METU BS PROG
GRADUATE SEMINARS

BS 501 & 601 Fall Semester 2025-26

BS 501& BS 601

This is the official document prepared for the graduate seminar course of BS 501 and BS 601.

Fall 2026 Semester

Date of the Meeting: 13.01.2026
at Dekanlık Büyük Toplantı Salonu, Faculty of Architecture

Online Meeting Link:
https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZjE1NjYwZDItNjE1ZS00ZDdiLWFmZTItMzA1MTE4MDVmY2Q4%40thread.v2/0?context=%7b%22Tid%22%3a%22b0a2e24d-d188-4a4c-a1e4-82162e060566%22%2c%22Oid%22%3a%22624a362a-6add-4ed7-afc7-fd1576bc26eb%22%7d

Meeting ID: 345 774 201 083 70
Passcode: Yh7YF2Cd

Course Instructor: M. Koray Pekeriçli

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Life-Cycle-Based Approaches to Seismic Loss Assessment in Buildings: A Review of Methods and Variability

Buse Akçay Pehlivanoğlu

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601

Integrating Interactive Architecture into Architectural Education Using Visualization as a Design and Evaluation Instrument

Hatice Hilal Topuz

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601

Bridging Architecture and Agriculture: A Critical Review of Building-Integrated Agriculture from a Building Science Perspective

Kaya Emre Gönençen

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The Potential of 4D Printed Kinetic Façades for Thermal and Visual Comfort

Ilgın Büke Ulular

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The Critical Synthesis of Global Water Crises and Multi-scalar Water Management Strategies in The Built Environment

Dilara Albayrak

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Post-occupancy Evaluation in Smart Buildings

Rabia Çelik

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A Tri-Layered Approach for Multi-Modal Smart Building Frameworks

Emel Uçak

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Comparison of Perceived Value in AEC Industry: Turkey as a Case Study

Arda Fidansoy

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A Comparative Analysis of Wood Preservation Methods in Terms of Moisture-Focused Performance Criteria and Environmental Impacts

Beyza Özdemir

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Digital Product Passports for 3D Concrete Printing (3DCP) Construction: Standardization and Implementation

Melis Toktaş

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Planning and Redesign of Hybrid Production-Office Spaces: The case of Additive Manufacturing

Elif Adak

09:00 – 09:20

601

Life-Cycle-Based Approaches to Seismic Loss Assessment in Buildings: A Review of Methods and Variability

Buse Akçay Pehlivanoğlu

Supervisor: **Bekir Özer Ay, Ayşem Berrin Çakmaklı**
Jury Members: **Meltem Şenol Balaban**
Mehmet Koray Pekeriçli

Earthquake-related damage to buildings results in a wide range of consequences that extend beyond structural safety and direct economic loss, including environmental impacts arising from material production, construction, repair, strengthening, and end of life processes. In response, an expanding body of literature has applied life cycle-based assessment approaches to evaluate earthquake-induced losses in the built environment, quantifying environmental impacts, economic costs, and both. This literature review examines how such life cycle-based approaches have been employed in the context of seismic damage assessment, focusing on the diversity of impact indicators, analytical tools, data sources, and methodological assumptions used across studies. Particular attention is given to sources of variability related to system boundaries, life cycle stage definitions, and the treatment of repair, retrofit, and replacement actions following seismic events. The review further explores how assessment outcomes are influenced by building characteristics, such as structural system, usage, height, and construction period, as well as by the spatial scale of analysis, ranging from individual components and buildings to multi-building and urban scale applications. Rather than treating environmental and cost-based assessments as separate research streams, the review highlights their shared analytical foundations and complementary roles in representing earthquake-induced loss. The synthesis identifies persistent challenges related to comparability, transferability, and scale integration, and underscores the need for more consistent and multi-scale frameworks to support future research on earthquake-related environmental loss estimation.

keywords: Environmental Loss, Economic Loss, Seismic LCA, Building Taxonomy, Spatial Scale

09:20 – 09:40

601

Integrating Interactive Architecture into Architectural Education Using Visualization as a Design and Evaluation Instrument

Hatice Hilal Topuz

Supervisor: Soofia Tahira Elias Özkan
Jury Members: Bekir Özer Ay
Ayşem Berrin Çakmaklı

In architecture, research and practice related to the design of behaviors, systems, and interactions are becoming widespread with a growing emphasis on interdisciplinary studies. This is also reflected in architectural education through the adoption and development of new learning approaches and methods that better prepare and equip architecture students to keep pace with these developments. To contribute to this direction, this study focuses on integrating interactive architecture into architectural education by giving particular importance to experimental studios and workshops that support students with interdisciplinary tools and methods. These environments offer students the opportunity to learn by doing, thus positioning them as active participants in the process. However, such learning platforms are not common in most universities. It is believed that increasing extracurricular activities to foster the establishment of these environments may facilitate their inclusion in curricular education, and workshops hold a significant potential in this regard. Accordingly, this research aims to understand how interactive and kinetic design practices can be developed in educational settings, especially through workshops, and how visualization can support enabling this. Within this scope, the literature review was carried out firstly on the conceptual and technical foundations of interactive and kinetic systems; secondly, on the pedagogical, cognitive, and design dimensions of these systems in architectural education; and finally on visualization as a means for making interaction, movement, and decisions in the process perceptible, testable, and evaluable.

keywords: Interactive Architecture, Kinetic Architecture, Architectural Education, Visualization, Workshops

09:40 – 10:00

601

Bridging Architecture and Agriculture: A Critical Review of Building-Integrated Agriculture from a Building Science Perspective

Kaya Emre Gönençen

Supervisor: Soofia Tahira Elias Özkan
Jury Members: Gizem Deniz Güneri Söğüt
Ayşem Berrin Çakmaklı

Climate change, resource depletion, and rapid urbanization are intensifying pressures on both conventional food production systems and the built environment. As response strategies, urban agriculture (UA), controlled environment agriculture (CEA), and building-integrated agriculture (BIA) have gained importance to reduce environmental loads, enhance urban resilience, and shorten supply chains. Although academic interest is growing, existing research remains fragmented across agronomy, agricultural engineering, urban planning, architecture, and building science. Effective integration of food production within the built environment is limited.

This seminar report synthesizes findings from 111 articles to evaluate building science perspective and knowledge on BIA. The review examines BIA sources in terms of architectural typologies, environmental and circularity performance, and the role of digital and computational tools in their design and simulation. The literature demonstrates reliance on life cycle assessment (LCA) and quantitative simulations of case studies; however, many studies ignore crop-based parameters, symbiosis with host buildings, and architectural design considerations to mitigate energy demand. Emerging technologies including generative design frameworks, AI-based control systems and simulations show significant potential yet are rarely integrated into BIA projects and interdisciplinary research.

The literature review and synthesis reveal critical gaps in current research such as the lack of co-simulation frameworks linking biological and building systems in different climates with various farm geometries, insufficient empirical data and real-life application in the built environment, undefined architectural typologies for BIA, and limited attention to urban symbiosis and circularity. Ultimately, creating a BIA simulation tool, to investigate environmental loads, different parameters, and different scale applications, is essential.

Building-integrated Agriculture (BIA), Urban Agriculture (UA), Controlled Environment Agriculture (CEA), Architectural Typologies, Circular Urban Metabolism.

10:00 – 10:20

601

The Potential of 4D Printed Kinetic Façades for Thermal and Visual Comfort

Ilgın Büke Ulular

Supervisor: **Soofia Tahira Elias Özkan**
Jury Members: **Mehmet Koray Pekeriçli**
Müge Kruşa Yemişcioğlu

Environmental problems caused by building construction sector have been one of the significant concerns in recent years. Therefore, more sustainable solutions should be considered while providing proper indoor environmental quality. As an interface between the exterior and interior environments, the building envelope has a vital role in regulating comfort conditions. Kinetic façades with their moveable elements can adapt to distinct environmental conditions; therefore, they can enhance user comfort. However, conventional kinetic façades have limitations in terms of cost, complexity, and energy. Technological developments in 3D and 4D printing enable more feasible and cost-effective material-based applications of kinetic facades implemented in highly glazed building, providing proper thermal and visual comfort conditions.

This research aims to investigate the integration of smart materials into kinetic facades to provide thermal and visual comfort. It was based on literature review using Web of Science Database. Kinetic systems and its history were examined to understand the concept. Afterwards, configurations, control mechanisms and movements were inspected. Then, thermal and visual comfort provided by kinetic facades were presented. Subsequently, simulation-based evaluation, 3D and 4D printing for physical prototyping were investigated. As a result, it is observed there are few studies related to physical prototyping. Hence, this study emphasizes the potential of self-shaping material technology can reduce mechanical complexity, while also addressing current gaps in real-world applications.

keywords: Kinetic Facades, Thermal Comfort, Visual Comfort, 4D Printing, Smart Materials

10:20 – 10:40

601

The Critical Synthesis of Global Water Crises and Multi-scalar Water Management Strategies in The Built Environment

Dilara Albayrak

Supervisor: **Arzu Gönenç Sorguç**
Jury Members: **Ayşem Berrin Çakmaklı**
Müge Kruşa Yemişcioğlu

The intensifying impacts of climate change, combined with urbanization and high population density, are becoming increasingly unpredictable. Global water crises are one of the most significant consequences of these impacts. These water crises, manifesting as drought and water scarcity in some regions and massive floods in others, are progressively worsening. While the causes of water crises vary depending on the region and its climatic conditions, they are largely linked to access to water resources, water quality, and the state of water infrastructure. This study critically examines the impact of climate change on main water infrastructure components in the built environment, including water supply, drainage, and treatment systems, and evaluates potential adaptation strategies. The study first presents a general framework of architectural practices and strategies at different scales throughout history. It emphasizes the paradigm shift from traditional centralized models to decentralized and hybrid water infrastructure systems, outlining measures and strategic recommendations for enhancing climate resilience. Then, strategies developed for different regions are analyzed. The aim is to synthesize this evaluation to identify gaps in the literature and draw conclusions about potential research directions.

keywords: Water Infrastructure, Integrated Water Management, Nature-Based Solutions

10:40 – 11:00

601

Post-occupancy Evaluation in Smart Buildings

Rabia Çelik

Supervisor: **Ayşem Berrin Çakmaklı**
Jury Members: **Funda Baş**
Mehmet Koray Pekeriçli

Sustainability in architecture has a significant role in the sustainable development since buildings are responsible of a considerable amount of energy consumption and production of green gases. Hovewer, sustainability is not limited to creating more energy-efficient, and more economical structures, but especially society, which reflects the human scale in architecture is the most important aspect of the sustainability of the built environment. People are affected by their environment physically and mentally and they affect the performance of the building with their behaviours and habits of using the space. Many buildings that are expected to be energy efficient and healthy cannot meet those expectations due to not taking the human factor into account. According to studies, energy consumption of a building can rise up to 75% according to occupant behaviours. Therefore, in the aim of promoting energy efficient behaviour and enhancing building performance, quality of user and building interfaces is very important and one way to achieve this purpose is smart architecture.

Smart buildings provide a communication system between human and environment with sensors by mimicking the human nervous system to collect environmental data and take action and enhances the occupant control and energy efficiency. Therefore, smart buildings are a key concept for both sustainability and user-oriented design. Moreover, evaluations after occupation are needed to be done to understand the occupant behaviour and building performance. Post-occupancy evaluation is a method that aims to understand the mutual action between building and occupant demands to evaluate building performance after occupation by taking the user as the benchmark of feedback. This study focuses on the post-occupancy evaluation of smart buildings and aims to survey the extent of user engagement with these technologies and understand their key contributions to the sustainability and resilience of buildings.

keywords: Smart Building, POE, Sustainability, Human-Centric Design

11:00 – 11:20

601

A Tri-Layered Approach for Multi-Modal Smart Building Frameworks

Emel Uçak

Supervisor: **Mehmet Koray Pekeriçli**
Jury Members: **Ali Murat Tanyer**
Fatih Topak

The built environment is changing rapidly due to climate change and the rise of digitalization. Within this shifting landscape, indoor conditions have emerged as an important concern for well-being, particularly as people spend a significant portion of their time indoors. Although buildings are equipped with advanced technologies, the systems do not respond well to the varied and subjective needs of occupants. Despite the proliferation of smart technologies, a significant disconnect persists between data-driven automation and qualitative human experience. While advancements exist within individual domains, there is a lack of integrated research that explains how experiential knowledge is encoded into smart concepts and subsequently instantiated through physical infrastructure. This research establishes a tri-layered conceptual framework, comprising Experiential, Cognitive, and Infrastructural layers, to investigate how occupants perceive and live with indoor conditions, how buildings think, how experiential knowledge is encoded into smart concepts, and how cognitive concepts are materially instantiated infrastructurally. The aim is to bridge the gap between human-centered needs and automated systems by synthesizing how buildings perceive (experience), process (cognition), and act (infrastructure). Providing an intra- and cross-layer synthesis, the research first interrogates the Experiential Layer, centering on Human-Centered Design (HCD), occupant comfort, and Indoor Environmental Quality (IEQ). Subsequently, the Cognitive Layer is explored through smart and intelligent buildings, dimensions of building intelligence, and smart office concepts. Finally, the Infrastructural Layer investigates the underlying technological substrate, including Building Automation Systems / Building Management Systems (BAS/BMS), Building Energy Management (BEMS), and indoor tracking and occupancy analytics. By mapping these layers, this research aims to identify critical gaps and provide insights for potential research directions, particularly regarding the disconnect between data-driven automation and qualitative human experience.

keywords: Human-Centered Design, Indoor Environmental Quality (IEQ), Smart Buildings, Building Automation Systems, Occupancy Analytics

11:20 – 11:40

501

Comparison of Perceived Value in AEC Industry: Turkey as a Case Study

Arda Fidansoy

Supervisor: Mehmet Koray Pekeriçli
Jury Members: Açelya Ecem Yıldız
Rıfat Sönmez

Professional service fees in the Architecture, Engineering, and Construction (AEC) industry are frequently assessed through simplified metrics such as time spent or direct labor costs. However, this approach inadequately reflects the multidimensional nature of professional services, particularly in countries such as Turkey, where comparative service prices are demonstrably low relative to international benchmarks. Drawing on international architectural fee scales—typically expressed as a percentage of construction cost—and sectoral reports comparing Turkey with European and global practices, this study establishes that Turkish design and consultancy fees remain significantly below international norms despite comparable service outputs. Simultaneously, existing literature highlights that the scope of services, contractual responsibilities, and professional risks borne by AEC professionals have expanded substantially, especially in public-sector projects. Building on the trade-off perspective proposed by Bos-de Vos et al. (2016), this research argues that service pricing reflects a complex balance between sacrifices (effort, risk, liability) and benefits (quality, reliability, long-term performance). Perceived value is operationalized through measurable sub-components such as service scope, risk exposure, and responsibility intensity. Furthermore, the study links project service fees to building life-cycle outcomes, including durability, maintenance costs, and functional performance, demonstrating the long-term impact of service quality. A Turkey–international comparison is therefore essential to reveal how institutional structures, professional regulations, and value perceptions—beyond pure economic conditions—shape AEC service fees.

keywords: Perceived value; Professional service fees; Architecture, Engineering, and Construction (AEC); Service scope; Life-cycle performance; International comparison; Turkey

11:40 – 12:00

501

A Comparative Analysis of Wood Preservation Methods in Terms of Moisture-Focused Performance Criteria and Environmental Impacts

Beyza Özdemir

Supervisor: **Ayşem Berrin Çakmaklı**
Jury Members: **Filiz Diri Akyıldız**
Mehmet Koray Pekeriçli

Wood is a construction material produced through biological processes and has been used continuously from ancient times to the present day. Recently, its use has increased again, particularly because it is an important part of sustainable architecture. However, as a natural material, wood has limited resistance to moisture and water; therefore, it is prone to organic, inorganic, and even structural degradation. Its fibrous and cellular structure facilitates water uptake, while its hygroscopic nature makes it particularly sensitive to moisture. Since early periods, various solutions have been developed to protect wood against water and moisture. Traditional methods based largely on natural substances were gradually supplemented by chemicals whose use expanded with industrial production. Today, wood preservation methods cover a broad spectrum, supported by nanotechnological interventions and advances in material modification technologies.

This study aims to collect various examples of wood preservation methods developed to date and to present a comprehensive moisture-effect analysis by comparing these examples with each other. For this purpose, wood is examined using tests that demonstrate moisture-related effects from the surface to the bulk, including surface wettability, capillary absorption, and dimensional stability. The resulting data are intended to contribute to a methodological framework that also considers environmental impact and usage context in the selection of preservation methods. By combining theoretical knowledge with experimental work, this thesis seeks to provide an academic basis for extending material service life and optimizing the performance of wood preservatives.

keywords: Timber Preservative, Wood-Moisture Relationship, Hygroscopicity, Surface Wettability, Water Absorption

12:00 – 12:20

501

Digital Product Passports for 3D Concrete Printing (3DCP) Construction: Standardization and Implementation

Melis Toktaş

Supervisor: Mehmet Koray Pekeriçli
Jury Members: Müge Kruşa Yemişcioğlu
Deniz Üçer Erduran

The Architectural, Engineering and Construction (AEC) industry faces significant challenges in implementing sustainability goals due to high material consumption, data fragmentation and limited traceability of life cycle data for building products. Data related to building components is typically limited to the design and construction phases, while information from use, maintenance and end-of-life is largely lost. This limits life cycle-based assessments and circular economy approaches. Digital Product Passports (DPPs), developed by the European Union (EU), aim to manage product-level identity, content, production, life cycle data through standardized digital structures, particularly in line with regulatory frameworks after 2024. However, current DPP frameworks primarily target mass-produced goods and are not sufficiently adaptable to project-based productions of the AEC industry.

Three-dimensional concrete printing (3DCP) transforms building components into data-intensive products by allowing design and manufacturing processes to be defined in a digital environment, generating data such as geometric definitions, material mixtures and production parameters. Nevertheless, limited research exists on how such production data, including production-related waste, can be systemically structured within DPP systems.

This study examines the relationship between DPP and 3DCP technologies within the AEC context. Using literature review and conceptual analysis methods, the research identifies key data categories required for DPPs of 3DCP-produced building components, focusing on production, waste and life cycle sustainability. This study further evaluates the role of digital production data in enabling traceable and data-driven building products in relation to EU digital product data requirements expected to become mandatory by mid-2026.

keywords: Digital Product Passport (DPP), 3D Concrete Printing (3DCP), Life Cycle, Circular Construction, Traceability

12:20 – 12:40

501

Planning and Redesign of Hybrid Production-Office Spaces: The case of Additive Manufacturing

Elif Adak

Supervisor: **Mehmet Koray Pekeriçli**
Jury Members: **Hasan Okan Çetin**
İpek Gürsel Dino

In the context of increasing integration between digital fabrication technologies and traditional office environments, spatial optimization of hybrid workplaces has become a key concern in both design and operational efficiency. This research explores the spatial layout of a production office that integrates additive manufacturing (3D printing) amenities with office-oriented functions. The primary aim is to improve the usability, accessibility, and ergonomic quality of the environments in which additive manufacturing and administrative tasks are collocated.
The study follows a case study methodology founded on a real working setting to examine contemporary spatial configurations and work processes. Close attention is placed on the layout and use patterns of 3D printing machines, as well as the dynamics and requirements of the workers using these devices. Using workplace ergonomics, lean manufacturing principles, and theories of spatial analysis, this study creates a foundation for proposing better layouts and operational models that facilitate both workers' health and production efficiency.
This study contributes to the interdisciplinary field of workspace design for digital manufacturing and offers a practical framework for implementing spatial improvements in similarly structured hybrid facilities.

keywords: Additive Manufacturing, Spatial Optimization, Hybrid Workplace, Workplace Layout, 3D Printing, Human-Centered Design