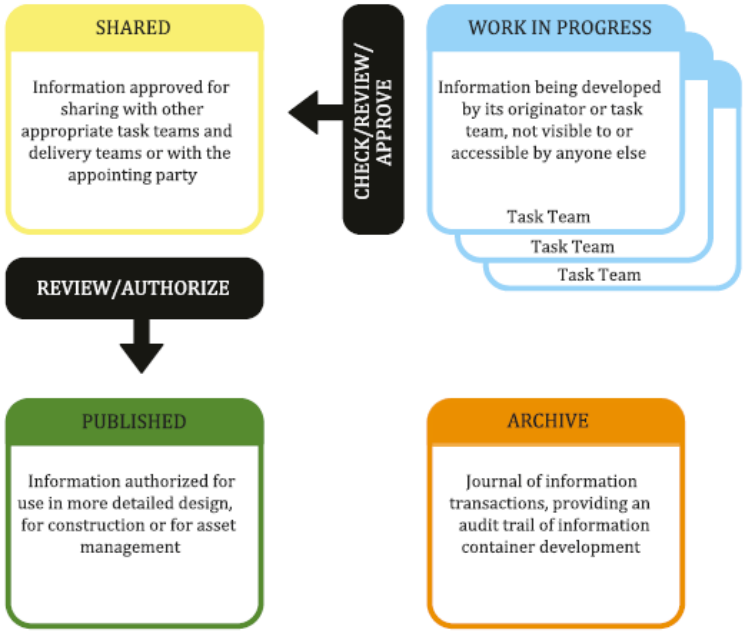


Figure 2.12 : CDE Concept (ISO 19650-1, 2018).

Asia – Singapore BIM Guide Version 2:

When the Singapore BIM Guide document is examined; Some standard processes have been proposed, primarily through the delivery of 2D documents. According to the document, all 2D delivery documents must be obtained from the BIM model with a naming procedure and shared in this way (BCA, 2013, pg. 21). In addition, the documents and original models published from BIM models must first be archived in the project folder, then the deliveries made on the critical milestones of the project phases must be kept in the archive with delivery dates as a record that should not be changed for any reason. It is recommended that the BIM archive consists of two sets of files. The first is defined as a collection of BIM models and related output from other model authors. The second set of files is defined as the folder where individual BIM models are properly stored for archiving and viewing. It is recommended to have this archive on a network with the necessary permission restrictions and to back it up for data security (BCA, 2013, pg. 22).

Australia – NATSPEC:

When the NATSPEC document of Australia is examined; it does not mention a common data environment, but for data use and security, it is recommended to standardize information stores to be transferred with a folder protocol. In this folder infrastructure, four main folders under the name of BIM files, Support Files,

Coordination Files and Other Files are recommended. In BIM files, 2D documents are shared in two subfolders, model and layout, together with the project model and naming procedure. Reference documents with standards to be applied in the project will be found in the support folder. In the coordination folder, there will be coordination models to be shared for conflict control. Other files will contain images, simulations and analyse produced within the scope of the project (NATSPEC, 2011, pg. 20). Also, a COBie database needs to be created to continue the project during the operational phase. In the document, project sharing is done through print and CD without suggesting a central environment.

New Zealand – BIM Handbook:

When the New Zealand BIM Handbook document is examined; Information transfer is linked to the Common Data Environment (CDE) used to collect, manage, disseminate, exchange and receive project information throughout the project life cycle. CDE guides the exchange of information among project stakeholders on milestones agreed in the project BEP. The resources in the BIM process should be created and shared in accordance with the naming procedures specified in the BEP. Project deliveries are made in 2D documents compatible with the BIM model. The background of these submissions should be defined in the BEP document (BAC, 2019).

Summary:

Project delivery processes should be made in certain rules in each document by mutually agreeing with the project members. These decisions should be defined with documents such as BEP or BPEB before the project. Deliveries continue with different processes in the documents. However, it is a common requirement to make it under a standard folder structure by certain transportation permissions over a common data environment. It is of great importance that the deliveries are archived at certain stages and that these archives are a digital archive in order not to lose data. It is also recommended to back up the archives occasionally for the same reasons.

The Comment in terms of educational gains:

The main knowledge that needs to be learned within the scope of this subject is the necessity of creating the project documents with the discipline of standard naming procedures and publishing them in accordance with a delivery strategy determined

before the project. In work in this discipline, it is critical knowledge to make deliveries in a common data store that is reached easily from everywhere by every project member like cloud storages.

2.3.7 Collaboration

The building sector requires many disciplines to work together efficiently. In order to capture the efficiency in this process, it is necessary to align many different areas of expertise in the background over the project life cycle. Besides, it is very important to ensure that the flow of information between different disciplines is smooth and without loss of information. For this reason, the collaboration strategies that are established to manage and control the interoperability processes are arranged in the standards. The main topics collected within the scope of cooperation are; communication processes between project stakeholders, coordinated model and information generation, clash detection, common data formats and sharing.

The United State – NBIMS Version 3:

When the United State NBIMS document is examined; primarily describes common data formats proposed for interdisciplinary collaboration. In this process, it is suggested that communication between BIM models in different disciplines can be achieved with BCF. In addition, the Industry Foundation Class 2X3 (IFC 2X3) class published by ISO 16739 in 2006 is recommended as the information exchange standard (NBIMS, 2015, chp.2, pg. 1-2). These standards ensure that the models prepared by different disciplines are easily readable by everyone and that project documents are shared on a systematic infrastructure. In the document, the details related to the information exchange between the basic 3D information model and other model dimensions and disciplinary analyses are also discussed under the title of "Exchange Standards". Sample templates such as the "Model View Description (MDV)" document required for the information changes related to the topics discussed in this process have been added in the subject headings. With all these references, the information exchange and collaboration strategies are preferred by arranged in the BPEP document. Especially in the tables within the "BIM Information Exchange" and "Collaboration Procedures" topics in the BPEP document, there are some crucial issues such as document transfer, information changes, meeting times, model delivery, approval processes, communication and technological infrastructure. Finally,

coordination requirements have been clearly stated especially for MEP models and it is reported that interim coordination meetings should be organized for the management of these processes. Before the meetings, each discipline should clean its own model for discipline and then compare it with the models in other disciplines to make the necessary revision decisions (NBIMS, 2015, chp.5.5, pg. 4-6).

The United Kingdom – PAS and BS Documents:

When the UK PAS and BS documents are examined; It is clearly stated that the main purpose of the documents is to make the collaboration process efficient. First of all, the production of information starts with the design phase. In the process, it is important to define the information in the correct standards and to explain the process to other stakeholders through interim meetings. Then, considering the information exchange procedures, the information continues exponentially for other project phases with the same standard processes (BSI, 2013). In the common data sharing process, IFC standards are proposed under the heading COBie. In this process, it is proposed to create a COBie database and to define the models with MDV documents and to transfer them in IFC 2x3 format (BSI, 2014, pg 4). In prior to the coordination meetings, each team should be complete the discipline-specific and interdisciplinary clashes according to procedures in the document (BSI, 2013, chp.9.4, pg. 29).

The United Kingdom – International – ISO 19650-1:

When ISO 19650-1 document is examined; In order to ensure consistency for each stakeholder, information exchange is recommended in all cases using open standards and clearly defined operating procedures. It recommends defining CDE and workflows for interdisciplinary collaboration. Coordination of models and information packages are required for the process. Coordination must be completed and approved for an information package to be shared in the broadcast folder. (ISO 19650-1, 2018, pg. 11) In order to control the sharing of federated information packages, the necessary criteria are stated in the document under the title of "Federation Strategy" (ISO 19650-1, 2018, pg. 31-32).

Asia – Singapore BIM Guide Version 2:

When the Singapore BIM Guide document is examined, necessary details are explained in the heading "BIM Modelling and Collaboration Procedures". Following these details, each discipline creates and shares its own models within the framework

of the model rules established between the project members and the disciplines determined within the BEP. Afterwards, it is stated that shared models should be interactively controlled by coordination meetings (BCA, 2013, pg. 15-17). Clashes are made primarily in discipline-specific and then among higher-level interdisciplinary (BCA, 2013, pg. 20). It is recommended to keep the old version records of the models before revisions required after clashes. Also, it is stated that while revisions are taking place in the document, the models can only be changed by the responsible teams, and the teams in other disciplines can only read the shared model. For this reason, it is suggested that the models should be shared with an open format such as IFC, which is publicly readable (BCA, 2013, pg. 12). A common (software) platform is recommended to reduce the possibility of data loss or errors when sharing different models (BCA, 2013, pg. 19).

Australia – NATSPEC:

When the NATSPEC document of Australia is examined; First of all, IFC should be used with MDV document in interdisciplinary model sharing. However, upon the employer's request or approval, the shares can be made in different file formats (NATSPEC, 2011, pg. 3). It is also reported that a design must be passed from clash detection and turned into a coordinated federated model (NATSPEC, 2011, pg. 8). If the employer does not provide a document that coordinates cooperation processes, this document should be prepared by BIM teams. In the document prepared, it is recommended to report responsibilities, communication procedures, reporting procedures, approval processes, information requirements and changes, model coordination processes and versions of project documents (NATSPEC, 2011, pg. 9).

New Zealand – BIM Handbook:

When the New Zealand BIM Handbook document is examined; collaboration procedures need to be reported in the BEP document and it is argued that it is necessary to achieve a coordinated model. Model authors should clearly state how the model will be used during sharing with the "Model Description Document (MDD)" document detailed in the Appendix J document (BAC, 2019, pg. 16). The need to exchange and manage information over the common data environment is reported throughout the project life cycle (BAC, 2019, pg. 20). It is important to determine in the BEP document the file formats of the shared models and documents. In Appendix I, "Model

Coordination" document is prepared for coordination process procedures and details of coordination are clearly stated in this document. In this context, it is suggested that information which elements to evaluate the coordination models required at the project stage, should be determined within the project (BAC, 2019, Appendix I).

Summary:

In the documents reviewed, it is emphasized that the collaboration procedures should be determined before the project in the documents such as BEP or BPEB as well as the workflows before the project. In addition, the process of sharing the model with a reference document specific to the disciplines in every delivery process of the project, making the necessary model clash detections between both disciplinary and disciplines, and publishing them as a federated model, is same in all documents. If the stakeholders in different areas of expertise in the project are specified on which platform to communicate with each other and which procedures should be coincided with the coordination models, the collaboration process can work with maximum efficiency. Besides, sharing of the shared documents using open sources such as BCF or IFC is required as a requirement in order to be easily readable by other model users.

The comment in terms of educational gains:

The main awareness in the subject is that a project is progressing to create a common digital model by requiring different disciplines and expertise. For this purpose, each model is under the responsibility of the model manufacturer and they come together with other disciplines only during the coordination checks on the model. Considering this is coming together process on the single and federated model in BIM level three; the process should be required continuous and coordinated collaboration. The subject that should be learned basically for both purposes is related to how to work together with different disciplines and efficiently. The critical knowledge for the subject is that the communication and file-sharing procedures. The process is required to define through the documents.

2.4 Summary of Chapter

Within the scope of this section, firstly, the history and importance of standardization are discussed. Especially the first part of ISO 19650 document published at the end of 2018 shows the necessity of international standardization for BIM systems. With this

requirement and the goal of creating a common BIM background, this section provided analysis of the main topics of the BIM process by examining the most comprehensive national BIM documents and the first international BIM publication on all four continents of the world.

Within the scope of this analysis, there are some issues that are handled in each document and are necessary for the efficient functioning of the process. These topics are classified under various topics.

Basic Knowledge of BIM: Information about BIM terms, maturity levels and usage

Project Lifecycle: Defining the project stages and associated workflows within the project life cycle

Roles and Responsibilities: Responsibility distribution of project members according to their roles.

BIM Model Dimensions: Preparation of different dimension models of information for the various purposes of the project such as 3D information model, 4D planning (time management) model, 5D cost management model, 6D building performing model and 7D facility management model.

LOD: Defining the geometric and informatic details of the elements in the model according to the project stages

CDE and Project Delivery: Conducting document transfers by controlling with procedures in the project process through a common centre

Collaboration: Organizing documents, models and information sharing of teams in different disciplines that will work together

Within this classification, basic educational knowledge emerges that need to be gained:

Basic Knowledge of BIM: Before starting the BIM process, a theoretical BIM knowledge that is suitable for BIM terms, usage and purposes is required.

Project Lifecycle: In the BIM process, the needs of each phase in the project life cycle must be defined correctly, and the information transfer between the stages must be appropriately advanced. Therefore, knowledge of the project stages and the importance of the project life cycle should be learned.

Roles and Responsibilities: In order for the collaboration to be organised and to function systematically during the BIM process, the job descriptions of the people who will take part in the project must be properly defined. Therefore, the roles and responsibilities according to project phases and organisations should be learned. Also, Also, gaining team-work and work-sharing skills are very crucial in the subject.

BIM Model Dimensions: Firstly, the 3D information model is needed for the BIM process. For this purpose, modelling skills is very crucial. A proper information model can be transformed into models of various dimensions to be used for time management, cost management, building performance analysis and facility management in the continuation of the process. In this transformation, having information about these issues is very important for process management. In this context, high-level analysis programs created for these purposes are used. For using the analysing programs can be required computational skills.

LOD: Each model element used in the BIM process is created in order to facilitate management during the operation phase. It is necessary to transfer the necessary information from the design phase to the operation phase by the right people and to detail the model by the right people. In this context, in order to transfer the details of the elements used in the project from simple to complex, the information parameters and geometries must be properly organised. Therefore, each project member should dominate on their preferred model element and materials knowledge.

CDE and Project Delivery: It is necessary to work with a common central information warehouse with the procedures required for the transfer of project documents within the BIM process. For this aim, each project member should gain discipline in working on a common data platform.

Collaboration: The BIM process is interdisciplinary. In this context, project members should have skills of working systematically with each other in the interdisciplinary workflow.

3. THE INTEGRATION APPROACHES OF THE BIM SYSTEMS TO THE CURRENT EDUCATION IN UNIVERSITIES

BIM educations can be divided into based on market and academy as shown in Figure 3.1. Market training is taken generally by companies which prefer BIM in their operational processes or by legal entities to want to be experienced by post-academy. Many private institutions provide such training. The training in this context is also given by some private institutions where BIM reference documents such as Building Smart and BSI are created. In training provided by independent organisations such as these, it is critical to know BIM standards. On the other hand, the training in the academy mostly deals with the operational framework of the system. In this context, in Turkey, some universities open BIM expertise certification programs such as ITU and METU (Middle East Technical University). This type of training provides the flow of information from universities to markets. When the subject is taken at the level of basic university education, the BIM learning process can be completed in graduate education in many universities such as Georgia Tech, Middle Sex etc.

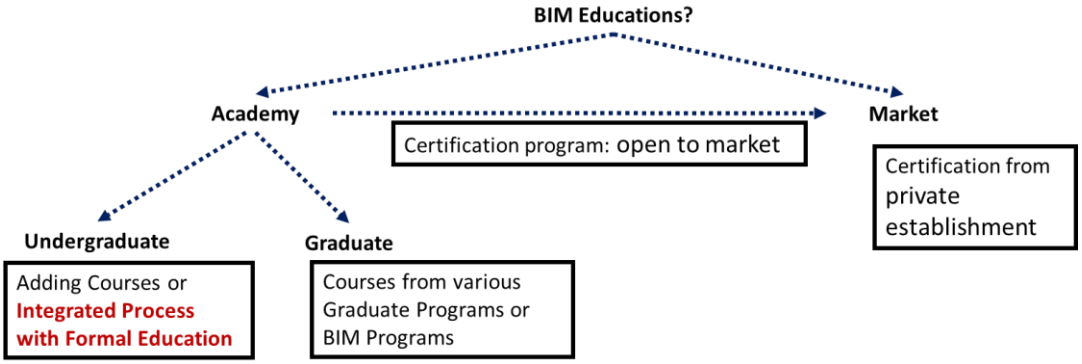


Figure 3.1 : Types of the BIM Educations.

In this context, when looking at Turkey, BIM is discussed in the graduate programs in some state universities such as Istanbul University, Istanbul Technical University, Mimar Sinan Fine Arts University, Middle East Technical University (METU) and Karadeniz Technical University (KTU) (Caglayan S, 2017). The main topic of the thesis is to discuss BIM education in architectural undergraduate education. For this

purpose, since undergraduate education is in question, the most prone process to formal education is that it can be realised with an integrated learning model. For this reason, examples integrated with education, especially within the scope of universities, are reviewed.

Various studies related to the integration of BIM systems into education are observed in various countries, especially in The United States. Most of these studies discuss how to integrate the BIM courses given into the curriculum of Universities, and the approaches that are used in this process. This section starts with the history of BIM theory and technology for awareness of BIM mentality. After then, it continues with necessity and the integration suggestions of BIM theory and technology in university. The integration proposals provide to discover a common pedological approach for the process. Lastly, for applying the pedological approach, skills and knowledge related to BIM learning are analyse from various literature sources with their steps, and they are synthesised..

3.1 The History of BIM Theory and Technology

The BIM theory is first introduced in the 1960s and identified as an object-oriented modelling process based on the database of a buildings. In 1962, Douglas C. Englebart discussed the object-oriented design and relational database ideas that would be used by architects in his article, titled "Augmenting Human Intellect" (Engelbart, 1962). However, since computers, databases and information technologies had not developed in those years, the idea remained only on a theoretical scale. In the same period, software developments at different companies started for the computer-centric design idea. In 1957, Pronto, the first computer-aided processing software for the manufacturing industry, was developed by Dr. Patrick J. Hanratty. Then, in 1961, Design Automated by Computer (DAC) software was produced for the complex molds of General Motor. DAC, which has a graphical user interface, recommended Computer-aided Design (CAD) and Computer-aided Manufacturing (CAM) software together compared to Pronto. In 1963, Sketchpad, which is the first CAD software, was developed by Ivan Sutherland (Sutherland, 1964). The software formed the basis of many other CAD software such as AutoCAD.

In 1974, Charles Eastman proposed a definition, suitable for the modern BIM system, in his article titled "Using Computer Instead of Drawings in Building Design". This

article discussed combining different project-oriented geometric objects, the possibilities of viewing a particular building model from different angles, and the need for an extensive database for building components for this purpose. He called the system: “Building Definition System (BDS)” and reveals the closest draft to modern BIM systems within the scope of the project (Eastman, 1975). In the late 1970s, Dr. John Davison and John Watts started developing the first BIM software RUCAPS, based on Eastman's BDS concept, and then the software was sold by GMW Computer (Aish, 1986). In the same years, Graphisoft produced a similar program under the name of ArchiCAD in Hungary. The software was presented in 1987 as the first BIM software to be used on personal computers. In 2000, the company named Charles River Software developed "Revit", one of the most comprehensive applications currently used for the implementation of 3D BIM by Irwin Jungreis and Leonid Raiz. After the development, Autodesk bought the company of Irwin and Leonid and marketed the Revit as Autodesk BIM software.

With the development of software and BIM systems, data exchange became another problem in the process of working with object-oriented models. A clear international standard was therefore required, which made it possible to retain and exchange relevant data between various software applications. Therefore, the Interoperability Alliance, founded in the 1990s under the leadership of Autodesk, developed IFC, a standard data format for BIM models (Kiviniemi, 2006). In the same years, ArchiCAD launched its first file exchange-based teamwork solution. This innovation was revolutionary for the collaboration process in BIM systems and allowed more architects to work on a building model at the same time. In 1999 in Japan, Onuma enabled virtual teams to collaborate on BIM over the Web and developed a database-based BIM preparation program that paved the way for the smooth convergence of BIM applications and parametric technology into the future. In the early 2000s, NavisWorks developed a coordination software called Jetstream, which controls changing file format data, allows clash detection. After four years, Autodesk developed the simultaneous collaboration working model, which was the revolution of ArchiCAD, with the Revit 6 version in its software, and after, it also acquired Nawisworks company and gathered all its interoperability models within itself (Khochare and Waghmare, 2018). Moreover, in recent years, the same company

develops next-generation BIM 360 products for the online collaboration process in the projects. The development of BIM systems to date is shown in Figure 3.2.

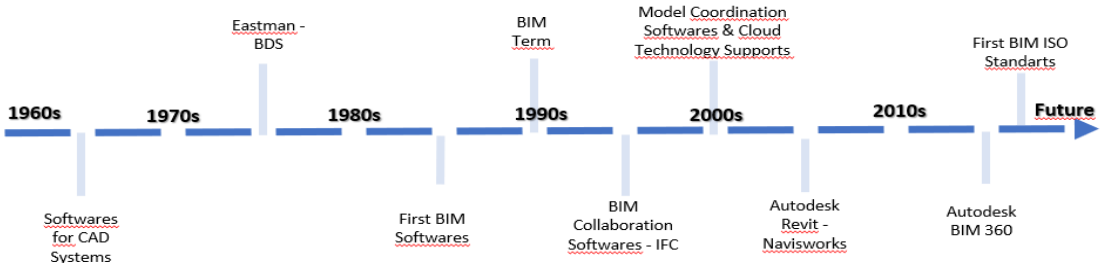


Figure 3.2 : History of BIM.

Although the history of BIM systems dates back to the 1970s, their use in countries increases significantly in 2010 and beyond. The reason for this is the increasing digitalization with the 4th Industrial Revolution and making BIM systems compulsory with state support in order to increase the efficiency indices in the construction industry to normal levels. The BIM concept becomes a point of view as well as BIM tools, along with the specifications and standards.

3.2 The Necessity of BIM Education in Universities

Universities are where the BIM theory begins. However, with the development of technology, this theory evolves into a system. This system, which serves the AEC market, has progressed much faster than the education backgrounds in universities and has become a state obligation with standards in some countries. SmartMarket Reports documents published by Dodge Data and Analytics make evaluations of BIM systems on the markets at different times in various regions. The results of the surveys conducted in North America in 2012, New Zealand and Australia in 2014, China in 2015 and the Middle East in 2017 are shown in Figure 3.3. One of the similar assessments in all surveys is that more internal staff with BIM skills should be available on the market (Bernstein et al, 2012; Construction, 2013; Harvey and Stephen, 2015; Donna and Stephen, 2017).

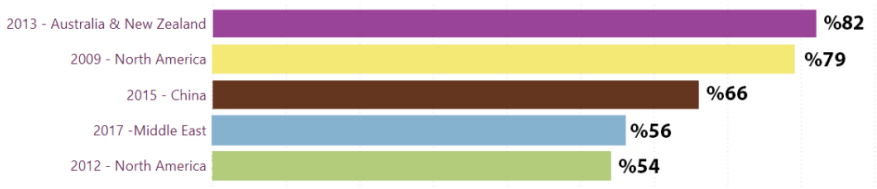


Figure 3.3 : Demand Rate of More Internal Staff with BIM Skills (Bernstein et al, 2012; Construction, 2013; Harvey and Stephen, 2015; Donna and Stephen, 2017).

Academic institutions have begun to include learning of these new technologies in their programs to meet industry needs for these skills. Schools such as Penn State, Georgia Tech, University of Southern California, Technion Israel Institute of Technology and the University of Texas in Austin have integrated BIM education into their programs as shown in Table 3.1 (Barison and Santos, 2010).

Table 3.1 : Departments with BIM Courses at Universities (Barison and Santos, 2010).

	UNIVERSITY	AUTHOR(S)	PROGRAM	*BIM COURSE*
Introductory	U. of North Carolina	Nelson	Architecture	Building Information Modeling
	Montana State University	Berwald	Architecture	Digital Graphics and Design
	U. of Wisconsin-Milwaukee	U. of Wisconsin-Milwakee	Architecture	Computers in Architecture (Arch 382)
	Israel Institute of Technology	Sacks and Barak	Civil Engineering	Communicating Engineering Information
	Auburn University	Taylor, Liu & Hein	Construction Management (CM)	Constr. Info. Tech. , Digital Constr. Graphics
	California State University	Kymmell	Construction Management	Building Information Modeling I, II
Intermediary	Texas Tech University	Rex and Park	Architecture	Digital Media II
	USC	Becerik-Gerber	Engineering and CM	Building Information Management
	University of Utah	Scheer	Architecture	Building Information Modeling, Design Studio
	Queensland U. of Tech.	Nielsen et al.	Architecture	BIM Unit (Architectural Tech. and Science VI)
	NJ Institute of Technology	NJ School of Architecture	Architecture	Design Studio
	Texas State University	Mulva and Tisdel	Architectural Engineering	Design Studio I and II
	George Mason University	George Mason University	Civil, Environ., Infrastructure Eng.	Building Information Modeling (CEIE499/690)
	University of Washington	University of Washington	Construction Management	Advanced Project Management Concepts
	California State University	Kymmell	Construction Management	Building Information Modeling III
	Purdue University	Schmelter and Cory	Computer Graphic Technology	Commercial Construction *BIM Course*
	Norwegian U. of Sc. & Tech.	Hjelseth	Structural Engineering	Design of Buildings and Infrastructure
	Cal Poly	Korman and Simonian	CM and Civil Engineering	MEP Coordination Studio-Laboratory
Advanced	Cal Poly	Dong	Architecture, CE and CM	Int. Design Studio and Int. Bldg. Envelopes
	Virginia Tech	Ku	CM, Building Construction, Arch.	Several *BIM courses*
	Texas A&M University	Texas A&M University	Architecture, CM	Integrated Design Studio
	Penn State University	Poerschke at al.	Architecture, Civil Engineering	Integrated Design Studio (ARCH 497A)
	GeorgiaTech	GeorgiaTech	Graduate curses	Building Information Modeling: Case Studies
	California State University	Kymmell	Construction Management	Building Information Modeling IV
	University of North Texas	Arnold	Construction Engineering Tech.	Senior Design Class

One of the reasons for integrating BIM systems in universities is that the business strategies in the market have changed and the curriculum of education in the university lag behind this update.

> The growing globalization, importance of sustainable solutions and the need to increase performance the project lifecycle, require new solutions to education in AEC (Geber, 2010).
>
> BIM systems require collaborative work and the presence of employees with this working discipline in the industry is very important for efficiency in the market. However, at most universities in The United State, Europe and Australia, AEC students continue to study in separate departments, with little integration or collaboration across disciplines (Macdonald, 2012).

This aspect is not mean that universities serve the construction market because the update provides new research points related to AEC concepts for the universities. Another cause for the integration of BIM in education is to provide the building systems easily understood and be integrated more readily into a real project by architecture and engineering students.

BIM systems are a helpful tool for architects and engineers to understand the gap between the building elements and process flow in building complex structures (Boon and Prigg, 2011).

Usage requirements of 4D and 5D BIM tools contribute to understanding the construction process and management by students (Maghiar, 2014).

The last reason is that university education is required for fully understood this process. There are necessary training in the market for the development of this process. However, continuing BIM training only with the market leads to inefficiency, since the processes advanced with these training cannot be fully integrated with the design-construction perspectives gained at universities.

BIM systems serve as a bridge between the construction market and universities in integrated project delivery and sustainability concepts (Molavi ve Shapoorian, 2012).

Universities need to support the further adoption of BIM by including BIM in the curriculum to support the industry and provide graduates with the necessary knowledge and skills (Hore, 2016).

In a study conducted in New Zealand, even though Building Smart has BIM training support on the market, it is advocated that universities should train staff ready for the BIM process due to the difficulties of employees to understand BIM training (Puolitaival and et al, 2017).

Considering the requirements of SmartMarket reports and literature; The necessity of integrating BIM systems into education is closely related to the AEC market that keeps up with the developing technology and accelerates. In this section totally three causes are mentioned for the requirement of BIM education in Universities;

- The curriculum of education in the university lay behind the market developments.
- BIM education provides a new perspective to the student for understanding building systems and real projects processes.
- The BIM market training needs a perspective related to BIM process that is gained from undergraduate educations of staff.

Although universities are not a market-oriented institution, they are the primary institutions that train architects and engineers to steer the market. The integration of BIM systems to universities will enable architecture and engineering students who graduate from universities to obtain the necessary knowledge and skills under the market business models required by the day and enable them to become qualified employees for the sector. Also, professionals supported by university education, as well as the administrative and economic benefits of BIM systems, will provide the development of the system and winning the universal value of the technology by evaluating the construction process with the framework of architectural and engineering expertise.

3.3 Proposals of BIM Integration to Universities

In the academic literature, in many countries, mainly The United States and The United Kingdom, there are many kinds of research related to BIM systems. However, when these studies are examined in Table 3.2; It is clear that the concept of "BIM in Universities" is slightly less questioned than the concept of “BIM”. When Figure 3.4 is examined in the same study, it is observed that the concept of "BIM in University" did not make enough improvement when compared to the "BIM”, which was examined in the same period and has a parabolic structure (Chihib et al, 2019). This situation and other reasons that are analysed in the previous title require that the concept of "BIM in University" be handled more.

Table 3.2 : Number (N) of publishes based on Elsevier Scopus database which is titled "BIM" and "BIM in University" (Chihib et al, 2019).

BIM			BIM in University		
Affiliation	**Country**	**N**	**Affiliation**	**Country**	**N**
Georgia Institute of Technology	USA	101	Pennsylvania State University	USA	9
Curtin University	UK	98	Hong Kong Polytechnic University	China	9
University of Florida	USA	93	Tsinghua University	China	8
University of Salford	UK	68	Arizona State University	USA	6
Kyung Hee University	South Korea	56	Ceské vysoké ucení technické v Praze	Czech The Czech Republic	5
Pennsylvania State University	USA	55	National Taipei University of Technology	China	4
Hong Kong Polytechnic University	China	54	University of Southern California	USA	4
Politecnico di Milano	Italy	49	Vilniaus Gedimino technikos universitetas	Lithuania	4
Tongji University	China	49	Universidade de Lisboa	Portugal	4
Hanyang University	South Korea	48	Helsingin Yliopisto	Sweden	3
Universiti Teknologi Malaysia	Malaysia	47	University of Texas at San Antonio	USA	3
Cardiff University	UK	46	National Taiwan University	Taiwan	3
UCL (University College London)	UK	43	University of Salford	UK	3
Tsinghua University	China	43	University of Wyoming	USA	3
Technion—Israel Institute of Technology	Israel	42	Universitat d’Alacant	Spain	3
Technical University of Munich	Germany	41	International University of Florida	USA	3

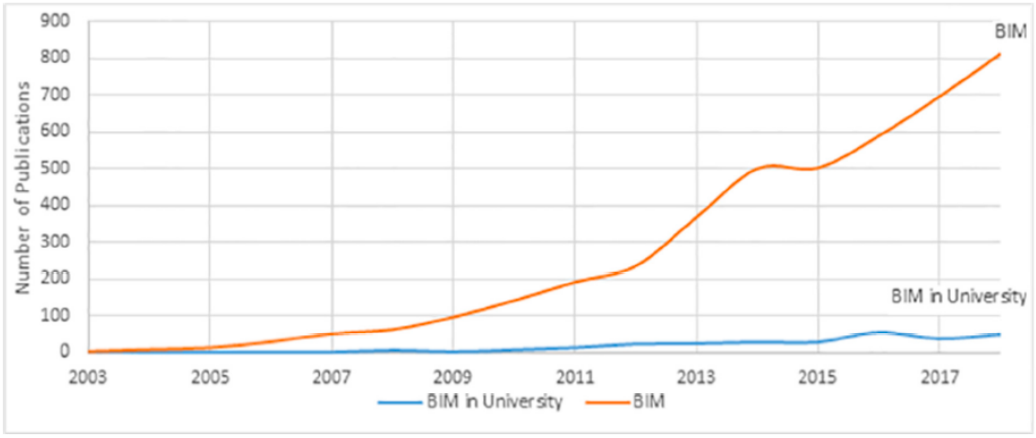


Figure 3.4 : Evolution of the scientific publishes of BIM from 2003 to 2018 in Elsevier Scopus database (Chihib et al, 2019).

In the literature, whether universities are ready for this change is one of the issues that should be questioned before proposals related to BIM education in universities.

> Almutiri (2016), in his work on King Saud University, conducts a SSI with academics to integrate BIM education into the architectural curriculum. The results of the research reveal that the concept of BIM has not been correctly understood by academics yet. Therefore, he suggests that awareness should be raised with conferences and workshops in order to present the latest research and needs related to the implementation of BIM in his education (Almutiri, 2016).

Some of the studies reveal that some courses in the curriculum should work interactively with each other by defending that BIM systems require a holistic process.

> Dobelis (2013) defines the concept of integration as the most basic element in the BIM teaching process and defends that interrelated courses should be run together, so theoretical teachings can be completed in this way (Dobelis, 2013).

> By revealing the lack of connection of BIM-focused theoretical courses with applied courses with the BIMTRAIN project at Riga Technical University of Modris Dobelis (2015) recommends that computational subject-specific courses be evaluated in an integrated way with core project courses (Dobelis, 2015).

The first proposal for the integration of BIM systems in education is to use BIM tools in the stages of project documentation instead of CAD tools within the existing courses and to run the process with the project courses together.

> In the research of Denzer and Hedges (2008), it encourages the students of architecture to progressively develop projects by using BIM tools from design to project documents within the scope of architectural project lessons. With this study, it aimed to increase the time spent in the design process and to question the design process with the construction process. On the problems that may be encountered in the process; reported that these courses should be handled as a phased series covering all of the training, leaving CAD systems out of use (Denzer and Hedges, 2008).

> In Livingston's study on Montana Technical University School of Architecture; The perspective of building systems and technical document creation process moves from 2DCAD systems to 3D information modelling process. With this goal, it supports the learning of materials, assemblies and systems and proposes a technical lesson called "Comprehensive Architectural Project" to implement BIM systems on a digital project. It identifies the BIM as a process to provide a digital test building, not as a tool (Livingston, 2008).

The second proposal is theoretical lessons that support the BIM process. After the theoretical courses, it can be continued with practical courses. In this suggestion, it is advocated that BIM should be considered in causality as a whole process (Becerik-Gerber, 2009; Sacks and Barak, 2010).

Another proposal is the necessity for BIM education to be handled with the collaboration process at universities. Authors who proposed the idea highlight some topics such as multi-disciplinary collaboration, integrated project delivery process and model analysis processes.

> Shelbourn et al. (2017) evaluated BIM training in The United State and The United Kingdom through the eyes of students. In this context, it is revealed that the efficiency of the BIM process can only be increased by working together with students from different disciplines. As a result of the research, it is

recommended that multidisciplinary physical fields should be created in the university to function properly (Shelbourn et al, 2017).

Ofluoğlu and Alkavi (2016) propose an interdisciplinary T-Type education for architectural education, demonstrating the benefits of the ITU Design Together Competition among students from different disciplines. As shown Figure 3.5, T-Type approach can be defined as getting deeper in a profession and having general information about other disciplines. In the process, it is advocated to access information in other disciplines through an interdisciplinary interactive study (Ofluoğlu and Alkawi, 2016).

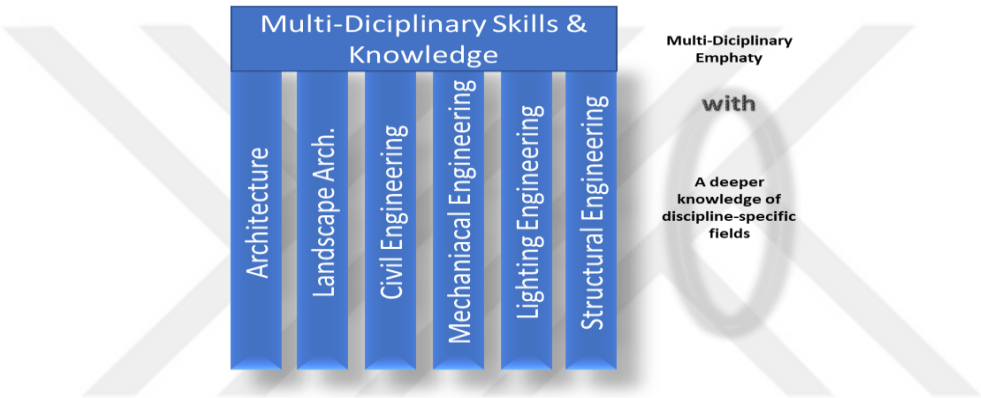


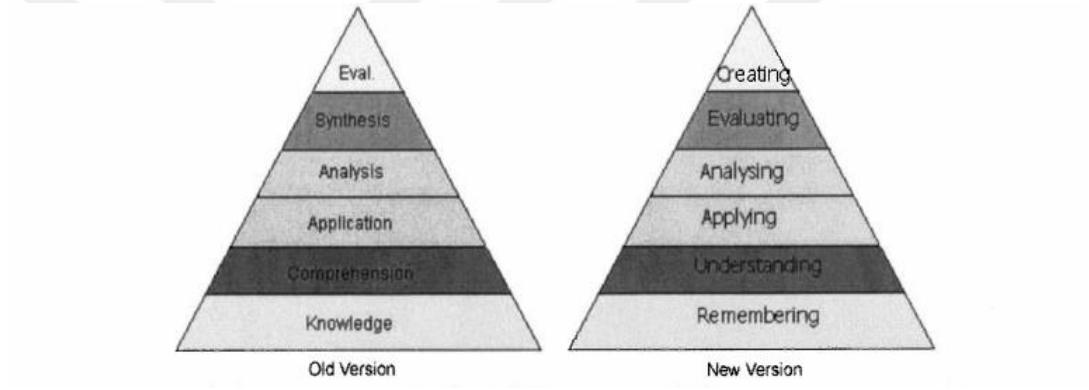
Figure 3.5 : T-Type Approach from Penn State University Design Course (Ofluoğlu and Alkawi, 2016).

Richards and Clevenger (2011) provide a model that requires the use of BIM, where structural engineering and construction management students can work together. It offers teaching modules at Colorado State University that allows students to experience BIM in an interdisciplinary way. Modules consist of two parts. While the first module consists of introductory videos about defining and accessing the information in the building model; The second section proposes an e-learning assessment in which they experience the BIM process in real life using software (Richards and Clevenger, 2011).

Özener (2011), by evaluating BIM systems with an integrated project delivery (IPD) phenomenon, advocates advancing this concept with studio projects. In this context, he examines case studies and presents a theoretical model for integrated design studios. It proposes to advance the studio projects together

with dynamic, continuous and circular design processes using BIM systems. It defines BIM technology not only as a tool, but also as an infrastructure that enables simulations that increase building performance and should be developed with a collaborative working method discipline (Özener, 2011).

The last proposal is that BIM teaching should be handled with a curriculum as a whole. For this purpose, in the literature, the process is approached by the Bloom Taxonomy method, which was introduced as a pedological approach by Benjamin Bloom in 1954. Bloom Taxonomy aims to gradually classify cognitive skills so that students can judge the information they have learned. In 2001, Krathwohl et al. (2001) revised the approach by adding high-level cognitive processes (Anderson and Krathwohl, 2001). In Figure 3.6, the cognitive pyramid is shown with revisions and explanations of terms.



- **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
- **Understanding**: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
- **Applying**: Carrying out or using a procedure through executing, or implementing.
- **Analyzing**: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
- **Evaluating**: Making judgments based on criteria and standards through checking and critiquing.
- **Creating**: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Figure 3.6 : Bloom Taxonomy Pyramid (Forehand 2010).

After examining the schools where individual courses support BIM education, Barison and Santos (2010) argue that the acquisition of BIM perception is more than just adding a new lesson to the curriculum. As shown in Figure 3.7, they handle the courses to be developed for BIM in a hierarchical framework based on Bloom Taxonomy (Barison and Santos, 2010).

Level	Introductory	Intermediary	Advanced
BIM Specialist	BIM Modeler	BIM Analyst	BIM Manager
Prerequisites	Unnecessary to know CAD tools and higher computer skills	BIM Concepts, Construction Materials, a BIM tool and Design Fundamentals	Construction Methods, BIM and application tools Building Technology and Professional Practice
***BIM Course* Categories**	Digital Graphic Representation	Integrated Design Studio Building Technology	Interdisciplinary/Collaborative Design Studio Course Construction Management
Project BIM Model	A simple building project or parts of it  Structural elements of a simple building Israel Institute of Technology	A common building project, Architectural, Structural, MEP designs  Small rectangular building Auburn University	A real comprehensive building project  Complex building Health Science Center -TAMU

Figure 3.7 : Matrix of BIM Education (Barison and Santos, 2010).

Macdonald (2012) progressively demonstrates the BIM learning process with the IMAC scheme based on the Bloom Taxonomy, which is shown on Figure 3.8 This scheme deals with BIM learning in four stages, namely Illustration Stage, Manipulation Stage, Application Stage, and Collaboration Stage (Macdonald, 2012).

Jennifer A. Macdonald - Target in Bloom Taksonomy for CM		BUILDING TECHNOLOGY	ENVIRONMENT		MANAGEMENT			IT		SPECIALISM		
		Framing	Materials	Sustainability	People	Communication	Team Work	General IT	BIM Tools	Architecture	Engineering	Construction
Collaboration	Knowledge / Comprehension Receiving/ Responding				■	■	■			■	■	■
Application	Comprehension /Application and Responding/ Valuing							■				
Manipulation	Application/ Analysis and Valuing/ Organising											
Illustration	Synthesis/ Evaluation and Characterising	■	■									
Courses												

Figure 3.8 : Mapping Exercise for a CM Course (Macdonald, 2012).

Wu et al. (2018) develop the Body of Knowledge (BOK) project from 2015 in order to develop accreditation on BIM education and create international BIM information set with the support of the Academic Interoperability Coalition (AIC). Within the scope of this project, based on Bloom Taxonomy, they aim to reveal the necessity and procedures of education globally (Wu et al, 2018).

When the relevant literature is analysed, first of all, it should be evaluated whether the university is ready for the BIM process or not. The evaluation is essential for the

acceptability of the integration of BIM education. In this process, a SSI with the faculty members of the university can be useful. In addition, in the scope of the literature review, it turns out that the fragmented structure of the curriculum is not suitable for BIM learning, and it should be considered as a whole. In the proposals for the integration of BIM education to university, the four approaches have occurred.

- 3D BIM tools should be learned as a whole with project courses.
- Theoretical courses are a necessity to adopt the awareness and conceptual structure of the BIM concept.
- Education should be supported by an integrated project-based application with an interdisciplinary teamwork approach.
- BIM learning should be handled in a whole and progressive series with a curriculum rather than a single course. Also, the process should be evaluated together with the students' level of skills and knowledge. Bloom Taxonomy was found appropriate for creating a learning model in a frame of the pedagogical approach.

3.4 Skills and Knowledge Related to BIM

When the BIM education proposals in the literature are analysed, the common knowledge and skills that are aimed to be acquired in the BIM learning process draw attention. The continuous learning processes structured with Bloom Taxonomy in the applied approaches require the topics included in the essential to be handled with knowledge and skills related to BIM.

> Kymmell (2008) discusses BIM-related knowledge and skills under three main headings; these are defined as BIM tools knowledge within the scope of technical skills, management processes knowledge within the scope of computing skills, and knowledge of project team roles under the social skills (Kymmell, 2008).

In the literature, having comprehensive discipline-specific knowledge is quite crucial in terms of creating the background for integrating to BIM process. This process can be supported by theoretical knowledge related to BIM systems as a first step.

Denzer and Hedges (2008) argue that prior to the use of BIM, students must have a good command of representations, building systems and professional implementation processes related to design fundamentals (Denzer and Hedges, 2008).

The other step of expectation from BIM education is acquiring basic BIM tools skills with the project process together. In this process, the first part is related to the experience of 3D modelling; second part various BIM analysing tools according to model dimension such as time, cost, performance and managements can be tried with parallel theoretical courses.

Wu and Luo (2015) addressed the BIM knowledge and skill sets by evaluating student outputs after a project-based learning system in his article, which tested the use of BIM systems for green buildings. In this context, it demonstrated the importance of knowing the building performance criteria and then the importance of modelling and analysis capabilities (Wu and Luo, 2015).

After the completed previous steps, the experience of the interdisciplinary collaboration process is suggested. The experience can be thought within social skills by being supported with team-work and communication skills.

In the curriculum they address with the Bloom Taxonomy method, Barison and Santos (2010) aim to learn basic modelling and model analysis skills within the first two years within the scope of BIM, and suggest developing skills to work together in the following years (Barison and Santos, 2010).

Mcdonald (2012) stage by stage elaborates his BIM learning with the IMAC scheme. In this context, after the knowledge of discipline-specific courses, it aims to teach necessary theoretical information about BIM and then to improve communication skills by developing interdisciplinary solutions (Mcdonald, 2012).

Lastly, management and computation skills are handled for BIM process learning.

Abdirad and Dossick (2016) predicate BIM technologies to be complicated and advanced technologies for AEC disciplines, so suggests developing technical and management skills in the background (Abdirad and Dossick, 2016).

Maghiar and Fu (2015) suggest that the BIM process should be integrated with the courses in the construction management curriculum, and in this context, it gathers some topics that will be integrated into certain courses each year. In this context, basic knowledge and skills; it starts with introductions related to the BIM scope for preparing the theoretical infrastructure; these processes continue with learning how to use BIM software and interoperability applications; end of the process, management and analysis processes are discussed (Maghiar and Fu, 2015).

The knowledge and skills foreseen in BIM in the literature reveal that the process should continue in an infrastructure that will progress gradually. These knowledge and skills are evaluated together on Table 3.3. When the proposed knowledge and skills are considered together; The basic prerequisite for the knowledge and skills discussed is that the disciplines have knowledge of their own expertise. Then, it is suggested to understand the process with a theoretical infrastructure related to BIM. The BIM gaining started with a theoretical infrastructure can be continued with the modelling skills in the first phase. After learning on BIM modelling skills is completed, the analysis processes of the models can be started. Modelling and analysis skills to be learned in disciplines can be supported with interdisciplinary collaboration processes in order to experience a real BIM process. Finally, these interdisciplinary supported models and analysis processes can be ended with the teaching of high-level issues related to how to manage and analyse an interdisciplinary model

Table 3.3 : Mapping of The BIM Skills and Knowledge.

Authors	Maturity on Discipline Spesific Knowledge	Theoretical Knowledge of BIM	BIM Tools for Modelling	BIM Tools for Model Analysing	Collaboration (Multi - Disciplinary)	Computation and Management
Abdirad ve Dossick			First			Second
Maghiar ve Fu		First	Second			Third
Barison & Santos			First	Third	Second	Third
Wu ve Luo	First		Second			
Mcdonald	First	Second			Third	
Denzer ve Hadges	First					
Kymmell			Technical Skills		Social Skills	Computation Skills

These first comments were revealed by matching the knowledge and skill suggestions obtained in the literature together. However, in the basic infrastructure of the process, it is foreseen to advance these stages in a parallel structure that will support each other continuously (Table 3.4). In this regard, it is important to gain theoretical BIM

processes after a specific discipline and to continue this theory infrastructure for each skill throughout the process. In addition, the analysis processes after modelling skills should be continued within the interdisciplinary study and with various computational methods and tools during the development of management skills. Finally, the management and computability (measurability) of the BIM process is a skill that must be gained as awareness from the introduction of the BIM theory. Knowing what will be achieved in the whole process is valuable for the efficient of BIM training.

Table 3.4 : Comment of the BIM Skills and Knowledge.

<table>
<tr><td>Abdirad ve Dossick</td><td></td><td></td><td colspan="2">First</td><td colspan="2"></td><td>Second</td></tr>
<tr><td>Maghiar ve Fu</td><td></td><td>First</td><td colspan="4">Second</td><td>Third</td></tr>
<tr><td>Barison & Santos</td><td></td><td></td><td>First</td><td>Third</td><td colspan="2">Second</td><td>Third</td></tr>
<tr><td>Wu ve Luo</td><td>First</td><td></td><td colspan="3">Second</td><td></td><td></td></tr>
<tr><td>Mcdonald</td><td>First</td><td>Second</td><td></td><td></td><td colspan="2">Third</td><td></td></tr>
<tr><td>Denzer ve Hadges</td><td>First</td><td></td><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Kymmell</td><td></td><td></td><td colspan="2">Technical Skills</td><td colspan="2">Social Skills</td><td>Computation Skills</td></tr>
<tr><td></td><td>Maturity on Discipline Spesific Knowledge</td><td colspan="2">Theoretical Knowledge of BIM</td><td>BIM Tools for Modelling</td><td>BIM Tools for Model Analysing</td><td>Collaboration (Multi - Disciplinary)</td><td>Computation and Management</td></tr>
<tr><td></td><td></td><td colspan="5">Theoretical Knowledge of BIM</td><td></td></tr>
<tr><td></td><td></td><td colspan="5">Computation and Management</td><td></td></tr>
</table>

3.5 Summary of Chapter

Within the scope of this chapter, firstly, the history of BIM theory and its development with technology are discussed. When the BIM theory and the software developed for this purpose are examined, the BIM process is much more than a tool. Considering that this issue is a structure supported by the reports and government created in certain committees, it is clear that BIM systems offer a new perspective to AEC discipline.

After the review, the necessity of this perspective in the academy is analysed with various research and market reports. It is observed that the integration of BIM systems into education was strictly related to the developments in the AEC market. Along with this requirement, BIM education proposals in universities are examined. First of all, it is important to question whether the university is ready for this process and to analyse the structure of the courses in the curriculum. In the approaches to the structuring process of education, it is recommended to run the courses as a whole, to advance the process in the project courses by using BIM tools, to gain theoretical infrastructure related to BIM systems and to experience interdisciplinary collaboration in the process. Pedagogical approaches are also taken into consideration in the literature; In this

context, an attempt is made to reach a gradual, critical and homogeneous education system. Bloom Taxonomy method is one of the necessary infrastructures to achieve this goal. This pedagogical approach has demonstrated the importance of BIM knowledge and skills. For this reason, in the last title of the chapter, the knowledge and skills are analysed and six main knowledge and skills related to BIM education are revealed in five steps. The knowledge and skills are given as BIM theoretic knowledge, modelling skills, model analysing skills, collaboration skills, management and computational skills as seen in table 3.3 by using the literature background. Lastly, it is proposed that knowledge and skills are run parallel, as seen in table 3.4.

4. THE ANALYSIS OF ITU ARCHITECTURE UNDERGRADUATE PROGRAM

In this study, the proposal to analyse a current curriculum of an architecture undergraduate program for the integration process is started and for this purpose, the ITU architecture undergraduate program is chosen as a case. There are many reasons why ITU is preferred for case selection. Firstly, ITU is one of the most often preferred school for architecture undergraduate program by many students. Also, when looking at the mission of the department, the school cares the need to go beyond knowing technology and following international developments. In addition, with these aims, ITU has the first international architecture accreditation in Turkey.

Accreditations for higher education is a procedure that aims to reveal that the higher education institution or any program within the higher education institution has certain quality standards at the national and/or international level and to enable that the public creates a trust to institutions (Gencel and Aktan, 2010). When it comes to architecture programs at the universities on a national scale, in Turkey, these procedures are carried out by the Board of Higher Education, Higher Education Quality Council Chamber of Engineers and Architects of Turkey, and the Department of Architectural Accrediting Board (MIAK). However, given the increasing globalization, professions no longer depend on specific countries or regions, so international accreditation needs arise for higher education institutions to keep up with this process. Standardization and quality assessment processes in higher education at the international level started in 1999 under the name of the Bologna Process to create a similar higher education area by Europe. In this process, Turkey has been included in 2001 (Arslan and Bahadır, 2007). While the positive and negative effects of the process on the education system are still being discussed, the improvement and accreditation processes of the programs are carried out by other international organizations. While the positive and negative effects of the process on the education system are still being discussed, the improvement and accreditation processes of the programs are carried out by other international organizations. Some international organizations such as UNESCO, RIBA, NAAB and

CANBERRA ACCORD make professional evaluations of architectural programs (Masri and Arnaouty, 2015). In Turkey, three universities register international recognition and quality in this context. Istanbul Technical University (ITU) and Yıldız Technical University (YTU) Architecture Departments have NAAB accreditation and Mimar Sinan University Architecture Department has UNESCO-UIA Validation. Also, Eastern Mediterranean University (DAU) in the Turkish Republic of Cyprus has NAAB accreditation. In Table 4.1, universities are given with the final evaluation report dates received from international accreditations..

Table 4.1: International Accreditation Certifications for Architectural Department of Turkish Universities and Dates of Issue.

University	Documents	Report Date
Istanbul Technical University	NAAB - Substantial Equivalency	2008, 2015
Yıldız Technical University	NAAB - Substantial Equivalency	2019
Eastern Mediterranean University	NAAB - Substantial Equivalency	2016
Mimar Sinan Fine Art University	UNESCO-UIA - Validation Certificate	2017

The first attempt to establish national standards in architectural education started with the establishment of the Association of Collegiate Schools of Architecture (ACSA) in 1912. This association, together with the American Institute of Architects (AIA) and the National Council of Architectural Registration Boards (NCARB), established the NAAB in the 1940s and empowered the institution to accredit architectural schools nationally. The institution started the international evaluation program as of 2003 and registered the schools with NAAB International Certification (Url 4). The first member of this process was ITU, with its 2008 certification. Therefore, ITU has a unique value for the international accreditation process of the Department of Architecture in Turkey. This value also strengthened the preference of ITU for the BIM integration plan.

Within the scope of the study, it is aimed to analyse the must courses in ITU architecture undergraduate curriculum. The reason for this is to evaluate the courses that all students can take common. Thus, the must courses in the curriculum, which is last updated in the 2017-2018 academic year, are analysed within the scope of their contents taken from department's website and sheets of the Ninova platform and classified under certain common headings. This analysis and classification process ensures that must courses are distinguished within the scope of courses that will affect BIM integration. With this distinction, it is determined that 29 of the 44 compulsory courses has the necessary infrastructure for the analysis. In the analysis, the data

collection method is used with the SSI method. With this aim, one-on-one and mutual meetings are held with the instructors of the courses. There are courses taught by the same faculty members. In this context, 17 different instructors are interviewed for 29 courses. The interview results are evaluated separately for each BIM subject. Lastly, the gaps and potentials in the curriculum are revealed within the scope of the subject.

4.1 Current Curriculum and Selection of Must Courses Related to the BIM

The ITU architecture undergraduate curriculum has been undergone the last update in 2017. Current lesson plans and lessons are available on the department's website and the “Ninova” platform. In the current curriculum, there are a total of 44 must courses and nine elective courses in four years.

With the last update in 2017-2018 in the lesson plan (Appendix D):

In the first semester, "Introduction to Architecture and Ethics (MIM 119/119E)" and "Academic Consulting (DAN 101)" courses are added to the curriculum. Besides, the elective courses for this semester and the English course are removed. The code of the course "Static (MIM 113/113E)" is changed to "MIM 125/125E". The course is divided into theory and practice by adding one credit in ECTS.

In the second semester, “Introduction to Computational Design Tools and Methods in Architecture (MIM 120E)” course is added to the curriculum. The course "Strength of Materials (MIM 125/125E)" is divided into theory and practice, the course code is changed to "MIM 126/126E" and the ECTS credit is increased by half credit. In addition, the courses “Introduction to Building Construction (MIM162 / 162E)” and “Introduction to Computer and Information Systems (BIL 101 / 101E)” are removed from the old curriculum. The English lesson taken from the first semester is combined with the course in this semester and is given with the code "ING 112".

With the revision in the third semester, the name of the course "Building Construction Methods (MIM 263/263E)" is changed to "Building and Construction in Architecture (MIM 203/203E)" and it is decided to be run the course as "three theories and one application" instead of "two theories and two applications".

In the fourth semester, the codes of “Reinforced Concrete Structures (MIM 232/232E)” and “Environmental Control Studio (MIM 242/242E)” courses are changed to "MIM 234/234E" and "MIM 246/246E" .The ECTS credits of the courses

are reduced one credit. In addition, the code of “Building Element Design (MIM 244 / 244E)” is changed to “MIM 204/204E”. The ECTS credit is increased by two credits, the application hour of the course is reduced and the theory hour is increased.

In the fifth semester, the codes of “Building Production Systems (MIM 331 / 331E)” and “Urbanism and Planning Law (MIM 341 / 341E)” courses are changed to "MIM 333/333E" and "MIM 343/343E" . The ECTS credits od the courses are reduced one credit. In addition, the course "Statistics (MIM 305 / 305E)" is added to the curriculum.

In the sixth semester, the codes of “Architectural Survey and Restoration Studio (MIM421 / 421E)” and “Construction Management and Economy (MIM 332 / 332E)” courses are changed to "MIM 361/361E" and " MIM 359/359E". The ECTS credits of the courses are reduced one credit. In addition, the “Career Counselling” course is added to this semester with the code DAN 301.

In the seventh semester, only the code of the course "Construction Project (MIM 431 / 431E)" is changed to "484 / 484E" and the ECTS credit is increased four credit.

In the eighth semester, the name of the "Graduation Project (MIM 492 / 492E)" course is revised as "Diploma Project". The code of the course is changed to “4902 / 4902E” and the course credit is reduced four credit. In addition, the course is revised as eight practices in a week instead of six practice courses in a week.

Analysis Process:

Within the scope of the study, since the presence of BIM topics are questioned over the must courses, the courses are first classified and analysed with their contents accessed through the website of registrar's office. Since the descriptions of some courses are not found on the website of registrar's office, they are rechecked from “Ninova", and evaluated according to the table of the course contents prepared for this purpose (Appendix E).

When the contents of the courses are examined, some courses are removed from the SSI evaluation of BIM education integration:

“Mathematics I (MAT 103E)” and “Economy (EKO 201 / 201E)” courses are architectural independent basic science courses. The objectives of the courses are to be included as basic sciences in the infrastructure of other courses. “Turkish (TUR 101 and TUR 102)” and “English (ING 112 and ING 201)” courses are given as basic

language courses. According to the contents of the courses, the courses of “Principles of Ataturk And Turkish Revolution History Course I (ATA 101)” and “Principles Of Ataturk And Turkish Revolution History Course II (ATA 102)” are general culture and history lessons out of architecture. Finally, “Academic Consulting (DAN 101)” and “Career Counselling (DAN 301)” courses are added in the curriculum with the last update. When all these courses are compared with BIM topics, they are not included in the SSI because they do not address specific topics that support the BIM perspective.

"Ancient and Byzantine Architecture (MIM 122 / 122E)", "History of Turkish Architecture (MIM 221 / 221E)", "History of European Architecture (MIM 222 / 222E)" courses are related to understanding the historical and cultural structure of various states. When we look at the contents, it is observed that they focus on the historical developments in the architectural concept and the impact of cultures on architecture. Likewise, “Contemporary Architecture (MIM 321 / 321E) course includes the same topics. When the content of the course is analysed, it is seen that it especially deals with the change of architectural perspectives after the 19th century and modern architectural processes. All these evaluations enabled the studied lessons to take place in the "Architectural History" class. In this context, it is observed that they are not in a parallel structure when evaluated with BIM topics.

When the contents of the courses are analysed, it is seen that all the must courses, except for the above courses, are qualified to be evaluated by SSI evaluation of BIM education integration:

First of all, the courses with TES codes that started in the first semester and ended in the third semester are discussed. When the contents are compared; the “Project I (TES 111E)” course is in parallel with the course of “Architectural Design I and Rendering Techniques (MIM 115)”, the “Project II (TES 121E)” course is in parallel with the course of “Architectural Design II, and Rendering Techniques (MIM 116)” and “Project III (TES 211 / 211E)” course is in parallel with the course of “Architectural Design III (MIM 211)”. When the course contents in the Ninova system are analysed; the main teaching issues of the courses are design processes and the role of the designer in the project. When continuing with other courses which have TES code; “Basic Design and Visual Arts (TES 113 / 113E)” course has undergone a slight change in the NAAB process. The basic principle of the course is to develop students' visual perceptions by interpreting the design principles and elements with geometric

representations. In the "Visual Communication I (TES 112 / 112E)" and "Visual Communication II (TES 122 / 122E)" courses that continue with the same code, two-dimensional and three-dimensional representations, geometric transitions between these representations, scale perception, discipline-specific structural and Learning of drawing of contextual elements are discussed. All TES coded courses are generally given to improve basic design knowledge and skills, so they are classified under "Basic Design Studio". Basic teachings of the lessons are briefly explained in Table 4.2. Within the context of the content, it is observed that they will be the basis for BIM topics, and it becomes necessary to be handled within the scope of the SSI.

Table 4.2: Basic Design Studio Must Courses – Brief Content.

Basic Design Studios	**TES 111E - Project I**	Simple Design Problems & Design Solutions with 2D & 3D Drawings and Model
	TES 121E - Project II	Perception of Universal Design and Planing - Context between Design and Other Parametres
	TES 211E - Project III	Perception of Integrated ans Sustainable Design and Planing
	TES 113E - Basic Design and Visual Arts	Theory of Design & Design Perception
	TES 112E - Visual Communication I	Technical Drawing and Presentation, Perception of Scale
	TES 122E - Visual Communication II	Technical Drawing and Presentation, Perspective and from 3D to 2D, Shading Perception

After design studio courses, the architectural design studio courses, which started in the fourth semester and continue until the seventh semester as a continuation of TES coded courses, are examined. The first thing that stands out in the curriculum is that these courses have the most ECTS credits in the semester. When considering the contents of the courses, it is seen that the courses are basically the same, but different skills in design maturity are expected for each design course. In this context, architectural design courses expect students to create projects from simple design to multifunctional design. Basic teachings of the lessons are briefly explained in Table 4.3. As the project delivery procedures and process are discussed in the courses, the BIM topics can be evaluated within the scope of this course.

Table 4.3: Architecture Design Studio Must Courses – Brief Content.

Architecture Design Studios	**MIM 212E - Architectural Design IV**	On Concept of Non- Complex Buildings , Projects Development by Critical, Experimental, Sustainable Design Thinking
	MIM 351E - Architectural Design V	On Concept of Multi Dimentional Desing , Projects Development by Using Design and ConstructionTechnologies
	MIM 312E - Architectural Design VI	On Concept of Multi Functional Program , Projects Development by Thinking Sustainability, Energy, Economy, Advanced Building Systems and Technologies
	MIM 411E - Architectural Design VII	On Concept of Urban Scale , Multi-Functional and Dimentional Projects Development by Thinking Socio-Cultural Aspect and Cultural Heritage with Integrating Other Diciplines

When the course contents table continues to be examined; the "Introduction to Architecture and Ethics (MIM119 / 119E)" course, which is given in the first semester and included in the last update and curriculum, can be considered as a course created to convey the basic principles of the profession to the student, to introduce the profession and to adopt the concept of architectural ethics. When the “Accessibility (MIM114 / 114E)” course given in the second semester is examined, the principles to be considered in the architectural profession process and the information about the universal design are covered in this course. Besides, every user to be considered within the responsibility of the profession and the rules to be followed are also discussed in the course. These two courses are included in the class of "Architectural Design Theory" class within the scope of the study. Then, when the “Introduction to Computational Design Tools and Methods in Architecture (MIM 120E)” course, which is included in the last curriculum for the second semester, is analysed, a computational design process and software are taught; also production technologies are experienced. Finally, when the "Statistics (MIM 305/305E)” course given in the fifth semester is examined, it is defined as a course in which the teaching and methods of statistics theory are identified; it can be considered as a basic science course. However, in order to discuss the availability of sampling for architectural evaluations and the teaching of statistical calculations in this context, it takes place in the "Architectural Design Tools and Technologies" class along with "Introduction to Computational Design Tools and Architectural Methods (MIM 120E)" course. Basic teachings of the lessons are briefly explained in Table 4.4. The courses will be re-evaluated in the SSI for discussing on the basic theory of the BIM process, the BIM software teachings and the calculations in the BIM process.

Table 4.4: Architecture Design Theory and Architecture Design Tools and Technologies Courses – Brief Content.

Architectural Design Theory	**MIM 114 - Accessibility**	Perception of Universal Design and Multifimentional Design Principles (Users such as eldersly and disabled, Potential etc.)
	MIM 119E - Int.to Architecture and Ethics	Basic Principle Related to Profession of Architecture
Architectural Design Tools & Technologies	**MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.**	3D Geometric Modelling, Visual Programming and Algorithmic Modelling; Fabrication Techniques
	MIM 305 Statistics	Basic Statistical Methods and Role of the Methodologies in Architecture

In the content analysis, some courses are observed to focus on structural systems teaching. "Static (125 / 125E)" which is given in the first semester, "Strength of Materials (MIM126 / 126E)" which is given in the second semester, "Theory of Structures (MIM 271 / 271E)" and "Steel Structures (MIM 253/ 253E) " which are given in the third semester, and "Reinforced Concrete Structures (MIM 234 / 234E) " which are given the fourth semester can be placed in “Structural Systems” class. When the contents of these courses are examined, the details and calculations of structural systems are transferred to students in the context of the courses. Also, the course of "Strength of Materials (MIM126 / 126E)" is given by considering the building performance principles. Moreover, the courses which are given third and fourth semester are advanced by considering architectural design. It is noteworthy that especially in these lessons, students gain some knowledge such as building elements and material, and some skills related to working together. Basic teachings of the lessons are briefly explained in Table 4.5. The courses will be re-evaluated in the SSI to evaluate how much they are experienced in terms of BIM education integration.

Table 4.5: Structural Systems Courses – Brief Content.

Structural Systems	**MIM 125 - Static**	Basic Load Bearing Systems and Force Computations
	MIM 126E - Strength of Material	Internal Forces Computations According to Structural Systems and Materials
	MIM 271E - Theory of Structures	Internal Forces Computations and Force Distribution in Determinate and Indetermiat Structural System
	MIM 253E - Steel Structures	Forces Computation on Steel Structure Systems & Capable of the Systems with Real Examples
	MIM 234E - Reinforced Concrete Structures	Building Structural RC System Analysis and Computation; and Earthquake Regulations

In the scope of the content, some courses teach the basic elements and materials in the construction process. The course "Building Materials (MIM 231 / 231E)" gives students information in terms of material classes and quality. In the course of "Building and Construction in Architecture (MIM 203 / 203E)", the introduction of the necessary structural elements for the building systems and the construction techniques of the elements are taught. In addition, in the course of "Building Element Design (MIM 204 / 204E)", students also experience the effects and use of the design criteria in the construction process. These three courses, they can be placed under the name of the "Building Elements and Materials" class. Basic teachings of the lessons are briefly explained in Table 4.6. The courses are re-evaluated in the SSI because of including topics that are the basis of the BIM process.

Table 4.6: Building Elements and Materials Courses – Brief Content

Building Elements & Materials	**MIM 231E - Building Materials**	Identification and Classification of Building Materials - Relation with Building Elements
	MIM 203 - Building and Const inArch.	Basic Contruction Technologies with Building Elements
	MIM 204 - Arch.Building Element Design	Pre-Defined Building Elements According to Design Criteria and Analysis of the Elements related witv Building Systems

"Environmental Control Studio (MIM 246 / 246E)" course is considered as a more comprehensive and specific subject in terms of content analysis. It continues with the teaching of some basic specialities based on building performance. Climate, lighting, acoustics and fire issues; and calculations on these topics are taught in the course. When the course content is evaluated, all the teachings required for accessibility, safety, comprehensive project production, performance criteria of building systems and environmental effects in the project design process are covered in this course. The course is classified with its own name since it is quite comprehensive and singular. The basic teaching of the lesson is briefly explained in Table 4.7. Within the scope of the course, the topics to be addressed in the analysis phase in the BIM process. Therefore, how integrated it is with BIM systems are questioned again in SSI.

Table 4.7: Physical Environment Control Course – Brief Content

Physical Environment Control	**MIM 246E - Environmental Control Studio**	Analysis and Calculation of Physical Environmental Effects for Building Performance with Environmental Standards and Regulation

Some courses in the curriculum are observed to focus on building systems and management. The "Building Production Systems (MIM 333 / 333E)" course, which is given in the fifth semester, investigates the effect of technology and social structure on the construction of building systems and provides the recognition of construction technologies on this basis. When evaluated according to the content of the courses, it is seen that subjects such as project costs, working together, customer role, project management, business plan, time management, risk management and the regulations are questioned within the scope of the course. Another course is "Construction Management and Economy (MIM 359,359E)". This course introduces the construction sector, particularly in Turkey and for this purpose, the project life cycle, roles and responsibilities, time management, cost management considers issues such as direct. Both courses are classified under the title of "Construction Systems and Management" due to the parallelism in their content. The basic teaching of the lesson is briefly explained in Table 4.8. The courses are re-evaluated in the SSI because of parallel to the BIM process.

Table 4.8: Construction Systems and Management Course – Brief Content

Construction Systems & Management	**MIM 333E - Building Production Systems**	Perception of Components and Structures which Includes in Complex Building Production System; Social and Technological Situation Effects on the Systems
	MIM 359E - Construction Management & Economy	Importance of the Construction Sector in Turkey, Project Lifecycle, Roles and Responsibilities of Architects, Cost and Time Management Process and Management Tools

When the curriculum content is examined, another course to be considered within the scope of planning, regulations and management is the "Urbanism and Planning Law (MIM 343 / 343E)" course given in the sixth semester. Teaches the concept of urbanism, the criteria, rules and city management that should be considered in this regard, from theoretical pain. As it is the only urbanism course in the architecture curriculum, it is classified under the name of "Urban Planning". The basic teaching of the lesson is briefly explained in Table 4.9. As it sets out certain regulations and criteria in terms of content, it is re-evaluated with the SSI whether the main issues in BIM systems are discussed within the scope of the theory.

Table 4.9: Urban Planning Course – Brief Content

Urban Planning	**MIM 343 - Urbanism and Planning Law**	Urban Planning and Design Principles; Evaluating Urban Law,Regulation and Management

Some courses within the scope of reviews have teachings on the preservation and restoration of the historical heritage. In this context, the course of "Conservation of History Building and Sites (MIM 322 / 322E)", which is given in the fifth semester teach to students about the basic principles and methods for the protection of buildings. When the content of the “Architectural Survey and Restoration Studio (MIM 361 / 361E)” course which is given in the next semester is analysed, it is understood that studies are carried out to apply conservation methods on a true historical heritage. These two courses are classified under the title of "Architecture and Urban Conservation". The basic teaching of the lesson is briefly explained in Table 4.10. The courses are re-evaluated in the SSI because of parallel to the BIM education integration in terms of the conservation building process.

Table 4.10: Architectural and Urban Conservation– Brief Content

Architectural and Urban Conservation	**MIM 322E - Conserv.of Hist. Build.&Sites**	Theory, Basic Principles, Techniques and Methodologies related with Conservation of Buildings
	MIM 361E-Archtctrl Survey & Restrtn Std	Apply Conservation Techniques and Methodologies on History Buildings; Researches of Site , Building System, Material; and Suggestion for Initial Construction and Repair with Drawings

The curriculum includes must courses for students to develop projects in the last years. Especially when the content of the "Construction Project (MIM 431 / 431E)" course, which is given in the seventh semester is examined, expects the teachings in the structure system and environmental control courses taken in the previous semesters to be implemented within the scope of a project. The design stage is not seen in its content. The course is classified in the name of "Construction Studio". When the “Diploma Project (MIM4902E)” course given in the next semester is examined, it is seen that students are expected to produce a design on a topic and complete a project. In the study, it is classified under its own name. The basic teaching of the lesson is briefly explained in Table 4.11. They can be taken as one-to-one core courses associated with BIM, as they expect the learning of very comprehensive information in terms of content on behalf of the infrastructure of BIM processes. However, the way

the lessons are taught and the teachings required to gain the BIM background issues should be questioned again in the SSI.

Table 4.11: Construction Studio and Diploma Project Courses– Brief Content

Construction Studio	**MIM 431E Construction Project**	Prepare of the Application Project which is Integrated to of Other Application Projects (static, sanitary installation and electricity) with Architectural Construction Drawings by Thinking the Laws and Regulations
Diploma Project	**MIM 4902 - Diploma Project**	Development of a Project with Architectural Idea, Program and Spatial Configuration by Using all Gained Knowledge of Architecture Discipline and Its Sub-topics

When Content Analysis (Appendix E) is examined; Must course in the curriculum are divided into seventeen basic classes as Basic Sciences, Language, Basic History, Intro Courses, History of Architecture, Basic Design Studio, Architectural Design Studio, Architectural Design Theory, Architectural Design Tools and Technologies, Structural Systems, Building Elements and Materials, Physical Environmental Control, Building Systems and Management, Urban Planning, Architectural and Urban Conservation, Building Studio and Diploma Project. The first four of them are gathered in a wider class as courses outside of the architecture teaching. Along with these courses, the History of Architecture courses is filtered out of the scope of the BIM process due to their content. Thirty lessons in the other twelve titles are gathered again under five meta titles, namely Architectural Design, Construction, Urban Design, Conservation and Diploma Project within the scope of the main topics which they focus on. The courses in the meta titles are left to be re-examined through the SSI with instructors in terms of their BIM education infrastructure building qualities (Appendix F).

4.2 Semi-Structural Interview

Within the scope of the study, BIM subjects are scanned and defined in the second part on the standards. The necessary gains based on these subjects are also interpreted and presented in the first study of the thesis. Most of the teachings are processes developed in light of the basic knowledge and skills acquired in the architectural education curriculum. Therefore, the must courses in the curriculum related to BIM subjects are selected by analysing courses' contents in the previous section. 29 courses are observed to have a structure that could form the BIM background. In this section, in terms of

the accuracy of this hypothesis, the courses are evaluated within the scope of the SSI with the instructors.

In this section, firstly SSI Questions are preparation by benefiting BIM subjects defined in the first study. The questions are prepared as closed and open questions homogenously. Therefore, take more deep information about the courses are aimed. Afterwards, for the 29 courses separated in the previous section, 17 instructors are reached. Different expertness of the faculty members is important on the selection of the instructors. Although it is aimed to reach different lecturers individually for each course, the same faculty members who have mastered different courses have been taken into consideration because of time constraints. Therefore, it has been spoken with the same faculty member for more than one course. However, separate meeting time is reserved for each course. Lastly, collected data with google forum are evaluated in the BIM subjects. In the evaluation, gap and potentials of the current curriculum are discussed with data revealed from each course according to BIM subject holistically.

4.2.1 Preparation of Interview Questions:

45 subject-specific questions are prepared before the SSI to introduce the course and evaluate it in terms of BIM subjects. 23 of the questions are prepared as closed-ended questions and twenty-two is open-ended questions. While some of the closed-ended questions have singular answers, some of them are prepared in the format where more than one answer can be selected. The questions are distributed homogeneously adjusted by including least one open-ended question is created in each BIM subjects. The questions are not directly asked to the course instructor through terms with the subjects of the BIM process. The aim here is whether the information and the disciplined work that will form the background of the BIM subjects are taught in the course, and whether the knowledge and skills to support the understanding of the BIM subject are gained within the course. Only in the last questions are the issues included for whether the BIM processes are mentioned in the content of the lessons and the perceptions of this subject (Appendix G).

The first eleven questions question the purpose, content, processing, evaluation and course tools of the course. These are collected under the heading “General Questions”.

Then the first evaluated subject is “Common Data Environment and Project Delivery”. Here, the delivery, presentation and archiving process of the documents requested in the course are discussed with five questions placed between 11th and 17th questions in order to perceive whether gaining the discipline of the common data environment in the BIM process with the current education.

The second subject is "Project Life Cycle". The five questions placed between 16th and 22nd questions addressed in this subject are prepared in order to question whether the importance of the project stages and the project life cycle is taught within the course.

The next subject is "Roles and Responsibilities" which analysed with two questions placed between 21th and 24th questions. In this subject, whether the role of the designer is perceived within the scope of the lessons and whether the students manage their processes in certain responsibilities by the distribution of roles in group studies, are evaluated.

Then, within the “BIM Model Dimensions” subject, three-dimensional modelling information, orientations based on parametric thinking, the importance of time management and cost management processes, the concept of sustainability and higher-level model dimensions are questioned with ten questions placed between 23th and 34th questions.

In the next subject, “LOD” , four questions placed between 33th and 38th questions are prepared in order to reveal how building elements and materials are handled in the lessons and what are the qualifications taught in this context.

Then, with the four questions between 37th and 42nd questions prepared under the subject of “Collaboration”, the students are asked whether they experienced the communication processes with other disciplines, the perspectives of other disciplines and whether they experienced the interdisciplinary working process.

Finally, beyond all these subject, it is discussed with the last four questions whether any information is given about BIM systems in the course, what subjects they are informed about and whether they carry out an application in this context are revealed whether there is a study for the BIM process.

All prepared questions are processed on Google Forum. The use of this tool in the study is important in terms of being able to note the answers in the SSI process easily and to systematically display the total result of the SSI in the csv data format.

4.2.2 Reaching of Architecture Faculty Members

Within the scope of the study, it is aimed to reach at least one faculty member for each course due to time limitation. First of all, the course plans opened in the spring semester of 2019-2020 are reached through website of registrar's office, and the names of the instructors who gave the course are determined in these lesson plans. Then, for the courses outside the spring semester, the course sheets on the website of the department and the information of instructors included in the course contents in Ninova are used.

In the process of reaching the instructors of the course, two basic details related to the courses draw attention:

- Although the "Statistics (MIM 305 / 305E)" course is passed as an architectural course, it is observed as a course where statistical methods and calculations are taught. For this reason, the lecture notes are examined by obtaining from the assistant of the course. According to lecture notes, it is seen that the course is given through the concept of statistics and its use in architectural processes is supported only by examples. So, the course is placed in "Basic Science" classes and is out from the scope of the interview.
- In addition, current course sheets are exactly the same for “Architectural Design IV (MIM 212 / 212E)” and “Architectural Design V (MIM 351 / 351E)” courses. This also applies to the courses "Architectural Design VI (MIM 312 / 312E)" and "Architectural Design VII (MIM 411 / 411E)". This shows that the courses are opened with common sub-categories each semester and they can be handled within the scope of a single course.

It is important for the instructors selected for each course to have more than one year of experience within the scope of that course and to be current in the course. In this context, faculty members who can easily get in contact with are primarily preferred.

The current contact addresses of the instructors are reached through the “Avesis” platform. Within the scope of the information obtained; The names, e-mail addresses

and the lectures of the instructors along with their titles are organized in an excel data. The main purpose of this arrangement is to determine the common instructors of twenty-nine courses and to send their requests for interviews with the "merge mail" fast tool.

A mail template is created in Word in order to reach faculty members systematically and quickly. In this template, the name of the instructor and the lectures he gave are called using the excel data. Thus, it is ensured sending emails at once to all faculty members. The process is advanced in two stages in terms of organizing the time planning. First of all, the instructors on courses which belong to Architecture-Design, Urban Planning and Conservation classes; Then, the faculty members who gave the courses in the Construction class courses and Diploma Project are reached. After completing some of the interviews in the first stage, the faculty members in the other subject are reached..

4.2.3 Process of Semi-Structural Interview

The interview request to be made online via the Merge-mail (with Microsoft Teams or Zoom preferences) is sent to the faculty members by informing the purpose of the interview and the thesis topic title. Interview timings are planned considering the time frame requested by the faculty members and the digital platform they prefer. A maximum of one hour is reserved for each lesson. After the feedbacks, meeting requests are sent to faculty members via their preferred online platform. Online interviews are held with fifteen faculty members and two course assistants for a total of twenty-nine courses at the specified date and time. The interview process is completed within two and a half months. The dates and times of the interviews within the scope of the lessons are given in **Appendix H**.

Each interview started with the personal presentation and the value of the answers given in the scope of the thesis, and then continued with the answers of the instructors within the scope of the questions. The questions in the interview are read to each faculty member completely. The answers are instantly recorded on the forum. In an interview with faculty members who gave several lessons; The questions are addressed one by one. The questions are asked for each lesson in the same time, and two separate templates are filled together. The reason for this is to prevent the questions being read from the beginning for each lesson, for the instructor being interviewed to hear the

question for the first time. Thus, the instructor is able to give the answers to each lesson without thinking about the next question. When all questions are completed, the forum is closed and sent to the database.

4.2.4 Evaluation of Results of SSI

After the interviews are completed, a collective csv data format is received. This data is converted to an "excel" data, in which question answers are listed for all courses. The answers of the question groups prepared according to BIM topics in order to be easily interpreted together with the lesson classes were reorganized in the matrix of the question groups and lessons (**Appendix I**).

General Questions: The results in this context provide detailed analysis of the course by finding answers to questions such as the content of the course for a semester, how it is operated, what the contents of the homework are, outcomes of the course.

Considering the answers given about the contents, within the scope of must courses, students take many comprehensive courses that will form their architectural backgrounds. In this context, it is seen that various courses are taken from different specialities. Approximately twenty percent of the must courses in the curriculum have theory-based background are run jointly with all students of in a semester. However, most of the applied courses have more than one-course group opened by different faculty members due to the student density (Figure 4.1). These course groups prevent students from learning processes homogeneously. However, the fact that the course sheets are open and the studios teach in the open concept increases the transparency of the information between the groups.

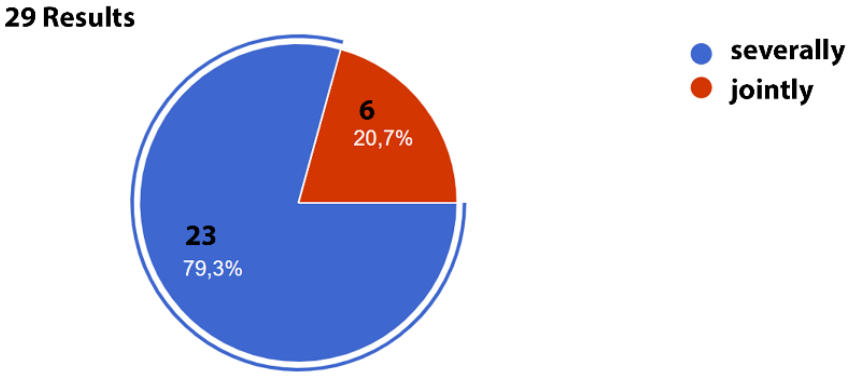


Figure 4.1 : Types of the lessons' running (severally or jointly).

In more than half of the lessons, the discipline to work together is gained with group assignments (Figure 4.2). Group assignments support the initial processes in basic design studios and architectural design studios but being ended individually. Most of the courses that continue with group assignment or end with group assignment also carry out written exams for individual evaluation.

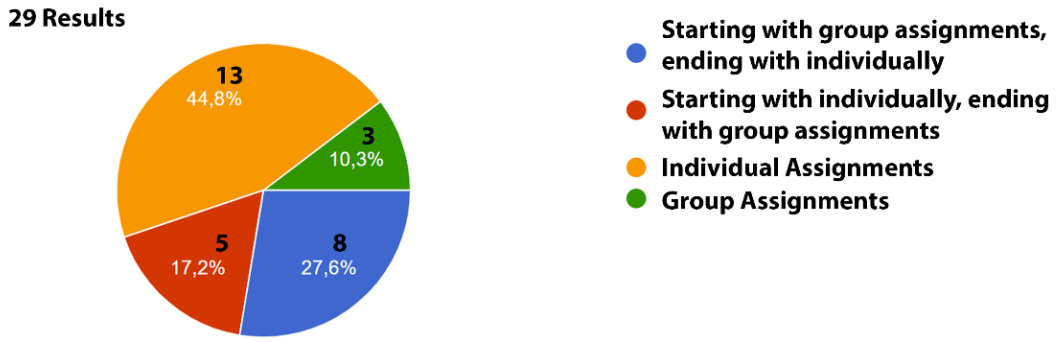


Figure 4.2 : Types of assignments (group assignment or individual).

During the undergraduate education, basic design studios, architectural design studios, building studio and graduation project courses, where students are taught design perspectives, cover the project development, experience and questioning processes more than other courses. Essentially, students need to develop a project that can operate in the market; architectural basic elements and materials, carrier systems and service systems, architectural application information and management processes are taught under the management of separate experts independent of design courses. In addition, the courses progress independently with each other. There is no common course in which these courses are covered as a whole, including the design process. Although the construction project course is considered the closest to this scope, the fact that the design is not questioned in delivery, that it is progressing with a single discipline and that the evaluation is continued with only two-dimensional drawings revealed that the course could not be handled within this scope. In addition, when the basic infrastructure is examined within the scope of the courses, no findings regarding the learning and discipline of BIM technology are found. The closest lesson to this scope is the course of construction management and economy, but the main concern in this course is not the learning of BIM technology. The new teaching method tried within the course draws attention. In the conclusion section, the method will be discussed in term of whether it can be used in BIM learning process.

Only one of the lessons includes software training, which is very important in terms of gaining three-dimensional modelling and parametric thinking skills. However, when looking at the preferred software in the project lessons, various three-dimensional modelling and BIM software that students gain with their personal learning are also encountered. However, the accuracy of the use of these programs is a risky issue, since no three-dimensional model is delivered. The expected deliveries in most of the lessons are two-dimensional technical drawing and poster design.

CDE and Project Delivery: The results of the questions prepared under this topic provide the question of whether familiarity is gained within the curriculum to the common data environment structure and project delivery procedure processes in the BIM process.

In approximately ninety percent of must courses, students' hand in their homework documents digitally through a shared platform (Figure 4.3). Students usually make presentations of documents in printed form. Due to the problems associated with the file sizes in Ninova, the university's common data-sharing platform, faculty members also use platforms such as Google Drive or Google Class for digital assignment submissions. The fact that these platforms are used in the course of the course supports students to become familiar with the concept of the common data environment they will encounter during the BIM process.

> In the scope of "Introduction to Architecture and Ethics (MIM 119/119E)" course, Res. Assist. Dr. H.T. adds his comments as that "The Ninova platform is valuable in terms of common data storage, but the platform has restrictions on file sizes. For this reason, Google Class is a platform we frequently use, especially during the pandemic period. With this requirement, it has become much easier to organize and archive the course contents and process"

In addition, in more than half of the lessons, it is desirable to conduct homework assignments with specific naming conventions (Figure 4.4). Thus, students experience details about naming, such as letterheads and filenames, which they should pay attention to in project submissions, to some extent within the scope of lessons.

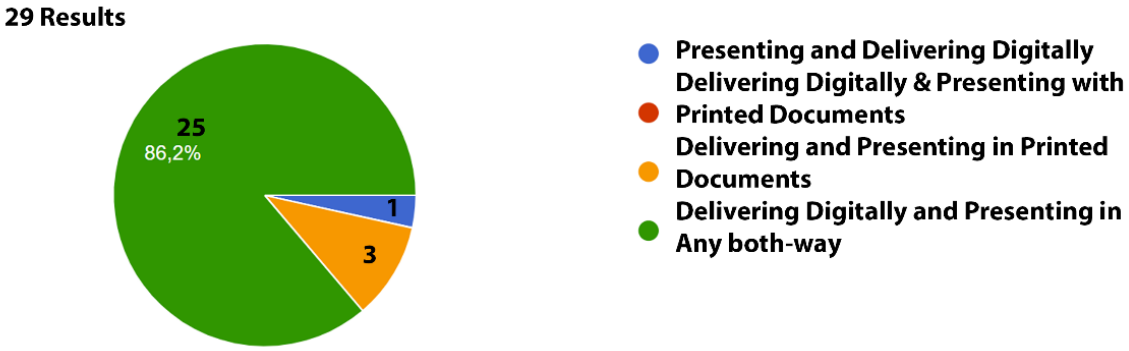


Figure 4.3 : Types of the delivery of assignments (hardcopy or digital).

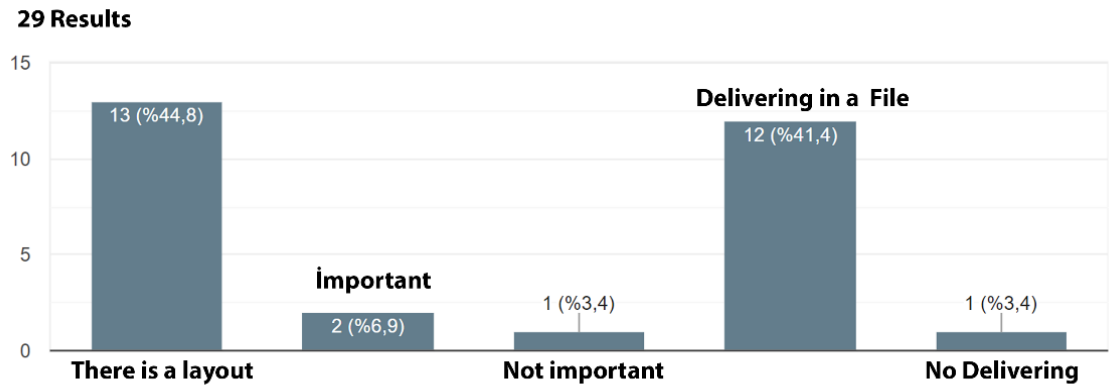


Figure 4.4 : Results from " Are the deliveries made with specific naming rules?" question.

Project Lifecycle: The results of the questions prepared under this topic examine whether the subjects of the project life cycle and project phases required for understanding the necessary infrastructure of BIM processes are gained within the scope of the courses. Generally, the approach to the final product is questioned within the scope of the lessons. For design, assignments and learning process, various process diagrams and mind maps are used. Especially, the analysis matrix based on learning stations project draws attention.

> In the scope of “Building Production Systems (MIM 331 / 331E)” course, Assoc. Prof. Dr. E.A. adds his comments as that “This year, we moved our learning stations project to undergraduate education within the scope of this course. Learning stations is a project that will provide students with a high-level knowledge pool and learning flows independent of formal education. One of the data to be taken in this context is to analyse how the students learn themselves. With this goal, we made an analysis of the stages by which they

completed the homework (learning tasks) given to the students within the scope of this course with learning tickets."

Project life cycle and project phases are mentioned in more than half of the lessons (Figure 4.5). In building systems and management courses, this concept is operated with direct subject content. The field and business processes in the projects are also mentioned in approximately half of the lessons (Figure 4.6). Generally, the issues are advanced by discussing the end product and the scenarios of the product in the operating phase. However, this is not handled within the scope of business management and risks professionally, and the background of these stages is provided through discussions in the process.

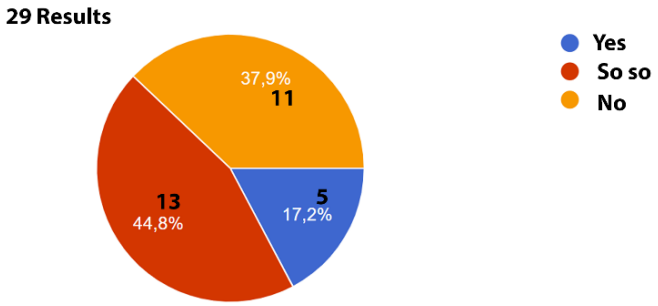


Figure 4.5 : Result from "Are the project phases and project life cycle mentioned in the course?" question.

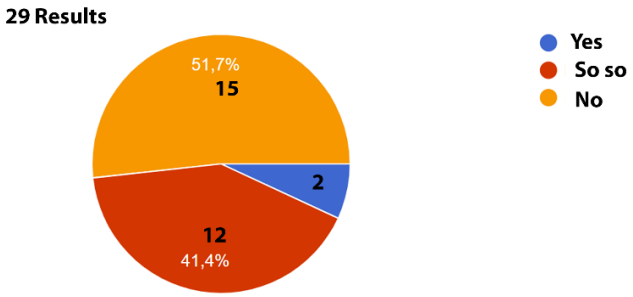


Figure 4.6 : Result from "Do they discuss design processes by considering construction practices, site and operation phase?" question.

Roles and Responsibilities: Results of the questions prepared under this topic questions whether architectural responsibilities are gained throughout the curriculum and whether students are testing the distribution of roles and responsibilities in group work in lessons.

In all courses except Architectural Design Tools and Technologies course, the roles and responsibilities of architects in the project are addressed with various criteria in

the courses. Role and responsibility distribution are not compulsory in any of the courses conducted in group work. In addition, within the scope of the “Construction Management and Economy (MIM 359,359E)” course in the building management and economy class, the structure and necessity of the “responsibility matrix” in management are mentioned.

> In the scope of “Construction Management and Economy (MIM 359,359E)” course, Assoc. Prof. Dr. E.A. adds his comments as that “Roles and responsibilities in the project are one of the main topics of this course. We explain this issue with a responsibility matrix within the subject of management documents.”

BIM Model Dimensions: In the results of the questions prepared under this topic, whether issues such as three-dimensional information modelling knowledge, time management discipline and knowledge, the necessary teachings in the background of cost management, view of sustainability, facility management, quality control and field safety topics are analysed.

The only lesson that requires three-dimensional modelling throughout education is “Introduction to Computational Design Tools and Methods in Architecture (MIM 120E)”. Apart from this course, all project and studio courses support the making of an optional three-dimensional model. When considering the software used in this process, the use of BIM software in architectural project lessons and application project can be found; however, this software is learned personally and are preferred because they ease the process of creating and documenting the project model. The topic of parametric thinking is one of the topics introduced in several lessons and informative. Within the scope of the course "Introduction to Computational Design Tools and Methods in Architecture (MIM 120E)", the teaching and software dimension of this subject are discussed directly. Parametric approaches are handled within the scope of the search for forms in modelling processes. All of the lessons share the lesson plans within the time management discipline with the students and try to comply with these plans. However, the time management issue within the scope of the Project is only one of the topics mentioned in the course "Construction Management and Economy (MIM 359,359E)". Within the scope of this course, the subject is discussed in detail and software promotions specific to the subject are also made. More to sixty percent of the lessons address the economy and cost as a design

criterion (Figure 4.7). However, within the scope of the answers given, the subject of cost management in the project is again addressed only in the course "Construction Management and Economy (MIM 359,359E)". Within the scope of the Implementation Project, this issue is discussed and a zone list is requested in the project documents. Sustainability is one of the issues that are considered in more than half of the lessons (Figure 4.8). The subject is discussed in various courses in ecological, social and economic dimensions. Topics such as higher-level facility management, quality control and field safety are placed in the course "Construction Management and Economy (MIM 359,359E)".

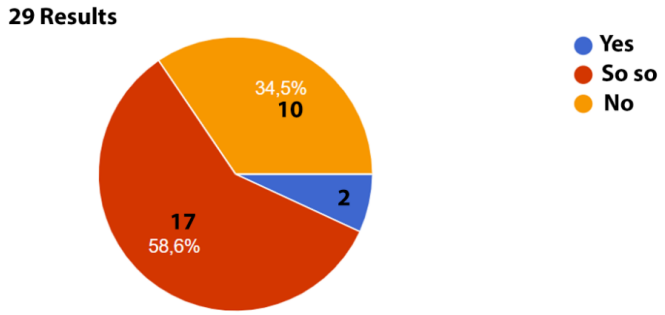


Figure 4.7 : Result from "Do students discuss the building economically during the lesson?" question.

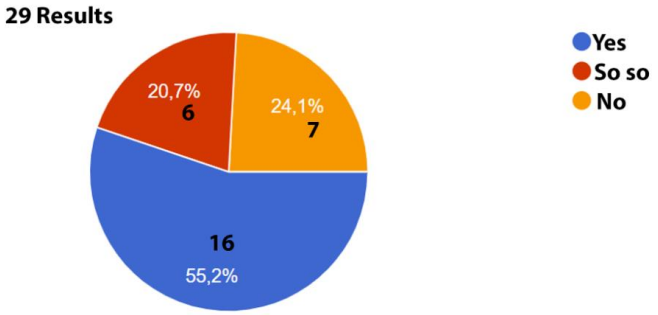


Figure 4.8 : Result from "Is the concept of sustainability mentioned in the course?" question.

LOD: The results of the questions prepared under this topic question how much qualitative information they receive about the elements and materials used in the building systems of students in their education for the evaluation of the level of detail in BIM processes and their requirements during the project stages.

The subject of building elements is generally advanced in parallel with the subject of material within the scope of courses. In this process, correct representations of

architectural elements and materials are expected from students. The courses "Building and Construction in Architecture (MIM 203 / 203E)" and "Building Element Design (MIM 204 / 204E)" are two courses in which architectural elements are discussed in detail with their parameters and qualities. The subject of material is learned in the finest detail with the course “Building Material (MIM 231 / 231E)”.

> In the scope of “Building Material (MIM 231 / 231E)” course, Assoc. Prof. Dr. S.A.O adds her comments as that “The main subject of the course is to teach many details about building materials, so we teach materials and the parameters of them to be used in building processes in this course.”
>
> In the scope of “Building and Construction in Architecture (MIM 203 / 203E)" course, Assoc. Prof. Dr. İ.Ç. adds her comments as that "Our subject in this course is basically building elements' function and components. We are talking about the construction methods and performance requirements of the building elements. We also mention the damages that may occur in the life cycle of the building elements and their criteria in the regulations.”

In addition, structural elements and the materials to be used for the elements are examined in the carrier system lessons. Lighting elements, acoustic elements and materials, installation elements and necessary materials are discussed in detail in the "Environmental Control Studio (MIM 246 / 246E)" course. All the information learned is remembered with input and output analysis which are expected in homework in the Building Systems and Management courses. The use of elements and materials in projects is represented detailly in the system sections in the application project and diploma project. However, representing the elements and materials as an information model in these lessons are not mentioned; Although the information in this context is learned, the representations only remain in two dimensions.

Collaboration: The results of the questions prepared under this topic discusses the interdisciplinary dimension of the collaboration process. For this purpose, it is questioned whether communication processes to be encountered with other disciplines, whether the perspectives of other specialities exist in the course, and whether an interdisciplinary practice is carried out within the scope of courses.

Within the scope of the courses, the communication of the architect with other disciplines is generally mentioned. Within the scope of this subject, communication

processes are handled only in the course of "Construction Management and Economy (MIM 359,359E)".

> In the scope of “Construction Management and Economy (MIM 359,359E)” course, Assoc. Prof. Dr. E.A. adds his comments as that "Communication and responsibilities with other disciplines are critical values for direct management. For this reason, interdisciplinary communicationis an especially operated subject within the this course."

However, in other courses, communication with engineers or with municipalities in urban dimensions is also mentioned during the project design. In more than half of the lessons, support is received from different discipline specializations as expert presentations or jury memberships (Figure 4.9). The interdisciplinary collaboration process exists within the scope of TES courses, but students do not yet create their own disciplines while taking these courses.

> In the whole of TES courses, Lec. Dr. E.S.Y.K adds her comments as that “Within the scope of this courses, different disciplines are taking courses as urban planning, industrial design and architecture; but students are not yet expert on the discipline.”

> In the scope of “Diploma Project (MIM 4902/ 4902E)” courses, Assist. Prof. Dr. A.K. adds her comments as that “The basic expectation of this project course is to reflect the seven-semester experiences of students on their projects. Students do not receive any additional knowledge for project process, but their projects are evaluated with three basic juries throughout the semester. When considering the different courses in the seven-term and instructors with different expertness in the jury team supports, multi-discipline space can be provided. However, I should also mention that the students are still only architects, and they deal with the project individually. Moreover, the fact that design instructors are the jury chair, time constraints and design-based education cause more design-oriented evaluation of the projects.”

In fact, they only experience a disciplined-independent studio experience. In Urban Planning and Architectural Conservation courses, this process is evaluated with the presence of students who come from the double major undergraduate program;

however, this does not offer to work with different disciplines for every student; it is not considered as an application in the course.

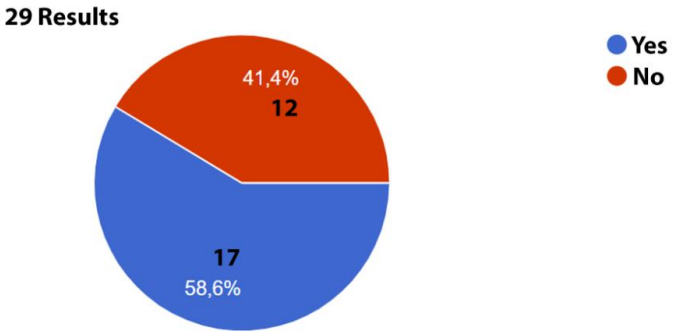


Figure 4.9 : Result from "Is support received from the teams (or person) receiving other discipline education within the scope of the course?" question.

BIM Knowledge: The results of the questions prepared under this topic; It inquires whether the concept of BIM is mentioned in the lessons, what features of the concept are addressed, and whether students in a practical experience BIM systems application.

There is no course in which the concept of BIM is defined exactly. The concept is mentioned partially by guests or faculty in about forty percent of the lessons (Figure 4.10). In the "Construction Management and Economy (MIM 359,359E)" course, it is seen valuable to explain the integrated project delivery process and to mention BIM in this regard. Expected time and cost management, project delivery strategies under the standards are explained at least in this course. In the implementation project, the use of BIM tools is allowed, but the learning and use of the tools cannot be controlled.

> In the scope of "Construction Project (MIM 431 / 431E)" courses, Assist. Prof. Dr. F.P.Ç. adds her comments as that "We do not teach BIM tools in this course, but some of the students can prefer these tools, and we release free for selecting tools at this stage."

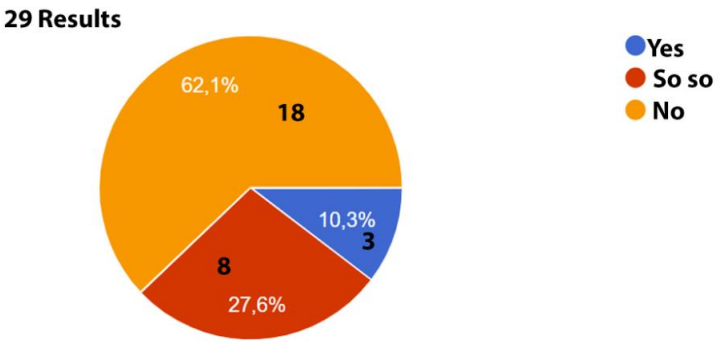


Figure 4.10 : Result from "Have you give a demonstration about definition of BIM in lessons or homework?" question.

4.3 Summary of Chapter

In the department, firstly, ITU's the current architecture undergraduate curriculum are introduced with updates, it is seen that some courses related to vehicle training are added to the curriculum. In addition, the fact that the curriculum updates itself reveals the university's approach to change and development. However, it is noteworthy that there is not much change in the curriculum, especially after the third semester.

In the continuation of the study, the must courses in the current curriculum are classified by evaluating the course contents with the manual content analysis method in order to be evaluated more systematically with the questions prepared on the BIM topics. Since some classes remain theoretical for the BIM process, they are not transferred to the SSI section.

In the process of the SSI, online meetings are taken by contacting the lecturers of the courses after interview questions are prepared. Forms prepared via Google Forum are filled during the meetings. The results of all interviews are collected in an Excel data and separated by topics. Interview results are interpreted over the separated documents.

The SSI results reveal that the basic information required in architecture undergraduate education is obtained. However, the studio classes are taught in groups with separate faculty members. The different approaches in the studio classes can cause differentiates on the technology infrastructure of undergraduate students.

Having online delivery processes in most of the lessons and progressing through a digital pool throughout the term is similar to the common data environment in the BIM process. Besides, the fact that the deliveries are made with certain templates by near half of the lessons can also enable the students to capture the background discipline about folder and file naming in the common data environment.

Defining the processes of approach to the final product can teach approaches to progress and planning in the project. However, the project life cycle is only run directly as a subject which includes project stages within the scope of the Building Systems and Management courses. In the "Conservation of History Building and Sites (MIM 322 / 322E)"course, the subject is mentioned as the life of the building. Nearly half of the lessons evaluate the final product through the field and operational processes, but the expected documents and requirements in the stages are not adequately addressed.

Architectural roles and responsibilities are one of the subjects mentioned in ninety percent of the courses. But again, the place and importance of the subject in the project are considered only within the scope of the Building Systems and Management course.

When it comes to model dimensions, the fact that three-dimensional modelling is not a necessity and the use of BIM software is only advanced with individual learning makes it clear that there is no BIM model to be questioned in other model dimensions. However, in most of the lessons, students become aware of time and economic criteria. In addition, 4D and 5D vehicles are introduced within the scope of the Building Systems and Management course; time management and cost management are operated in detail. Sustainability is seen in many lessons, is addressed from different perspectives, and are essential in design criteria.

Although there is the necessary background awareness for all these issues to work with the BIM model, their values and applications in the project stages cannot be demonstrated within the scope of the courses. Top-level facility management, quality management and field safety issues are not mentioned outside the Construction Systems and Management course.

The buildings elements and material information handled under the LOD heading are taught with specialized courses for these subjects within the scope of the curriculum and are expected in only two studio deliverables in all studio courses. However, the gap between the specialized courses and the project courses and BIM systems lead to incomplete information.

The interdisciplinary collaboration process is not experienced in any course. Students work within only the architectural discipline after the third semester. This may result in the project process not being fully understood in terms of the implementation phase.

Finally, it is seen that there are some naive initiatives towards the definition and promotion of the BIM concept. However, no course is covered in detail within the scope of the courses. The course “Construction Management and Economy (MIM 359,359E)” is seen as one of the closest courses to this subject, but it is not possible to focus directly on this subject in terms of the content and learning outcomes of the course. The new generation learning method (learning stations) encountered within the scope of this course can consciously direct the student to specialize in many subjects,

independent of the curriculum intensity, by offering students a more open and broader learning universe than the curriculum.

In short, some critical problems and gaps are revealed in the analysis:

- Disconnectedness between must courses in which main knowledge about building systems are taught.
- The intensity of the curriculum
- No interdisciplinary collaboration
- Lack of knowledge about BIM

In addition, there is some potential for the integration of the BIM to education:

- There are many discipline-specific courses and instructors in the curriculum.
- Online platforms such as Google Drive and Ninova are used for the delivery process.
- There are some specific courses such as "Building Material", " Building Construction and Architecture" and "Construction Management and Economy" provide the background of BIM subjects.
- There are studios courses for project practice such as "Architecture Design" courses, "Construction Project" and "Diploma Project" in the curriculum.

5. RESULTS AND PROPOSALS

BIM systems are not just a technological change for the construction market but a process evolution. This evolution has been used in the construction market for more than a decade. Moreover, it has been made compulsory by the government in construction projects for some countries. Guidance documents on BIM processes are published in many countries for the system to function correctly and to be managed efficiently. These documents have become national standards, especially for countries with BIM requirements. Within the study's scope, there are twelve documents examined in four regions (The United States, The United Kingdom, Asia, Australia). When these documents are analysed, it is seen that they touched on some issues required for the BIM process.

The subjects are required for evaluating BIM systems in a platform. In the scope of the thesis, the subjects are revealed for evaluating in an architecture undergraduate curriculum.

The basic of BIM: Clear definition of BIM-related terms, maturity levels and uses

Project Lifecycle: Setting out the project lifecycle and project phases

Roles and Responsibilities: Defining the roles and responsibilities of the people involved in the project

BIM Model Dimensions: Preparation the models which are suitable using aims in the project process

LOD: Defining the required element and material qualities properly for the project phases.

CDE - Project Delivery: Defining how the project documents are shared and archived through the project process.

Collaboration: Defining the details of the data flow of different disciplines or stakeholders within the project correctly and determining the communication processes.

After the determination of these topics, the BIM process's theory and technological infrastructure are analysed. As a result of this review, it is observed that BIM matured in the research data as an idea before market use. The theory is served market use with the development of technology. The continuity and necessity of the BIM in academia issue are based on the universities not being indifferent, especially to the change and development in the AEC market. In this regard, the approaches and suggestions on the integration of BIM education at universities are examined by using literature data. These reviews show that the subject requires a strong background first. If we mention about the integration of the BIM to formal education, it may be reasonable to continue the process pedagogically through the Bloom Taxonomy method. For this purpose, within the academy researches, knowledge and skills related to BIM learning are examined and arranged in a table hierarchically to be handled.

The main aim of the thesis is to discuss the existence of the background required for the BIM process in the architecture undergraduate program and to interpret how to follow the current situation considering the BIM education integration. In this context, the ITU architecture faculty undergraduate program must course are discussed for the case study. An SSI is realised with the instructors of the lectures to answer questions about whether the courses allocated for the BIM process prepared a background for the BIM subjects and whether they did a study for the BIM process.

Obtained results:

First of all, when the general structure of the courses is examined, it is one of the main conclusions drawn from the curriculum, in which different courses and specialities address all the topics related to the project's scope. In this context, it is noteworthy that there are no courses in the curriculum where the project processes are experienced as a whole and the gap between the courses in which the basic infrastructures required for the project are prepared::

Proposal 1- Integrated Project Process: Some of the studio lessons in which the project processes are experienced can only get out of the idea of design development and handle the project processes as a whole and gradually.

Proposal 2 – More Integration Between Must Courses: Lessons in which subjects requiring expertise in project development are taught can be combined more frequently with common assignments or evaluations during the semester.

The results obtained from the questions prepared for the background of BIM topics:

- ***Project Lifecycle:*** The project lifecycle is one of the topics mentioned in more than sixty percent of the lessons; however, the details of the subject's project phase and management are mentioned only in the Building Systems and Management courses.
- ***Roles and Responsibilities:*** Different specialties in lessons teach architectural responsibilities, but role distributions and responsibility matrices within the project are only addressed within the scope of the course of "Construction Management and Economics (MIM 359,359E)".
- ***BIM Model Dimensions:*** The use of BIM modelling tools varies from student to student and is not taught in classes. However, time management, cost management, and sustainability issues related to model dimensions are the subjects mentioned in more than sixty percent of the lessons. However, the issues of how they are managed and calculated within the project scope are detailed only in the course of "Construction Management and Economics (MIM 359,359E)".
- ***LOD:*** Element and materials are shown in detail in the project processes as 2Dpresentations in the most comprehensive Application Project course. In fact, the two issues need to be dealt with in detail before these representations in order to identify the smart objects and materials correctly in the BIM model. The courses in the "Buildings Elements and Materials" course class are courses developed on these two topics. However, there is no process for 3D modelling within the scope of these courses.
- ***CDE - Project Delivery:*** The common data environment and document delivery process in the BIM process parallels the Ninova and Google Drive shares and archiving processes used within the university. It is thought that students may be prone to sharing online projects and using a common data store after graduation. The only lesson that deals with IPD on the flow of project processes among different stakeholders in stages is the course of "Construction Management and Economics (MIM 359,359E)".

- ***Collaboration:*** Interoperability is a subject that is handled with different disciplines within the standards. In this context, there was no project process experienced in the courses.
- ***BIM:*** There is no specific study for the BIM process within the scope of must courses.

Proposal 3 - Introductory Presentations and Seminars for the BIM: The fact that there is no study for BIM processes requires some studies in order to get accustomed to this point of view of undergraduate education. It is suggested to spread this approach within the department with introductory BIM seminars. In addition, the process can be supported with guests who are experts in their subjects and worked in the BIM infrastructure.

Proposal 4 – Learning Phase of BIM: If a BIM education model is planned in the curriculum in parallel with the results obtained from the knowledge and skills background in the second part, the semesters of three critical courses can be taken into consideration. This process can be continued with the project courses in those semesters (Figure 5.1):

The fourth semester of "Buildings Elements and Materials" courses can be considered as the starting semester for BIM courses. In this process, theoretical infrastructure and 3D modelling teachings can be completed until the sixth semester.

Teachings on management and model analysis are recommended to continue with the information learned in the "Construction Management and Economics (MIM 359,359E)" course, which will be taken in the sixth semester.

***Proposal 5 – Semi-Open BIM Learning*:** Considering the intensity of the project courses and critical courses, BIM learning which is run parallel with the specific topics to be taught in the process, can be followed up from online sources and evaluated within the scope of assignments.

***Proposal 6 – Interdisciplinary Project Course*:** An Interdisciplinary project course is precious in terms of advancing the process like a real collaborative project. In this context, the implementation project's infrastructure can be carried out interdisciplinary by using BIM models instead of CAD in the documentation process.

***Proposal 7 – Learning Stations*:** The idea of creating learning models by students handled within the learning stations project applied in Building Systems and Management lessons encountered during the interview process can also be applied against the background of BIM learning. Thus, the learning module of the BIM process can be measured and updated according to the students' productivity and orientation. (Url 5)

The proposals are arranged in Figure 5.1, and are evaluated in SSI with the head of the department to clarify the perspective of the architecture undergraduate program. Interview outputs reveal that this change in education is viewed positively by the department, and some ideas are added for the proposals.

Opinions of the head of the department:

According to the result of SSI which is made with the head of the department, especially introduction presentations and seminars for the BIM is required, but it is late for this process, faster attacks are required for the BIM education. It is revealed that a separate working group should be created for BIM training in the process planning and the BIM learning model should be examined and developed with the experts in this working group. Integrated project process and more integration between must courses are deemed necessary by the head of the department. Besides, Semi-open BIM learning process and learning station integration to courses welcome as innovative opinions. Learning phases of BIM should be evaluated with tests on the graduate students. Lastly, the seventh architectural project course can be suitable for interdisciplinary project course, if it can be organized systematically with departments in other disciplines.

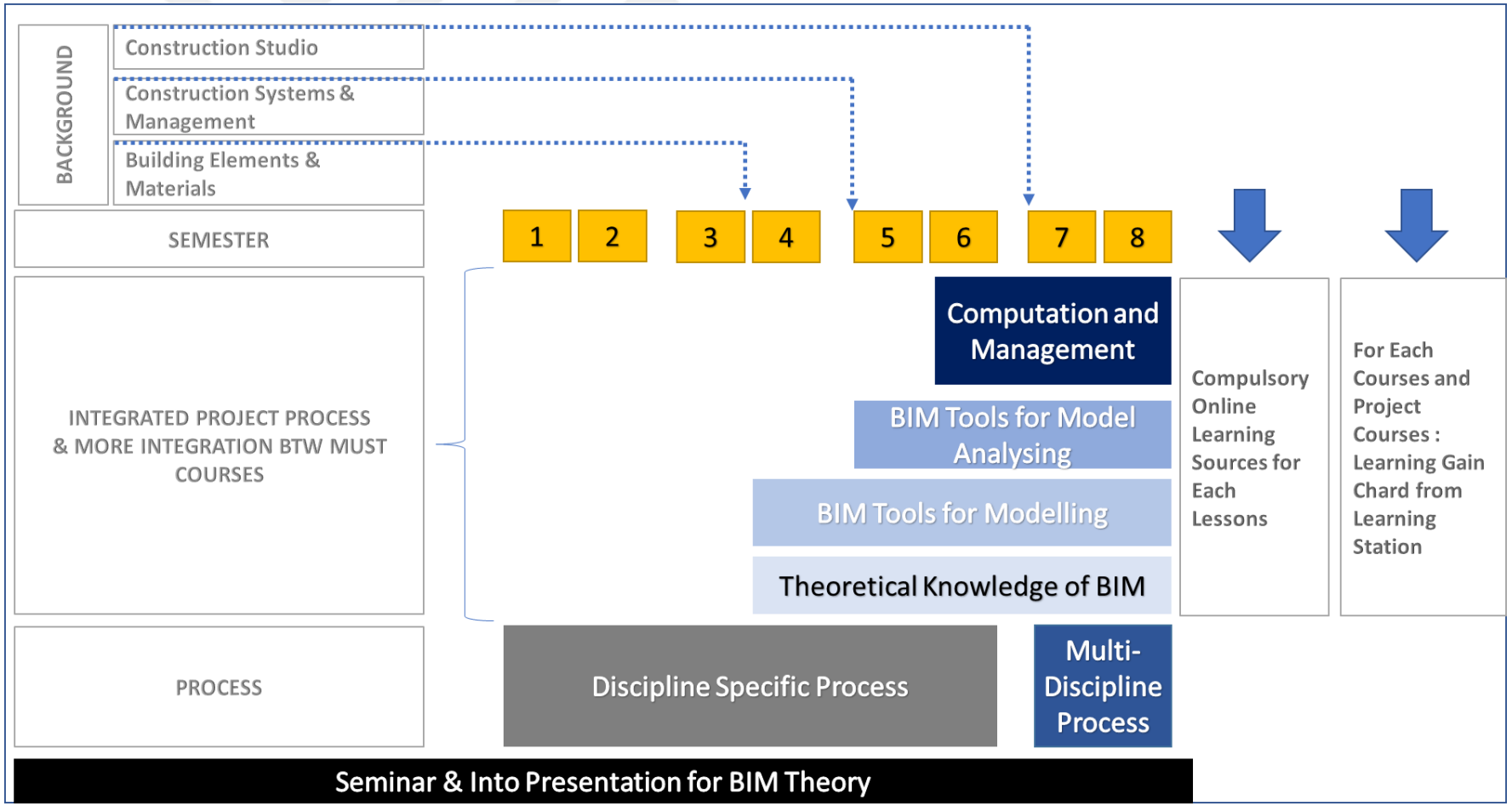


Figure 5.1 : Learning Model – Proposals.

6. CONCLUSION

Design and construction processes reveal new generation business strategies with the change of technology. BIM systems are at the top of these strategies. When the history of this system is analysed, scientific researches are the pioneer for the system. However, the practical use of the system starts when it became a necessity in terms of market efficiency, and its use with public support and standards was expanded. This widespread use increases the need for staff working with these systems in projects. For this requirement, training on the BIM system has started to be provided in many universities. Besides in each year, the views on how to continue the training related to BIM are being developed in various researches.

The fact that real projects are evaluated in the AEC industry within the scope of BIM standards reveals the value of the learning some basic subjects based on these standards to be adopted in Universities that train experts in these sectors. These subjects are obtained from in this study as BIM terms in standards, BIM uses, BIM maturity degrees, project life cycle, roles and responsibilities within the project, model types and dimensions, BIM models development levels, common data environment and interdisciplinary collaboration processes. In the literature, it is clear that these issues cannot be advanced only through training in the market. In addition, universities need to keep up with this changing process in terms of the efficiency of the process and evaluation of systems.

In the literature, researches within this scope generally improve the process by addressing one or more subjects in another, with curriculum evaluations. In this context, the common pedagogical approach is Bloom Taxonomy. With this method, the process is evaluated with the knowledge and skills to be gained gradually. In this approach, it is important to start the teachings of the BIM education process with the acquisition of basic knowledge specific to disciplines and to be advanced it by adopting the theoretical meaning and content of BIM. In the later stages, the fact that the process is developed with a digital information model requires the acquisition of information modelling skills. Afterwards, other dimensions of the BIM system such as

time, cost, building performance and facility management can then be integrated into the process. A real project simulation is valuable for the evaluation of this system in universities. The real projects simulation requires to experience interdisciplinary projects. Since the basic structure of the system is to manage and advance the building efficiently, the gain of management and calculation skills is of great importance in these high-level subjects.

As a result of the thesis research, it is revealed that the course running process in the architectural curriculum is of great importance for the integration of BIM systems. Analysis of the current curriculum situation has given valuable data for the regulation of the system tried on students. This data provides the required background to present a learning model approach in term of the BIM training process.

In the next stage of this study, an SSI or survey study with fourth-grade students can be matured the proposed learning model approach. Afterwards, the learning model can be experienced with an interdisciplinary digital learning platform that will support the learning of the BIM modelling and analysis tools in the process which continues until the graduation from third semester independent of the current curriculum. Training to be carried out in this context can be supported with the theoretical and practical effects of BIM systems on real projects by getting support from experts in the market.

This approach has been evaluated within the scope of the thesis only on the basis of architecture undergraduate education. In order to construct an interdisciplinary working process, the undergraduate education of other disciplines working actively in the system should also be examined. This system must also be experienced with an interdisciplinary project course in order to allow a real project simulation. This course can be tried with an elective course in the first place within the scope of the curriculum. Moreover, Studies conducted may reveal an AEC working group on departments at the university. If this working group can systematically translate this process into common must courses integrated, it is anticipated that students who graduate from the university will increase their efficiency in new generation projects by evaluating and developing new generation technologies in the scope of their expertise.

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APPENDICES

APPENDIX A

Table A.1 : Content of the United States – NBIMS Version 3.

Basic Knowledge of BIM	**UNITED STATE - NBIMS V3**
Project Lifecycle	**1 SCOPE**
Roles& Responsibilities	**2 REFERENCE STANDARDS**
BIM Model Dimensions	2.1 Introduction to Reference Standards
LOD	2.2 ISO 16739, Industry Foundation Class 2X3 – February 2006 *
CDE&Project Delivery	2.3 W3C XML 1.0 Fifth Edition – November 2008 *
Collaboration	2.4 OmniClass™
	2.4.1 Scope
	2.4.2 Normative references
	2.4.3 Terms, definitions, symbols, units and abbreviated terms
	2.4.4 The 13 inter-related OmniClass™ tables
	2.4.4.1 Table 11 – Construction Entities by Function – February 2013
	2.4.4.2 Table 12 – Construction Entities by Form – October 2012
	2.4.4.3 Table 13 – Spaces by Function – May 2011 *
	2.4.4.4 Table 21 – Elements – February 2011 *
	2.4.4.5 Table 22 – Work Results – August 2013
	2.4.4.6 Table 23 – Products – June 2010
	2.4.4.7 Table 31 – Phases – October 2012
	2.4.4.8 Table 32 – Services – June 2010 *
	2.4.4.9 Table 33 – Disciplines – October 2012
	2.4.4.10 Table 34 – Organizational Roles – October 2012
	2.4.4.11 Table 36 – Information – June 2010 *
	2.4.4.12 Table 41 – Materials – October 2012
	2.4.4.13 Table 49 – Properties – October 2012
	2.5 International Framework for Dictionaries (IFD)/buildingSMART Data Dictionary (BSDD) – Revised May 2012 *
	2.6 BIM Collaboration Format (BCF) – Version 1.0
	2.7 LOD Specifications – August 2013
	2.8 United States National CAD Standard® (NCS) - Version 5

Table A.1 (continued) : Content of the United States – NBIMS Version 3.

Basic Knowledge of BIM
Project Lifecycle
Roles& Responsibilities
BIM Model Dimensions
LOD
CDE&Project Delivery
Collaboration

3 TERMS AND DEFINITIONS
3.1 Scope of Terms and Definitions
3.2 Additional Items
3.3 Terms and Definitions
3.4 Glossary
3.4.1 Terms
3.4.2 Cited Standards
3.4.3 Organizations
3.4.4 XML and Digital Formats
4 INFORMATION EXCHANGE STANDARDS
4.1 Introduction to Information Exchange Standards
4.2 Construction Operations Building information exchange (COBie) –
Annex A – COBie Mapping Rules
Annex B – Life Cycle information exchange (LCie) for Product and Product
Exchanges
4.3 Design to Spatial Program Validation (SPV) *
4.4 Design to Building Energy Analysis (BEA) *
4.5 Design to Quantity Takeoff for Cost Estimating (QTO) *
4.6 Building Programming information exchange (BPie) – Version 1.0
4.7 Electrical information exchange (SPARKie) – Edition 2013
4.8 Heating, Ventilation and Air Conditioning information exchange
Edition 2013
4.9 Water Systems information exchange (WSie) – Edition 2013
5 PRACTICE DOCUMENTS
5.1 Introduction to Practice Documents
5.2 Mnimum BIM – 2nd Edition
5.3 / 5.4 BIM Project Execution Planning Guide – Version 2.1 *
BPEP
Bim Project Execution Plan Overview
Project Information
Key Project Contacts
Project Goals / Bim Uses
Organizational Roles / Staffing
Bim Process Design
Bim Information Exchanges
Bim And Facility Data Requirements
Collaboration Procedures
Quality Control
Technological Infrastructure Needs
Model Structure
Project Deliverables
Delivery Strategy / Contract
5.5 Mechanical, Electrical, Plumbing and Fire Protection Systems Spatial
Coordination Requirements for Construction Installation Models and
5.6 Planning, Executing and Managing Information Handover *
5.7 BIM Planning Guide for Facility Owners
5.8 Practical BIM Contract Requirements
5.9 The Uses of BIM

Table A.2 : Contents of the United Kingdom PAS and BS Documents.

Basic Knowledge of BIM
Project Lifecycle
Roles& Responsibilities
BIM Model Dimensions
LOD
CDE&Project Delivery
Collaboration

UNITED KINGDOM - PAS/BSI
BIM Maturity Level
Term and Defination
Information Delivery
EIR - BEP
MIDP (Master Information Delivery Plan
TIDP (Task Information Delivery Plan)
Team Roles, Responsibilities and Authority
PIM (Project Implementation Model)
CDE (Common Data Environment)
File&Layer Naming
Spatial Co-Ordination - IFC
Spatial Co-Ordination - IFC
Publication of Information
Design for bespoke manufacture
Using Assemblies and Library Information
LOM (Level of Model Defination)
LOMD (Level of Model Detail)
LOM (Level of Model Information)
Classification - Uniclass
AIM (Asset Information Model)
Business Process
Facility Management - COBie - Data Type
CDE & AIM (Asset Information Management)
Roles And Responsibilities
Information Exchange
Collaboration Management
Code of Practice
Naming
Projetc Types
Originator
Divisions
Type
Role
Classification
Presentation
Number
Description
Status
Security

Table A.3 : Contents of the ISO 19650-1 Document.

Basic Knowledge of BIM
Project Lifecycle
Roles& Responsibilities
BIM Model Dimensions
LOD
CDE&Project Delivery
Collaboration

INTERNATIONAL - ISO 19650-1
3 Terms and definitions
3 1 General terms
3 2 Terms related to assets and projects
3 3 Terms related to information management
4 Asset and project information, perspectives and collaborative working
4 1 Principles
4 2 Information management according to the ISO 19650 series
4 3 Information management perspectives
5 Definition of information requirements and resulting information models
5 1 Principles
5 2 Organizational information requirements (OIR)
5 3 Asset information requirements (AIR)
5 4 Project information requirements (PIR)
5 5 Exchange information requirements (EIR)
5 6 Asset information model (AIM)
5 7 Project information model (PIM)
6 The information delivery cycle
6 1 Principles
6 2 Alignment with the asset life cycle
6 3 Setting information requirements and planning for information delivery
7 Project and asset information management functions
7 1 Principles
7 2 Asset information management functions
7 3 Project information management functions
7 4 Task information management functions
8 Delivery team capability and capacity
8 1 Principles
8 2 Extent of capability and capacity review
9 Information container-based collaborative working
10 Information delivery planning
10 1 Principles
10 2 Timing of information delivery
10 3 Responsibility matrix
10 4 Defining the federation strategy and breakdown structure for information containers
11 Managing the collaborative production of information
11 1 Principles
11 2 Level of information need
11 3 Information quality

Table A.3 (continued) : Content of the ISO 19650-1 Document.

Basic Knowledge of BIM	
Project Lifecycle	
Roles& Responsibilities	
BIM Model Dimensions	
LOD	
CDE&Project Delivery	12 Common data environment (CDE) solution and workflow
Collaboration	12 1 Principles
	12 2 The work in progress state
	12 3 The check/review/approve transition
	12 4 The shared state
	12 5 The review/authorize transition
	12 6 The published state
	12 7 The archive state
	12 3 The check/review/approve transition
	12 4 The shared state
	12 5 The review/authorize transition
	12 6 The published state
	12 7 The archive state

Table A.4 : Contents of the Asia – Singapore BIM Guide Version 2 Document.

Basic Knowledge of BIM	SINGAPORE - BIM GUIDE V2
Project Lifecycle	1 Introduction
Roles& Responsibilities	BIM Deliverables
BIM Model Dimensions	BIM Processes (Modelling – Collaboration)
LOD	BIM Professionals (BIM Manager and BIM Coordinator)
CDE&Project Delivery	2. BIM Execution Plan
Collaboration	3. BIM Deliverables
	BIM Elements
	Attributes of BIM Elements
	Model Progression
	BIM vs 2D Practices
	BIM Objective & Responsibility Matrix
	Model Author
	Model Users
	Compensation Expectations
	Other Additional Value-added BIM Services
	4. BIM Modelling and Collaboration
	Individual Dicipline Modelling
	Modelling Guidelines for BIM Elements
	Modelling Guidelines for Regulatory Submission
	Model Orientation
	Model Division and Structure
	Revision Management
	Cross-disciplinary Model Coordination
	Types of Model Coordination
	Model & Documentation Production
	Publishing 2D Drawings
	BIM Exchange Formats
	Documentation after Coordination
	Data Security & Saving
	Quality Assurance and Quality Control
	Workflow of Design-Build Projects
	Workflow of Design-Bid-Build Projects
	4. BIM Professionals

Table A.5 : Contents of the Australia – NATSPEC Document.

Basic Knowledge of BIM
Project Lifecycle
Roles& Responsibilities
BIM Model Dimensions
LOD
CDE&Project Delivery
Collaboration

AUSTRALIA - NATSPEC
Inrtoduction-Project Requirements
Implementation
Procurement Strategies
BIM Responsibilities
Data Reuse
Terms of Use
Open Standards (IFC)
BIM Management Plan (like BEP)
Introduction
Design BMP
Construction BMP
Software Compatibility and Data Flow Testing
BIM Roles and Resonsibilities
Model Sharing
Collaboration Procedures
Requirements for Using BIM
Project Definition, Planning and Pre-design
Architectural Modelling (Design)
Architecture – spatial and material design models (LOD)
Design visualisation for communication and functional analysis
Code checking
Sustainability evaluation
Structural Modelling and Analysis
MEP Modelling and Analysis
Quantity Take-off and Cost Planning
Construction Models
Clash detection/coordination.
Construction system design
Digital fabrication
Planning construction scheduling and sequencing – 4D
Communication of construction scheduling and sequencing
Lift planning
Facilities Management/As-built Models
COBIe/commissioning
Other FM information handover/commissioning systems
Security assessment and disaster planning
3D Models, Formats, and Model Structures
Technology Platform And Software
Modelling Requirements
Types of Model Elements
Model Geographical Location
Points of Reference
Requirements for Modelling space
Meta Data
Space Naming and Coding
Equipment Coding
Additional Modelling Standards
Final BIM Deliverables
File Storage and Security
Requirements for 2D Drawings

Table A.6 : Contents of the New Zealand Handbook Document.

Basic Knowledge of BIM
Project Lifecycle
Roles& Responsibilities
BIM Model Dimensions
LOD
CDE&Project Delivery
Collaboration

NEW ZEALAND - BIM HANDBOOK
Introduction
BIM defined
Purpose of this handbook
Handbook structure
Benefits of adopting BIM processes
BIM in New Zealand
Global BIM
ISO 19650 Parts 1 and 2
BIM and the NZCIC design documentation guidelines
BIM and procurement
BIM Basics
Defination
BIM and Project Management
Legal Implication of BIM
Client Information Requirements
Information
Asset information requirements
Information structure
Information requirements and BIM
Typical BIM workflow
Information delivery cycle
Project BIM brief
Model element authoring schedule
BIM evaluation and response template – pre-contract
Design BIM execution plan
Common Data Environment (CDE)
Construction BIM execution plan
FM/AM plan
Data capture
Modelling and Documentation Practice
Planning the modelling process
Model location and orientation
Naming conventions and structures
Level of Development (LOD
BIM quantity surveying and cost estimation
Model coordination
Model handovers
BIM deliverables
BIM in New Zealand Construction
BIM and Horizontal Infrastructure
Enabling Asset Management
Modelling best practice
Building owners and FM use
Applying BIM to AM – challenges
The move from passive to active BIM
Recommended approach

APPENDIX B

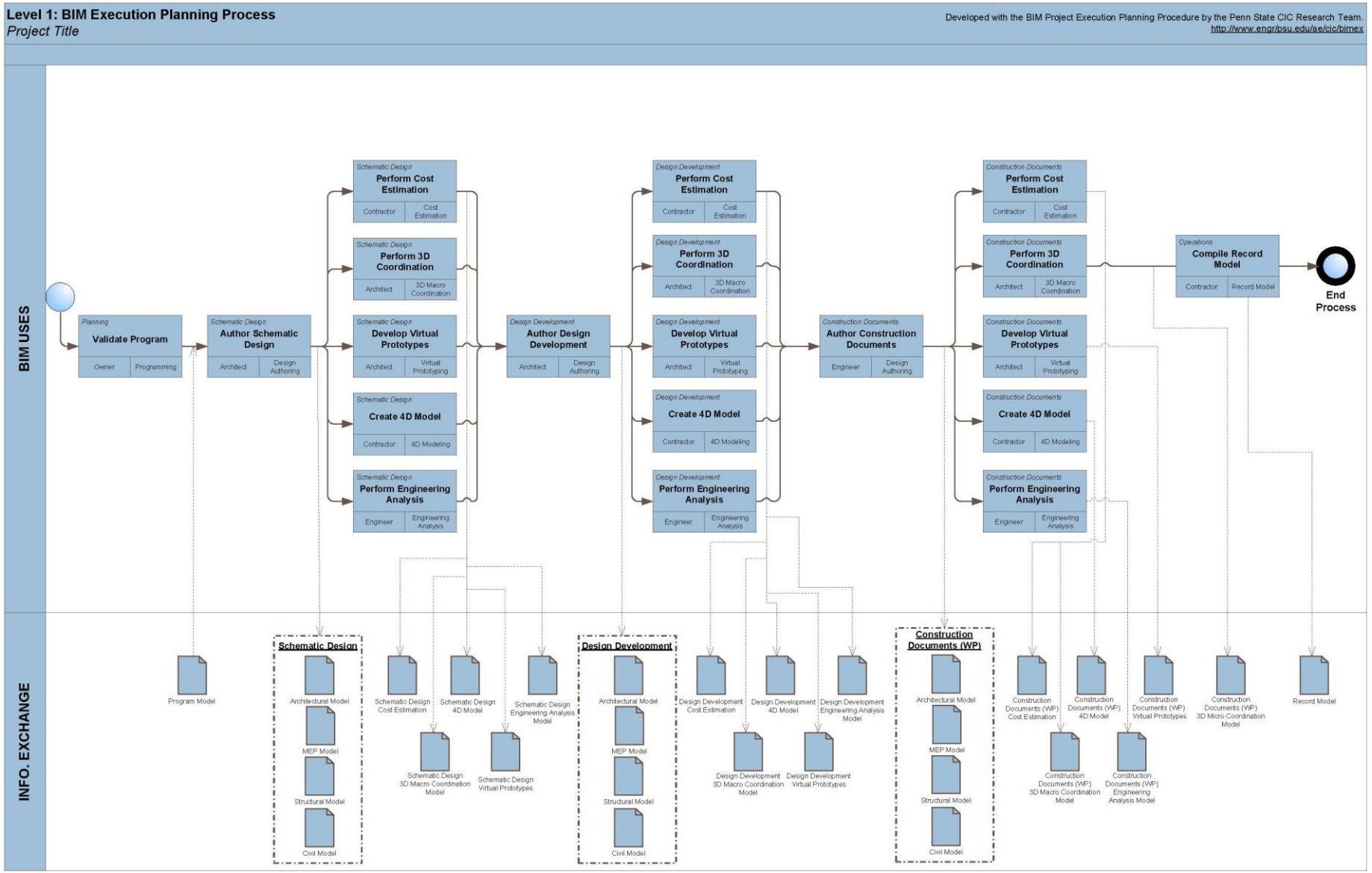


Figure B.1 : Level 1 - BIM Execution Plan Process in NBIMS (NBIMS, 2015).

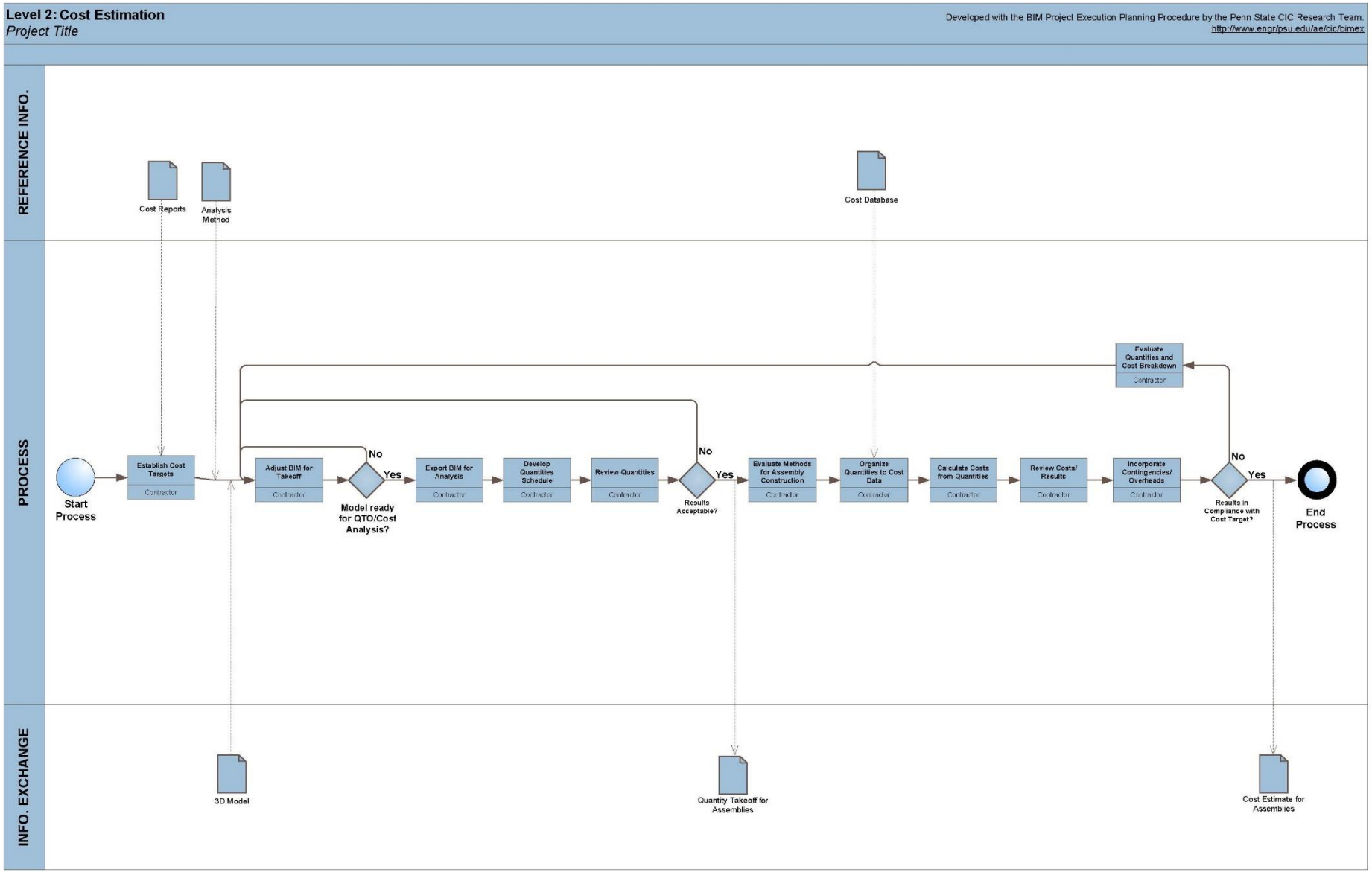


Figure B.2 : Level 2 – Cost Estimation in NBIMS (NBIMS, 2015).

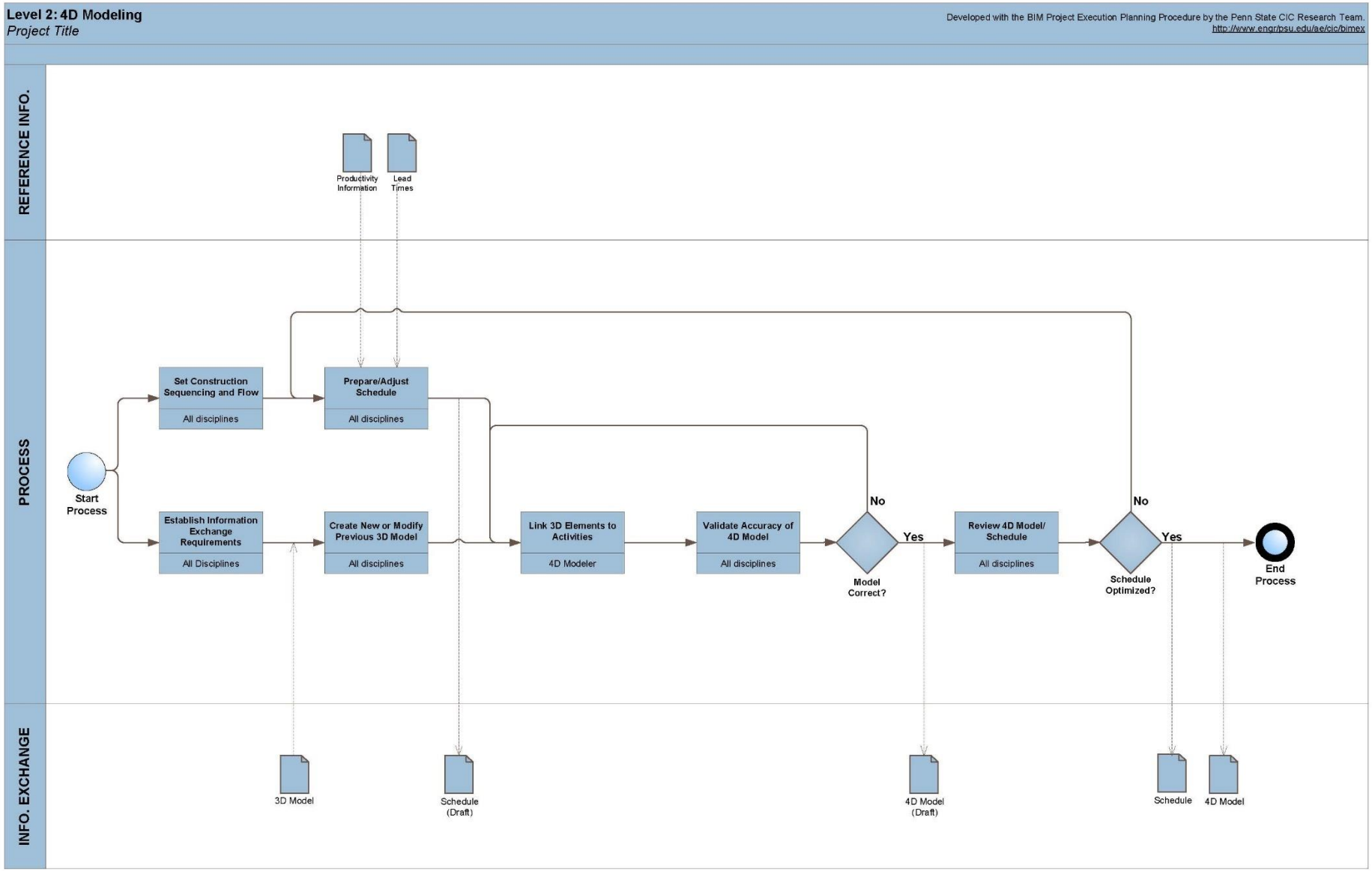


Figure B.3 : Level 2 – 4D Modelling in NBIMS (NBIMS, 2015).

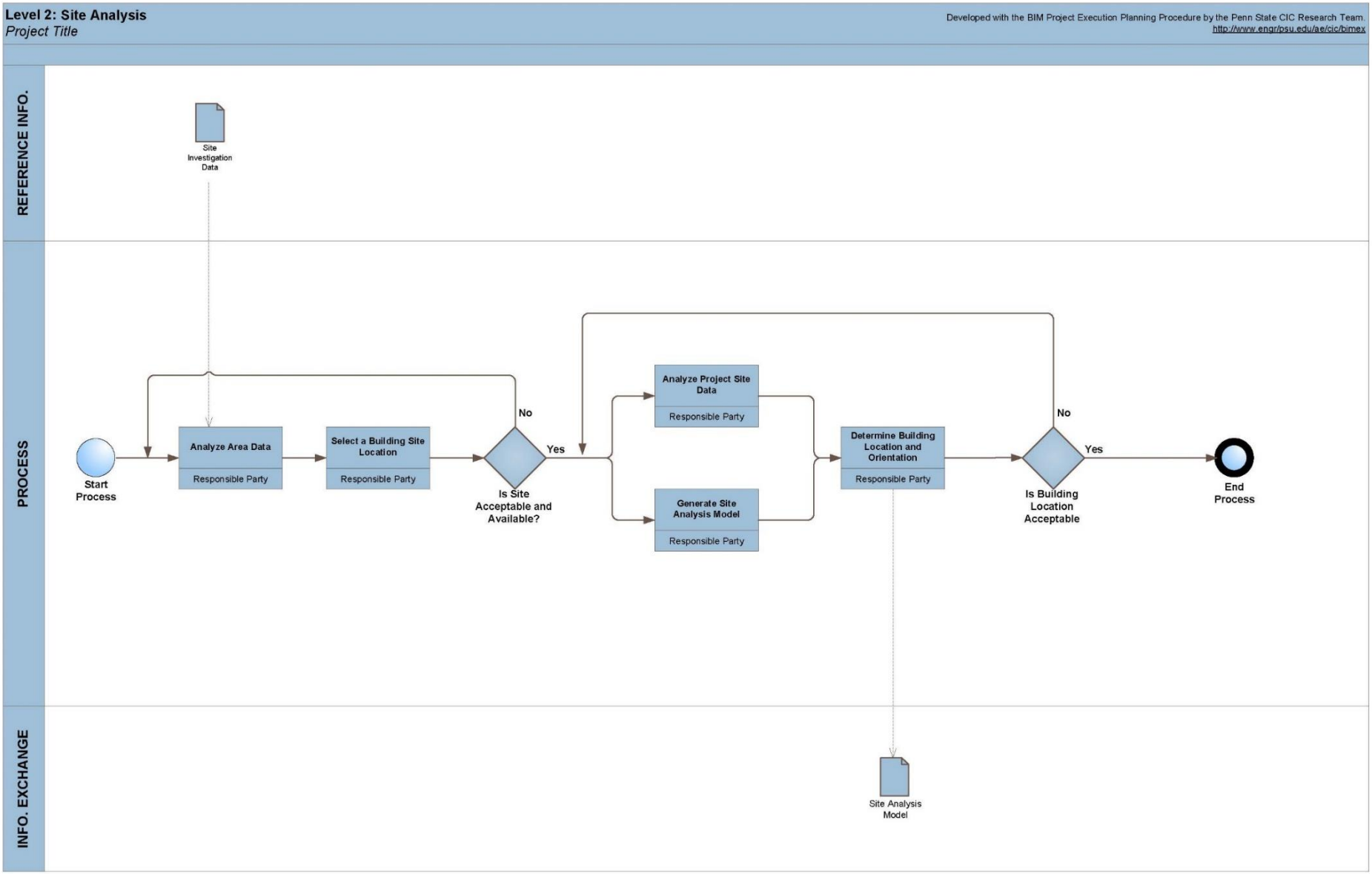


Figure B.4 : Level 2 – Site Analysis in NBIMS (NBIMS, 2015).

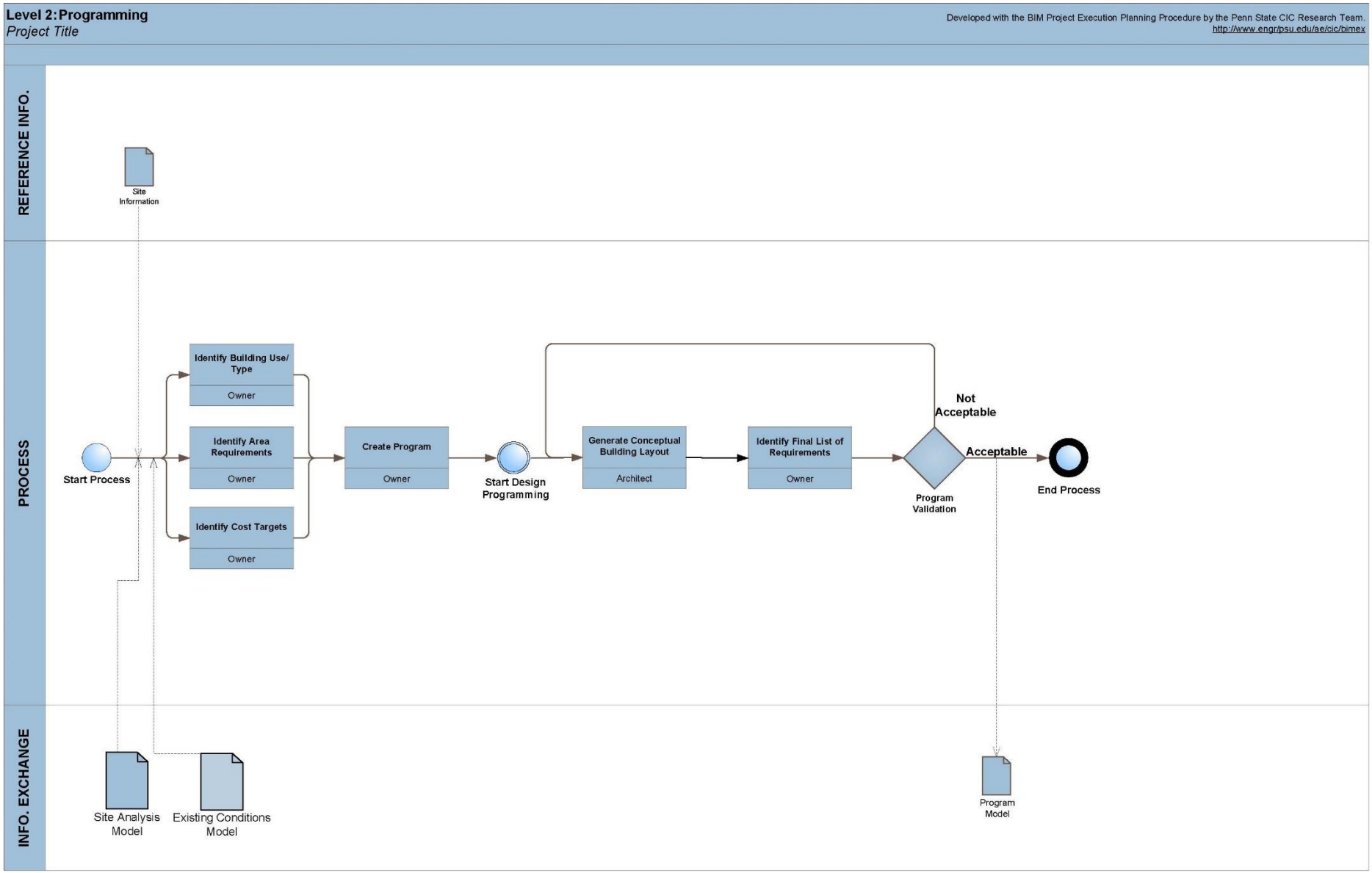


Figure B.5 : Level 2 – Programming in NBIMS (NBIMS, 2015).

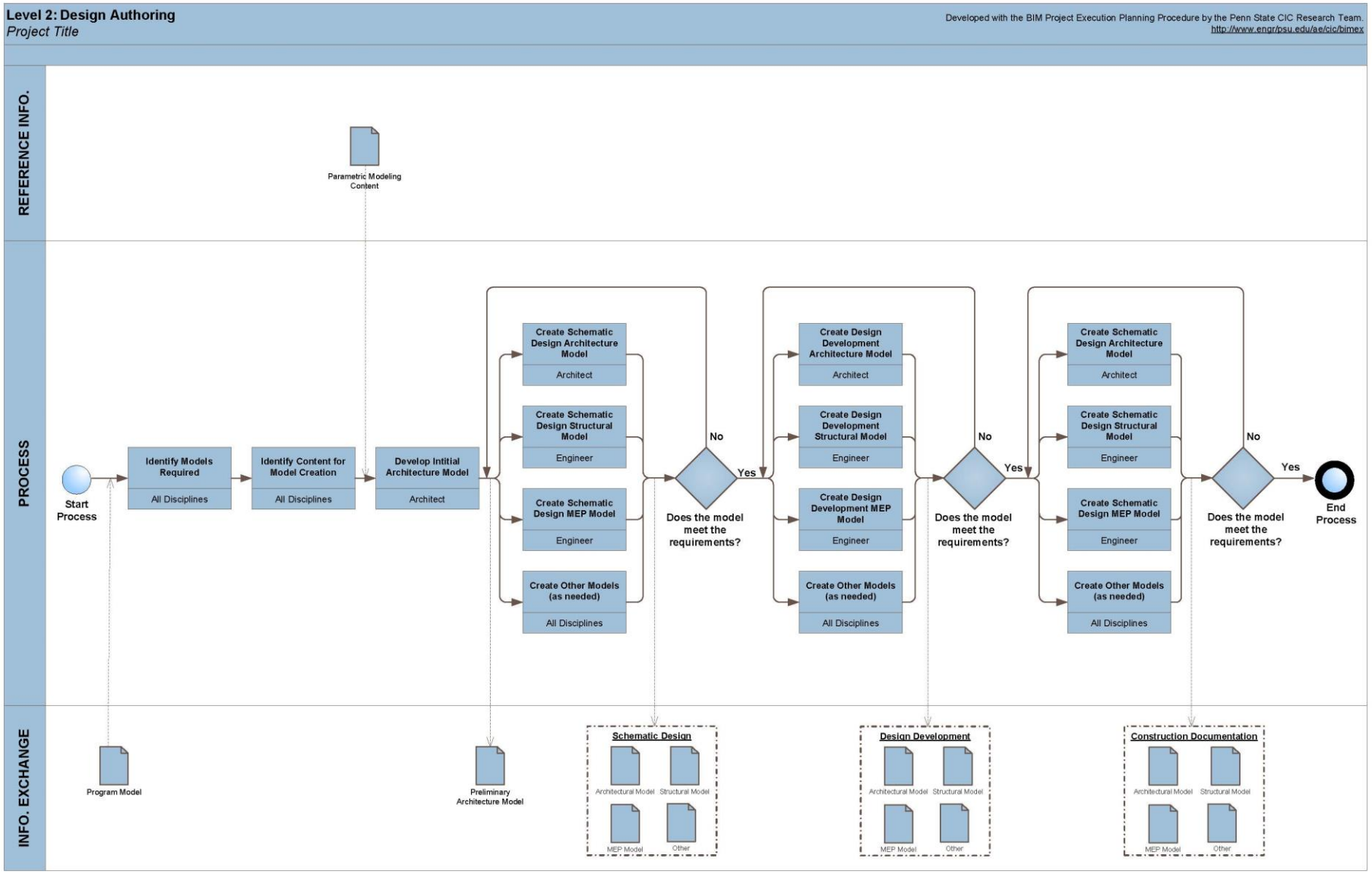


Figure B.6 : Level 2 – Design Authoring in NBIMS (NBIMS, 2015).

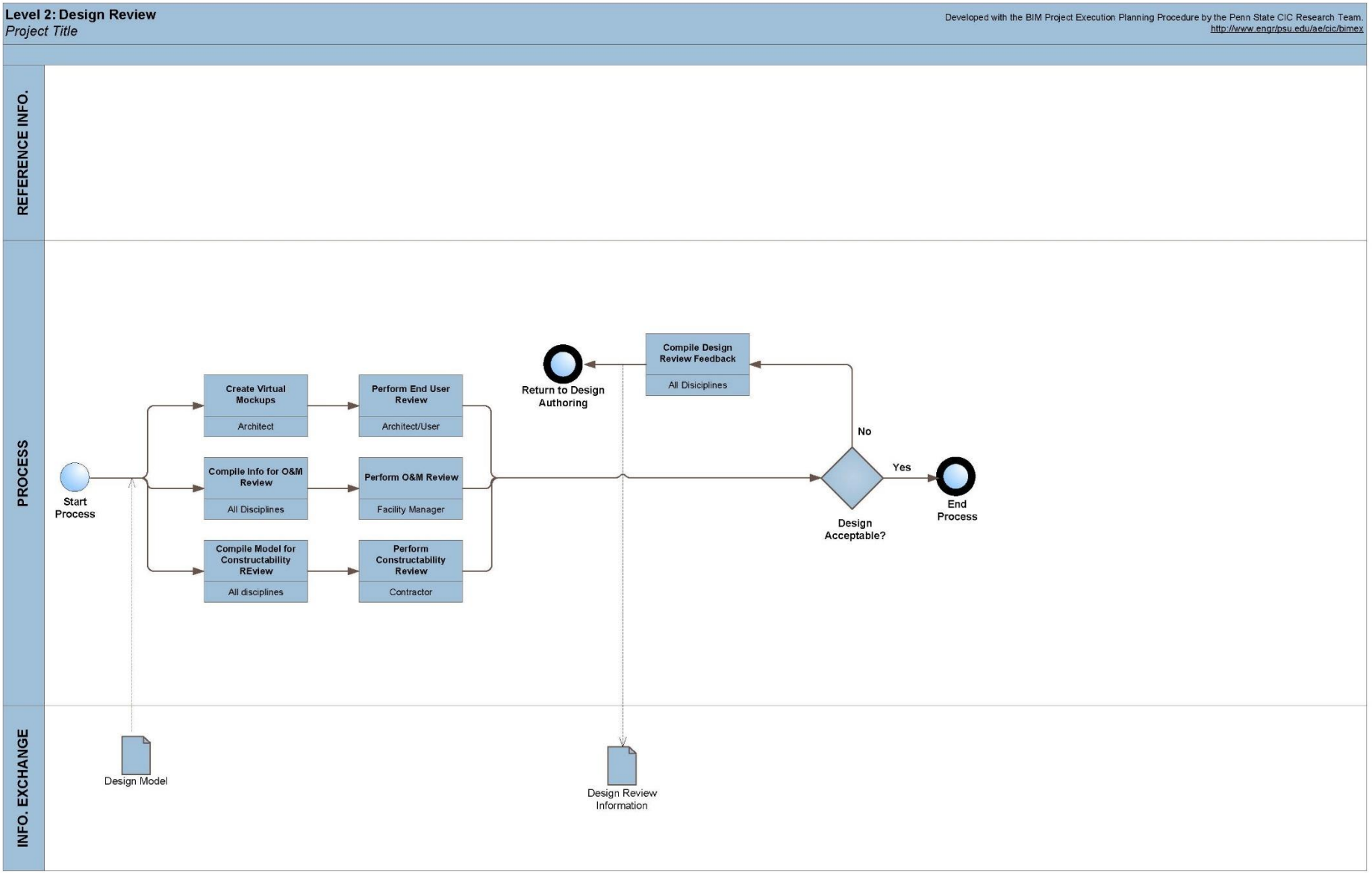


Figure B.7 : Level 2 – Design Review in NBIMS (NBIMS, 2015).

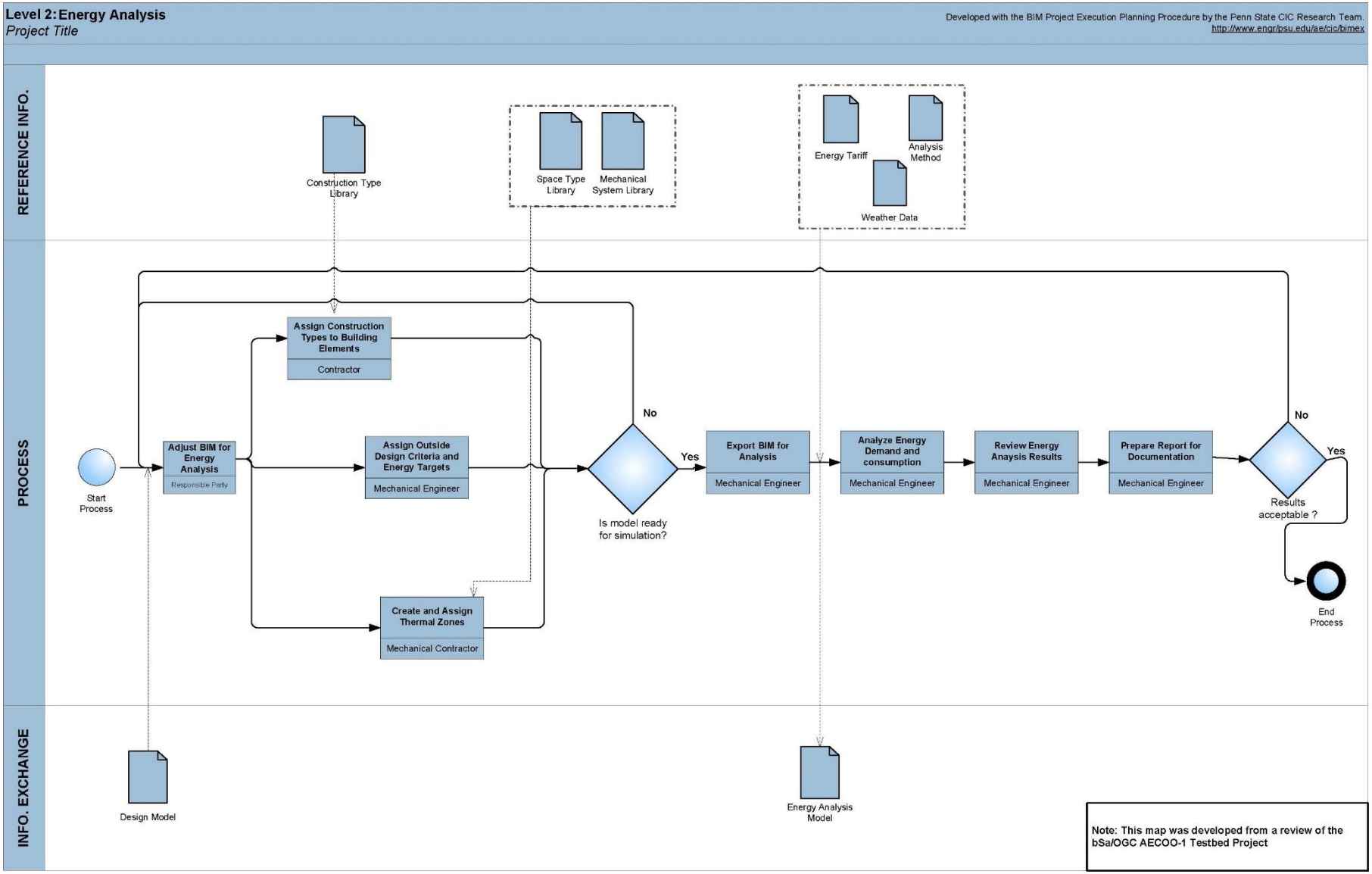


Figure B.8 : Level 2 – Energy Analysis in NBIMS (NBIMS, 2015).

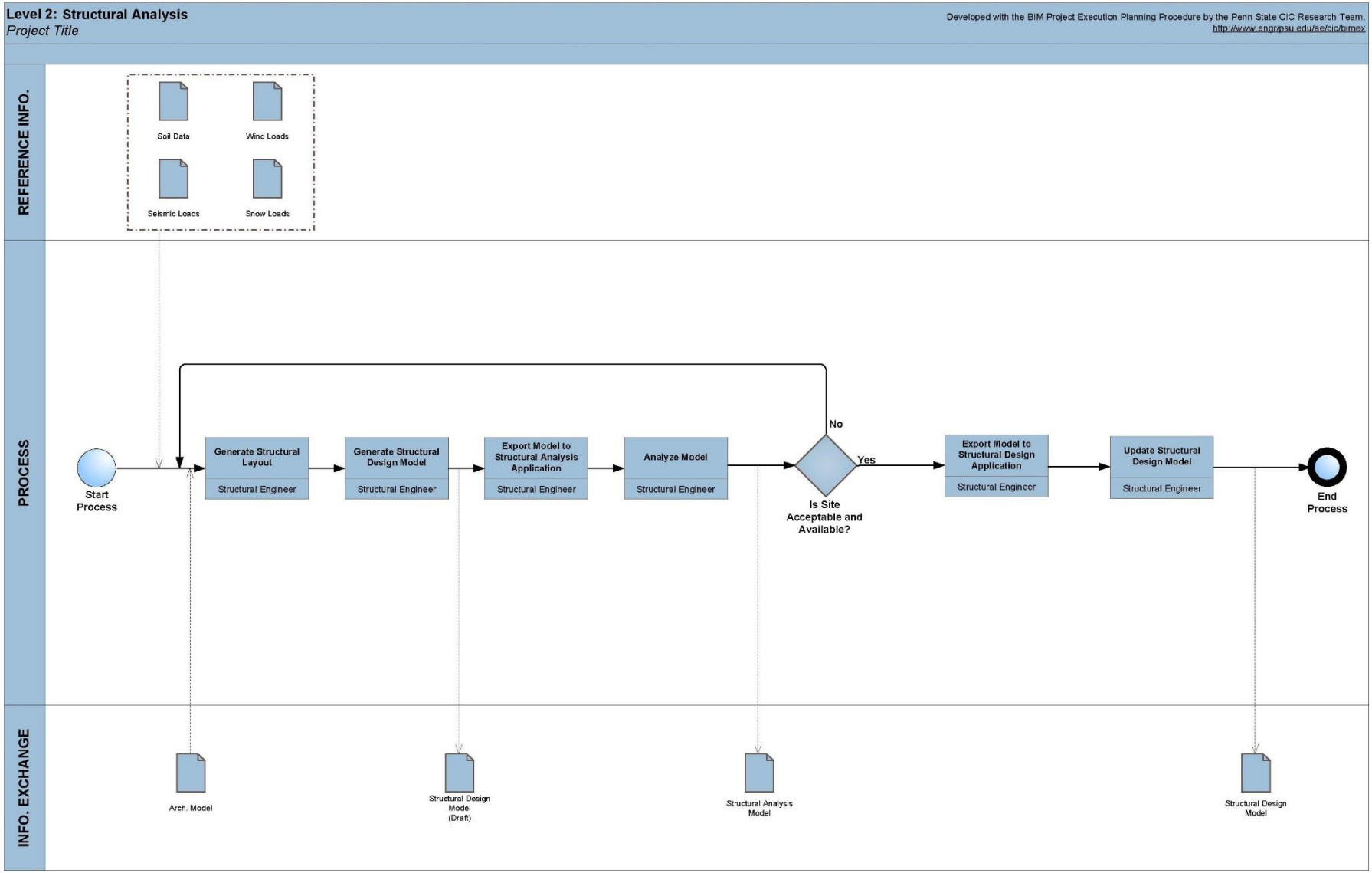


Figure B.9 : Level 2 – Structural Analysis in NBIMS (NBIMS, 2015).

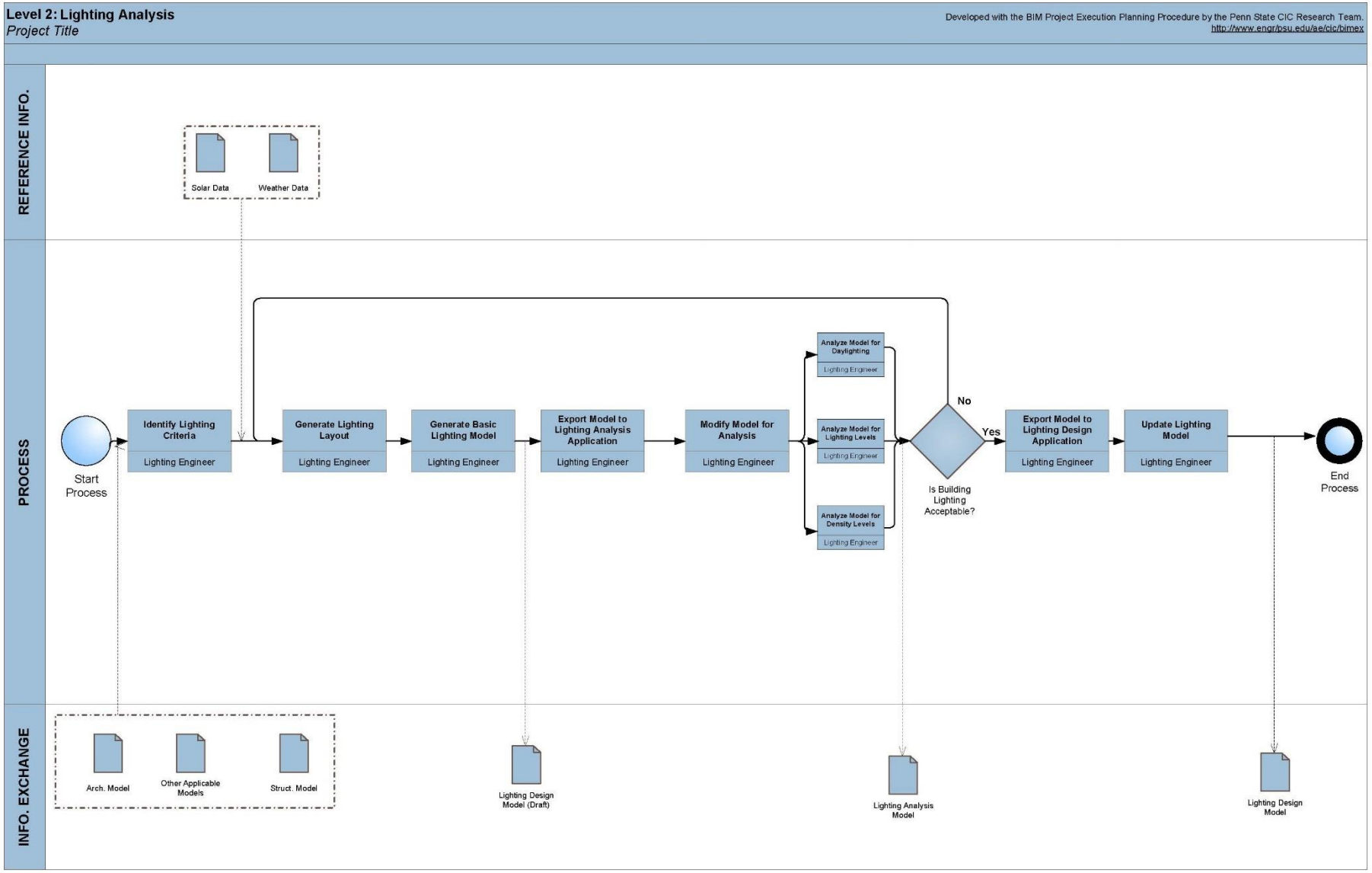


Figure B.10 : Level 2 – Lighting Analysis in NBIMS (NBIMS, 2015).

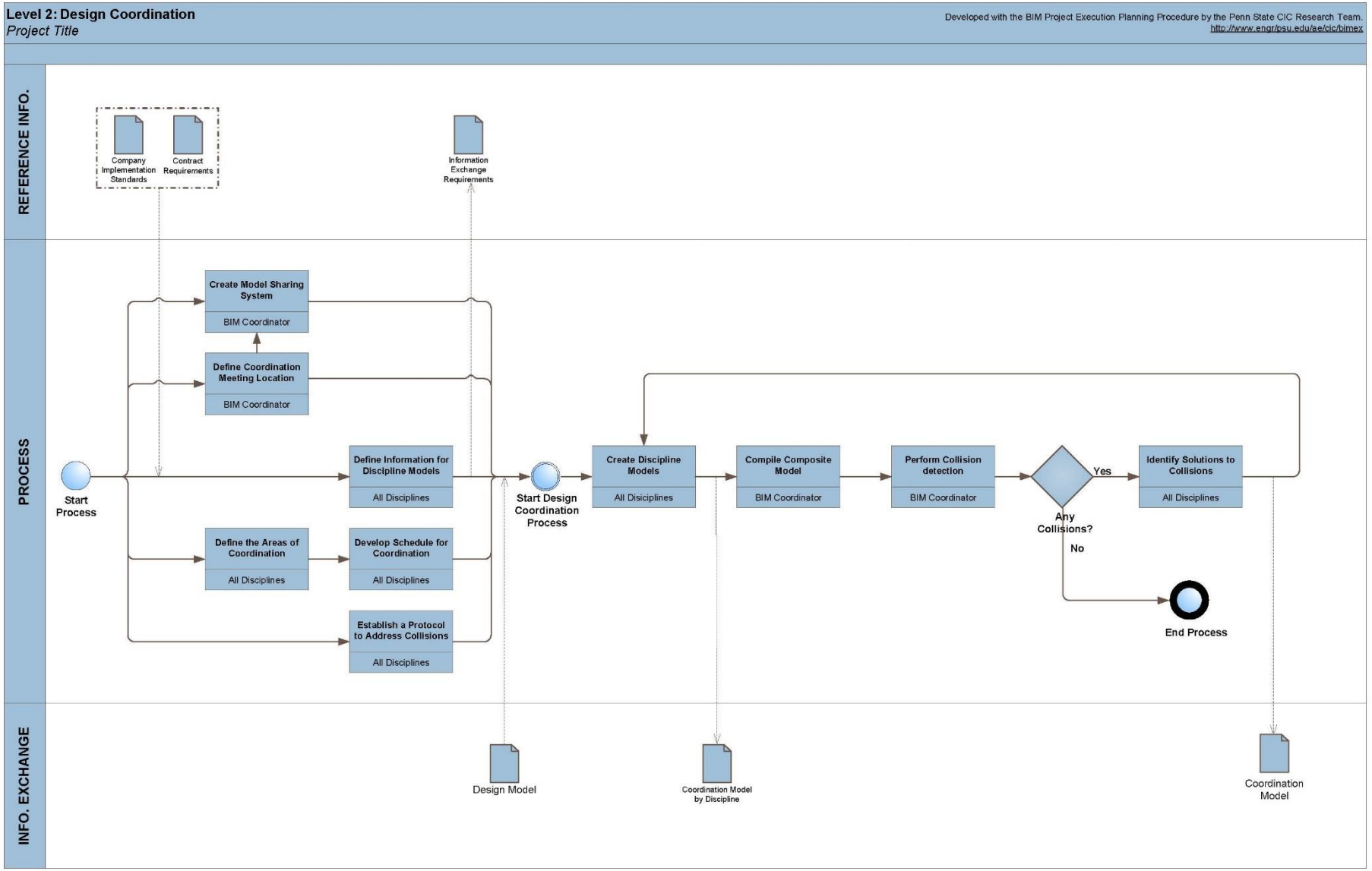


Figure B.11 : Level 2 – Design Coordination in NBIMS (NBIMS, 2015).

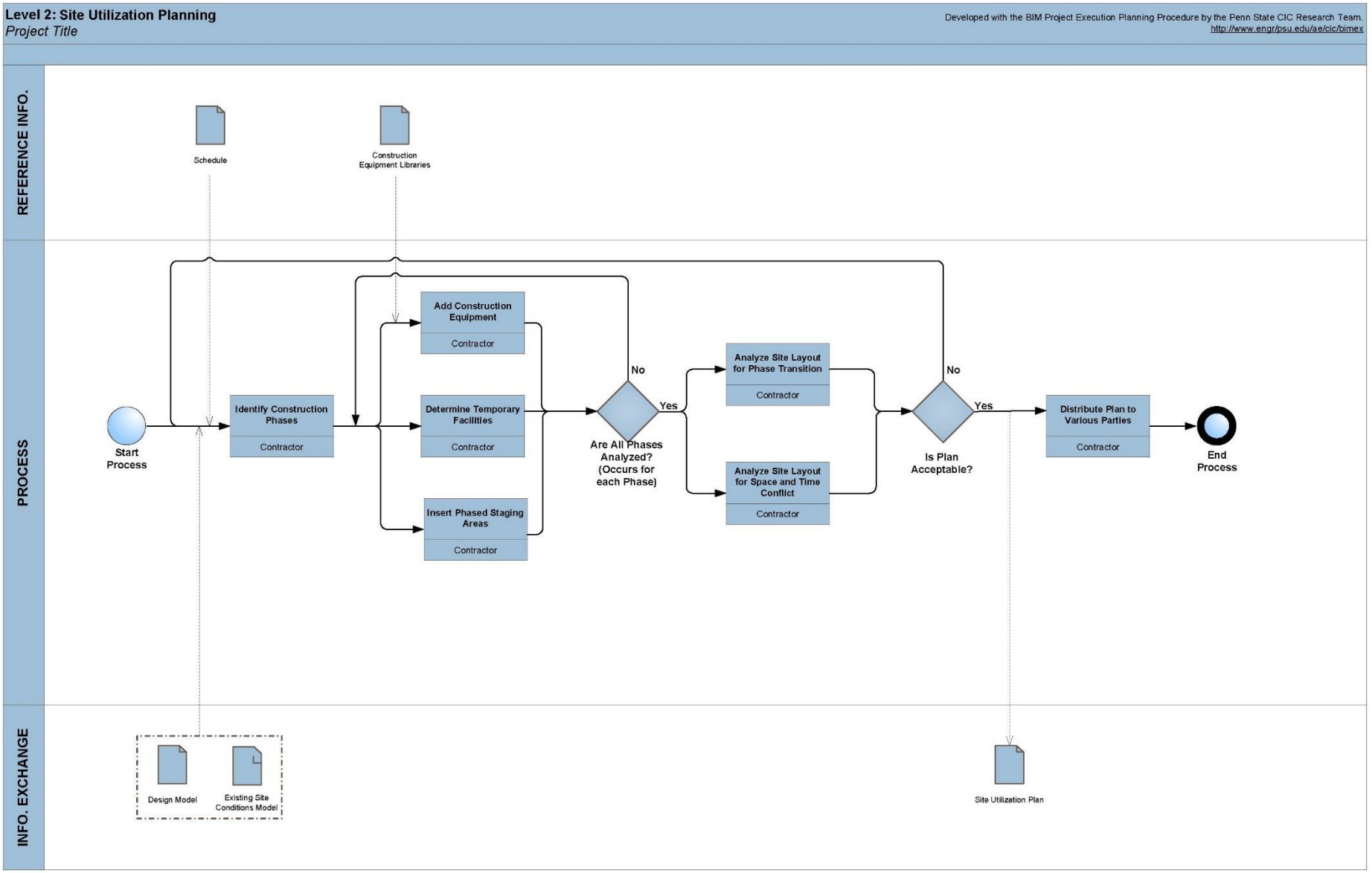


Figure B.12 : Level 2 – Site Utilization Planning in NBIMS (NBIMS, 2015).

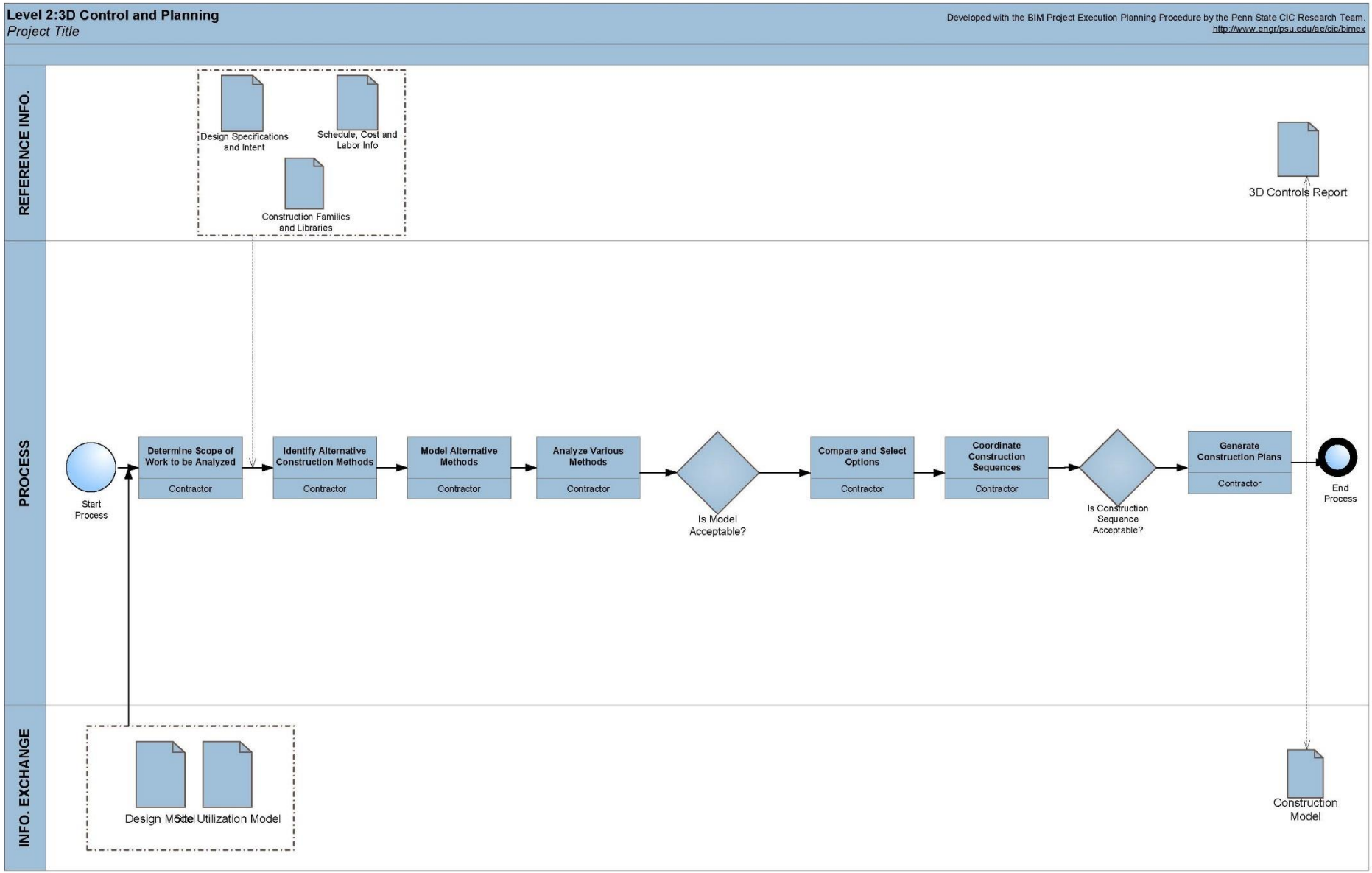


Figure B.13 : Level 2 – Control and Planning in NBIMS (NBIMS, 2015).

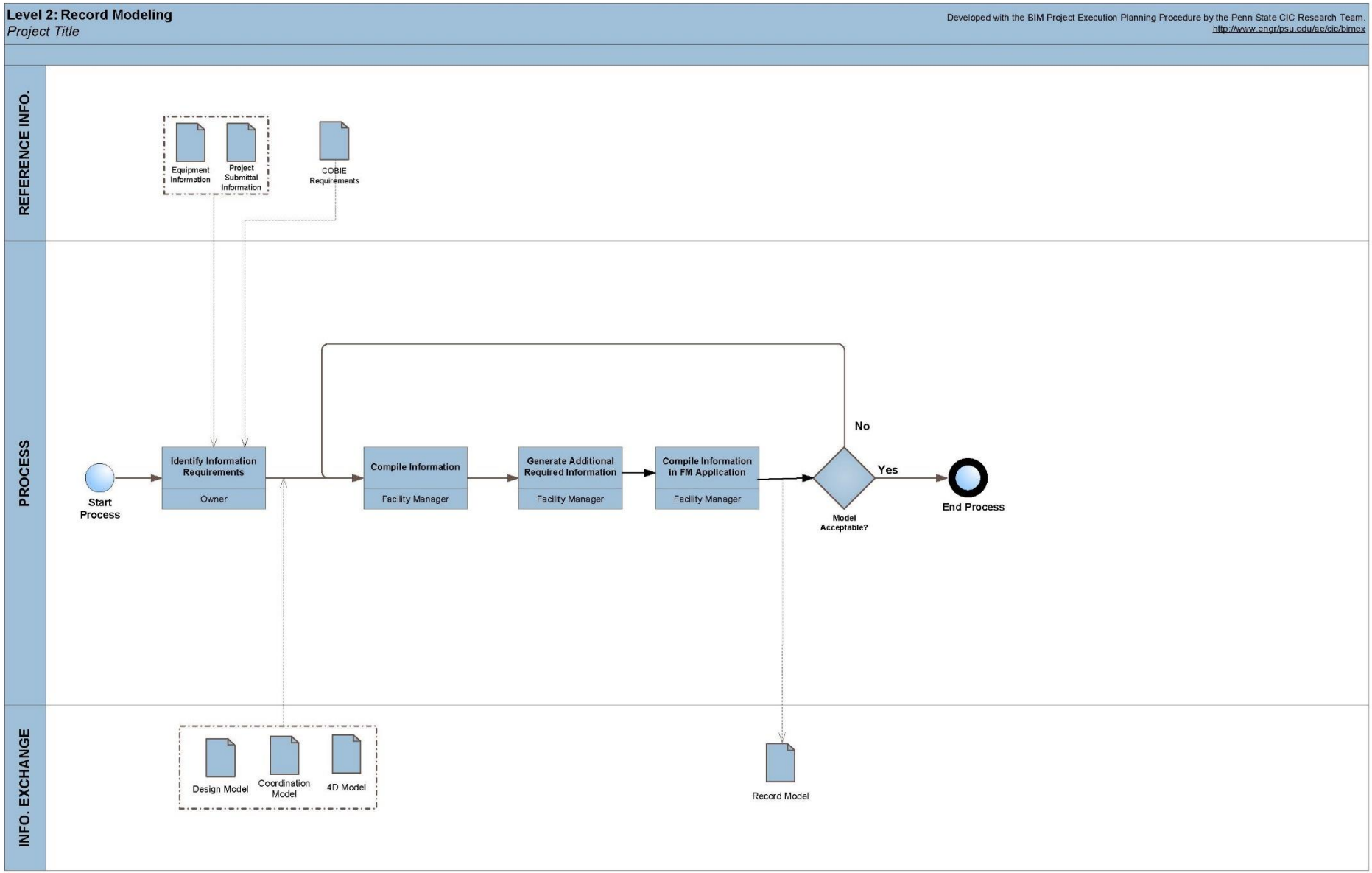


Figure B.14 : Level 2 – Record Modelling in NBIMS (NBIMS, 2015).

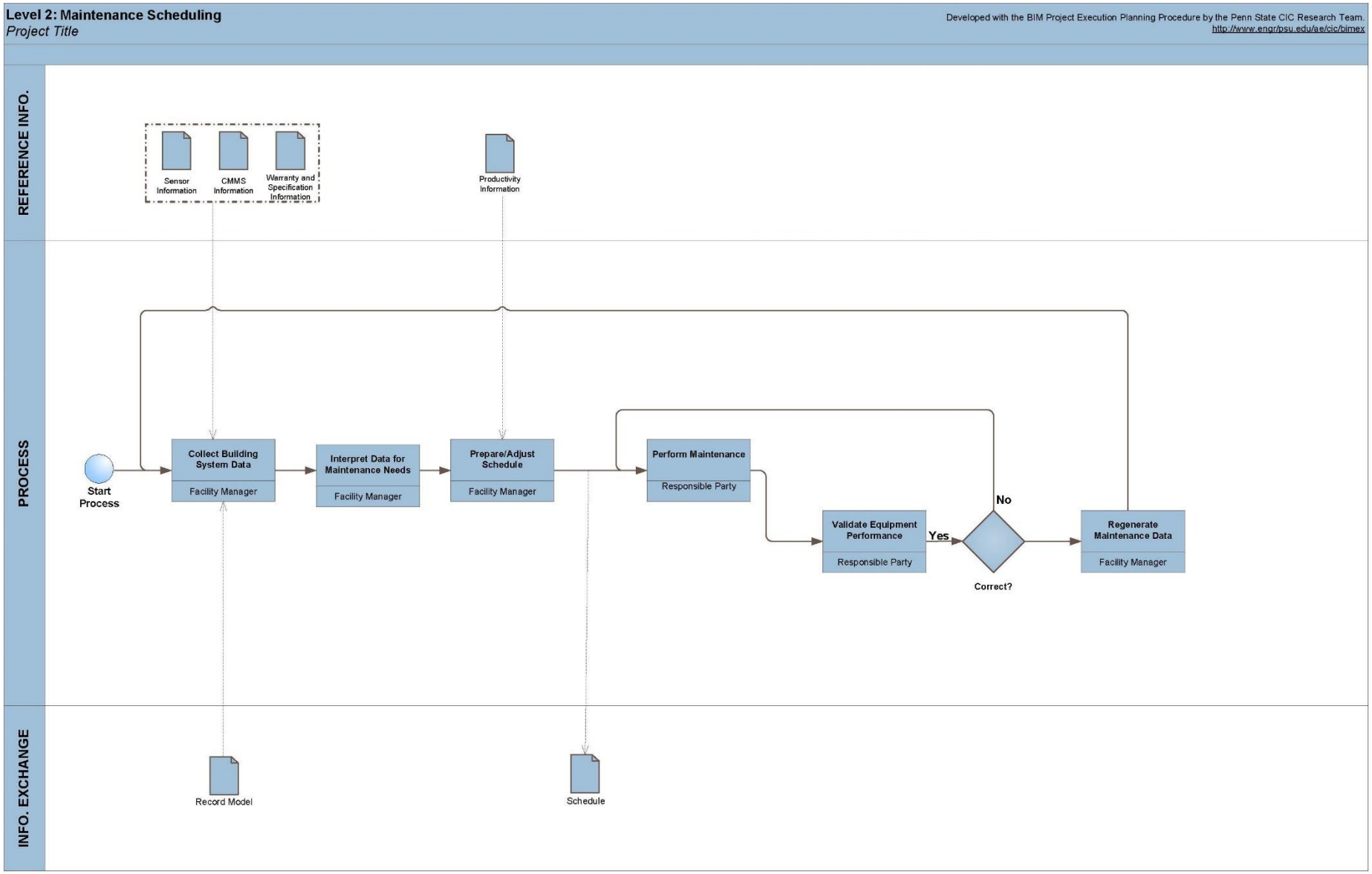


Figure B.15 : Level 2 – Maintenance Scheduling in NBIMS (NBIMS, 2015).

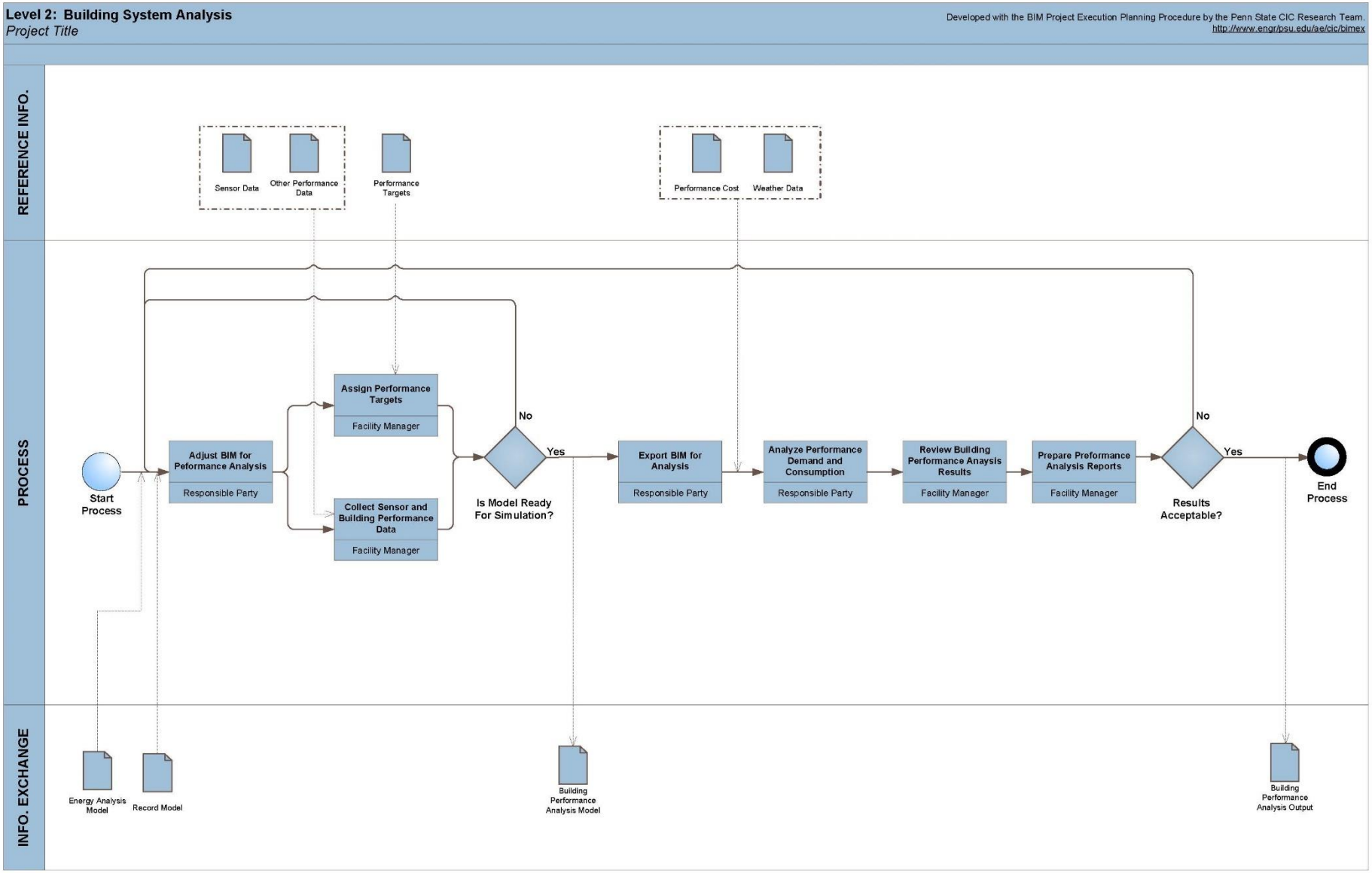
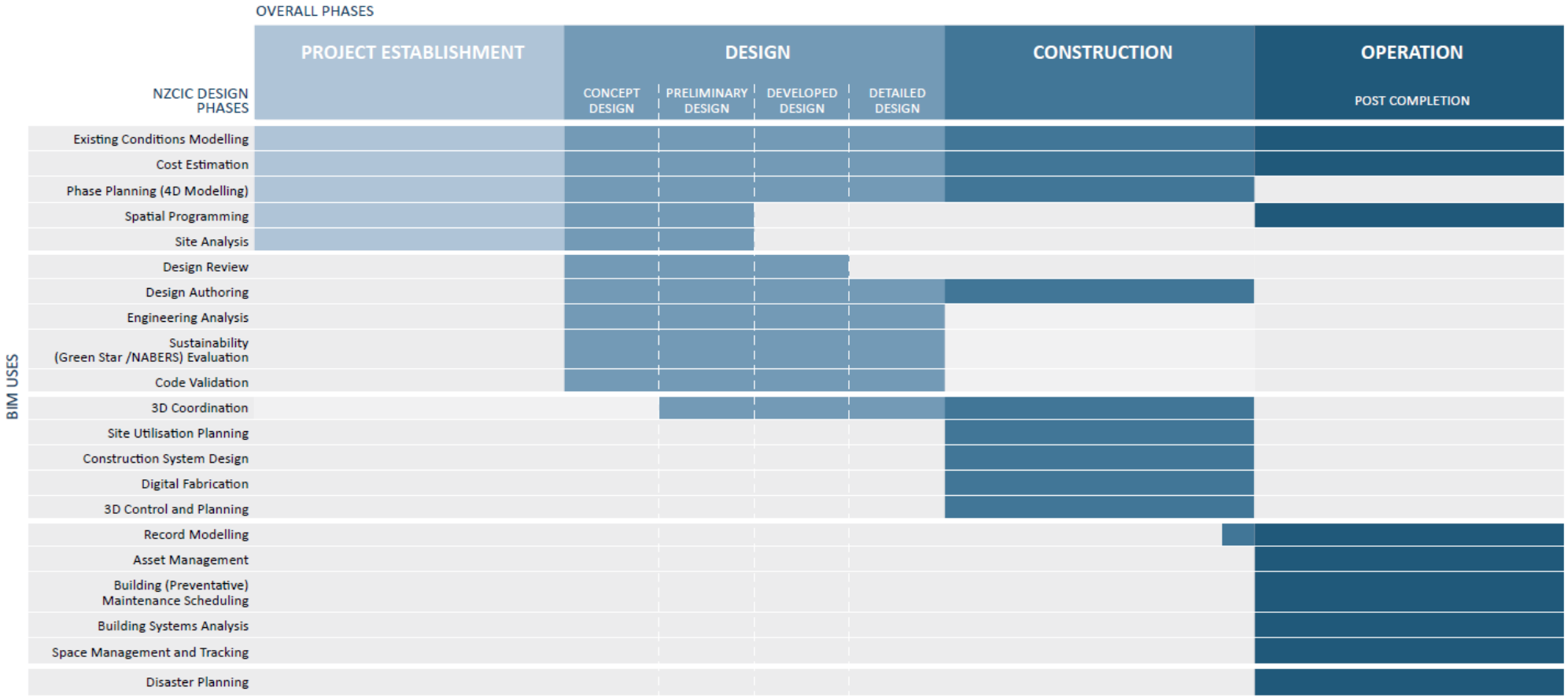


Figure B.16 : Level 2 – Building System Analysis in NBIMS (NBIMS, 2015).

APPENDIX C:

Table C.1 : Table of BIM Uses in New Zealand Handbook (BAC, 2019).



APPENDIX D:

Table D.1 : Table of the Last Curriculum Updates in ITU Architecture Department Undergraduate Program.

2015-2016 / Architecture - Lecture Plan								Changes	2017-2018 / Architecture - Lecture Plan							
1. Semester									**1. Semester**							
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
MAT 103E	Mathematics I	4,0	3,0	2,0	0,0	**5,0**	6,0		MAT 103E	Mathematics I	4,0	3,0	2,0	0,0	**5,0**	6,0
TES 111E	Project I	5,0	2,0	6,0	0,0	**8,0**	8,0		TES 111E	Project I	5,0	2,0	6,0	0,0	**8,0**	8,0
TES 113E	Basic Design and Visual Arts	2,0	0,0	4,0	0,0	**4,0**	3,0		TES 113E	Basic Design and Visual Arts	2,0	0,0	4,0	0,0	**4,0**	3,0
MIM 113/113E	Statik / Statics	2,0	2,0	0,0	0,0	**2,0**	2,5	Change	**MIM 125/125E**	Statik / Statics	**1,5**	**1,0**	**1,0**	0,0	**2,0**	**3,5**
	English Theory I	3,0	0,0	0,0	0,0	**0,0**	3,5	Removing								
TES 112E	Vis.Comm.I:Visualiz.&Tch.Drw.	3,0	2,0	2,0	0,0	**4,0**	4,0		TES 112E	Vis.Comm.I:Visualiz.&Tch.Drw.	3,0	2,0	2,0	0,0	**4,0**	4,0
								Adding	MIM 119/119E	Mimarlığa Giriş ve Etik / Int.to Architecture and Ethics	2,0	1,0	2,0	0,0	**3,0**	5,5
								Adding	DAN 101	Akademik Danışmanlık	1,0	0,0	2,0	0,0	**2,0**	1,0
Total		**16,0**	**7,0**	**12,0**	**0,0**	**19,0**	**23,0**		Total		**18,5**	**9,0**	**19,0**	**0,0**	**28,0**	**31,0**
	1thSemesterElectiveTheory(ITB)	3,0					4,0	Removing								
2. Semester									**2. Semester**							
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
BIL 101E	Int to Comp and Inf Systems	1,5	1,0	0,0	1,0	**2,0**	2,5	Removing								
TES 121E	Project II	5,0	2,0	6,0	0,0	**8,0**	8,0		TES 121E	Project II	5,0	2,0	6,0	0,0	**8,0**	8,0
MIM 103/103E	Mukavemet / Strenght of Materials	2,0	2,0	0,0	0,0	**2,0**	3,0	Change	**MIM 126/126E**	Mukavemet / Strenght of Materials	**1,5**	**1,0**	**1,0**	0,0	**2,0**	**3,5**
MIM 162 /162E	Yapı Bilgisine Giriş / Intr.to Building Construction	2,0	2,0	0,0	0,0	**2,0**	2,0	Removing								
MIM 122/122E	İlkçağ & Bizans Mimarl Tarihi / Ancient&Byzantine Architecture	2,0	2,0	0,0	0,0	**2,0**	4,0		MIM 122/122E	İlkçağ & Bizans Mimarl Tarihi / Ancient&Byzantine Architecture	2,0	2,0	0,0	0,0	**2,0**	4,0
	English Theory II	3,0	0,0	0,0	0,0	**0,0**	3,5	Removing								
TES 122E	Vis.CommII:Visualization&Persp	3,0	2,0	2,0	0,0	**4,0**	4,0		TES 122E	Vis.CommII:Visualization&Persp	3,0	2,0	2,0	0,0	**4,0**	4,0
MIM 114/114E	Erişilebilirlik / Accessibility	2,0	2,0	0,0	0,0	**2,0**	2,0		MIM 114/114E	Erişilebilirlik / Accessibility	2,0	2,0	0,0	0,0	**2,0**	2,0
								Adding	MIM 120E	Int.toCmp.Ds.Tools&Mth.inArch.	2,0	1,0	2,0	0,0	**3,0**	4,0
								Adding	ING 112	English I	3,0	3,0	0,0	0,0	**3,0**	3,5
Total		**20,5**	**13,0**	**8,0**	**1,0**	**22,0**	**29,0**		Total		**18,5**	**13,0**	**11,0**	**0,0**	**24,0**	**29,0**
3. Semester									**3. Semester**							
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
ING 201	English III	3,0	3,0	0,0	0,0	**3,0**	3,5		ING 201	English III	3,0	3,0	0,0	0,0	**3,0**	3,5
MIM 221/221E	Türk Mimarlık Tarihi / Hstry of Turkish Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0		MIM 221/221E	Türk Mimarlık Tarihi / Hstry of Turkish Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0
TES 211E	Project III	5,0	2,0	6,0	0,0	**8,0**	8,0		TES 211E	Project III	5,0	2,0	6,0	0,0	**8,0**	8,0
MIM 231/231E	Yapı Malzemesi / Building Materials	3,0	2,0	2,0	0,0	**4,0**	6,0		MIM 231/231E	Yapı Malzemesi / Building Materials	3,0	2,0	2,0	0,0	**4,0**	6,0
MIM 271 / 271E	Yapı Statiği / Theory of Structures	1,5	1,0	1,0	0,0	**2,0**	2,0		MIM 271 / 271E	Yapı Statiği / Theory of Structures	1,5	1,0	1,0	0,0	**2,0**	2,0
MIM 263/263E	Yapı ve Yapım Yöntemleri / Building Construction Methods	3,0	2,0	2,0	0,0	**4,0**	5,0	Change	**MIM 203/203E**	**Mimarlıkta Yapı ve Yapım / Building and Const inArch.**	**3,5**	**3,0**	**1,0**	0,0	**4,0**	5,0
MIM 253/253E	Çelik Yapılar / Steel Structures	1,5	1,0	1,0	0,0	**2,0**	2,5		MIM 253/253E	Çelik Yapılar / Steel Structures	1,5	1,0	1,0	0,0	**2,0**	2,5
Total		**19,0**	**13,0**	**12,0**	**0,0**	**25,0**	**30,0**		Total		**19,5**	**14,0**	**11,0**	**0,0**	**25,0**	**30,0**
4. Semester									**4. Semester**							
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
MIM 222/222E	Avrupa Mimarlık Tarihi / Histry of Europn Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0		MIM 222/222E	Avrupa Mimarlık Tarihi / Histry of Europn Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0
MIM 232/231E	Betonarme Yapılar / Reinforced Concrete Structures	3,0	2,0	2,0	0,0	**4,0**	4,0	Change	**MIM 234/234E**	Betonarme Yapılar / Reinforced Concrete Structures	3,0	2,0	2,0	0,0	**4,0**	**3,0**
MIM 212/212E	Mimari Proje IV / Architectural Design IV	5,0	2,0	6,0	0,0	**8,0**	8,0		MIM 212/212E	Mimari Proje IV / Architectural Design IV	5,0	2,0	6,0	0,0	**8,0**	8,0
MIM 244/244E	Yapı Elemanları Tasarımı / Building Element Design	2,5	1,0	3,0	0,0	**4,0**	4,0	Change	**MIM 204/204E**	Yapı Elemanları Tasarımı / Building Element Design	**4,0**	**3,0**	**2,0**	0,0	**5,0**	**6,0**
MIM 242/242E	Çevre Kontrolü Stüdyosu / Environmental Control Studio	5,0	2,0	6,0	0,0	**8,0**	7,0	Change	**MIM 246/246E**	Çevre Kontrolü Stüdyosu / Environmental Control Studio	5,0	2,0	6,0	0,0	**8,0**	**6,0**
Total		**17,5**	**9,0**	**17,0**	**0,0**	**26,0**	**26,0**		Total		**19,0**	**11,0**	**16,0**	**0,0**	**27,0**	**26,0**
	4.yy Seçime Bağlı Theory I(MT) / 4th Elective Theory (MT)	3,0					4,0			4.yy Seçime Bağlı Theory I(MT) / 4th Elective Theory (MT)	3,0					4,0

Table D.1 (continued) : Table of the Last Curriculum Updates in ITU Architecture Department Undergraduate Program.

5. Semester									5. Semester								
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
EKO 201/201E	Ekonomi / Economics	3,0	3,0	0,0	0,0	**3,0**	4,0		EKO 201/201E	Ekonomi / Economics	3,0	3,0	0,0	0,0	**3,0**	4,0
MIM 351/351E	Mimari Proje V / Architectural Design V	5,0	2,0	6,0	0,0	**8,0**	8,0		MIM 351/351E	Mimari Proje V / Architectural Design V	5,0	2,0	6,0	0,0	**8,0**	8,0
TUR 101	Türk Dili I	2,0	2,0	0,0	0,0	**2,0**	2,0		TUR 101	Türk Dili I	2,0	2,0	0,0	0,0	**2,0**	2,0
MIM 331/331E	Yapım Sistemleri / Building Production Systems	2,0	2,0	0,0	0,0	**2,0**	4,0	Change	**MIM 333/333E**	Yapım Sistemleri / Building Production Systems	2,0	2,0	0,0	0,0	**2,0**	**3,0**
MIM 321/321E	Çağdaş Mimarlık / Contemporary Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0		MIM 321/321E	Çağdaş Mimarlık / Contemporary Architecture	2,0	2,0	0,0	0,0	**2,0**	3,0
MIM 341/341E	Şehircilik ve İmar Hukuku / Urbanism and Planning Law	3,0	2,0	2,0	0,0	**4,0**	5,0	Change	**MIM 343/343E**	Şehircilik ve İmar Hukuku / Urbanism and Planning Law	3,0	2,0	2,0	0,0	**4,0**	**4,0**
MIM 322/322E	Tarihi Çevre Koruma & Restr / Conserv.of Hist. Build.&Sites	2,0	2,0	0,0	0,0	**2,0**	4,0		MIM 322/322E	Tarihi Çevre Koruma & Restr / Conserv.of Hist. Build.&Sites	2,0	2,0	0,0	0,0	**2,0**	4,0
								Adding	MIM 305/305E	İstatistik / Statistics	2,0	1,0	2,0	0,0	**3,0**	3,0
Total		**19,0**	**15,0**	**8,0**	**0,0**	**23,0**	**30,0**		Total		**21,0**	**16,0**	**10,0**	**0,0**	**26,0**	**31,0**
6. Semester									**6. Semester**								
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
MIM 312/312E	Mimari Proje VI / Architectural Design VI	5,0	2,0	6,0	0,0	**8,0**	8,0		MIM 312/312E	Mimari Proje VI / Architectural Design VI	5,0	2,0	6,0	0,0	**8,0**	8,0
TUR 102	Türk Dili II	2,0	2,0	0,0	0,0	**2,0**	2,0		TUR 102	Türk Dili II	2,0	2,0	0,0	0,0	**2,0**	2,0
MIM 332/332E	Yapım Yönetimi ve Ekonomisi / Construction Mngmnt & Economy	4,0	3,0	2,0	0,0	**5,0**	6,0		**MIM 359/359E**	Yapım Yönetimi ve Ekonomisi / Construction Mngmnt & Economy	4,0	3,0	2,0	0,0	**5,0**	**5,0**
MIM 421/421E	Rölöve ve Restorasyon Stüdyosu / Archtctrl Survey & Restrtn Std	3,0	2,0	2,0	0,0	**4,0**	6,0	Change	**MIM 361/361E**	Rölöve ve Restorasyon Stüdyosu / Archtctrl Survey & Restrtn Std	3,0	2,0	2,0	0,0	**4,0**	**5,0**
								Adding	DAN 301	Kariyer Danışanlığı	1,0	0,0	2,0	0,0	**2,0**	1,0
Total		**14,0**	**9,0**	**10,0**	**0,0**	**19,0**	**22,0**		Total		**15,0**	**9,0**	**12,0**	**0,0**	**21,0**	**21,0**
	6.yy Seçime Bağlı Theory I(MT)/6th Elective Theory I (MT)	3,0					4,0			6.yy Seçime Bağlı Theory I(MT)/6th Elective Theory I (MT)	3,0					4,0
	6.yy Seçime Bağlı Theory I(MT)/6th Elective Theory I (MT)	3,0					4,0			6.yy Seçime Bağlı Theory I(MT)/6th Elective Theory I (MT)	3,0					4,0
7. Semester									**7. Semester**								
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
ATA 101	Atatürk İlk & İnkılap Trh I	2,0	2,0	0,0	0,0	**2,0**	2,0		ATA 101	Atatürk İlk & İnkılap Trh I	2,0	2,0	0,0	0,0	**2,0**	2,0
MIM 411/411E	Mimari Proje VII / Architectural Design VII	5,0	2,0	6,0	0,0	**8,0**	8,0		MIM 411/411E	Mimari Proje VII / Architectural Design VII	5,0	2,0	6,0	0,0	**8,0**	8,0
MIM 431/431E	Uygulama Projesi / Construction Project	5,0	2,0	6,0	0,0	**8,0**	8,0	Change	**MIM 484/484E**	Uygulama Projesi / Construction Project	5,0	2,0	6,0	0,0	**8,0**	**12,0**
Total		**12,0**	**6,0**	**12,0**	**0,0**	**18,0**	**18,0**		Total		**12,0**	**6,0**	**12,0**	**0,0**	**18,0**	**22,0**
	7.yy Seçime Bağlı Theory I(MT)/7th Elective Theory I (MT)	3,0					4,0			7.yy Seçime Bağlı Theory I(MT)/7th Elective Theory I (MT)	3,0					4,0
	7.yy Seçime Bağlı Theory II (MT)/7th Elective Theory II (MT)	3,0					4,0			7.yy Seçime Bağlı Theory II (MT)/7th Elective Theory II (MT)	3,0					4,0
8. Semester									**8. Semester**								
Code	**Name**	**Credit**	**Theor**	**App.**	**Lab.**	**Hour**	**AKTS**		**Code**	**Name**	**Credit**	**Theory**	**App.**	**Lab.**	**Hour**	**AKTS**
ATA 102	Atatürk İlk & İnkılap Trh II	2,0	2,0	0,0	0,0	**2,0**	2,0		ATA 102	Atatürk İlk & İnkılap Trh II	2,0	2,0	0,0	0,0	**2,0**	2,0
MIM 492/492E	Bitirme Çalışması / Graduation Project	3,0	0,0	6,0	0,0	**6,0**	16,0	Change	**MIM 4902/4902E**	**Diploma Projesi / Diploma Project**	3,0	0,0	6,0	0,0	**6,0**	**12,0**
Total		**5,0**	**2,0**	**6,0**	**0,0**	**8,0**	**18,0**		Total		**5,0**	**2,0**	**6,0**	**0,0**	**8,0**	**14,0**
	8.yy Seçime Bağlı Theory I (MT)/8th Elective Theory I (MT)	3,0					4,0			8.yy Seçime Bağlı Theory I (MT)/8th Elective Theory I (MT)	3,0					4,0
	8.yy Seçime Bağlı Theory II (MT)/8th Elective Theory I (ITB)	3,0					4,0			8.yy Seçime Bağlı Theory II (MT)/8th Elective Theory I (ITB)	3,0					4,0
	8.yy Seçime Bağlı Theory II (MT)/8th Elective Theory II (MT)	3,0					4,0			8.yy Seçime Bağlı Theory II (MT)/8th Elective Theory II (MT)	3,0					4,0
	8.yy Seçime Bağlı Theory III (MT)/8th Elective Theory III (MT)	3,0					4,0			8.yy Seçime Bağlı Theory II (ITB)/8th Elective Theory II (ITB)	3,0					4,0

APPENDIX E:

Table E.1 : Table of the Current Curriculum Courses' Content.

2017-2018 / Architecture - Lecture Plan			
1. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
MAT 103E	Mathematics I	Functions of a Single Variable, Limits and Continuity, Derivatives, Applications of Derivatives, Sketching Graphs of Functions, Asymptotes, Integration, Fundamental Theorem of Calculus, Applications of Integrals, Transcendental Functions, Techniques of Integration, Indeterminate Forms, L'Hopital's Rule, Improper Integrals **(from www.sis.itu.edu.tr)**	Theory of Math - Computation
TES 111E	Project I	This course is focused on applying various **presentation techniques** through simple design solutions. Students develop a spatial understanding of **urban, landscape, building, interior space and product-related issues**. They learn how to assess, interpret and **represent those entities by using 2D - 3D drawings and models**, including **computer techniques**, on a given design problem. Students develop an aptitude in **explaining ideas** through their own **visual language**. The course **enhances the intuition** of relevant issues in design such as **building construction and structural systems** working through **simple design problems**. **The relationship of urban, landscape, building, interior space and product-related materials with their environment** is discussed through small-scale design exercises. The course aims to provide students the means to understand, interpret and evaluate natural, historical and cultural environments. **(from Ninova)**	Simple Design Problems & Design Solutions with 2D & 3D Drawings and Model
TES 113E	Basic Design and Visual Arts	The course includes **design elements** (point, line, surface, sphere, texture, colour, light, form), **design principles** (repetition, rhythm, ratio, scale, balance, harmony, contrast, union of contrast, continuity, hegemony), **visual perception** (psychology of perception, gestalt principles - closeness, likeness, form-base etc., visual fallacy), the **concept of space** (space organization in two and three dimensional work, geometry of urban space), the **analysis of natural and man-made environment** (decomposition, disintegration, abstraction and reinterpretation), patterns (point, line, accented line, value, contour, movement), colour and the psychological effects of colour. **(from Ninova)**	Theory of Design & Design Perception
MIM 125/125E	Statik / Statics	Within the context of the course, the following subjects are given; **concept of force, moment, rigid body, equilibrium of forces, introduction of load bearing systems** and loads, evaluating **support reactions of determinite systems (beams, columns, frames, arches**) by using equilibrium concept, configuring **truss systems** and determining member f**orces of trusses, cable structures**, determining cable forces under point and distributed loads. At the end of the course, students will be capable of choosing various appropriate **load bearing systems for their architectural design projects. (from www.sis.itu.edu.tr)**	Basic Load Bearing Systems and Force Computations
TES 112E	Vis.Comm.I:Visualiz.&Tch.Drw.	The course covers **basic elements of design** (line, form, color, texture, shade), **basic and complex geometries**, object/product geometry and the **drawings of structural elements**. Students work on the relationship of **human-object- environment and topography**. Subjects include; **isometric and artistic perspective**, collage, visualization, principles of projection, parallel, perpendicular and oblique projection techniques and sections and elevations. Students are expected to understand **basic graphical elements and composition**. Students learn to **use technical drawing media, tools and equipment**. The technical drawing section includes line types, lettering, fundamentals of dimensions, markers and symbols and scale. **(from Ninova)**	Tachnical Drawing and Presentation, Perception of Scale
MIM 119/119E	Mimarlığa Giriş ve Etik / Int.to Architecture and Ethics	This introductory course includes the fundamental concepts and various dimensions of the field of architecture and provides knowledge about the **practical fields of the profession for the starting freshman students**. The course comprises a **wide spectrum of topics related to profession of architecture**: profession of architecture throughout the **history; design thinking for architecture, the architectural design process, studio culture, contemporary architecture, space-human-context relationships; fundamentals of building systems, building design and construction technologies; terms, concepts and approaches in the history of architecture; architectural and cultural heritage, architectural conservation ?** urban conservation concepts and professional ethics in the field of architecture.**(from www.sis.itu.edu.tr)**	Basic Principle Related to Profession of Architecture
DAN 101	Akademik Danışmanlık	Academic advising is a training/education process that helps to bring meaning and purpose to undergraduate study. Through the undergraduate study, it provides intellectual and personal development of academic achievement and lifelong learning. Academic advising in ITU provides opportunities for students to gain access to education, personal and career goals, realize the abilities needed for academic success, learn **how to access the countless resources and services offered by the institution, and establish relationships with one or more academic advisers. (from www.sis.itu.edu.tr)**	Access the Resources of Department

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

2. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
TES 121E	Project II	Design, planning, analysis, research, abstraction, conceptualization, interpretation, systematization, composition, construction, production, experiment; Human-nature-culture relations and environmental context; Contemporary art and design theories and concepts; Planning and design in philosophical, ethical, aesthetic, legal and social context; **Representation in design and planning**; **Urban space experience in the context of social and urban dynamics**; Spatial experience and bodily sensation; User experience in the context of formal function; **Scale: structure, construction, material relations**; Participatory **design / planning; sustainability; Universal Design**; Place / Product identity; Ergonomics and anthropometry; Experimental studies on m**ass, motion, texture, color and light; Perception, evaluation and expression on structure, meaning, function, identity** **(from Ninova)**	Perception of Universal Design and Planing - Context between design and other parametres
MIM 126/126E	Mukavemet / Strenght of Materials	Within the context of the course, the following subjects are given; concept of **stress and strain, stress-strain relationship of various materials of structural members**, **internal force** distribution in **structural systems**, simple and combined internal effects in structural members, buckling problem under compression are given with some examples of **timber, masonry and steel buildings**. At the end of the course, students are expected to be capable of designing cross sections of various load bearing systems. **(from www.sis.itu.edu.tr)**	Internal Forces Computations According to Structural Systems and Materials
MIM 122/122E	İlkçağ & Bizans Mimarl Tarihi / Ancient&Byzantine Architecture	The course covers a survey of the Anatolian cultures starting from the **prehistoric time**s to the **end of the Byzantine Empire**. It is centered around the architectural styles, their relations, influences and continuity in the **Hittite, Urartian, Ancient Greek, Roman and Byzantine cultures**. It also examines examples of **religious, representative and public buildings** within the context of their **social and cultural frame**. **Painting, sculpture and minor arts, their relations with architecture, construction techniques, plan types and architectural theories**, and buildings of special importance in the process of architectural development are discussed. **(from www.sis.itu.edu.tr)**	Ancient & Byzantine Construction Techniques and Plan Types
TES 122E	Vis.CommII:Visualization&Persp	**Free hand perspectives** of simple geometrical shapes, Axonometric, isometric and dimetric perspectives, Rules of the one, two and three vanishing point perspectives. Standing point, variations of the **vertical and horizontal viewing angles**. Showing object perspectives in the objects in its environment. **Shading in perspective**. Examples and applications to scattered perspective of a product and perspectives of details. Explanation of the perspectives used in design presentation. **(from Ninova)**	Technical Drawing and Presentation, Perspective and from 3D to 2D, Shading Perception
MIM 114/114E	Erişilebilirlik / Accessibility	In this fundamental course the concept of **accessibility design-universal design** is examined and discussed in relation to the principle of no discrimination-equal status and the **different scales of design**:, planning, architecture and interior architecture- product design. The approach of the course is to developing design students with an understanding of design as a **multidimensional and multi-scale process** in accessibility studies involving problem resolution and the discovery of new opportunities that will create value for all. Particularly, the course addresses by referring to different design scales, the fundamental **knowledge on disability and elderly people** as well as **other groups** who have the potential to be discriminated by design; s**ocial, psychological and demographic situation;** the **kinds of disability, accessories, equipment and building elements** for the **disabled and elderly**; building and home design for the disabled and elderly; **laws**; **new standards** and **design criteria** of the u**rban environment for the disabled and elderly are given.** **(from www.sis.itu.edu.tr)**	Perception of Universal Design and Multifimentional Design Principles (Users such as eldersly and disabled, Potential etc.)
MIM 120E	Int.toCmp.Ds.Tools&Mth.inArch.	This is a compulsory unit of study which aims at introducing students to **general principles of computation** and its **wide range of applications in architectural design**. It also aims to introduce the students to the **various digital design, fabrication and manufacturing technologies** utilized in architectural design practices and make them develop a beginner level knowledge and experience in a suite of these technologies which involve **a geometric modeling application (Rhinoceros),** together with an **algorithmic modeling plug in (Grasshopper)** and **laser cutting** as a method for **digital fabrication**. With these objectives, as can be seen in the weekly plan, the course covers a wide range of topics to be delivered in lecture hours and tutorials and hands on working with Rhinoceros and Grasshopper during the lab hours. **(from www.sis.itu.edu.tr)**	3D Geometric Modelling, Visual Programming and Algorithmic Modelling; Fabrication Techniques
ING 112	English I	The students of English 112 course improve their efficient reading techniques, learn to analyze outside sources and elicit proper information, develop their critical thinking skills and go through the processes of reading and analyzing texts, planning, drafting and editing. Students working on text exploration and academic writing simultaneously produce argumentative essay both in their homework assignments and their exams. Besides, they participate in the in-class discussions of the reading materials.**(from www.sis.itu.edu.tr)**	Academic Reading, Analysing and Writing for English Language

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

3. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr**	Summary
ING 201	English III	English 201 is a course designed to teach the organizational and **critical thinking skills necessary for logical written** expression. The course focuses on writing a **research paper of at least 3000 words** based on sound **scholarly sources** on a topic of interest related to a student?s field by conforming to the APA standards of writing without committing plagiarism. In this course the whole research process is taught step by step through skills including research, source selection, choice of topic, construction and defense of a **thesis statement, citing sources, outlining, organizing** a References page and note taking. Critical elements of the course are instruction in paraphrasing and **summarizing techniques, use of quotations** and the incorporation of these research findings in the paper together with the inclusion of personal comments, avoidance of plagiarism and conforming to ethical rules. **(from www.sis.itu.edu.tr)**	Critical Academic Reading, Research Paper by Using Citing and Qutation with English
MIM 221/221E	Türk Mimarlık Tarihi / Hstry of Turkish Architecture	The course examines the **pre-Islamic Turkish architecture** in Asia, Uighur, Karakhanid, Ghaznevid, Seljuk architecture, and the origins of the Anatolian Turkish architecture. It focuses on **characteristics of space, mass, façade and structure design and form language** of the **Early Anatolian** emirates, **Anatolian Seljuks**, **14th-c. emirates** and **Ottoman** architecture until the **end of the 17th-c**. with various examples of building types; such as **mosques, madrasas, hospitals, tombs, caravanserais, palaces and building complexes. (from www.sis.itu.edu.tr)**	Pre-Islamic Turkish Architecture: Building Types, Plan Types and Construction Techniques etc.
TES 211E	Project III	**Integrated and sustainable planning and design process**; theoretical scrutiny and research on basic facts and concepts in the planning and design process; Natural, physical, **socio-cultural and economic structure data analysis**; Planning & Design - user relations; F**unction-texture-form-structure-material-carrier system-technology relations**; **Identity-meaning-concept-form relationships**; Planning & Design **process-method-strategy and techniques (from Ninova)**	Perception of Integrated ans Sustainable Design and Planing
MIM 231/231E	Yapı Malzemesi / Building Materials	In the context of the **importance of building-material-design relationship** in architecture, the content of the course is covered with three basic approaches: (i) introduction of **mechanical, physical and technological properties necessary for the identification of a building material**; (ii) introduction of building **materials in each group by emphasizing the main differences between the materials classified** on the basis of material science (Ceramics: stone, binders, concrete, glass, fired-clay; Polymers: wood and plastics; Metals: ferrous and non-ferrous); (iii) introduction of the **functional materials (fire, acoustical, thermal insulation and water proofing)** used in the building element depending on the basic performance criteria required. **(from www.sis.itu.edu.tr)**	Identification and Classification of Building Materials - Relation with Building Elements
MIM 271 / 271E	Yapı Statiği / Theory of Structures	Within the context of the course; concept of **structural determinacy and indeterminacy**, internal force distribution in determinate systems (**continuous beams with hinges, three hinged frames and arches**), **truss configurations for large spans**, deflection problems of **beams and frames under gravity and/or lateral forces**, internal force distribution in indeterminate systems and important rules to configure a regular structural system are given with examples of various real buildings. At the end of the course, students are expected to be capable of configuring proper structural systems with their approximate **cross-sectional dimensions**. **(from www.sis.itu.edu.tr)**	Internal Forces Computations and Force Distribution in Determinate and Indetermiat Structural System
MIM 253/253E	Çelik Yapılar / Steel Structures	Within the context of the course; **properties of steel as a structural material,** sections used in **steel structures, Load and Resistance Factore**d Design(LRFD)/Allowable **Strength Design(ASD)**, Design of Steel Structural members under **tension, compression and bending effects**, Connection (Hinged and moment resisting connections) design, Design of steel **trusses, Frames, Steel Slab systems, Arrangement of bracings in vertical and horizontal planes, Composite Structures, Tall Steel Buildings** are given with **examples of various real buildings**. At the end of the course, students are expected to be capable of configuring proper steel structural systems.**(from www.sis.itu.edu.tr)**	Forces Computation on Steel Structure Systems & Capable of the Systems with Real Examples
MIM 203/203E	Mimarlıkta Yapı ve Yapım / Building and Const inArch.	Concepts of building, **architectural and construction technology**. Introduction of **building, building elements and construction methods** according to the systems approach. Interaction of user-environment-building. Introducing different types, design criteria, **construction methods of external wall systems , window and door systems, floor systems, vertical circulation systems, roof systems, partition systems.** Introducing of construction inputs (**materials, workmanship, tools**) and steps in the construction of building elements in observation of mockup production. Studio work for analysis and synthesis of building element systems. **(from www.sis.itu.edu.tr)**	Basic Contruction Technologies with Building Elements

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

4. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
MIM 222/222E	Avrupa Mimarlık Tarihi / Histry of Europn Architecture	The course firstly introduces the **architectural styles**. **Early Christian architectur**e, **Romanesque architecture, Gothic architecture, the modern conditions in the genesis of the Renaissance**, the shift from the regularity of the Renaissance to the subjectivity of Mannerism and its reasons, the complexity of architecture during the periods of **Baroque and Rococo** with total and multi-layered design ideas., together with the introduction of **light and spatial effects in architecture**, palatial **architecture and urban design** in these periods are examined. The architecture in the **Ottoman Empire's Westernization** period is also examined. **(from www.sis.itu.edu.tr)**	Architectural Styles from Early Christian to Ottoman Empire's Westernization.
MIM 234/234E	Betonarme Yapılar / Reinforced Concrete Structures	Related **building codes and structural analysis methods** for principles of **ultimate strength theory,** simple and combined bending of beams , cross-sections with double reinforcement, **T sections, columns, beams under shear, one-way and two-way RC slabs are introduced.** RC load b**earing systems, stages of design, application projects, loads cases, principles of design of load bearing systems,** slab systems, joints, tall buildings, behavior under lateral loads , roofs, precast systems, plates, reinforced concrete frames, archs, shells, cylindrical and double curvature shells, folded plates, principles of **Turkish Seismic Code are investigated. (from www.sis.itu.edu.tr)**	Building Structural RC System Analysis and Computation; and Earthquake Regulations
MIM 212/212E	Mimari Proje IV / Architectural Design IV	Development of **critical, experimental, sustainable design thinking**; approaching **contemporary architectural and urban design problems** regarding the issues of **accessibility and sustainability**; development and interpretation of program for non-complex buildings or building groups; enriching **architectural thinking by integrating programmatic, contextual, formal and tectonic qualities**; addressing **structural, material and technological issues** within the **design process; investigation on the representation** tools peculiar to a project. **(from www.sis.itu.edu.tr)**	On Concept of Non- Complex Buildings , Projects Development by Critical, Experimental, Sustainable Design Thinking
MIM 204/204E	Yapı Elemanları Tasarımı / Building Element Design	**Analysis, design and integration of building elements** with **pre-defined design criteria** and constraints: external wall systems, window and door systems, floor systems, vertical circulation systems, roof systems, partition systems. Integration of building materials and assemblies in building element design. Interaction of building design with the building element design process in the context of external envelope, intermediate floor, stair and partition systems. **Integration of building element systems** with **each other and the structural system**. Making **technical drawings and preparing models** of **designed building elements and assemblies**. Lectures and studio work. **(from www.sis.itu.edu.tr)**	Pre-Defined Building Elements According to Design Criteria and Analysis of the Elements related witv Building Systems
MIM 246/246E	Çevre Kontrolü Stüdyosu / Environmental Control Studio	**Physical environmental factors** affecting built environment design are introduced. Information on c**limate, light, sound, fire protection parameters, clean water supply and sewage disposal systems aiming at user comfort and efficient use of energy is provided.** Turkey's current **national environmental standards and regulations (fire, noise, heat protection)** related substances are discussed. In the studio applications, a project that is aimed to be designed integrated with the environment in terms of passive and active systems included, which performs optimum in climatically, visual and aural ways, protected against fire and equipped with sanitary installation is conducted. **(from www.sis.itu.edu.tr)**	Analysis and Calculation of Physical Environmental Effects for Building Performance with Environmental Standards and Regulation

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

5. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
EKO 201/201E	Ekonomi / Economics	This course examines the **basic concepts in economics**. The first part covers **microeconomics**. In this part, we will study of how firms decide on production and households decide on **consumption of goods and services**. The second part covers **macroeconomics.** In this part, we will study the economy as a whole. Topics include national **income, unemployment, inflation, and economic growth**. **(from http://www.econ.itu.edu.tr/egitim/li-sans/havuz-dersi-(eko201-eko201e))**	Basic Concepts in Economics, Microeconomis and Macroeconomis Consepts
MIM 351/351E	Mimari Proje V / Architectural Design V	Exploration of **multi-dimensional design problems** and s**patial configurations in urban context**; discussion of societal and cultural aspects of architecture through its relationship with place, context, program, space, identity, representation; approaching architecture in relation to a**dvanced design and construction technologies, application of digital methods and tools in design processes**; advancing representational **skills in multi-faceted media environments**. **(from www.sis.itu.edu.tr)**	On Concept of Multi Dimentional Desing , Projects Development by Using Design and ConstructionTechnologies
TUR 101	Türk Dili I	In this course, firstly, the **definition of language** is emphasized. The relationship of language with thought, culture and society is examined. **General information about the origin of languages and languages in the world is given**. Then the place of Turkish among language families is discussed; developmental stages are exhibited. Structural features of **Turkish are spoken in general terms.** Studies on **spelling rules are done.** The criteria for evaluating a language as a language of science are discussed; In this context, the **situation of Turkish is evaluated.** **(from Ninova)**	Using Properly Turkish by Knowing about History and Rules
MIM 333/333E	Yapım Sistemleri / Building Production Systems	In this course, on the **basis of the concept of building production system**; **components, structure and environment** of building production systems; characteristics of building production system and its differences from other production systems; product and demand **characteristics of building and the effects of these characteristics on production are emphasized**. Following the analysis of the building production systems in parallel with the **social and technological developments in time**; **conventional, rationalized and industrialized building production systems** are described from small scale to large scale, from simple to complex, from general to specialization. Major actors; their roles and responsibilities; their effects on the decisions taken during the process; their positive and negative characteristics as well as production process are evaluated according to resource utilization/speed/quality and the advantages and limitations of building production systems are emphasized in terms of design. **(from www.sis.itu.edu.tr)**	Perception of Components and Structures which Includes in Complex Building Production System; Social and Technological Situation Effects on the Systems
MIM 321/321E	Çağdaş Mimarlık / Contemporary Architecture	Contemporary Architecture aims to introduce students to the discussions about the **cultural bases and definition of modernity,** modernity and industry, **modernity and avantgarde approaches,** understanding of **modern urbanism and the impact of those discussions on** architecture in Republican Turkey. **(from www.sis.itu.edu.tr)**	Modern Architecture Definition and Effects of Modernity on Architecture and Urbanism
MIM 343/343E	Şehircilik ve İmar Hukuku / Urbanism and Planning Law	**Urban planning** process and the **city** in history. **Urban Components** and **Land Use**: living, working, recreational areas and transportation networks. Population, settlement and dwellings densities. **Development plans and implementation technics**. **Urban law and regulation and management. Site planning and site conservation.** Urban renewal. Urban **design principles**. Urban **structure and pattern.** Public places. **(from www.sis.itu.edu.tr)**	Urban Planning and Design Principles; Evaluating Urban Law,Regulation and Management
MIM 322/322E	Tarihi Çevre Koruma & Restr / Conserv.of Hist. Build.&Sites	Conservation of Historic Buildings and Sites is an introductory course on the **general concepts of conservation of historic buildings** and sites for the students studying architecture at the undergraduate level. The course comprises a wide spectrum of topics related to the **profession of architecture in the field architectural conservation: theory of conservation** beginning from the 19th century, historic building survey, inspection, recording, **conservation criteria and values**, **conservation techniques and methodology**, national legislation concerning conservation and its administrative aspects in Turkey. The **modern approach and practice** are discussed through numerous case studies in different scales starting from traditional dwellings and monuments to building aggregates and urban/vernacular texture from Turkey and abroad. **(from www.sis.itu.edu.tr)**	Theory, Basic Principles, Techniques and Methodologies related with Conservation of Buildings
MIM 305/305E	İstatistik / Statistics	This is an **introductory course to statistics.** The **probability theoretic concepts underlying statistical treatment** are explained, including event, random variable, probability density, probability, and probability distribution. The principle of statistical inference and the associated concepts of hypotheses testing and confidence intervals are described. They are exemplified via T-test, Chi- squared non-parametric test of independence, as well as linear regression. Premises underlying statistics are highlighted, so that the role of the **methodology in studies of architecture is clarified.** **(from www.sis.itu.edu.tr)**	Basic Statistical Methods and Role of the Methodologies in Architecture

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

6. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
MIM 312/312E	Mimari Proje VI / Architectural Design VI	Investigation of **multi-faceted design problems** in **various scales and details** in discussion with the frameworks of participation, pluralism and **social awareness; critical analysis and holistic evaluation of urban context**, program, **sustainability, energy, economy, advanced building systems and technologies together with contemporary debates**, architectural theory and criticism; development of complex, multi-functional programs and building solutions; evaluating diverse disaster scenarios (natural or manmade) as inputs into the design process; advanced use of representational media. **(from www.sis.itu.edu.tr)**	On Concept of Multi Functional Program , Projects Development by Thinking Sustainability, Energy, Economy, Advanced Building Systems and Technologies
TUR 102	Türk Dili II	This course is a **written and verbal lecture**. In the written expression section, firstly, the concepts of method and plan and their applications are emphasized. Literary genres are examined through **scientific research articles** and **official writings**. In the verbal lecture section, general information about **verbal communication is given**; Then oral **literature types are discussed**. **(from Ninova)**	Academic Reading, Analysing and Writing for Turkish Language
MIM 359/359E	Yapım Yönetimi ve Ekonomisi / Construction Mngmnt & Economy	In this course, the **importance of the construction sector** and its position in Turkey's economy; country, sector, company, project and transaction level administrative and economic decisions taken during building production process; the effects of these decisions; stakeholders and participants of the building production process; building and project life cycle are introduced. In addition to the roles and responsibilities of an architect, as the coordinator of building production process, in different project delivery methods and construction contract types; knowledge and skills that an architect should have in design management, cost management and time management in different stages of the process are described and practical studies are made with the help of various project management tools and techniques. **(from www.sis.itu.edu.tr)**	Importance of the Construction Sector in Turkey, Project Lifecycle, Roles and Responsibilities of Architects, Cost and Time Management Process and Management Tools
MIM 361/361E	Rölöve ve Restorasyon Stüdyosu / Archtctrl Survey & Restrtn Std	This is an introductory course on the ar**chitectural survey and research** putting emphasis on the preparation phase of a conservation project. It is **practice-based and comprises all the steps of the process**; architectural survey, **material - damage** and **chronological analysis, restitution and restoration**. After the introduction of **basic traditional survey techniques through in-situ practices**, each student group starts to work on a **historic structure developing a term project including the above-mentioned steps until the end of the semester**. The a**rchitectural documentation phase** accompanies with the **research to understand the historical context** of the subject using different sources such as historic **documents, maps, drawings, engravings, books, photos etc**. A detailed survey and analysis process provide fundamental information on the **initial construction/repair phases** a**s well as the materials and techniques** employed for the subject. The **damage mechanisms and problems** are diagnosed and proper treatment methods are developed. These proposals might start from very simple interventions and steps up to more complex ones depending on the state of the art and the circumstances. **(from www.sis.itu.edu.tr)**	Apply Conservation Techniques and Methodologies on History Buildings; Researches of Site , Building System, Material; and Suggestion for Initial Construction and Repair with Drawings
DAN 301	Kariyer Danışanlığı		Seminers for Introducing Professions

Table E.1 (continued) : Table of the Current Curriculum Courses' Content.

7. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
ATA 101	Atatürk İlk & İnkılap Trh I	Full Content **(from http://www.ataturkilkeleri.itu.edu.tr/Icerik.aspx?sid=8651)**	Turkish History from the Ottoman Empire to the Lausanne Peace Agreement in the 18th and 19th Centuries
MIM 411/411E	Mimari Proje VII / Architectural Design VII	Engaging architecture with **urban dynamics in national and international contexts** and **develop visions for future scenarios**; analysis and evaluation of various scales of urban, regional and global dynamics in order to translate them into architectural knowledge; discussion of architecture's **socio-cultural aspect in relation to natural, historical and cultural heritage;** building dialogues and **integrating with other disciplines**; developing **creative and innovative solutions to large scale**, **complex and multi- use architectural programs** with advanced construction systems and detailing, developing a personal position in the design process based on the accumulation of skills and experiences earned in previous years. **(from**	On Concept of Urban Scale , Multi-Functional and Dimentional Projects Development by Thinking Socio-Cultural Aspect and Cultural Heritage with Integrating Other Diciplines
MIM 484/484E	Uygulama Projesi / Construction Project	Material, building, construction, environmental control and project management in building design, Design and detailing of architectural systems, Integration and coordination of building subsystems (building elements, carrier, service) in design, Building legislation (zoning regulation, earthquake regulation, heat preservation regulation, etc.) Integration with Design, Expression of each design phase (preliminary project, final project and application project) with different techniques. **(from Ninova)**	Prepare of the Application Project which is Integrated to of Other Application Projects (static, sanitary installation and electricity) with Architectural Construction Drawings by Thinking the Laws and Regulations
8. Semester			
Code	**Name**	**Content from www.sis.itu.edu.tr & Ninova**	**Summary**
ATA 102	Atatürk İlk & İnkılap Trh II	Full Content **(from http://www.ataturkilkeleri.itu.edu.tr/Icerik.aspx?sid=8651)**	Contemporary Turkish History since the War of Independence
MIM 4902/4902E	Diploma Projesi / Diploma Project	Development of given project subject by taking care of theme, site/city, history/memory and global dynamics, ecologic, social, public and private issues, technologic and cultural potentials and future visions. Design and presentation of the project by making all necessary research, design and representation works, by applying **all gained knowledge of architecture discipline and its sub-topics**, and then **development of the project as an architectural idea, program and spatial configuration** by also taking care of the critical potentials of the jury sessions. Finally, completing the project as a critical and creative, new diploma project **(from www.sis.itu.edu.tr)**	Development of a Project with Architectural Idea, Program and Spatial Configuration by Using all Gained Knowledge of Architecture Discipline and Its Sub-topics

APPENDIX F:

Table F.1 : Table of the Current Curriculum Courses' Content.

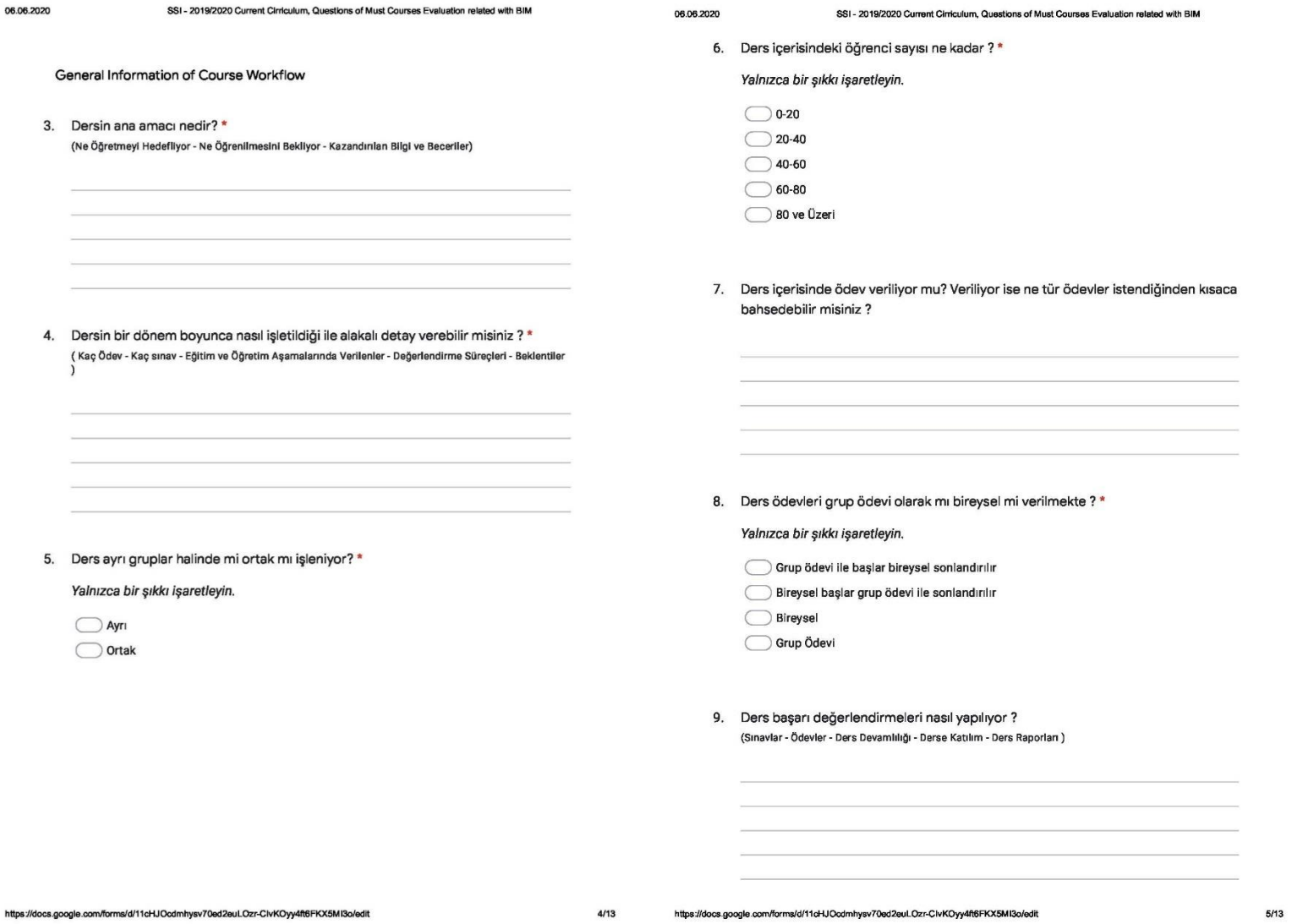
General Classes	Classes	Course Name	SUM. CONTENT
OUT OF ARCHITECTURE	Basic Sciences	Mathematics I (MAT 103E)	Theory of Math - Computation
		İstatistik / Statistics (MIM 305/305E)	Basic Statistical Methods and Role of the Methodologies in Architecture
		Ekonomi / Economics (EKO 201/201E)	Basic Concepts in Economics, Microeconomis and Macroeconomis Consepts
	Language	English I (ING 102)	Academic Reading, Analysing and Writing for English Language
		English III (ING 201)	Critical Academic Reading, Research Paper by Using Citing and Qutation with English
		Türk Dili I (TUR 10I)	Using Properly Turkish by Knowing about History and Rules
		Türk Dili II (TUR 102)	Academic Reading, Analysing and Writing for Turkish Language
	Basic History	Atatürk İlkeleri & İnkılap Tarihi I (ATA 101)	Turkish History from the Ottoman Empire to the Lausanne Peace Agreement in the 18th and 19th Centuries
		Atatürk İlkeleri & İnkılap Tarihi II (ATA 102)	Contemporary Turkish History since the War of Independence
	Intro Courses	Akademik Danışmanlık (DAN 101)	Access the Resources of Department
		Kariyer Danışmanlığı (DAN 103)	Seminers for Introducing Professions
HISTORY OF ARCHITECTURE	History of Architecture	İlkçağ & Bizans Mimarl Tarihi / Ancient&Byzantine Architecture (MIM 122/122E)	Ancient & Byzantine: Construction Techniques and Plan Types
		Türk Mimarlık Tarihi / History of Turkish Architecture (MIM 221/221E)	Pre-Islamic Turkish Architecture: Building Types, Plan Types and Construction Techniques etc.
		Avrupa Mimarlık Tarihi / Histry of Europn Architecture (MIM 222/222E)	Architectural Styles from Early Christian to Ottoman Empire's Westernization.
		Çağdaş Mimarlık / Contemporary Architecture (MIM 321/321E)	Modern Architecture Definition and Effects of Modernity on Architecture and Urbanism

COURSES SELECTED FOR SEMI-STRUCTURAL INTERVIEW EVALUATION			
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Simple Design Problems & Design Solutions with 2D & 3D Drawings and Model
		TES 121E - Project II	Perception of Universal Design and Planing - Context between Design and Other Parametres
		TES 211E - Project III	Perception of Integrated ans Sustainable Design and Planing
		TES 113E - Basic Design and Visual Arts	Theory of Design & Design Perception
		TES 112E - Visual Communication I	Technical Drawing and Presentation, Perception of Scale
		TES 122E - Visual Communication II	Technical Drawing and Presentation, Perspective and from 3D to 2D, Shading Perception
	Architecture Design Studios	MIM 212E - Architectural Design IV	On Concept of Non- Complex Buildings , Projects Development by Critical, Experimental, Sustainable Design Thinking
		MIM 351E - Architectural Design V	On Concept of Multi Dimentional Desing , Projects Development by Using Design and ConstructionTechnologies
		MIM 312E - Architectural Design VI	On Concept of Multi Functional Program , Projects Development by Thinking Sustainability, Energy, Economy, Advanced Building Systems and Technologies
		MIM 411E - Architectural Design VII	On Concept of Urban Scale , Multi- Functional and Dimentional Projects Development by Thinking Socio-Cultural Aspect and Cultural Heritage with Integrating Other Diciplines

Table F.1 (continued) : Table of the Current Curriculum Courses' Content.

	Architectural Design Theory	MIM 114 - Accessibility	Perception of Universal Design and Multifimentional Design Principles (Users such as eldersly and disabled, Potential etc.)
		MIM 119E - Int.to Architecture and Ethics	Basic Principle Related to Profession of Architecture
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	3D Geometric Modelling, Visual Programming and Algorithmic Modelling; Fabrication Techniques
CONSTRUCTION	Structural Systems	MIM 125 - Static	Basic Load Bearing Systems and Force Computations
		MIM 126E - Strength of Material	Internal Forces Computations According to Structural Systems and Materials
		MIM 271E - Theory of Structures	Internal Forces Computations and Force Distribution in Determinate and Indetermiat Structural System
		MIM 253E - Steel Structures	Forces Computation on Steel Structure Systems & Capable of the Systems with Real Examples
		MIM 234E - Reinforced Concrete Structures	Building Structural RC System Analysis and Computation; and Earthquake Regulations
	Building Elements & Materials	MIM 231E - Building Materials	Identification and Classification of Building Materials - Relation with Building Elements
		MIM 203 - Building and Const inArch.	Basic Contruction Technologies with Building Elements
		MIM 204 - Arch.Building Element Design	Pre-Defined Building Elements According to Design Criteria and Analysis of the Elements related witv Building Systems
	Physical Environment Control	MIM 246E - Environmental Control Studio	Analysis and Calculation of Physical Environmental Effects for Building Performance with Environmental Standards and Regulation
	Construction Systems & Management	MIM 333E - Building Production Systems	Perception of Components and Structures which Includes in Complex Building Production System; Social and Technological Situation Effects on the Systems
		MIM 359E - Construction Management & Economy	Importance of the Construction Sector in Turkey, Project Lifecycle, Roles and Responsibilities of Architects, Cost and Time Management Process and Management Tools
	Construction Studio	MIM 431E Construction Project	Prepare of the Application Project which is Integrated to of Other Application Projects (static, sanitary installation and electricity) with Architectural Construction Drawings by Thinking the Laws and Regulations
URBAN DESIGN	Urban Planning	MIM 343 - Urbanism and Planning Law	Urban Planning and Design Principles; Evaluating Urban Law,Regulation and Management
CONSERVATION	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Theory, Basic Principles, Techniques and Methodologies related with Conservation of Buildings
		MIM 361E-Archtctrl Survey & Restrtn Std	Apply Conservation Techniques and Methodologies on History Buildings; Researches of Site , Building System, Material; and Suggestion for Initial Construction and Repair with Drawings
DIPLOMA PROJECT	Diploma Project	MIM 4902 - Diploma Project	Development of a Project with Architectural Idea, Program and Spatial Configuration by Using all Gained Knowledge of Architecture Discipline and Its Sub-topics

APPENDIX G:



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General Information of Course Workflow

3. Dersin ana amacı nedir? *
(Ne Öğretmeyi Hedefliyor - Ne Öğrenilmesini Bekliyor - Kazandırılan Bilgi ve Beceriler)

4. Dersin bir dönem boyunca nasıl işletildiği ile alakalı detay verebilir misiniz ? *
(Kaç Ödev - Kaç sınav - Eğitim ve Öğretim Aşamalarında Verilenler - Değerlendirme Süreçleri - Beklentiler)

5. Ders ayrı gruplar halinde mi ortak mı işleniyor? *
Yalnızca bir şıkkı işaretleyin.
- Ayrı
- Ortak

https://docs.google.com/forms/d/11cHJOcdmhysv70ed2euLOzr-ClvKOyy4ft6FKX5MI3o/edit 4/13

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6. Ders içerisindeki öğrenci sayısı ne kadar ? *
Yalnızca bir şıkkı işaretleyin.
- 0-20
- 20-40
- 40-60
- 60-80
- 80 ve Üzeri

7. Ders içerisinde ödev veriliyor mu? Veriliyor ise ne tür ödevler istendiğinden kısaca bahsedebilir misiniz ?

8. Ders ödevleri grup ödevi olarak mı bireysel mi verilmekte ? *
Yalnızca bir şıkkı işaretleyin.
- Grup ödevi ile başlar bireysel sonlandırılır
- Bireysel başlar grup ödevi ile sonlandırılır
- Bireysel
- Grup Ödevi

9. Ders başarı değerlendirmeleri nasıl yapılıyor ?
(Sınavlar - Ödevler - Ders Devamlılığı - Derse Katılım - Ders Raporları)

https://docs.google.com/forms/d/11cHJOcdmhysv70ed2euLOzr-ClvKOyy4ft6FKX5MI3o/edit 5/13

Figure G.1 : Questions for SSI (3-9).

10. Ders sürecinde öğrencilerden beklenen dokümanlar nelerdir ?

(Araştırma Yazısı - Sunum - Poster - İş Akış Analizi - Fiziksel Model - Dijital Model - Animasyon - Basılı Paftalar - CD)

11. Ders içerisinde kullanılan yazılımları sayabilir misiniz ?

(3D Modelleme Yazılımları - CAD Yazılımları - Görsel Programlama Dili Yazılımları - Bilgi İşlem Yazılımları (Java - C++) - Oyun Yazılımları (Unity - Maya vb) - Dokuman Paylaşım Platformları - Google Drive / Teams / One Drive / BIM 360 - BIM Yazılımları (Revit - ArchiCA D- AllPlan - Tekla - Syncro - Navisworks - Civil 3D - Solibri Model Chaker vb.)

Examination of Basic Knowledge related with CDE&Project Delivery

12. Ödev teslimleri ve sunumlar nasıl yapılıyor? *

Yalnızca bir şıkkı işaretleyin.

- ◯ Dijital Şekilde Teslim Ediliyor ve Sunuluyor
- ◯ Dijital Şekilde Teslim Ediliyor & Basılı Dokümanlar ile Sunuluyor
- ◯ Basılı Dokümanlar Halinde Teslim Ediliyor ve Sunuluyor
- ◯ Dijital ve Basılı Şekilde Teslim Ediliyor ve Her Şekilde Sunulabiliyor

13. Dijital halde sunum yapanların oranı nedir ?

Yalnızca bir şıkkı işaretleyin.

- ◯ % 0 - 10
- ◯ % 10 - 30
- ◯ % 30- 60
- ◯ % 60 - 100

14. Ödev teslimleri ve sınavlar tarafınızca nasıl arşivleniyor ?

Uygun olanların tümünü işaretleyin.

- ☐ Dijital Ortamda
- ☐ Basılı Dokümanlar ve CD'ler Halinde Bir Odada
- ☐ Arşivlenmiyor

15. Tüm bu süreçler için kullandığınız ve herkesin erişebildiği bir platform var mıdır ?

(Google Drive - One Drive - Slack - Teams - Diğer Bulut Platformları)

16. Teslimler belirli isimlendirme kuralları ile mi yapılıyor ?

Examination of Basic Knowledge related with Project Lifecycle

17. Ders içerisindeki sunumlarda öğrencilerden tasarım süreçlerini açıklayan bir doküman isteniyor mu? *

Yalnızca bir şıkkı işaretleyin.

- ◯ Evet
- ◯ Hayır

Figure G.2 : Questions for SSI (10-17).

18. Ders kapsamında proje süreçleri ve proje yaşam döngüsünden bahsediliyor mu?

Yalnızca bir şıkkı işaretleyin.

- ◯ Evet
- ◯ Kısmen
- ◯ Hayır

19. Ders kapsamında proje süreçleri ve proje yaşam döngüsü nasıl ele alınıyor ? *

20. Tasarım süreçlerini inşaat uygulamaları-saha ve işletme aşaması düşünerek tartışıyorlar mı ? *

Yalnızca bir şıkkı işaretleyin.

- ◯ Evet
- ◯ Kısmen
- ◯ Hayır

21. Evet ise; Hangi konu ağırlıklı tartışılıyor ? / Hayır ise; niçin tartışılmıyor?

Examination of Basic Knowledge related with Roles & Responsibilities

22. Ders içerisinde tasarımcının rolünden ve projedeki sorumluluklarından bahsedilmekte mi? *

Yalnızca bir şıkkı işaretleyin.

- ◯ Evet
- ◯ Hayır

23. Gruplar halinde verilen ödevlerde kişilerin iş paylaşımları ve grup içerisindeki rolleri tartışılıyor mu ? Grup ödevleri değerlendirilirken bu esaslar da göz önüne alınıyor mu ?

Examination of Basic Knowledge related with BIM Model Dimention (3D-4D-5D-6D)

24. Ders içerisindeki teslimlerinde 3 boyutlu modelleme yapılıyor mu? *

Yalnızca bir şıkkı işaretleyin.

- ◯ Bu bir gereklilik
- ◯ İsteğe Bağlı
- ◯ Sadece iki boyutlu teslimler yapılıyor
- ◯ Kapsam Dışı

25. Ders içerisinde 3 boyutlu modelleme ile ilgili hangi programlardan bahsediliyor? Bu amaçla kullanılan BIM programları var mı ? *

Sketch Up - 3ds MAX - ArchCAD - Revit- AllPlan - Rhino - AutoCAD - Solidworks vb.)

26. Ders içeriğinde parametrik düşünmeye ilişkin yönlendirmeler var mı ? Bu kapsamda kural tabanı yazılımlar veya görsel programlama dilleri öğretiliyor mu ? *

Uygun olanların tümünü işaretleyin.

- ☐ Konudan hiç bahsedilmiyor
- ☐ Bu beceri ile alakalı yazılım bilgilendirmeleri yapılıyor
- ☐ Bu beceri ile alakalı yazılım eğitimleri ders içerisinde veriliyor
- ☐ Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor
- ☐ Bu becerinin direkt olarak projelerde kullanılması isteniyor

Figure G.3 : Questions for SSI (18-26).

27. Ders içerisinde tasarım süreci ve proje teslimi arasında ki zamanlama için öğrenciler bilgilendiriliyor mu ? Bu süreci nasıl yönetiyorsunuz? *

28. Ders kapsamında projedeki zaman yönetimine dair metotlar gösteriliyor mu? (Gantt Çizelgesi gösteriliyor mu ?)

Yalnızca bir şıkkı işaretleyin.

- Evet
- Hayır

29. Öğrenciler ders esnasında mekan, bina yapı elemanı ve malzeme kullanımlarını ekonomik açıdan tartışıyor mu ? *

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

30. Metraj konusuna ders kapsamında değiniliyor mu ?

31. Ders içerisinde sürdürülebilirlik kavramına değiniliyor mu ? *

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

32. Sürdürülebilirlik nasıl ele alınıyor ?

33. Ders içerisinde tesis yönetimi, kalite kontrolü, saha güvenliği gibi üst düzey konulardan bahsediliyor mu?

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

Examination of Basic Knowledge related with LOD

34. Ders içerisinde yapı elemanlarından bahsediliyor mu ?

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

35. Ders içerisinde yapı elemanlarından ne detayda bahsediliyor - öğrencilerden bu süre zarfında ne öğrenimi bekleniyor ?

(Gereklilik - Fonksiyon - Yapım Sırası - Ölçek -Teknik İfade - Sürdürülebilirlik - Takip Edilebilirlik - Üretim Tekniği - Maliyet

36. Ders içerisinde tasarım sürecindeki malzeme seçimleri için öğrencilere malzeme tanıtımları yapılıyor mu ?

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

Figure G.4 : Questions for SSI (27-36).

37. Tasarım kararlarında tercih edilen malzemeler hangi nitelikleri ile tartışılıyor?
(Estetik - Teknik İfade - Isı ve Ses Geçirgenliği - Yangın Dayanımı - Sürdürülebilirlik - Takip Edilebilirlik - Üretim Tekniği - Maliyet vb.)

Examination of Basic Knowledge related with Collaboration

38. Ders içerisinde tasarımcının diğer paydaşlar ile ilgili iletişiminden bahsedilmekte mi ? *
(İşveren - Yüklenici - Proje Ekibi(Mühendisler) - Saha Ekibi - İşleten)

39. Diğer disiplin eğitimlerini alan ekiplerden ders kapsamında destek alınıyor mu? *
(Kentsel Tasarım - Mühendislikler gibi)

Yalnızca bir şıkkı işaretleyin.

- Evet
- Hayır

40. Mimari disiplin dışında diğer disiplinlerle ortak işletilen bir süreç denemesi yapıldı mı? *

Yalnızca bir şıkkı işaretleyin.

- Evet
- Hayır

41. Mimari disiplin dışında diğer disiplinlerle ortak nasıl bir süreç izlendi?

Examination of Basic Knowledge related with Basic BIM

42. Ders içerisinde veya ödev kapsamında BIM kavramı ile ilgili tanım veya tanıtıma yer verildi mi? *

Yalnızca bir şıkkı işaretleyin.

- Evet
- Kısmen
- Hayır

43. BIM kavramı ile alakalı hangi konulardan bahsedildi ?

44. Ders içerisinde veya ödev kapsamında BIM kavramına yönelik entegre bir çalışma yapıldı mı ? *
(Yapıldıysa çalışma hakkında kısaca bilgilendirebilir misiniz * Yapılmadı ise bunun bir nedeni var mıdır - yapılması düşünülür mü ?)

Yalnızca bir şıkkı işaretleyin.

- Evet
- Hayır

45. Ders içerisinde veya ödev kapsamında BIM kavramına yönelik nasıl bir çalışma yürütüldü?

Figure G.5 : Questions for SSI (37-44).

APPENDIX H:

Table H.1 : Table of the SSI Planning.

General Classes	Classes	Course Name	Course Instructor	Date	Platfrom
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Assoc. Prof. Dr. H.S.K	23.04.2020	Microsoft Teams
		TES 121E - Project II			
		TES 211E - Project III	Assoc. Prof. Dr. C.T.	1.05.2020	Zoom
		TES 113E - Basic Design and Visual Arts	Assist. Prof. Dr. A.K.	18.05.2020	Zoom
		TES 112E - Visual Communication I	Lec. Dr. E.S.Y.K	4.05.2020	Zoom
		TES 122E - Visual Communication II			
	Architecture Design Studios	MIM 212E - Architectural Design IV	Assoc. Prof. Dr. D.Y.	13.04.2020	Microsoft Teams
		MIM 351E - Architectural Design V			
		MIM 312E - Architectural Design VI	Res. Assist. B.D.	9.04.2020	Microsoft Teams
		MIM 411E - Architectural Design VII			
	Architectural Design Theory	MIM 114 - Accessibility	Assoc. Prof. Dr. G.I.	17.04.2020	Zoom
		MIM 119E - Int.to Architecture and Ethics	Res. Assist. Dr. H.T.	1.05.2020	Zoom
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Res. Assist. B.D.	9.04.2020	Microsoft Teams
CONSTRUCTION	Structural Systems	MIM 125 - Static	Res. Assist. S.E.	14.05.2020	Zoom
		MIM 126E - Strength of Material			
		MIM 271E - Theory of Structures	Prof. Dr. O.C.Ç.	30.04.2020	Zoom
		MIM 253E - Steel Structures			
		MIM 234E - Reinforced Concrete Structures			
	Building Elements & Materials	MIM 231E - Building Materials	Assoc. Prof. Dr. S.A.O	14.05.2020	Zoom
		MIM 203 - Building and Const inArch.	Assoc. Prof. Dr. İ.Ç.	28.04.2020	Zoom
		MIM 204 - Arch.Building Element Design			
	Physical Environment Control	MIM 246E - Environmental Control Studio	Assoc. Prof. Dr. G.M.	23.04.2020	Zoom
	Construction Systems & Management	MIM 333E - Building Production Systems	Assoc. Prof. Dr. E.A.	25.04.2020	Microsoft Teams
		MIM 359E - Construction Management & Economy			
	Construction Studio	MIM 431E Construction Project	Assist. Prof. Dr. F.P.Ç.	25.04.2020	Microsoft Teams
URBAN DESIGN	Urban Planning	MIM 343 - Urbanism and Planning Law	Prof. Dr. M.O	14.04.2020	Zoom
CONSERVATION	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Prof. Dr. D.M.	15.04.2020	Microsoft Teams
		MIM 361E-Archtctrl Survey & Restrtn Std			
DIPLOMA PROJECT	Diploma Project	MIM 4902 - Diploma Project	Assist. Prof. Dr. A.K.	18.05.2020	Zoom

APPENDIX I:

Table I.1 : Result Table of the General Questions.

CLASSES		GENERAL QUESTION	3	4	5	6	7	8	9	10	11
Ders Sınıfları		Dersin Adı	Dersin ana amacı nedir?	Dersin bir dönem boyunca nasıl işletildiği ile alakalı detay verebilir misiniz ?	Ders ayrı gruplar halinde mi ortak mı işleniyor?	Ders içerisindeki öğrenci sayısı ne kadar ?	Ders içerisinde ödev veriliyor mu? Veriliyor ise ne tür ödevler istendiğinden kısaca bahsedebilir misiniz ?	Ders ödevleri grup ödevi olarak mı bireysel mi verilmekte ?	Ders sürecinde öğrencilerden beklenen dokümanlar nelerdir ?	Ders başarı değerlendirmeleri nasıl yapılıyor ?	Ders içerisinde kullanılan yazılımları sayabilir misiniz ?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Çevreyi ve mekanı anlamak, basit tasarım problemleri üzerinden fikir geliştirmek + Mimari Temsiller ile Sunmak	Disiplin bağımsız ilerletiliyor, gruplara bölünüyoruz; ilk 7 hafta bir proje geliştirmeleri sonraki 7 haftada başka bir proje geliştirmeleri bekleniyor. Ara derslerde uzmanlar çağrılarak ortak ortak teorik sunumlar ve kritikler ile ilerleniyor.Ara projeler grup içi jürileri ile final projesi kolokyum jürisi ile değerlendiriliyor.	Ayrı Gruplar Halinde	20-40	Proje Geliştirmek her haftanın temel ödevi /Analizlerin ve Tasarım Fikirlerinin Hazırlanması Geliştirici Ara Ödevler	Grup ödevi ile başlar bireysel sonlandırılır	Juri Notları, Ders Devamlılığı, Proje Gelişimlerine Göre Kritiklerdeki Notlandırmalar (Derse Katılım), Ödevler	Analizler, Tasarımlarını Temsil Ettikleri: Çizimler (El Çizimleri), Fiziksel Maketler, Videolar	Adobe Photoshop
		TES 121E - Project II	Fonksiyonlara göre farklılaşan mekanların bağlamını kurarak fikir geliştirmek + Mimari Temsiller ile Sunmak	Disiplin bağımsız ilerletiliyor, gruplara bölünüyoruz; ilk 7 hafta bir proje geliştirmeleri sonraki 7 haftada başka bir proje geliştirmeleri bekleniyor. Ara derslerde uzmanlar çağrılarak ortak ortak teorik sunumlar ve kritikler ile ilerleniyor.Ara projeler grup içi jürileri ile final projesi kolokyum jürisi ile değerlendiriliyor.	Ayrı Gruplar Halinde	20-40	Proje Geliştirmek her haftanın temel ödevi /Analizlerin ve Tasarım Fikirlerinin Hazırlanması Geliştirici Ara Ödevler	Grup ödevi ile başlar bireysel sonlandırılır	Juri Notları, Ders Devamlılığı, Proje Gelişimlerine Göre Kritiklerdeki Notlandırmalar (Derse Katılım), Ödevler	Analizler, Tasarımlarını Temsil Ettikleri: Çizimler (El Çizimleri), Fiziksel Maketler, Videolar	AutoCAD - Adobe Photoshop - Adobe Premier
		TES 211E - Project III	Tasarım süreçlerini çevresel psikoloji ile birlikte yorumlamalarını, tasarım kriterleri (sosyo kültürel etki, sürdürülebilirlik gibi) kapsamında ve tasarım örnekleri üzerinde sorgulayıcı olmalarını , bu hususta yaratıcı fikirler ile kendi tarzlarını geliştirmelerini sağlamak	Disiplin bağımsız ilerletilen iki haftada çevre analizi ve sunum bekleniyor, Ardından disiplinlere ayrılıyorlar; ilk 5 hafta bir proje geliştirmeleri sonraki 7 haftada başka bir proje geliştirmeleri bekleniyor. Ara derslerde uzmanlar çağrılarak ortak ortak teorik sunumlar ve kritikler ile ilerleniyor.Finalde her iki projenin teslimi bütün halde yapılıyor. (1/100 ve 1/200 çizimler ile)	Ayrı Gruplar Halinde	20-40	Ekoloji ve ekonomik krizler ile alakalı araştırma ödevi, Bir ressam bakış açısını farklı açıdan temsil etmeleri için görselleştirme ödevi, Proje geliştirmeleri ve her hafta devam eden kritikler.	Grup ödevi ile başlar bireysel sonlandırılır	Ara ve Final Teslimleri, Ders Devamlılığı, Proje Gelişimlerine Göre Kritiklerdeki Notlandırmalar (Derse Katılım), Ödevler	Analizler, Dijital Sunum, Poster, Çizimler	Sketch Up - 3ds Max
		TES 113E - Basic Design and Visual Arts	Temel tasarım prensiplerini tanıtmak (ritim-harmony-denge süreklilik-vurgu) bu prensipleri 2 ve 3 boyut üzerindeki çalışmalar ile deneyimlenmesini sağlamak	Her ders teorik bir konsept ile başlar ardından ders özelinde pratik çalışmalar verilir. Toplamda yedi adet çalışma vardır bunlardan biri ara sınav diğeri final olarak değerlendirilir. Tüm ödevler final tesliminde revize edilerek verilebilir	Ortak	80 ve Üzeri	7 adet Uygulama: Temsil Teknikleri	Bireysel	Çizim ve Poster Teslimleri, Ders Devamlılığı	2, 2 buçuk ve 3 boyutlu çizimler, Storyboard	Kapsam Dışı
		TES 112E - Visual Communication I	Görsel ifade teknikleri - fikir temsili için kullanılan mimari dilin öğretimi - 2D ortografik izdüşüm tekniklerini öğretmek	Her hafta konu anlatımı+uygulama+ödev şeklinde ilerleniyor, 1 adet ara sınav yapılıyor(çizim sınavı), final için Dönemdeki TES projesinin çizimleri ve aradaki çizimlerin tümünü topluyoruz.	Ayrı Gruplar Halinde	20-40	Her hafta Proje dersine destek bir uygulama ödev yerine geçiyor	Bireysel	Çizim ve Poster Teslimleri, Ara Sınavlar,Ödevler, Ders Uygulamaları, Final - Projelerini anlatmak (Kolaj - çizim))- Sketch book + devamlılık kanaat	Teknik çizimler, Pafta - Poster - (post production photoshop / Boyama elle / Yaz) Process Map - (Ders Öğretim Üyesine Özel) Diagramatik temsil - zaman ve moment temsili	Adobe Photoshop
		TES 122E - Visual Communication II	2 boyuttan 3 boyuta geçişi; perspektif algısını ve bu temsilin kullanımını, Mind Map cognitive map yapısını kavratmak	Her hafta konu anlatımı+uygulama+ödev şeklinde ilerleniyor, 2 adet ara sınav yapılıyor(çizim sınavı), final için Dönemdeki TES projesinin çizimleri ve aradaki çizimlerin tümünü topluyoruz.	Ayrı Gruplar Halinde	20-40	Her hafta Proje dersine destek bir uygulama ödev yerine geçiyor	Bireysel	Çizim ve Poster Teslimleri, Ara Sınavlar,Ödevler, Ders Uygulamaları, Final - Projelerini anlatmak (Kolaj - çizim)- devamlılık kanaat	Teknik çizimler, Pafta - Poster - (post production photoshop / Boyama elle / Yaz) Process Map - (Ders Öğretim Üyesine Özel) Diagramatik temsil - zaman ve moment temsili	Adobe Photoshop
	Architecture Design Studios	MIM 212E - Architectural Design IV	Tasarım ve bağlam ilişkisi içerisinde eleştirel bir çerçevede kabaca işlevlerin tanımlandığı bir program ve seçilen bir arazide konsept proje geliştirmek	İlk hafta çevre verileri için ön okuma ödevleri ve çevre analizleri yapılıyor, ara tatile kadar tasarım fikirleri ortaya çıkıyor 1 juri yapılıyor, ara tatil sonrası kritikler ile 2. bir jüri tasarım geliştiriliyor ve finalde sunum teknikleri ile birlikte projenin tamamlanması bekleniyor	Ayrı Gruplar Halinde	0-20	Başta verilen okuma ödevleri ve analizler var.	Grup ödevi ile başlar bireysel sonlandırılır	Ödevler, Proje gelişimi, Teslimler - Son ürün- Juri değerlendirmesi - Ders devamlılığı	Posterler, Çizimler ve Mimari Projenin Anlatımının olduğu juri paftaları, Fiziksel veya Dijital Model	Lumion - Adobe Photoshop - Sketch Up - Revit - Autocad - Rhino- 3ds Max
		MIM 351E - Architectural Design V	Tasarım ve bağlam ilişkisi içerisinde eleştirel bir çerçevede kabaca işlevlerin tanımlandığı bir program ve seçilen bir arazide konsept proje geliştirmek	İlk hafta çevre verileri için ön okuma ödevleri ve çevre analizleri yapılıyor, ara tatile kadar tasarım fikirleri ortaya çıkıyor 1 juri yapılıyor, ara tatil sonrası kritikler ile 2. bir jüri tasarım geliştiriliyor ve finalde sunum teknikleri ile birlikte projenin tamamlanması bekleniyor	Ayrı Gruplar Halinde	0-20	Başta verilen okuma ödevleri ve analizler var.	Grup ödevi ile başlar bireysel sonlandırılır	Ödevler, Proje gelişimi, Teslimler - Son ürün- Juri değerlendirmesi - Ders devamlılığı	Posterler, Çizimler ve Mimari Projenin Anlatımının olduğu juri paftaları, Fiziksel veya Dijital Model	Lumion - Adobe Photoshop - Sketch Up - Revit - Autocad - Rhino- 3ds Max
		MIM 312E - Architectural Design VI	Çevre -Tasarım-Problem-Fonksiyon arasında Bağlam oluşturmak ve yeni nesil teknolojilerin kullanımı ile konsept proje geliştirmek	Yeni nesil teknolojileri tanıtmak amacı ile 3 hafta workshop yapılıyor,ve sonuçlar teslim ediliyor,sonraki hafta arazi seçimleri ve analizler yapılıyor ve bir ihtiyaç programı bekleniyor, 1 proje üzerinden kritikler ile ilerleniyor 2 ara jüri bir teslim jürisi yapılıyor. konsept tasarım etabında çözülmüş bir proje bekleniyor	Ayrı Gruplar Halinde	0-20	Ara ödev genelde verilmiyor. Kritiklerde proje geliştirmeleri ve workshop teslimleri sorumlulukları içerisinde.	Grup ödevi ile başlar bireysel sonlandırılır	Workshop aktivitesi, Proje gelişimi, Teslimler - Juri değerlendirmesi - Ders devamlılığı	Videolar, Dijital Modeller, Posterler, Çizimler ve Mimari Projenin Anlatımının olduğu juri paftaları, Fiziksel veya Dijital Model	AutoCAD - Setchup- Rhino - Unity - Cubity
		MIM 411E - Architectural Design VII	Çevre -Tasarım-Problem-Fonksiyon arasında Bağlam oluşturmak ve yeni nesil teknolojilerin kullanımı ile konsept proje geliştirmek	Yeni nesil teknolojileri tanıtmak amacı ile 3 hafta workshop yapılıyor,ve sonuçlar teslim ediliyor,sonraki hafta arazi seçimleri ve analizler yapılıyor ve bir ihtiyaç programı bekleniyor, 1 proje üzerinden kritikler ile ilerleniyor 2 ara jüri bir teslim jürisi yapılıyor. konsept tasarım etabında çözülmüş bir proje bekleniyor	Ayrı Gruplar Halinde	0-20	Ara ödev genelde verilmiyor. Kritiklerde proje geliştirmeleri ve workshop teslimleri sorumlulukları içerisinde.	Grup ödevi ile başlar bireysel sonlandırılır	Workshop aktivitesi, Proje gelişimi, Teslimler - Juri değerlendirmesi - Ders devamlılığı	Videolar, Dijital Modeller, Posterler, Çizimler ve Mimari Projenin Anlatımının olduğu juri paftaları, Fiziksel veya Dijital Model	AutoCAD - Setchup- Rhino - Unity - Cubity
	Architectural Design Theory	MIM 114 - Accessibility	Erişilebilirlik (Fiziki boyutu - iletişim boyutu- teknoloji boyutu - sosyal boyutu - yönetimsel boyutu) konularını kavratmak ve Tasarım Algılarında yer edinmesini sağlamak	İlk 7 hafta teori ve bireysel ödevler ile devam ediyor - son yedi hafta ilk üç haftada grup çalışması ile uygulamalı erişilebilirlik problemini çözmelerini beklediğimiz dönem projesi ve sonraki haftalarda bunların sunumları ile dersi tamamlıyoruz. Bir yazılı sınav yapıyoruz finalde.	Ortak	80 ve Üzeri	Ara ödevler var ve uygulama grup ödevi var.	Bireysel başlar grup ödevi ile sonlandırılır	Ödevler, Sınavlar, Derse Katılım ve Sunum	Sunum - Senaryo Yazısı Video - Çizdiklerini Anime Etme Persona - Story Board Yapma - Windows movie (3D Kitap)	Persona Template - Adobe Photoshop - Windows Movie
		MIM 119E - Int.to Architecture and Ethics	Mimarlık mesleğini tarihten bu güne değerlendirerek;, mimari tasarım düşüncesini, meslekteki önemli kişileri ve meslek özelindeki etik değerleri algılatmak	Her hafta konuklar tarafından hazırlanan sunumlar veya bir film yardımı ile ilerletilen mimarlık mesleğine dair söyleşiler ile ilerliyor, her ders için bu sunumların öğrenimine dair öğrencilerden rapor bekliyoruz. Temsil yetilerini desteklemek amaçlı bir ünlü mimardan bina seçip tanıtımını yapıyorlar (kolaj gibi temsiller ile)	Ortak	80 ve Üzeri	Her ders sonunda ders içi raporu devam ediyor, bir bina seçerek tanıtıyorlar bu da dönem ödevi	Bireysel	Ders içi raporları vize olarak sayılıyor, Dönem sonu ödevi final olarak değerlendiriliyor	Poster - Rapor - Sunum	Adobe Photoshop - 3ds Max
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Temel modelleme bilgisini kavratmak, Hesaplamalı tasarım araçlarını tanıtarak ilgi duydurmak	İlk 7 hafta destek öğretici videolar ile ilerletilen ve Laboratuvar uygulama ile devam eden program öğretileri bunlara dair Laboratuvar Raporları ile devam ediliyor,aradan sonra 3 adet üretim Workshop'ı yapılıyor sonra tüm raporlar ve Workshop model çıktıları ara sınav olarak değerlendiriliyor, ardından son üç hafta üretim teknolojileri, AR/VR ve Prototip geliştirme demo'ları ile devam ediyor ve bir adet yazılı sınav yapılıyor	Ortak	80 ve Üzeri	Ekstra ödev yok : Laboratuvar raporları ve teslimleri; üç adet prototip temel teslimleri	Bireysel başlar grup ödevi ile sonlandırılır	%60 vize (devam - ödevler-sınav : grup ödev teslimi 12 . hafta) %40 Final(Teorik sınav yazılı sınav)	Dijital Model Uygulamaları, Fiziksel Modeller	Rhino - Grasshopper

Table I.1 (continued) : Result Table of the General Questions.

CLASSES		GENERAL QUESTION	3	4	5	6	7	8	9	10	11
Ders Sınıfları		Dersin Adı	Dersin ana amacı nedir?	Dersin bir dönem boyunca nasıl işletildiği ile alakalı detay verebilir misiniz ?	Ders ayrı gruplar halinde mi ortak mı işleniyor?	Ders içerisindeki öğrenci sayısı ne kadar ?	Ders içerisinde ödev veriliyor mu? Veriliyor ise ne tür ödevler istendiğinden kısaca bahsedebilir misiniz ?	Ders ödevleri grup ödevi olarak mı bireysel mi verilmekte ?	Ders sürecinde öğrencilerden beklenen dokümanlar nelerdir ?	Ders başarı değerlendirmeleri nasıl yapılıyor ?	Ders içerisinde kullanılan yazılımları sayabilir misiniz ?
CONSTRUCTION	Structural Systems	**MIM 125 - Static**	Yükler altında basit sistemlerde oluşan kuvvetlerin algılatılması	Ders derste teori anlatılıyor, Lab etaplarında soru çözülüyor. Yazılı halde ve hesap üzerine 1 adet mid-term 1 adet final yapılıyor. Dönemde 1 adet ev ödevi veriliyor, araştırma ve hesaplama üzerine.	Ayrı Gruplar Halinde	40-60	Hesaplama sorusu ve Taşıyıcı sistemler özelinde araştırma ve poster	Bireysel	2 sınav 1 ödev Hesaplama ve Pafta Case Study-derse katılım	Pafta - Araştırma Yazısı - Problem Çözümü	Adobe Photoshop
		MIM 126E - Strength of Material	Taşıyıcı sistemlerde malzemeye bağlı iç kuvvet etkisinin algılatılması	Ders derste teori anlatılıyor, Lab etaplarında soru çözülüyor. Yazılı halde ve hesap üzerine 1 adet mid-term 1 adet final yapılıyor. Dönemde 1 adet ev ödevi veriliyor, araştırma ve hesaplama üzerine.	Ayrı Gruplar Halinde	40-60	Hesaplama sorusu ve Taşıyıcı sistemler özelinde araştırma ve poster	Bireysel	2 sınav 1 ödev Hesaplama ve Pafta Case Study-derse katılım	Pafta - Araştırma Yazısı - Problem Çözümü	Adobe Photoshop
		MIM 271E - Theory of Structures	Basit taşıyıcı sistemlerde sistem hesapları ile uygun kesit boyutları ve organizasyonu tartışarak tasarım öncesi bu kriterlerin tahmin edilebilmesini sağlamak	Ders derste teori anlatılıyor, Lab etaplarında soru çözülüyor. Yazılı halde ve hesap üzerine 1 adet mid-term 1 adet final yapılıyor. Dönemde 1 adet ev ödevi veriliyor, araştırma ve hesaplama üzerine.	Ayrı Gruplar Halinde	40-60	Orijinal düşünmeye odaklı ve eleştirisel ödevler - poster -Hesaplama ödevleri	Bireysel	2 sınav 1 ödev - Hesaplama ve Pafta Case Study , Derse katılım	Pafta - Araştırma Yazısı - Problem Çözümü	Adobe Photoshop - AutoCAD kullanan oluyor
		MIM 253E - Steel Structures	Çelik yapı sistemlerini tanıtmak ve çelik eleman sistemlerinin yükler altındaki davranışlarını algılatmak	Ders derste teori anlatılıyor, Lab etaplarında soru çözülüyor (Çelik makas sistemleri hesabı gibi). Yazılı halde ve hesap üzerine 1 adet mid-term 1 adet final yapılıyor. Dönemde 1 adet ev ödevi veriliyor, araştırma ve hesaplama üzerine.	Ayrı Gruplar Halinde	40-60	Orijinal düşünmeye odaklı ve eleştirisel ödevler - poster -Hesaplama ödevleri	Bireysel	2 sınav 1 ödev - Hesaplama ve Pafta Case Study , Derse katılım	Pafta - Araştırma Yazısı - Problem Çözümü	Adobe Photoshop - AutoCAD kullanan oluyor
		MIM 234E - Reinforced Concrete Structures	Taşıyıcı sistemlerde malzemeye dair farklılaşmaları ve betonarme sistemlerin malzeme seçimlerine göre yükler altındaki davranışlarını algılatmak	Ders derste teori anlatılıyor, Lab etaplarında soru çözülüyor. Yazılı halde ve hesap üzerine 1 adet mid-term 1 adet final yapılıyor. Dönemde 1 adet ev ödevi veriliyor, araştırma ve hesaplama üzerine.	Ayrı Gruplar Halinde	40-60	Orijinal düşünmeye odaklı ve eleştirisel ödevler - poster -Hesaplama ödevleri	Bireysel	2 sınav 1 ödev - Hesaplama ve Pafta Case Study , Derse katılım	Pafta - Araştırma Yazısı - Problem Çözümü	Adobe Photoshop - AutoCAD kullanan oluyor
	Building Elements & Materials	**MIM 231E - Building Materials**	Malzemeye dair kapsamlı altyapı oluşturmak, tasarım-yapı ve malzeme bağlamı kazandırmak	İlk haftalar malzeme ve teknik özelliklerini tanıtıcı sunumlar, hesaplama; sonraki haftalarda malzeme bilimi özelinde sınıflar, işlevsel ara malzemeler ve yapı elemanlarında malzemeler olmak üzere teorik ağırlıklı işliyoruz, 2 ara ödev veriliyor hesaplama ödevi ve 1 adet dönem içi ödev veriliyor grup halinde tamamlayacakları bir yapı elemanı için kullanılan malzeme tanıtımları. Yazılı şekilde 1 adet ara sınav bir adet final sınavı ile de değerlendiriliyorlar.	Ayrı Gruplar Halinde	60-80	Hesaplama ödevleri ve dönem ödevi : Malzeme Tanıtımı	Bireysel başlar grup ödevi ile sonlandırılır	2 sınav 3 Ödev - derse katılım	Araştırma Yazısı - Tez formatı gibi format veriyorum. Sunum - Poster - Malzeme Örneği - Uygulama Videoları	Adobe Photoshop - Power Point
		MIM 203 - Building and Const inArch.	Bina ve Bina alt sistemlerine (taşıyıcı - servis) kapsamlı alt yapı oluşturmak, ve uygulama tekniklerini öğretmek	İlk 4 hafta teorik anlatım, sonrasında firmalar yardımı ile yapım uygulamaları devam ediyor; bu süreçte öğrencilerden rapor etmeleri isteniyor, uygulamalardan sonra stüdyoda çizimler yapılıyor, bir ara sınav var; çizimler finalde raporlar ile birlikte teslim ediliyor tekrardan	Ortak	80 ve Üzeri	Rapor ve Çizimler ödev niteliği taşıyor.	Tüm süreç bireysel devam eder	Sınavlar - Çizim Teslimleri - Ders Raporları - Ders Devamlılığı - Derse Katılım	Çizim Teslimleri	AutoCAD
		MIM 204 - Arch.Building Element Design	Yapı elemanlarının bir proje içerisinde analiz edilmesini sağlamak ve birbirleri ile olan iletişimini algılatmak	İlk 6 hafta basit ev tasarımı ve temel elemanların yerleşimine yönelik grup halinde çalışılıyor ve gruplar (2 kişilik) ara tatil öncesi teslim yapıyorlar; ardından sonraki 7 hafta için bireysel çalışılıyor ve grup ödevinde yapılan projenin eleman tasarımları ve katmanlı elemanlardaki malzeme seçimleri ile çizimlerine devam ediyorlar. Finalde bu çizimlerin teslimleri alınıyor.	Ayrı Gruplar Halinde	20-40	Çizimler ödev niteliği taşıyor : Teslimler - 1. not ara teslim grup / Dönem sonu bireyse teslim: 2. not	Grup ödevi ile başlar bireysel sonlandırılır	Teslimlerle değerlendiriliyorlar, bazı gruplar yazılı sınav da yapabiliyor	Çizim Teslimleri	AutoCAD
	Physical Environment Control	**MIM 246E - Environmental Control Studio**	Bina performansında etkili iklimlendirme, aydınlatma, yangın, akustik ve tesisat konuları hakkında bilgi vererek tasarım kiterlerindeki diğer disiplin spesifik konuları algılatmak	Haftanın ilk dersi 4 saat teorik bilgi - 2. derste 4 saat uygulama yapıyoruz (Günlük teslimle devam ediliyor), 2 teorik yazılı sınav ve teslim edilen uygulamalardan değerlendiriliyor: Uygulamalar 1 hatalı konut planı ile başlıyor ve konu spesifik çözümler ve çizimler ile devam ediyor	Ayrı Gruplar Halinde	40-60	Çizim ve Hesaplama uygulamaları ödev niteliği taşıyor / Son teslimlerde istenirse 3D model yapılıyor	Tüm süreç bireysel devam eder	Sınavlar - Teslimler - Ders Devamlılığı - Derse Katılım	Çizim Teslimleri (Her konu için ayrı ayrı oluyor)	AutoCAD
	Construction Systems & Management	**MIM 333E - Building Production Systems**	Yapı üretim sistemlerini inşaat elemanlarından, yapım teknolojilerine doğru aşamalı bir seklide çok parametreli yapı içerisinde farklı bakış açıları sınıfında algılatmak.	Video ve Sunum destekli örnekler ile teknoloji nedir ve teknolojik sistemler nelerdir anlatılıyor sonra öğrencilerden araştırma, öğrenme istasyonu alt yapısında uygulamalı çalışma ve sunum bekleniyor; Ara tatile kadar 2 uygulama , ara tatilden sonra tek uygulama yapıyorlar; İlk konulara giriş yapıyoruz: üretim sistemler - inşat sektörü - bakış açıları üzerinden sınıflandırılarak anlatılıyor: öğrenme istasyonları altyapısında - input output process ile uygulamaları , Araştırma - case study - prototip - sunum) (Öğreterak öğrenmek) yapıyorlar. 1 ara sınav bir yıl sonu sınavı.	Ortak	60-80	Veriliyor, uygulama ve araştırma ödevleri şeklinde	Bireysel başlar grup ödevi ile sonlandırılır	1 Ara Sınav - 1 Final Sınavı - Ara Uygulamalar : 3 adet sunum ağırlıklı - Derse Devam ve Katılım	Araştırma Yazısı - Sunum - Poster - İş Akış Analizi - Çizim / Model - İstasyon künyeleri içerisinde öğrenme metodları ve referanslar	Ne Lazımsa Kullanıyorlar - Araç odaklı gitmiyoruz
		MIM 359E - Construction Management & Economy	Yapı sektöründeki gelişmeler, inşa yönetim stratejileri ve maliyet ve zaman yönetimleri gibi yönetim spesifik konuları algılatmak	Derste teorik anlatımlardan sonra, anlık anketler ile geri dönüşler alınıyor, teori ağırlıklı ve temel yönetim metotlarını algılatarak ilerleniyor. Yönetim - Proje Yönetimi - PDS (Delivery Methods)- Sözleşmeler- Fizibilite Analizi - Maliyet Tahmini - Ek: İhale - Güvenlik Yönetimi ve Zaman Yönetimi // Uygulamalar basit metotları deneyecekleri uygulamalar oluyor, teorik 2 ara sınav ve bir final sınavı oluyor.	Ayrı Gruplar Halinde	60-80	Veriliyor, uygulama ve araştırma ödevleri şeklinde	Bireysel başlar grup ödevi ile sonlandırılır	2 Ara Sınav - 1 Final Sınavı - Ara Uygulamalar : iki haftada bir konu spesifik uygulama ve quizler - Derse Devam ve Katılım	Mind Map - Planlama - Konu spesifik Araç tanıtımları hakkında yorumlar vs. - Kısa dijital soruların çözümü - İstasyon künyeleri içerisinde öğrenme metodları ve referanslar	Ne Lazımsa Kullanıyorlar - Araç odaklı gitmiyoruz - 4D ve 5D araç tanıtımları yapılıyor
	Construction Studio	**MIM 431E Construction Project**	Bir projenin şematik tasarımdan kesin proje aşamasına geçirilecek düzeyde belgelendirilmesi	Birinci hafta 1/200 konsept: yerleşim - pasif iklimlendirme - doğal aydınlatma konuları düşünülüyor) - Taşıyıcı sistem ve servis hizmetleri (Tesisat : ısınma - aydınlatma ve havalandırma - pis ve temiz su - elektrik gibi) 1 /50 projede tesmsil - 1/20 mimari proje: mahal listeleri, merdiven detayı, mutfak ve banyo detayları - 1/5 sistem detayı ile bitiriliyor - sınav veya juri yok.	Ayrı Gruplar Halinde	0-20	Yönetmelik araştırmaları ve malzeme araştırması ödevleri veriliyor son teslimde ayrıca malzeme kararları ile bir liste de teslim ediliyorlar. (Tüm Çizimler ile beraber)	Tüm süreç bireysel devam eder	Teslimler ve Derse Devamlılık	Araştırma Yazısı - Poster - iki boyutlu çizim (isteğe bağlı dijital model)	CAD yazılımları - Revit (Ön proje Teslimi) - Rhino - Sketch up - ArchiCAD

Table I.1 (continued) : Result Table of the General Questions.

CLASSES		GENERAL QUESTION	3	4	5	6	7	8	9	10	11
Ders Sınıfları		Dersin Adı	Dersin ana amacı nedir?	Dersin bir dönem boyunca nasıl işletildiği ile alakalı detay verebilir misiniz ?	Ders ayrı gruplar halinde mi ortak mı işleniyor?	Ders içerisindeki öğrenci sayısı ne kadar ?	Ders içerisinde ödev veriliyor mu? Veriliyor ise ne tür ödevler istendiğinden kısaca bahsedebilir misiniz ?	Ders ödevleri grup ödevi olarak mı bireysel mi verilmekte ?	Ders sürecinde öğrencilerden beklenen dokümanlar nelerdir ?	Ders başarı değerlendirmeleri nasıl yapılıyor ?	Ders içerisinde kullanılan yazılımları sayabilir misiniz ?
U.D.	Urban Planning	**MIM 343 - Urbanism and Planning Law**	Kentsel Planlama Süreçlerini ve Kriterlerini öğretmek	İlk 7 hafta teorik : Kent okuması - imar kanunu - analiz metodları / Sonraki 7 Hafta : bir alan tercih edip gruplar halinde analiz ve sentez sonucu potansiyeller ve problemler - çözüm önerileri şeklinde uygulamalı ilerliyor. 1 ara bir fial yazılı sınav da mğfredata dahil	Ayrı Gruplar Halinde	0-20	Sınırlı zaman dolayısıyla teorik tek taraflı gidiyor - Proje aşamasında çeşitli okumalar ve araştırmalar ödev kapsamında verilebiliyor	Tüm süreç grup ödevi olarak devam eder	Sınavlar - Ödevler- Proje Geliştirme - Devamlılık - Katılım	Kapsamlı araştırma - Harita araştırması - Poster - Sunum - Tasarımı 3D Dijital sunmalarını istiyoruz	Sketch up
CON.	Architectural and Urban Conservation	**MIM 322E - Conserv.of Hist. Build.&Sites**	Tarihi anıt ve çevre korumasının tarihçesi, uluslararası yaklaşımları, Türkiye'deki durumu, yasal arka planları ve koruma metotlarını öğretmek. (Yapı Belgeleme ve Koruma Projesi oluşturma)	Teorik Anlatı ve bir dönem ödevi ile devam ediyor. Dönem Ödevi . 1 ara sınav 1 final sınavı yazılı şekilde yapılıyor.	Ayrı Gruplar Halinde	60-80	Belirlenecek tarihi alanda envanter ve anıt fişlerini doldurarak, temsiller yardımı ile alanın mevcut yapısını analiz etmek üzerine 1 adet dönem ödevi var.	Tüm süreç grup ödevi olarak devam eder	Ara sınav - Final Sınavı - Dönem Ödevi	Dijital anıt fişleri - Haritalama - kısa rapor - Fotoğraflar	Kapsam Dışı
		MIM 361E-Archtctrl Survey & Restrtn Std	Kuramsal giriş dersinin ardından tarihi yapılarda bire bir çalışarak rölevenin ana ilkelerini öğretmek ve uygulatmak	Gerçek bir tarihi yapı üzerinde mevcut durum analizi, veri toplama ve belgeleme dönem boyunca devam ediyor. Final Teslimine kadar tarihi yapı üzerinde çalışılarak yapının 1/50 Plan, Görünüş ve kesitleri CAD ortamına aktarılıyor.	Ayrı Gruplar Halinde	20-40	Ödevleri: CAD çizimleri - krokiler - araştırma - fotoğraf albümü genel teslimde alıyoruz. Ara teslim var ama kritik almak için.	Tüm süreç grup ödevi olarak devam eder	Ara teslim ve final Teslimi (Çizimler 1/50 röleve - bu araştırmalar - raporlar - fotoğraf albümü - krokiler - İş Bölümü planı)	1/50 röleve cad çizimleri - raporlar - fotoğraf albümü - krokiler	AutoCAD
DIP.	Diploma Project	**MIM 4902 - Diploma Project**	Bir mekanın belli fonksiyonel gereksinimleri ile tüm tasarım kriterleri düşünülerek yaratıcı bir konsept proje haline getirilmesi.	Süreç: Proje konusu ve program öğrenciye on sayfalık dosya halinde veriliyor. Arka planı anlayan öğrenci bir süre projesini geliştiriyor, tamamen bireysel şekilde. Ardından 2 adet ara juri ile uzman destekli yorumlarla proje geliştirilmeye devam ediyor ve finalde anlaşılır bir temsil ve diğer disiplinlerden aldığı bilgilere aykırılık oluşturmayacak bir proje üretip savunma jurisine çıkıyor. (Juri üyeleri 3 Mimarlık - Yapı - Statik - Restorasyon -mimarlık tarihi uzmanlıklarının bir kaçından ve piyasadan katılacak bir konuktan oluşuyor)	Ayrı Gruplar Halinde	20-40	Kapsam Dışı	Tüm süreç bireysel devam eder	Juri Notu	Konsept - Temsil Teknikleri - Çizimler	El çizimi de yapıp getirebilir - Perspektiflerini de elde çizebilir // 3D temel kullanımlar Render - Photo

Table I.2 : Result Table of the Common Data Environment & Project Delivery Questions.

Classes		CDE-Project Delivery	12	13	14	15	16
Ders Sınıfları		Dersin Adı	Ödev teslimleri ve sunumlar nasıl yapılıyor?	Dijital halde sunum yapanların oranı nedir ?	Ödev teslimleri ve sınavlar tarafınızca nasıl arşivleniyor ?	Tüm bu süreçler için kullandığınız ve herkesin erişebildiği bir platform var mıdır ?	Teslimler belirli isimlendirme kuralları ile mi yapılıyor ?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova (Sınırlı Boyutta) - Blog, Facebook, Google Drive	Bir Şablon Veriliyor
		TES 121E - Project II	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova (Sınırlı Boyutta) - Blog, Facebook, Google Drive	Bir Şablon Veriliyor
		TES 211E - Project III	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 30- 60	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		TES 113E - Basic Design and Visual Arts	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Google Drive	Bir Şablon Veriliyor
		TES 112E - Visual Communication I	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Google Drive	Bir Şablon Veriliyor
		TES 122E - Visual Communication II	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Google Drive	Bir Şablon Veriliyor
	Architecture Design Studios	MIM 212E - Architectural Design IV	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 30- 60	Dijital Ortamda	Google Drive	Bir Şablon Veriliyor
		MIM 351E - Architectural Design V	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 30- 60	Dijital Ortamda	Google Drive	Bir Şablon Veriliyor
		MIM 312E - Architectural Design VI	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 10 - 30	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Google Drive	Bir Şablon Veriliyor
		MIM 411E - Architectural Design VII	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 10 - 30	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Google Drive	Bir Şablon Veriliyor
	Architectural Design Theory	MIM 114 - Accessibility	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 60 - 100	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	NinovaNinova (Sınırlı Boyutta - Çökme tehlikesi yaşadık) - Google Drive	Dikkat Ediliyor
		MIM 119E - Int.to Architecture and Ethics	Basılı Dokümanlar Halinde Teslim Ediliyor ve Sunuluyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova kapasite yetmiyor / Dijital Arşiv içi Google Class Kullanıyoruz	Hayır - (Klasör Altına Kaydediliyor)
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Dijital Şekilde Teslim Ediliyor ve Sunuluyor	% 60 - 100	Dijital Ortamda	Ninova	Bir Şablon Veriliyor

Table I.2 (continued) : Result Table of the Common Data Environment & Project Delivery Questions.

CLASSES		CDE - Project Delivery	12	13	14	15	16
Ders Sınıfları		Dersin Adı	Ödev teslimleri ve sunumlar nasıl yapılıyor?	Dijital halde sunum yapanların oranı nedir ?	Ödev teslimleri ve sınavlar tarafınızca nasıl arşivleniyor ?	Tüm bu süreçler için kullandığınız ve herkesin erişebildiği bir platform var mıdır ?	Teslimler belirli isimlendirme kuralları ile mi yapılıyor ?
CONSTRUCTION	Structural Systems	**MIM 125 - Static**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		MIM 126E - Strength of Material	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		MIM 271E - Theory of Structures	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		MIM 253E - Steel Structures	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		MIM 234E - Reinforced Concrete Structures	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
	Building Elements & Materials	**MIM 231E - Building Materials**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 60 - 100	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova	Dikkat Ediliyor
		MIM 203 - Building and Const inArch.	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda	Ninova	Hayır - (Klasör Altına Kaydediliyor)
		MIM 204 - Arch.Building Element Design	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda	Ninova	Hayır - (Klasör Altına Kaydediliyor)
	Physical Environment Control	**MIM 246E - Environmental Control Studio**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda	Ninova	Hayır - (Klasör Altına Kaydediliyor)
	Construction Systems & Management	**MIM 333E - Building Production Systems**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 60 - 100	Dijital Ortamda	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
		MIM 359E - Construction Management & Economy	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 60 - 100	Dijital Ortamda	Ninova - Google Drive	Hayır - (Klasör Altına Kaydediliyor)
	Construction Studio	**MIM 4902 - Diploma Project**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 30- 60	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova	Bir Şablon Veriliyor
U.D.	Urban Planning	**MIM 343 - Urbanism and Planning Law**	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda;Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Ninova - Google Drive	Kapsam Dışı
CON.	Architectural and Urban Conservation	**MIM 322E - Conserv.of Hist. Build.&Sites**	Basılı Dokümanlar Halinde Teslim Ediliyor ve Sunuluyor	% 0 - 10	Arşivlenmiyor	Hayır	Hayır
		MIM 361E-Archtctrl Survey & Restrtn Std	Hem dijital hem fiziksel olarak teslim yapılıyor - her iki şekilde de sunulabiliyor	% 0 - 10	Dijital Ortamda	Google Drive	Bir Şablon Veriliyor
DIP.	Diploma Project	**MIM 431E Construction Project**	Basılı Dokümanlar Halinde Teslim Ediliyor ve Sunuluyor	% 0 - 10	Basılı Dokümanlar ve CD'ler Halinde Bir Odada	Hayır	Bir Şablon Veriliyor

Table I.3 : Result Table of the Project Lifecycle Questions.

Classes		Project Lifecycle	17	18	19	20	21
Ders Sınıfları		Dersin Adı	Ders içerisindeki sunumlarda veya teslimlerde öğrencilerden sonuç ürüne yaklaşım süreçlerini açıklayan bir doküman isteniyor mu?	Ders kapsamında proje süreçleri ve proje yaşam döngüsünden bahsediliyor mu?	Ders kapsamında proje süreçleri ve proje yaşam döngüsü nasıl ele alınıyor ?	Tasarım süreçlerini inşaat uygulamaları-saha ve işletme aşaması düşünerek tartışıyorlar mı ?	Evet ise; Hangi konu ağırlıklı tartışılıyor ? / Hayır ise; niçin tartışılmıyor?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Hayır	Kısmen	**Not**: Temelde bu aşamaların önemine tam varamıyoruz son ürüne önem veriyoruz öğrenci sayısının fazla olması ve zamanın kısıtlı olması **Değinilen Konular:** Proje sürecinde tasarımın etkisi ve önemi - yapılan tasarımın işletme sürecinde çevreye etkisi - bina yapılırken nasıl devam edileceği : saha temsil ve sahada algılanış - Proje Ömrü	Kısmen	Tasarımın etkilediği her nokta bizim için önemli ama ağırlıklı olarak kritiklerde bu konu başlıklarının etkilediği ekonomik konuları ele alıyoruz
		TES 121E - Project II	Hayır	Kısmen	**Not:** Temelde bu aşamaların önemine tam varamıyoruz son ürüne önem veriyoruz öğrenci sayısının fazla olması ve zamanın kısıtlı olması **Değinilen Konular:** Proje sürecinde tasarımın etkisi ve önemi - yapılan tasarımın işletme sürecinde çevreye etkisi - bina yapılırken nasıl devam edileceği : saha temsil ve sahada algılanış - Proje Ömrü	Kısmen	Tasarımın etkilediği her nokta bizim için önemli ama ağırlıklı olarak kritiklerde bu konu başlıklarının etkilediği ekonomik konuları ele alıyoruz.
		TES 211E - Project III	Evet	Kısmen	Sürecin bütünsel bir bakış açısı ile izletilmesi için proje yaşam döngüsünün önemi anlatılıyor (Hayal - Gerçek)	Kısmen	Bu aşamalar kritiklerde tartışılıyor; erişilebilirlik doğa tahribatı gibi konulara da değiniliyor bu kapsamda
		TES 113E - Basic Design and Visual Arts	Evet	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 112E - Visual Communication I	Evet	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 122E - Visual Communication II	Evet	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
	Architecture Design Studios	MIM 212E - Architectural Design IV	Evet	Kısmen	Pisadaki konular ile bu konunun önemi tartışlıyor - Tasarımlarında diyagramların önemi ve akışın temsiline değiniyoruz.	Kısmen	Tasarım - ,işetme süreçleri yorumlarda yapılıyor - jürilerde . yangın kaçışları - yürüme mesafeleri
		MIM 351E - Architectural Design V	Evet	Kısmen	Pisadaki konular ile bu konunun önemi tartışlıyor - Tasarımlarında diyagramların önemi ve akışın temsiline değiniyoruz.	Kısmen	Tasarım - ,işetme süreçleri yorumlarda yapılıyor - jürilerde . yangın kaçışları - yürüme mesafeleri
		MIM 312E - Architectural Design VI	Evet	Hayır	Kapsam Dışı	Hayır	O kapsamda değil proje - gelişmeyi engelleyebiliyor
		MIM 411E - Architectural Design VII	Evet	Hayır	Kapsam Dışı	Hayır	O kapsamda değil proje - gelişmeyi engelleyebiliyor
	Architectural Design Theory	MIM 114 - Accessibility	Hayır	Evet	// Neden süreç ihityaçlar değişiyor // Dinamik bakış açısı şart // Binaların statik insanlar mobil diye bakmamak lazım zaman da bir parametre ve Binayı dinamik hale getiriliyor // Evrensel Tasarım - Erişebilirlik ve Kapsam açaılmalı Planlam - Tasarlama - Uygulama ya geçirme - Direkt bahsediliyor	Kısmen	Sorunlar ve hep bütünsel yaklaşılarak devam edilmeye çalışılıyor
		MIM 119E - Int.to Architecture and Ethics	Hayır	Evet	Pisadaki konular ile bu konunun önemi tartışlıyor - Ofisteki tasarım süreçlerine değinerek anlattılar	Kısmen	Konuşmacı ağırlıklı
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Evet	Hayır	Kapsam Dışı	Hayır	Proje yapılmıyor ancak ; Üretim süreci işin içine dahil

Table I.3 (continued) : Result Table of the Project Lifecycle Questions.

Classes		Project Lifecycle	17	18	19	20	21
Ders Sınıfları		Dersin Adı	Ders içerisindeki sunumlarda veya teslimlerde öğrencilerden sonuç ürüne yaklaşım süreçlerini açıklayan bir doküman isteniyor mu?	Ders kapsamında proje süreçleri ve proje yaşam döngüsünden bahsediliyor mu?	Ders kapsamında proje süreçleri ve proje yaşam döngüsü nasıl ele alınıyor ?	Tasarım süreçlerini inşaat uygulamaları-saha ve işletme aşaması düşünerek tartışıyorlar mı ?	Evet ise; Hangi konu ağırlıklı tartışılıyor ? / Hayır ise; niçin tartışılmıyor?
CONSTRUCTION	Structural Systems	MIM 125 - Static	Evet	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 126E - Strength of Material	Evet	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 271E - Theory of Structures	Evet	Hayır	Yapılmış projelerden verilen örnekler oluyor bu sürecte bazı aşamalarından bahsediyoruz ama konu bütünsel ele alınmıyor.	Hayır	Kapsam Dışı
		MIM 253E - Steel Structures	Evet	Hayır	Yapılmış projelerden verilen örnekler oluyor bu sürecte bazı aşamalarından bahsediyoruz ama konu bütünsel ele alınmıyor.	Hayır	Kapsam Dışı
		MIM 234E - Reinforced Concrete Structures	Evet	Hayır	Yapılmış projelerden verilen örnekler oluyor bu sürecte bazı aşamalarından bahsediyoruz ama konu bütünsel ele alınmıyor.	Hayır	Kapsam Dışı
	Building Elements & Materials	MIM 231E - Building Materials	Hayır	Kısmen	Malzeme seçimlerinde dikkat edilirken projenin aşamalarına dikkat edilerek ilerlenmesi anlatılıyor	Kısmen	Doğal Mazele bulmak zor ama endüstriyel malzemede bu sorun olur malzeme yaşam ömrü
		MIM 203 - Building and Const inArch.	Hayır	Kısmen	Bu konu kavramsal olarak anlatılıyor ve tanımlanıyor	Hayır	Kapsam Dışı
		MIM 204 - Arch.Building Element Design	Hayır	Kısmen	Tasarımların dikkat etmeleri gereken ve düşünmeleri gerekn bir konu olarak tartışılıyor.	Hayır	Özellikle bahsetmiyoruz soru gelirse tartışıyoruz
	Physical Environment Control	MIM 246E - Environmental Control Studio	Hayır	Kısmen	Her süreçte sorularla bu aşamalarda performans konuları ne zaman işin içine girer projede önemi nedir konuşuyoruz, interaktif bir ders olduğu için süreçlerin bir kısmını direkt uygulamalarda görüyoruz.	Hayır	Konu spesifik derslerimiz özellikle işletme aşamasındaki sonuçlarla örnekler veriyor. Tasarımda bunu değiştirirsm performans sonuçları nasıl etkilenir gibi. Ara aşamalara pek değinilmiyor.
	Construction Systems & Management	MIM 333E - Building Production Systems	Evet	Evet	Direk konu bazlı anlatılıyor ve işleniyor, örnekler ile zenginleştiriliyor.	Evet	Ana Konularımızdan Biri
		MIM 359E - Construction Management & Economy	Hayır	Evet	Direk konu bazlı anlatılıyor ve işleniyor, örnekler ile zenginleştiriliyor.	Evet	Ana Konularımızdan Biri
	Construction Studio	MIM 431E Construction Project	Hayır	Kısmen	Başından sonuna kadar hep konuşuyoruz - bunu neden, nasıl ve ne için yapıyoruz sorgulamalarında temel kritik.	Kısmen	Doğalgazın olmadığı bir yerde proje yapıyorduk LPG tankı kullandı - tanker erişemeyecek / Probleme göre şekilleniyor
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Evet	Kısmen	Metal MAP - Kentsel planlama süreçlerindeki aşamalardan bahsediyor ve konuyu mimari ile bütünsel ele alıyoruz	Kısmen	Kapsamlı analiz gereği bu konulara değiniliyor ve planlama kriterleri kapsamında bu konular konuşuluyor: Bitki varlığı ve ulaşım - yoğunluk
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Evet	Evet	Yapı Yaşam Ömrü asıl konu: Yapıların çok azı ilk inşa edildiği gibi - süreçte özgün yapının değişimi ve amacına kadar eskiye gidiliyor.	Kısmen	Restorasyon süreci için bu konu başlıkları yeri gelirse konuşulabiliyor
		MIM 361E-Archtctrl Survey & Restrtn Std	Evet	Kısmen	Teorik derste bahsedilmiş oluyor - uygulamada da bu konunun düşünülerek fikirlerin ilerletilmesi esas.	Kısmen	Restorasyon süreci için bu konu başlıkları yeri gelirse konuşulabiliyor
DIP.	Diploma Project	MIM 4902 - Diploma Project	Evet	Kısmen	Konsept Paftası içerisinde bekleniyor Form ve Yaklaşım ağırlıklı oluyor Tasarım Ağırlıklı Kalıyor / İşletme Evresi konuşuluyor - ekonomi değil kullanım ağırlıklı konuşuluyor.	Hayır	Tasarım Ağırlıklı Kalıyor - Senaryo üzerinden tartışmalarda bahsediliyor genelleyemeyiz

Table I.4 : Result Table of the Roles and Responsibilities Questions.

Classes		Roles & Responsiblities	22	23
Ders Sınıfları		Dersin Adı	Ders içerisinde tasarımcının rolünden ve projedeki sorumluluklarından bahsedilmekte mi?	Gruplar halinde verilen ödevlerde kişilerin iş paylaşımları ve grup içerisindeki rolleri tartışılıyor mu ? Grup ödevleri değerlendirilirken bu esaslar da göz önüne alınıyor mu ?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Evet	İşler verilirken o işin kalemlerini anlatıyoruz ama plan istenmiyor
		TES 121E - Project II	Evet	İşler verilirken o işin kalemlerini anlatıyoruz ama plan istenmiyor
		TES 211E - Project III	Evet	Bu bizim için önemli sunum öncesi kimlerin ne yaptığını sorguluyoruz. Bir iş planı yapmak durumundalar
		TES 113E - Basic Design and Visual Arts	Hayır	Bireysel devam ediyor
		TES 112E - Visual Communication I	Hayır	Bireysel devam ediyor
		TES 122E - Visual Communication II	Hayır	Bireysel devam ediyor
	Architecture Design Studios	MIM 212E - Architectural Design IV	Evet	Doküman istenmiyor ama süreçte kim ne yapıyor haberimiz oluyor. Bireysel potansiyeller ile değerlendiriliyor
		MIM 351E - Architectural Design V	Evet	Doküman istenmiyor ama süreçte kim ne yapıyor haberimiz oluyor. Bireysel potansiyeller ile değerlendiriliyor
		MIM 312E - Architectural Design VI	Evet	Hayır
		MIM 411E - Architectural Design VII	Evet	Hayır
	Architectural Design Theory	MIM 114 - Accessibility	Evet	Grup ödevleri veriliyor teslimler bireysel alındığı için öprenciler eşit çalışıyor, ancak bir sorumluluk ayrımı istenmiyor
		MIM 119E - Int.to Architecture and Ethics	Evet	Bireysel devam ediyor
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Hayır	Bireysel devam ediyor
CONSTRUCTION	Structural Systems	MIM 125 - Static	Evet	Bireysel devam ediyor
		MIM 126E - Strength of Material	Evet	Bireysel devam ediyor
		MIM 271E - Theory of Structures	Evet	Bireysel devam ediyor
		MIM 253E - Steel Structures	Evet	Bireysel devam ediyor
		MIM 234E - Reinforced Concrete Structures	Evet	Bireysel devam ediyor
	Building Elements & Materials	MIM 231E - Building Materials	Evet	Ayrı malzeme araştırmalarını herkesin yapmasını ortak bir konsepte birleştirmesini istiyoruz sorumluluklar önden verilmiş oluyor
		MIM 203 - Building and Const inArch.	Evet	Bireysel devam ediyor
		MIM 204 - Arch.Building Element Design	Evet	Tasarım - detay arasında grupdaki sorumlulukları biz de planlayabiliyoruz / herkesin deneyimledikleri sorumluluk aynı, yapı tercihi farklı oluyor
	Physical Environment Control	MIM 246E - Environmental Control Studio	Evet	Bireysel devam ediyor
	Construction Systems & Management	MIM 333E - Building Production Systems	Evet	Roller direkt tartışılıyor - Mimari Proje Yarışması içerisinde iş bölümü yapın diye uyarıyoruz
		MIM 359E - Construction Management & Economy	Evet	Roller direkt tartışılıyor - Mimari Proje Yarışması içerisinde iş bölümü yapın diye uyarıyoruz, Yönetim dokümanında sorumluluk matrisi alanı gösteriliyor.
	Construction Studio	MIM 431E Construction Project	Evet	Bireysel devam ediyor
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Evet	Bireysel devam ediliyor
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Evet	Evet - Fiziksel olarak takip ediyoruz
		MIM 361E-Archtctrl Survey & Restrtn Std	Evet	Evet - Fiziksel olarak takip ediyoruz
DIP.	Diploma Project	MIM 4902 - Diploma Project	Evet	Bireysel devam ediyor

Table I.5 : Result Table of the Model Dimensions Questions.

Classes		Model Dimentions	24	25	26	27	28	29	30	31	32	33
Ders Sınıfları		Dersin Adı	Ders içerisindeki teslimlerinde 3 boyutlu modelleme yapılıyor mu?	Ders içerisinde 3 boyutlu modelleme ile ilgili hangi programlardan bahsediliyor? Bu amaçla kullanılan BIM programları var mı ?	Ders içeriğinde parametrik düşünmeye ilişkin yönlendirmeler var mı ? Bu kapsamda kural tabanı yazılımlar veya görsel programlama dilleri öğretiliyor mu ?	Ders içerisinde tasarım süreci ve proje teslimi arasında ki zamanlama için öğrenciler bilgilendiriliyor mu ? Bu süreci nasıl yönetiyorsunuz?	Ders kapsamında "Gant Çizelgesi" gösteriliyor mu?	Öğrenciler ders esnasında mekan, bina yapı elemanı ve malzeme kullanımlarını ekonomik açıdan tartışıyor mu ?	Metraj konusuna ders kapsamında değiniliyor mu ?	Ders içerisinde sürdürülebilirlik kavramına değiniliyor mu ?	Sürdürülebilirlik nasıl ele alınıyor ?	Ders içerisinde tesis yönetimi, kalite kontrolü, saha güvenliği gibi üst düzey konulardan bahsediliyor mu?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Gerekli değil isteğe bağlı yapanlar var	Yalnızca teknik çizim var	Konudan hiç bahsedilmiyor	Zamanı organize etmekten bahsediyoruz. Syllabus veriliyor ve sürekli hatırlatılıyor. Haftalık planları bir ders öncesinde konuşuyoruz.	Hayır	Kısmen	Keşif konusunda ders içerisinde örnek veriliyor	Evet	LEED sertifikası ve Ekolojik sürdürülebilirlikten bahsediliyor - pasif iklimlendirme ve doğal kaynakların kullanılması ve mikro klima etkileri (Güneş - gölge rüzgar analizi)	Hayır
		TES 121E - Project II	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - Rhino kullananlar var	Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor;Bu becerinin direkt olarak projelerde kullanılması isteniyor	Zamanı organize etmekten bahsediyoru. Syllabus veriliyor ve sürekli hatırlatılıyor. Haftalık planları bir ders öncesinde konuşuyoruz.	Hayır	Kısmen	Keşif konusunda ders içerisinde örnek veriliyor	Evet	LEED sertifikası ve Ekolojik sürdürülebilirlikten bahsediliyor - pasif iklimlendirme ve doğal kaynakların kullanılması ve mikro klima etkileri (Güneş - gölge rüzgar analizi)	Hayır
		TES 211E - Project III	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - 3ds Max kullananlar var	Konudan hiç bahsedilmiyor	Syllabus veriliyor ve sürekli hatırlatılıyor	Hayır	Kısmen	Kritiklerde sadece sohbet havasında bahsediliyor	Evet	Temel Konumuz, tasarımlar temelde bu parametre önemsenerek geliştiriliyor.	Hayır
		TES 113E - Basic Design and Visual Arts	Sadece 2 boyutlu teslimler isteniyor	Yalnızca teknik çizim var	Konudan hiç bahsedilmiyor	Syllabus ve Haftaık Hanout veriliyor ve sürekli hatırlatılıyor	Hayır	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
		TES 112E - Visual Communication I	Sadece 2 boyutlu teslimler isteniyor	Yalnızca teknik çizim var	Konudan hiç bahsedilmiyor	Syllabus veriliyor ve sürekli hatırlatılıyor	Hayır	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
		TES 122E - Visual Communication II	Sadece 2 boyutlu teslimler isteniyor	Yalnızca teknik çizim var	Konudan hiç bahsedilmiyor	Syllabus veriliyor ve sürekli hatırlatılıyor	Hayır	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
	Architecture Design Studios	MIM 212E - Architectural Design IV	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - 3ds MAX - **ArciCAD - Revit**- Rhino - AutoCAD kullananlar var	Konudan hiç bahsedilmiyor.	Zaman yönetimine vurgu yapılıyor ancak temel kaygımız değil. Syllabus veriliyor, bire bir sadık kalmayabiliyoruz	Hayır	Kısmen	Juriede sorgulanabiliyor. Kritiklerde malzeme ve leman kulanımları seçiminde dikkat edilmesi söyleniyor.	Evet	Bu konu kritiklerde ve tasarım yaklaşımında ön planda - ekolojik tasarım artı puan alıyor	Hayır
		MIM 351E - Architectural Design V	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - 3ds MAX - **ArchiCAD - Revit**- Rhino - AutoCAD kullananlar var	Konudan hiç bahsedilmiyor.	Zaman yönetimine vurgu yapılıyor ancak temel kaygımız değil. Syllabus veriliyor, bire bir sadık kalmayabiliyoruz	Hayır	Kısmen	Juriede sorgulanabiliyor. Kritiklerde malzeme ve leman kulanımları seçiminde dikkat edilmesi söyleniyor.	Evet	Bu konu kritiklerde ve tasarım yaklaşımında ön planda - ekolojik tasarım artı puan alıyor	Hayır
		MIM 312E - Architectural Design VI	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - Rhino kullananlar var	Konudan hiç bahsedilmiyor	Juri tarihleri belli ama istenilenler net değil / iç işleniş aşırı programlı değil.	Hayır	Hayır	Kapsam Dışı	Evet	Bu konu tasarım için kritiklerden biri; Akıllı şehir yaklaşımını önemsiyoruz. Enerji korunumu ve bina performansına dikkat çekiliyor.	Hayır
		MIM 411E - Architectural Design VII	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up - Rhino kullananlar var	Konudan hiç bahsedilmiyor	Juri tarihleri belli ama istenilenler net değil / iç işleniş aşırı programlı değil.	Hayır	Hayır	Kapsam Dışı	Evet	Bu konu tasarım için kritiklerden biri; Akıllı şehir yaklaşımını önemsiyoruz. Enerji korunumu ve bina performansına dikkat çekiliyor.	Hayır
	Architectural Design Theory	MIM 114 - Accessibility	Sadece 2 boyutlu teslimler isteniyor	Kapsam dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor ve sürekli hatırlatılıyor	Hayır	Kısmen	İhtiyaçlar listesi halinde ekonomik kriterler tartışılıyor.	Evet	Sosyal sürdürülebilirlik üzerinde duruluyor: Ekonomik ve ekolojik yakaşımları önemsiyoruz.	Kısmen
		MIM 119E - Int.to Architecture and Ethics	Sadece 2 boyutlu teslimler isteniyor	3ds Max tanıtılıyor. İlk yıl araç kullanımını tehlikeli buluyorum.	Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor	Syllabus veriliyor ve bu konular görülecektir tanımı yapılıyor. Soft bir akış benimseniyor.	Hayır	Hayır	Hayır	Evet	Ders içerisinde davet edilen konuklar bu konuya değiniyor.	Hayır
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Bu bir gereklilik	Rhino ve Grasshooper kullanımı direkt öğretiliyor	Bu beceri ile alakalı yazılım bilgilendirmeleri yapılıyor;Bu beceri ile alakalı yazılım eğitimleri ders içerisinde veriliyor;Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor;Bu becerinin direkt olarak projelerde kullanılması isteniyor	Syllabus veriliyor ve sürekli hatırlatılıyor	Hayır	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır

Table I.5 (continued) : Result Table of the Model Dimensions Questions.

Classes		Model Dimentions	24	25	26	27	28	29	30	31	32	33
Ders Sınıfları		Dersin Adı	Ders içerisindeki teslimlerinde 3 boyutlu modelleme yapılıyor mu?	Ders içerisinde 3 boyutlu modelleme ile ilgili hangi programlardan bahsediliyor? Bu amaçla kullanılan BIM programları var mı ?	Ders içeriğinde parametrik düşünmeye ilişkin yönlendirmeler var mı ? Bu kapsamda kural tabanı yazılımlar veya görsel programlama dilleri öğretiliyor mu ?	Ders içerisinde tasarım süreci ve proje teslimi arasında ki zamanlama için öğrenciler bilgilendiriliyor mu ? Bu süreci nasıl yönetiyorsunuz?	Ders kapsamında "Gant Çizelgesi / CPM" gösteriliyor mu?	Öğrenciler ders esnasında mekan, bina yapı elemanı ve malzeme kullanımlarını ekonomik açıdan tartışıyor mu ?	Metraj konusuna ders kapsamında değiniliyor mu ?	Ders içerisinde sürdürülebilirlik kavramına değiniliyor mu ?	Sürdürülebilirlik nasıl ele alınıyor ?	Ders içerisinde tesis yönetimi, kalite kontrolü, saha güvenliği gibi üst düzey konulardan bahsediliyor mu?
CONSTRUCTION	Structural Systems	MIM 125 - Static	Kapsam Dışı	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor- Ödev teslim tarihi önden açıklanıyor	Hayır	Kısmen	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
		MIM 126E - Strength of Material	Kapsam Dışı	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor- Ödev teslim tarihi önden açıklanıyor	Hayır	Kısmen	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
		MIM 271E - Theory of Structures	Kapsam Dışı	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor - zaman disiplinini öğretmeye çalışıyorum	Hayır	Kısmen	Kapsam Dışı	Kısmen	Bir kritik olarak ele alındığından bahsediyoruz, önemini söylüyoruz.	Hayır
		MIM 253E - Steel Structures	Kapsam Dışı	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor - zaman disiplinini öğretmeye çalışıyorum	Hayır	Kısmen	Kapsam Dışı	Kısmen	Bir kritik olarak ele alındığından bahsediyoruz, önemini söylüyoruz.	Hayır
		MIM 234E - Reinforced Concrete Structures	Kapsam Dışı	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor - zaman disiplinini öğretmeye çalışıyorum	Hayır	Kısmen	Kapsam Dışı	Kısmen	Bir kritik olarak ele alındığından bahsediyoruz, önemini söylüyoruz.	Hayır
	Building Elements & Materials	MIM 231E - Building Materials	Sadece 2 boyutlu teslimler isteniyor	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Kısmen	Kapsam Dışı	Evet	Malzeme seçerken sürdürülebilirlik temel kritik, ayrıca malzemenin sürdürülebilirliğine giriliyor. (reuse veya reycycle olup olmaması)	Hayır
		MIM 203 - Building and Const inArch.	Sadece 2 boyutlu teslimler isteniyor	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı	Hayır
		MIM 204 - Arch.Building Element Design	Sadece 2 boyutlu teslimler isteniyor	Kapsam Dışı	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Hayır	Kapsam Dışı	Kısmen	Bahsidiliyor ancak deneyimlenemiyor - sürdürülebilir teknolojilerin kullanımını bekledim başarılı olamadılar (yeri burası değil)	Hayır
	Physical Environment Control	MIM 246E - Environmental Control Studio	Gerekli değil isteğe bağlı yapanlar var	Kapsam Dışı	Bu becerinin direkt olarak projelerde kullanılması isteniyor	Syllabus veriliyor ve aşamalı ilerleniyor.	Hayır	Kısmen	Kapsam Dışı	Evet	Temel konumuz bazı uygulamaları kapsıyor	Hayır
	Construction Systems & Management	MIM 333E - Building Production Systems	Gerekli değil isteğe bağlı yapanlar var	Beklenen 3D Model Değil	Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor	Syllabus veriliyor - uyuluyor	Hayır	Kısmen	Bazen, konu gerektirirse	Evet	Ekonomik açıdan önemine değiniliyor	Hayır
		MIM 359E - Construction Management & Economy	Gerekli değil isteğe bağlı yapanlar var	Beklenen 3D Model Değil	Ders içerisinde bu beceri ile alakalı tanıtım sunumlarına yer veriliyor	Syllabus veriliyor - uyuluyor	Evet	Evet	Detaylıca ele alınan konulardan biridir.	Evet	Ekonomik açıdan önemine değiniliyor	Evet
	Construction Studio	MIM 431E Construction Project	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up 3ds MAX - **Revit** - **ArchCAD** - Rhino - AutoCAD kullananlar var	Bu beceri ile alakalı yazılım bilgilendirmeleri yapılıyor	Syllabus veriliyor	Hayır	Evet	Mazleme ve sistem seçimlerinde tartışılıyor, Mahal Listesi İstiyoruz	Evet	Ekolojik açıdan değiniliyor - Aktif Pasif sistemler enerji verimliliği gibi konularda bilgilendiriliyorlar.	Hayır
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up kullananlar var	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Kısmen	Kapsam Dışı	Evet	Kültürel ve tarihi çevre ekolojisi ve sürdürebilirlik konuşuluyor	Hayır
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up kullananlar var	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Kısmen	Konuşmalarda bahsedilebiliyor.	Evet	Konu içerisinde teorik olarak anlatılıyor	Hayır
		MIM 361E-Archtctrl Survey & Restrtn Std	Gerekli değil isteğe bağlı yapanlar var	İsteğe bağlı Sketch Up kullananlar var	Konudan hiç bahsedilmiyor	Syllabus veriliyor	Hayır	Kısmen	Tasarım sürecinde malzeme seçimi ve kullanımı açısından değerlendiriliyor	Evet	Temel kritiklerimizden biri - eleştirisel olarak tartışılıyor.	Hayır
DIP.	Diploma Project	MIM 4902 - Diploma Project	Gerekli değil isteğe bağlı yapanlar var	Sketch Up - 3ds MAX	Konudan hiç bahsedilmiyor	Proje dosyası veriliyor	Hayır	Hayır	Kapsam Dışı	Kısmen	Konu spesifik bir durum varsa tasarım kriteri olarak tartışılıyor	Hayır

Table I.6 : Result Table of the LOD Questions.

CLASSES		LOD	34	35	36	37
Ders Sınıfları		Dersin Adı	Ders içerisinde yapı elemanlarından bahsediliyor mu ?	Ders içerisinde yapı elemanlarından ne detayda bahsediliyor - öğrencilerden bu süre zarfında ne öğrenimi bekleniyor ?	Ders içerisinde tasarım sürecindeki malzeme seçimleri için öğrencilere malzeme tanıtımları yapılıyor mu ?	Tasarım kararlarında tercih edilen malzemeler hangi nitelikleri ile tartışılıyor?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Kısmen	Sorunlar gelirse ve biz tasarımda bu tür sorunları fark edersek değiniyoruz	Kısmen	Sorunlar gelirse ve biz tasarımda bu tür sorunları fark edersek değiniyoruz
		TES 121E - Project II	Evet	Elemanların mekan ile ilişkileri ve üretim süreçlerinden bahsediliyor- yönetmelikler ve standartlar kapsamında bilgilendiriliyorlar	Evet	Malzeme detayı isteniyor - bekleniyor (Extreme environment konumuzda ısı yalıtımı önemliydi) Yönetmelikler ve standartlar kapsamında bilgilendiriliyorlar
		TES 211E - Project III	Evet	Taşıyıcı Sistemler sorgulanıyor, bina elemanlarının temsiline bakılıyor	Evet	Tasarım aşamasında mimarlar odası kataloğu ve fuarların dokümanları ile malzeme araştırmaları yapılıyor - nitelikleri de tartışılıyor
		TES 113E - Basic Design and Visual Arts	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 112E - Visual Communication I	Kısmen	Temsil - Teknik İfadesi yapılıyor, ama çok üstel	Hayır	Malzeme detayına değinmiyoruz boş ve dolu temsili
		TES 122E - Visual Communication II	Kısmen	Temsil - Teknik İfadesi yapılıyor, ama çok üstel	Hayır	Malzeme detayına değinmiyoruz boş ve dolu temsili
	Architecture Design Studios	MIM 212E - Architectural Design IV	Kısmen	Bina elemanları - taşıyıcı sistem elemanları üzerinden konuşuluyor, tartışılıyor.	Kısmen	Malzeme detaylarına giremiyoruz, tasarımları özelinde yeri gelire değiniliyor.
		MIM 351E - Architectural Design V	Kısmen	Bina elemanları - taşıyıcı sistem elemanları üzerinden konuşuluyor, tartışılıyor.	Kısmen	Malzeme detaylarına giremiyoruz, tasarımları özelinde yeri gelire değiniliyor.
		MIM 312E - Architectural Design VI	Kısmen	Bilindiği Kabul Ediliyor, tartışılıyor	Hayır	Bilindiği Kabul Ediliyor, tartışılıyor
		MIM 411E - Architectural Design VII	Kısmen	Bilindiği Kabul Ediliyor, tartışılıyor	Hayır	Bilindiği Kabul Ediliyor, tartışılıyor
	Architectural Design Theory	MIM 114 - Accessibility	Kısmen	Evrensel tasarımın ilkeleri anlatılırken elemanlara değiniyoruz ve arka plandan terimlerden bahsediliyor	Evet	Örnekler içerisinden malzeme kriterleri tartışılıyor, duyular ie algılanma özeliği kritik.
		MIM 119E - Int.to Architecture and Ethics	Kısmen	Konuklar bu konudan bahsediyor, terimlere aşinalık kazanıyorlar	Evet	Konuklar malzeme çeşitlerinden ve öneminden bahsediliyor
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı

Table I.6 (continued) : Result Table of the LOD Questions.

CLASSES		LOD	34	35	36	37
Ders Sınıfları		Dersin Adı	Ders içerisinde yapı elemanlarından bahsediliyor mu ?	Ders içerisinde yapı elemanlarından ne detayda bahsediliyor - öğrencilerden bu süre zarfında ne öğrenimi bekleniyor ?	Ders içerisinde tasarım sürecindeki malzeme seçimleri için öğrencilere malzeme tanıtımları yapılıyor mu ?	Tasarım kararlarında tercih edilen malzemeler hangi nitelikleri ile tartışılıyor?
CONSTRUCTION	Structural Systems	MIM 125 - Static	Evet	Taşıyıcı sistem elemanlarından bahsediliyor, fonksiyonları ve kesit boyutları temel kritik	Hayır	Kapsam Dışı
		MIM 126E - Strength of Material	Evet	Taşıyıcı sistem elemanlarından bahsediliyor, fonksiyonları ve kesit boyutları temel kritik	Evet	Hesap içerisinde gerekli parametreleri öğretiliyor
		MIM 271E - Theory of Structures	Evet	Güvenli yapı elemanı tasarımı - yönetmelik gereklilikleri tartışılıyor	Evet	Yönetmeliklerdeki gerekli parametreleri- Kalite sınıfları
		MIM 253E - Steel Structures	Evet	Güvenli yapı elemanı tasarımı - yönetmelik gereklilikleri tartışılıyor	Evet	Yönetmeliklerdeki gerekli parametreleri- Kalite sınıfları
		MIM 234E - Reinforced Concrete Structures	Evet	Güvenli yapı elemanı tasarımı - yönetmelik gereklilikleri tartışılıyor	Evet	Yönetmeliklerdeki gerekli parametreleri- Kalite sınıfları
	Building Elements & Materials	MIM 231E - Building Materials	Evet	Elemanların sürdürülebilirlikleri ve uygun malzemeleri üzerinden konuya değiniliyor. Teorik açıdan tartışılıyor.	Evet	Konumuz temelde malzeme ve niteliklerini öğretmek, malzeme sunumları yapılıyor, fiziksel örnek bekleniyor.
		MIM 203 - Building and Const inArch.	Evet	Konumuz temelde yapı elemanları, İşlevi, Bileşenleri - Yapım yöntemleri - Performans gereksinimleri,bazen yaşam döngüsünde oluşabilecek hasarlara ve yönetmeliklerdeki kriterlerine değiniliyor. Teorisi öğretiliyor. Fiziksel olarak uygulanıyor.	Evet	Malzemelerin birbiri ve yapı elemanları ile uyumlulukları - tasarımda dikkat edilmesi gereken kriterleri tartışılıyori Teorik açıdan ele alınıyor.
		MIM 204 - Arch.Building Element Design	Evet	Elemanları tasarlarken elemanın bulunduğu yere uygun olarak performans gereksinimleri ve yapım teknikleri düşünülerek tasarlanması bekleniyor. Modelleme yapmıyorlar.	Evet	Malzemelerin birbiri ve yapı elemanları ile uyumlulukları düşünülerek tasarım yapılması bekleniyor. İki boyutlu temsiller ile sunuluyor.
	Physical Environment Control	MIM 246E - Environmental Control Studio	Evet	Yapı elemanaları biliniyor kabul edilip, konu spesifik elemanların yönetmeliklere uygun değerleri ile hesaplar yapılıyor.	Evet	Malzemeler uygulamalı tanıtılıyor, Akustik lab. - Tesisat ve mekanik fiziksel stantlarımız var burada tartışılan temel konuları nitelikleri.
	Construction Systems & Management	MIM 333E - Building Production Systems	Evet	Ürün ve süreç bir arada işer bu nedenle sistemleri elemanlar ile ele alınıyor. Deneysel ve aktif öğrenmeyi savunuyoruz. (kitap öneriyorum) , (İnput - Output analizi)	Evet	Bu konuda araştırma ve serbest öğrenme önemli, kriter olarak seçilen sisteme uygun malzemenin tüm detayları ile bilinmesi bekleniyor.
		MIM 359E - Construction Management & Economy	Evet	Elemanları iyi tanımakla yönetimi mümkündür. Araştırmacı olmaları esasımız. (İnput - Output analizi)	Evet	Hesaplarda ürünü ve malzemeyi detaylı bilinmesi gerektiğine vurgu yapıyoruz. Sorgulatıyoruz.
	Construction Studio	MIM 431E Construction Project	Evet	Fonksiyon - Yapım Sırası - Ölçek -Teknik İfade - Sürdürülebilirlik - Takip Edilebilirlik - Üretim Tekniği - Maliyet	Evet	Temsil de kalıyor ve bir birleri ile uyumu - katmanları istiyoruz .

Table I.6 (continued) : Result Table of the LOD Questions.

CLASSES		LOD	34	35	36	37
Ders Sınıfları		Dersin Adı	Ders içerisinde yapı elemanlarından bahsediliyor mu ?	Ders içerisinde yapı elemanlarından ne detayda bahsediliyor - öğrencilerden bu süre zarfında ne öğrenimi bekleniyor ?	Ders içerisinde tasarım sürecindeki malzeme seçimleri için öğrencilere malzeme tanıtımları yapılıyor mu ?	Tasarım kararlarında tercih edilen malzemeler hangi nitelikleri ile tartışılıyor?
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Kısmen	Kent ölçeğinde kalıyor , fonksiyonel ele alınıyor.	Kısmen	kent ölçeğinde kalıyor, kentsel anlamı ile kullanılan elemanlar özelinde konuya değiniliyor.
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Evet	Döneme sözlük ile başlanıyor, süreçte elemanlar üzerinde konuşuluyor	Evet	Malzeme analizi yaptırıyoruz -performans kriterlerine kadar detaylı girilmiyor.
		MIM 361E-Archtctrl Survey & Restrtn Std	Kısmen	Proje amacına yönelik değiniliyor	Kısmen	Proje amacı özelinde değerlendiriliyor
DIP.	Diploma Project	MIM 4902 - Diploma Project	Evet	Sorgulanıyor - Sistem kesiti : Naif - hakkını vererek olmuyor	Evet	Sorgulanıyor - Sistem kesiti : Naif hakkını vererek olmuyor

Table I.7 : Result Table of the Collaboration Questions.

Classes		Collaboration	38	39	40	41
Ders Sınıfları		Dersin Adı	Ders içerisinde tasarımcının diğer paydaşlar ile ilgili iletişiminden bahsedilmekte mi ?	Diğer disiplin eğitimlerini alan ekiplerden ders kapsamında destek alınıyor mu?	Mimari disiplin dışında diğer disiplinlerle ortak işletilen bir süreç denemesi yapıldı mı?	Mimari disiplin dışında diğer disiplinlerle ortak nasıl bir süreç izlendi?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Kullanıcı ilişkileri ile başlıyoruz herkesin sorumluluğunu alıyoruz diye - Meslekler arası ilişkiden oldukça önemle bahsediliyor zaten TES altyapısı 3 disiplinle devam ediyor gruplar karılıyor.	Evet	Evet	Teorik olarak hep bahsediliyor - uygulamalı olarak zaten yapıyoruz - hocalar farklı bakış açılarına sahip oluyor - ama ilk sınıfta henüz ayrılmış da olmuyorlar: **yani bire bir disiplin özelinde çalışma yapılmıyor ancak disiplin spesifik kritikler alınabiliyor.**
		TES 121E - Project II	Kullanıcı ilişkileri ile başlıyoruz herkesin sorumluluğunu alıyoruz diye - Meslekler arası ilişkiden oldukça önemle bahsediliyor zaten TES altyapısı 3 disiplinle devam ediyor gruplar karılıyor	Evet	Evet	Teorik olarak hep bahsediliyor - uygulamalı olarak zaten yapıyoruz - hocalar farklı bakış açılarına sahip oluyor - ama ilk sınıfta henüz ayrılmış da olmuyorlar: **yani bire bir disiplin özelinde çalışma yapılmıyor ancak disiplin spesifik kritikler alınabiliyor.**
		TES 211E - Project III	Bahsediliyor - Bir mimar Pramitte en üstedir; diğerlerine iş dağılımı yapar önemli olan müşteri ilişkisidir - uyumla yaklaşılmalıdır.	Evet	Evet	Akustik konusunda uzman geldi Piyasadan ve anıtlar kurulundan konuklar çağırıldı ..Zaten şehirciler ile bir arada çalışılıyor.Ancak öğrenciler disiplin özelleşmiş değiller.
		TES 113E - Basic Design and Visual Arts	Kapsam Dışı	Evet	Hayır	Farklı disiplinden öğrenciler var ama henüz disiplinleşmemiş durumdalar
		TES 112E - Visual Communication I	Kapsam Dışı	Hayır	Hayır	Farklı disiplinden çocuklar var ama henüz disiplinleşmemiş durumdalar
		TES 122E - Visual Communication II	Kapsam Dışı	Hayır	Hayır	Farklı disiplinden çocuklar var ama henüz disiplinleşmemiş durumdalar
	Architecture Design Studios	MIM 212E - Architectural Design IV	Contratsal konulara değinilmiyor. Diğer mühendislik ve kentsel tasarım konuları konuşuluyor.	Evet	Hayır	Kapsam Dışı
		MIM 351E - Architectural Design V	Contratsal konulara değinilmiyor. Diğer mühendislik ve kentsel tasarım konuları konuşuluyor.	Evet	Hayır	Kapsam Dışı
		MIM 312E - Architectural Design VI	Bahsediliyor - Kentsel tasarım - bilgisayar bilimleri önemi - Endüstriyel Tasarım	Evet	Hayır	Kapsam Dışı
		MIM 411E - Architectural Design VII	Bahsediliyor - Kentsel tasarım - bilgisayar bilimleri önemi - Endüstriyel Tasarım	Evet	Hayır	Kapsam Dışı
	Architectural Design Theory	MIM 114 - Accessibility	Bahsediliyor : RIBA Eğitici materyal bunu veriyor / Saha tarsarım ekiplerinin erişilebilirlik kavramına bakılıyor	Evet	Hayır	Kapsam Dışı
		MIM 119E - Int.to Architecture and Ethics	Bahsediliyor	Evet	Hayır	Kapsam Dışı
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Hayır	Hayır	Hayır	Kapsam Dışı
CONSTRUCTION	Structural Systems	MIM 125 - Static	Bahsediliyor Müh - Mimari / Statik proje gelince bu noktada şunlara bakmalısınız gibi	Hayır	Hayır	Kapsam Dışı
		MIM 126E - Strength of Material	Bahsediliyor Müh - Mimari / Statik proje gelince bu noktada şunlara bakmalısınız gibi	Hayır	Hayır	Kapsam Dışı
		MIM 271E - Theory of Structures	Bahsediliyor , hata projeleri kapsamında soru sorabiliyorlar	Hayır	Hayır	Kapsam Dışı
		MIM 253E - Steel Structures	Bahsediliyor , hata projeleri kapsamında soru sorabiliyorlar	Hayır	Hayır	Kapsam Dışı
		MIM 234E - Reinforced Concrete Structures	Bahsediliyor , hata projeleri kapsamında soru sorabiliyorlar	Hayır	Hayır	Kapsam Dışı
	Building Elements & Materials	MIM 231E - Building Materials	Başta anlatılıyor - bina bütünleşik sistem : orkestra şefi mimar ve ekip arkadaşları service sistemleri, kimler ile çalışıyor anlatıyoruz	Evet	Hayır	Kapsam Dışı
		MIM 203 - Building and Const inArch.	Bahsediliyor	Hayır	Hayır	Kapsam Dışı
		MIM 204 - Arch.Building Element Design	Bahsediliyor - yapılırken elman tasarımında yeri gelirse disiplin özelinde ayrımlardan bahsediliyor	Hayır	Hayır	Kapsam Dışı
	Physical Environment Control	MIM 246E - Environmental Control Studio	Direkt konu spesifik bir ders olarak işletildiğinden her konu tasarımla olan ilişkisi çerçevesinde değerlendiriliyor - Teoride ve uygulama süreçlerinde diğer disiplinler ile karşılacakları anlatılıyor	Evet	Hayır	Kapsam Dışı
	Construction Systems & Management	MIM 333E - Building Production Systems	Open Learning ile hedeflenen daha farklı disiplindeki ve uzmanlıktaki kişilere ulaşılması bekleniyor.	Evet	Hayır	Kapsam Dışı
		MIM 359E - Construction Management & Economy	İletişim ve sorumluluklar direkt yönetim konusu için kritik değerler.	Evet	Hayır	Kapsam Dışı
	Construction Studio	MIM 431E Construction Project	Proje mühelifleri ile alakalı iletişimden bahsediliyor / Isıtma Aydınlatma Tesisat Projelendirmeden ve koordinasyonundan bahsediyorsunuz	Evet	Hayır	Kapsam Dışı
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Mimari ve Planlamanın çok disiplinli bir konu olduğundan bahsediliyor - Belediye ile ilişki kurduruyoruz - anket yapmalarını istiyoruz	Hayır	Hayır	ÇAP öğrencileri zaten disiplin farklılığı oluşturuyorlar, onların bulunduğu gruplardaki karma yapıda deneyimleniyor.
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Venedik Tüzüğünün maddesi: Mimari koruma sadece mimarların işi değildir bir çok disiplin bir araya gelerek bu işi çözer iş birliğinin önemi ve kimi zaman bir sosyolog ve hukukcunun bile ekibin parçası olabileceği konuşuluyor	Hayır	Hayır	Kapsam Dışı
		MIM 361E-Archtctrl Survey & Restrtn Std	Yapıda bir strüktürel sorun var diyelim : bünyemizden destek alınıyor; mimar çalışması sırasında başka disiplinlere de başvuran meslek insanı olarak tanıtılıyor.	Evet	Hayır	ÇAP öğrencileri (inşaat müh) / bunların olması hep avantaj oluyor onun gözünden de sorunlar değerlendiriliyor / Şehir bölge planlama ve mimarlık arasında ÇAP yapan oluyor makro bakışları çok tuhaf ama vaziyet planında uzmanlıklarını görüyoruz
DIP.	Diploma Project	MIM 4902 - Diploma Project	Kapsam Dışı	Evet	Hayır	Kapsam Dışı

Table I.8 : Result Table of the Knowledge of BIM Questions.

Classes		BIM	42	43	44	45
Ders Sınıfları		Dersin Adı	Ders içerisinde veya ödev kapsamında BIM kavramı ile ilgili tanım veya tanıtıma yer verildi mi?	BIM kavramı ile alakalı hangi konulardan bahsedildi ?	Ders içerisinde veya ödev kapsamında BIM kavramına yönelik entegre bir çalışma yapıldı mı ?	Ders içerisinde veya ödev kapsamında BIM kavramına yönelik nasıl bir çalışma yürütüldü?
ARCHITECTURE DESIGN	Basic Design Studios	TES 111E - Project I	Kısmen	BIM programlarının varlığı hakkında detaya girmeden - Metraj ve keşif hesapları yapabildiği açısından bilgilendiriyorum. (Sadece kendi grubumda)	Hayır	Kapsam Dışı
		TES 121E - Project II	Kısmen	BIM programlarının varlığı hakkında detaya girmeden - Metraj ve keşif hesapları yapabildiği açısından bilgilendiriyorum. (Sadece kendi grubumda)	Hayır	Kapsam Dışı
		TES 211E - Project III	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 113E - Basic Design and Visual Arts	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 112E - Visual Communication I	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		TES 122E - Visual Communication II	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
	Architecture Design Studios	MIM 212E - Architectural Design IV	Kısmen	Piyasadan gelen bir konuk - kapsam içinde kullandıysa vurgu yapıyor.	Hayır	Kapsam Dışı
		MIM 351E - Architectural Design V	Kısmen	Piyasadan gelen bir konuk - kapsam içinde kullandıysa vurgu yapıyor.	Hayır	Kapsam Dışı
		MIM 312E - Architectural Design VI	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 411E - Architectural Design VII	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
	Architectural Design Theory	MIM 114 - Accessibility	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 119E - Int.to Architecture and Ethics	Kısmen	Teorik açıdan gelecek süreçler içerisinde bahsedildi	Hayır	Kapsam Dışı
	Architectural Design Tools & Technologies	MIM 120E - Int.toCmp.Ds.Tools&Mth.inArch.	Kapsam Dışı	Kapsam Dışı	Hayır	Kapsam Dışı
CONSTRUCTION	Structural Systems	MIM 125 - Static	Hayır	Kapsam dışı	Hayır	Kapsam Dışı
		MIM 126E - Strength of Material	Hayır	Kapsam dışı	Hayır	Kapsam Dışı
		MIM 271E - Theory of Structures	Kısmen	BIM teknolojisine yönlendirme yapıyoruz, ama anlatmıyoruz	Hayır	Kapsam Dışı
		MIM 253E - Steel Structures	Kısmen	BIM teknolojisine yönlendirme yapıyoruz, ama anlatmıyoruz	Hayır	Kapsam Dışı
		MIM 234E - Reinforced Concrete Structures	Kısmen	BIM teknolojisine yönlendirme yapıyoruz, ama anlatmıyoruz	Hayır	Kapsam Dışı
	Building Elements & Materials	MIM 231E - Building Materials	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 203 - Building and Const inArch.	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 204 - Arch.Building Element Design	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
	Physical Environment Control	MIM 246E - Environmental Control Studio	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
	Construction Systems & Management	MIM 333E - Building Production Systems	Evet	Integrated Project Delivery - evrimi - gelecekte nerelere gidebilir konuşuluyor.	Hayır	Kapsam Dışı
		MIM 359E - Construction Management & Economy	Evet	Integrated Project Delivery - evrimi - gelecekte nerelere gidebilir konuşuluyor.	Hayır	Kapsam Dışı
	Construction Studio	MIM 431E Construction Project	Evet	Bir Sunuma katınıldı - Seminerlerle desteklenilen durumlar oluyor	Hayır	Teslim için BIM aracı kullanan öğrenciler oluyor.
U.D.	Urban Planning	MIM 343 - Urbanism and Planning Law	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
CON.	Architectural and Urban Conservation	MIM 322E - Conserv.of Hist. Build.&Sites	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
		MIM 361E-Archtctrl Survey & Restrtn Std	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı
DIP.	Diploma Project	MIM 4902 - Diploma Project	Hayır	Kapsam Dışı	Hayır	Kapsam Dışı

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