

MIDDLE EAST TECHNICAL UNIVERSITY
DEPARTMENT OF ARCHITECTURE

GRADUATE SEMINARS BS501/BS601

2020-2021 SPRING SEMESTER

July 8, 2021 Online: 09:00-12:00

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<https://zoom.us/j/94983447729?pwd=TXRHWXJKMG5vc2lwcXMySGxhTlZxZz09>

9:00 – 9:20

Ilgaz Azra Atılgan — Energy Performance Assessment in Ecological Timber Buildings: An Examination in Respect to Insulation Materials

Supervisor: Soofia Tahira Elias Özkan

Jury: Ayşe Tavukçuoğlu, Ayşem Berrin Çakmaklı

This study attempts to reduce the energy consumption of timber buildings by using ecological thermal insulation materials and at the same time to ensure environmental sustainability. It is clear that, timber structures are universally an important positive alternative to environmental concerns and destructive seismic impact. In Turkey, although the construction rate decreased after the 1940s, it is seen that the existence of traditional Turkish timber houses provides a strong application and design knowledge. The necessity of not having toxic production and usage characteristics of the building elements in order to be mentioned in full environmental sustainability has led to the search for alternative natural thermal insulation materials. In this study, it is planned to compare the thermal insulation materials examined with each other in terms of their structural properties, to find their superior properties and to observe the results in terms of energy in a typical timber structure with simulation.

Keywords: Timber Structure, Natural Thermal Insulation Materials, Energy Consumption, Energy Performance Simulation, Wood Construction

9:20 – 9:40

Rabianur Çulha — Serious Game for Occupational Health and Safety Training in the Construction Sector

Supervisor: Mehmet Koray Pekerçli

Jury: Elif Sürer, Ayşem Berrin Çakmaklı

Occupational accidents are a critical field to focus on because every year approximately 380 000 workers die, and 370 000 000 non-fatal accidents occur in working environments. The accidents cause psychological and social problems and economic loss. To overcome occupational accident-related problems and loss, regulations that create a safe working environment are significant. Moreover, the situation of the construction sector is more critical compared to other sectors because the construction sector is one of the most dangerous sectors in terms of occupational accidents. And the construction site accidents mostly because of the not proper attitude of employees, so they are preventable. To deal with occupational accidents in construction sites Occupational Health and Safety (OH&S) regulations and training are significant. However, the existing way of OH&S training is not effective enough, as the occupational accidents at construction sites are still 15% of the total accidents in Turkey, despite the OH&S training, compulsory in high risky sectors at least once a year. To overcome problems about OH&S training in the construction sector, a serious game can be the solution. Because games are tools to learn and socialize for a long time and video games are becoming more popular. A serious game is a video game with a pedagogy rather than pure entertainment, and it can be the way of learning OH&S rules at construction sites and providing a safer working environment.

Keywords: Construction Sector, Occupational Accidents, Fatal Accidents, Occupational Health And Safety, Serious Game

9:40-10:00

Gizem Nur Aydemir — Using Solar Systems for Energy Autonomy in Buildings

Supervisor: Soofia Tahira Elias Özkan

Jury: Ayşem Berrin Çakmaklı, Ayşegül Tereci

Vast amounts of energy were being used up in the built environment; therefore, buildings can play a crucial role in reducing the consumption as well as in the production of energy; one way forward would be to alter existing or newly designed buildings concerning energy efficiency in a way that they can contribute to the solution. The purpose of integrating renewable energy technologies in buildings is to harvest energy in situ and achieve energy autonomy by reducing grid dependency and producing clean energy with minimal greenhouse gas emissions. Among all the renewable energy generation systems, solar systems are more advantageous than others regarding applicability in existing buildings. With the rising demand for alternative energy generation, numerous studies have been developed and applied worldwide for energy retrofitting of the existing building stock and designing energy independent new buildings. This paper provides a literature review on active design strategies focusing on solar energy generation systems integrated into buildings. To this end, the use of solar energy; including solar thermal and photovoltaic (PV) technologies, the relation of buildings with PV technologies, Building Applied/Added/Attached Photovoltaics (BAPV), Building Integrated Photovoltaics (BIPV) and Building Integrated hybrid Photovoltaics/Thermal (BIPV/T) systems, their types, potentials, and challenges, their examination ways and methodologies in the literature are analyzed and discussed.

Keywords: Renewable Solar Energy, Building Applied/Added/Attached Photovoltaics (BAPV), Building Integrated Photovoltaics (BIPV), Building Integrated hybrid Photovoltaics/Thermal (BIPV/T)

10:00-10:20

Burak Dönmez — Examination of Traditional Passive Ventilation Techniques

Supervisor: Soofia Tahira Elias Özkan

Jury: Ayşem Berrin Çakmaklı, Ayşegül Tereci

The ever-increasing negative impacts of the global warming phenomenon on nature, environment, and people can no longer be ignored. Research on the traditional building technique since ancient times demonstrates the efficiency of passive solutions for providing thermal comfort. These traditional buildings reduce the energy consumption need of the building. Traditional /natural ventilation methods help both to reduce heat loads in buildings and to increase indoor air quality (IAQ). In order to select these methods, and to being efficient of the selected methods in terms of economic and environmental aspects, it is necessary to investigate the building tradition and user behaviors in the historical process. After this research, architectural interventions can be proposed and these interventions can be simulated by making a virtual model of the building. Moreover, its energy performance can be tested by using related software. Therefore, this study is consisted of the investigation of the natural ventilation, traditional passive ventilation techniques, building simulation techniques and examination criteria of the studies, and finally, case studies belong different regions and climates. The aim of this study is to examine the traditional methods used throughout the centuries in order to reduce energy consumption and increase indoor air quality, and to adapt / reconsider these methods according to contemporary / current architecture. In conclusion, this study examines the benefits of traditional passive ventilation techniques and their adaptation to existing architecture, using energy simulation software to predict the optimal solution.

Keywords: Natural Ventilation; Traditional Passive Ventilation Techniques; Building Simulation; CFD

10:20-10:40

Hatice Bıyık — Investigation of the Climate Change Impact on the Built Environment and Carbon Emissions from Buildings at Urban Scale

Supervisor: Ali Murat Tanyer

Jury: Gülsu Ulukavak Harputlugil, Ayşe Tavukçuoğlu

Climate change affects the world, and the impacts on earth, such as increasing temperatures, can be observed. Climate change has rapidly increased; therefore, a new mission to keep global temperature increase below 1,5-Celsius degrees was launched. In this respect, decreasing carbon emissions that are the major contributor to global warming is set as a goal, and building's impact of carbon emissions in the built environment has tried to be decreased. Hence, this study aims to provide a systematic literature review about the climate change impact on the built environment and carbon emissions from the buildings at urban scale regarding the operational energy phase. In this respect, climate change and carbon emissions from the built environment subjects in the distinguished papers were examined to present concept changes regarding the years, the most used keywords, key authors, the most used methods, futuristic scenarios, and pathways.

Keywords: Climate Change, Carbon Emissions, Operational Energy Phase, Built Environment

10:40-11:00

Hafize Büşra Bostancı Sabur — Circular Economy within the Built Environment: Evaluating Trends, Strategies and Digital Technologies

Supervisor: Ali Murat Tanyer

Jury: Gülsu Ulukavak Harputlugil, Ayşe Tavukçuoğlu

Reasons leading to increase in production and construction activities to meet the demands occurring due to factors such as rapid growth in population, migration, industrialization, and unplanned urbanization, cause problems as economic and ecological crises and climate change. The need to implement sustainable solutions has arisen to handle these problems resulting in both resource consumption and cost-increase. The circular economy (CE) concept has started to gain importance as a sustainable innovative paradigm for addressing challenges, and the reflection of the concept on the AEC industry has increased because of the expansion of construction and demolition activities. Within this context, the reflections of the circular economy in the built environment are discussed within the scope of this study. After demonstration of the concept's framework, origin, and different definitions assumed by various individuals, institutions, and organizations, the existing approaches and research trends of the circular economy in the built environment are examined. The strategies of the concept are classified according to the building life cycle stages and scale and the potentials of digital technologies for the adaptation of the circular economy to the built environment and construction industry is evaluated.

Keywords: Built Environment, Circular Economy, Digital Technologies, Existing Building Stock, Urban Mining

11:00-11:20

Beste Fakioglu — Embodied Carbon Assessment of Tall Building Structures

Supervisor: Bekir Özer Ay

Jury: Mehmet Halis Günel, Ayşem Berrin Çakmaklı

Building industry is responsible for nearly 40% of embodied greenhouse gas (GHG) emissions. Thus, reducing the life cycle carbon emissions namely the embodied carbon (EC) and the operational carbon (OC) emissions of buildings can mitigate the environmental impacts. The significance of EC compared to OC increases since buildings become more energy efficient over time. Specifically for tall buildings, the EC is more critical due to an increase in structural material use resulted from the exponential increase of lateral loads. The embodied GHG of tall building structural systems have the highest share in the lifecycle embodied GHG. Thus, the focus of this study is the embodied GHG emissions of tall building structures. Recent studies investigated the embodied GHG emissions of tall building structures depending on various parameters. However, the validity of the findings of these studies are questionable due to various factors concerning life cycle assessment methods and structural design and analysis methods. In this study, these factors are presented and critically examined. Future studies on EC of tall building structures should eliminate these factors to ensure the validity and reliability of the research.

Keywords: Embodied Carbon, Tall Building Structures, Structural Design, Life Cycle Assessment

11:20-11:40

Gökçe Nihan Taşkın — Design Optimization in Tall Buildings: Optimization Algorithms and Case Studies

Supervisor: Bekir Özer Ay

Jury: Mehmet Halis Günel, Ozan Cem Çelik

Tall buildings have been emerged in 19th century as a result of population growth in cities and increasing land values. Until then, the number of tall buildings has increased all around the world and continues to increase exponentially. As a result of their scale, tall building projects require high budgets and long time periods for designing and constructing. In that sense; design optimization, which is beneficial for any kind of projects, is critical for tall buildings design. This study presents a literature review on the structural design optimization methods and their applications for tall buildings. Current statistics of tall buildings and main concerns of tall building design are investigated. Structural optimization is defined and five optimization algorithms that are used in structural optimization are introduced. These five algorithm includes; genetic algorithm, ant colony algorithm, firefly algorithm, particle-swarm and neural dynamic algorithm. Existing studies in tall building design optimization are investigated and classified into three categories, which are size, topology and shape optimization. Methodologies and results of the existing studies are evaluated in a holistic manner and similarities, criticisms and limitations of these studies are discussed.

Keywords: Tall Buildings, Design Optimizations, Performance-Based Design, Optimization Algorithms

11:40-12:00

Damianur İlipınar — Investigation of Construction Technologies: BIM-Based Off-Site Production

Supervisor: Mehmet Koray Pekerçi

Jury: Arzu Gönenç Sorguç, Bekir Özer Ay

Digital technology, which represents innovative and computer-controlled production processes, has enhanced many industries like automobile, aerospace, shipbuilding, etc. However, digital technology has been grown slowly in the construction sector than in other industries in spite that digital technology is considered as the key to improve productivity in the construction industry. In this regard, the adoption of off-site construction with digitization and automation can improve overall productivity and also help to overcome challenges faced by the construction industry. Moreover, when off-site construction methods are joined to digital technologies associated with the Industry 4.0 concept, the yield of productivity and safety can increase. Therefore, in this paper, digital technology applications in the construction industry, in particular, for off-site construction are evaluated through current literature. Finally, coupled with the BIM-based automation process and off-site construction appraises how to impact the productivity of the construction sector.

Keywords: Off-site Construction, Building Information Modelling (BIM), Automated Construction Process, Digital Technology