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TEDU **Arch462** Profession and Practice

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Ersan ilktan 15172014472

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Communicative Architectural Practices between Structural Engineers and Architects & Using Professional Regulations as Tools for Design

Students who study architecture in university and become practicing architects face many different challenges and opportunities regarding their role in realizing an architectural project. As there are many stakeholders in designing a building, one of the main technical knowledge sources is structural engineers. These engineers specialize in calculating, predicting, and optimizing buildings and regard them as one stabilized system in our society.[1] As our world is constantly moving with earthquakes, changing with wind conditions, and exist regarding the force of gravity; any human-made structure needs to comply with these natural forces to exist structurally, keep its form and function. Therefore as we need architects who are highly interdisciplinary and providing a junction point where social, economical, structural, cultural, technical, and aesthetic concerns meet[2] ; we also need specialized professionals who are highly competent in defining and regulating rules about how to comply with these various aspects of interest.

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[1] **Cranston, B. (2002).** The place of the engineer in society. 32nd Annual Frontiers in Education, Frontiers in Education, 2002. FIE 2002. 32nd Annual, Frontiers in Education, 3.

[2] **McLaughlan, R., & Lodge, J. M. (2019).** Facilitating Epistemic Fluency through Design Thinking: A Strategy for the Broader Application of Studio Pedagogy within Higher Education. Teaching in Higher Education, 24(1), 81–97.

Structural engineers are both responsible for researching structural strengths of used materials, and also provide specific knowledge and calculations about a specific building during its design.[2] Although architects should have a basic understanding of how the building will structurally be stable and buildable, as they are concerned with many different aspects of the building as well as a technicality, it is both wise and extremely required to work collaboratively with a structural engineer.

Structural engineers have some similarities in terms of their profession to many design practices in the case of finding solutions to problems. [4] The difference may be that engineers deconstruct and meticulously understand the problem and therefore find the scientific correct answer, but in the case of architects, they are simulating a possible solution to the design problem and alter, transform the first solution to fit best the given design problem. The solution to the design problem will always have many alternative approaches and therefore there is no single direct answer. People who did not experience architecture education as well as any design pedagogy may be unfamiliar with the condition of multiple correct answers and could not specifically relate the vision or design idea of a designer. That may be why architects are often misunderstood and their efforts towards an architecture that are highly acclaimed throughout their design communities may be less valued by the public as well as other stakeholders such as engineers.[3] Some aspects of design such as light quality, material experience, relationships of our bodies to the spaces we use, and also the level of publicness are terms that cannot be scientifically and accurately calculated. [4] These concerns of architects who bring multi-disciplinary knowledge from both technical and social professions can be in stark contrast to the optimization oriented, calculable problems of structural engineers. [4]

[2] **McLaughlan, R., & Lodge, J. M. (2019).** Facilitating Epistemic Fluency through Design Thinking: A Strategy for the Broader Application of Studio Pedagogy within Higher Education. Teaching in Higher Education, 24(1), 81–97.
[3] **Naryzhna, O., & Akmen, I. (2017).** Architect and Society: Ways of Interaction within the End of 19Th Century and at the Beginning of 20Th. International Journal of Arts & Sciences, 9(4), 571–580.
[4] **Özmen, C., & Ünay, A. İ. (2011).** Architect -- Structural Engineer Collaboration In Sustainable Structural System Design. Gazi University Journal of Science, 24(4), 945–925.

Structural engineers are using highly improved computer software to exactly calculate and predict the behavior of the building as a structural system. Their applications are produced to model standardized and most optimal in terms of cost, time, and energy required to design a structurally stable building. Although these advancements in calculation especially BIM (Building Information Modelling)[5] allow smooth communication between many professionals collaborating on one project and apply regulations automatically, it has its limitations if these limitations are not considered. We need to use the software and medium that improve our workflow to not hinder our creative solutions but rather as another collaborator that brings with itself its input that can be challenged accordingly. Mostly engineers in Turkey are using computer-optimized programs to calculate and provide solutions. As I have mentioned before; the constant use of these standardized structure systems hinders the creative solutions that might even be more efficient and also provide value to qualities of architecture that cannot be fully calculatable. [6]

The promotion of critical thinking for all professions regardless of their works' nature to be more problem-based or solution-based can instill critical thought processes to professions where the correct answer is constant and break the status quo. Architects need to respect and value the technical expertise of structural engineers who are willing to design new and innovative structural configurations that build upon the logical standards. Finding common ground between what the public, contractors, and financiers are expecting while being in the financial plan that is proposed will create this condition. While this might come sometimes of the cost of more architectural theory and aesthetic sophistication, it is important because there also needs to be buildings that employers might want to build. Society will always build buildings and architects' responsibility is to guide them towards better design spaces within constraints. [3] Otherwise, our great ideas will be left in our papers.

The regulations and standards vary with location. Climates and the earth's conditions vary therefore the way we build buildings must also be adjusted to it. Structural engineers have much more rigid requirements for building in earthquake-prone zones for safety. In

[3] **Naryzhna, O., & Akmen, I. (2017).** Architect and Society: Ways of Interaction within the End of 19Th Century and at the Beginning of 20Th. International Journal of Arts & Sciences, 9(4), 571–580.
[5] **Issitt, M. (2019).** Building Information Modeling (BIM). Salem Press Encyclopedia.
[6] **Xiaolei, W. (2018).** Research on the Application of BIM Concept and BIM Software in Architectural Design. 2018 International Conference on Engineering Simulation and Intelligent Control (ESAIC), 2018 International Conference, 218–220.

different countries, the socio-economic condition dictates the standard of structural optimization of buildings. The material local to the region has much more different structural qualities and coefficients than materials imported or inherent in another region. Architects need to comply and use these constraints as tools for better design and find solutions that both satisfy realizable constraints and innovative characteristic building typologies.

The tools and standard process of building a building are composed of many highly experimented and approved building parts that will both allow for architects to provide design ideas and structural engineers to form a coherent structure system. For example; buildings need to have vertical loads, as well as lateral loads, be transferred to the ground. Vertical loads are for buildings to hold their structural loads and integrity while lateral loads are important in the case of crustal movement which in turn produces forces that behave in the lateral direction.

There are several ways to comply with these requirements that also help us design better buildings. These structural systems should not be seen as a limiting factor because of their constraints, the architecture can exist in the real world with very real gravitational and other environmental factors in mind. The use of curtain walls in symmetrical and equal manner inside the building will increase its capacity to withhold the forces in the lateral direction.[7] Rather than seeing this condition as a limiter for providing open spaces, we can use this condition to justify smaller scale divisions in some pars of the complex. These regulations are based on real-life relationships with physics and natural forces that also give architects better relationships between spaces. The constructs of design models that are not structurally competent usually lack the proper transfer of relationships in lateral and vertical directions. Architecture education aims at teaching this sensibility in the first years when students design and physically produce a construct that can be critiqued for its design coherency and structural relationships.

[2] **McLaughlan, R., & Lodge, J. M. (2019).** Facilitating Epistemic Fluency through Design Thinking: A Strategy for the Broader Application of Studio Pedagogy within Higher Education. Teaching in Higher Education, 24(1), 81–97.

[7] **Glassman, P. (2009).** Contemporary Curtain Wall Architecture. Library Journal, 134(18), 64.

To better delve into the structural regulations and construction patters that can also be used as a design tool that increases the communicability of the project to structural engineers, I want to mention some examples; Masonry construction is the use of individually placed bricks in a pattern to distribute loading around, besides the openings and doors.[8] The arrangement of the masonry shifts as the loads around the composition changes. The mortar between the individual blocks distributes stress around the wall. This method can be used as a design tool in the sense that because the wall is composed of discrete parts, the design of the building can use different arrangements to provide semi-permeable facades, gradually changing conditions on the wall even design different scaled elements from the same building block. If the building is designed using the material method, the structural engineer and the architect can collaborate to explore the potentials of the said building system. So traditional masonry is usually used with steel to hybridize and provide larger openings, departures on the edges, and cantilevers. [8] The lateral loads that act on the masonry wall can be configured to counteract with wind posts. [8] To use the masonry as a tool for design it is interesting that the masonry wall will be more flexible and resist lateral loads if the mortar is Lime Mortar but in that case, the wall is more susceptible to vertical loads [8] . In design terminology, the relationships between discrete elements are more rigid, constant when the elements that produce that relationship is more constant. But when the relations between parts loosen, although it can withhold changes, it is more inclined to not sustain itself as a whole (vertical loads).

As a conclusion, Architects and Structural engineers must collaborate in a project with a sense of allyship. The natural Gravity forces as well as other forces organize relationships withing architecture for both design sensibility and structural optimization. Architects and Structural Engineers should have a basic understanding of each other's goals and specialization. Critical Thinking can help ameliorate the stark rigidity of structural optimization software. Regulations and standards that are inherent to the location can help architecture become reliable, effective, and grounded with room for creative relationships. Even the material choice can determine the structural system and designed space terminology.

[8] **Sokolov, B. S., & Antakov, A. B. (2014).** The Results of Masonry and Reinforced Masonry Research. Proceedings of Moscow State University of Civil Engineering / Vestnik MGSU, 3, 99–106.

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