

Structural Evolution in Enhancing Architectural Aesthetics: Examples from Modern to Contemporary Era

Md. R. Khan¹, S.A. Tisa²

¹ Assistant Professor, Department of Architecture, KUET, Bangladesh (raihankhan@arch.kuet.bd.com,
raihankhan9@gmail.com)

² MURP student, Department of Urban and Regional Planning, KUET, Bangladesh (sadiatisa1805@gmail.com)

Abstract

The structure is the key to sustain a construction by ensuring firmness and makes it sound and safe for living. Evolve from the basic functional layout since ancient times; its role has been studied for understanding spatial and visual beautification. In all aspects of architecture and structure, the revivalism of classical periods along with the advent of new materials expanded the vocabulary of this aesthetic. The professionals have been engaged in designing form oriented geometric expression by the innovative structural system from analogical to the metaphoric idea and making the internal skeleton visible as part of visual appearances. In this study, the analysis of modern to contemporary buildings from a structural perspective opens up the critical considerations that influence visual aesthetics through embracing technological and sustainable languages. For doing this, the study emphasizes a desk-based review of research articles, books, and unique cases. Additionally, the idea based, experimental, proposed, and some regional architectural projects will illustrate to apprehend the structural significance in architectural aesthetics. The outcome of the study will signify the structural role from the visual perspective which is somewhat ignored by many regional architects

Keywords: *Aesthetic, Contemporary era, Modern phase, Structural Expressionism.*

1. Introduction

Functionally structure is perceived as the core that provides the necessary stability, strength to resist imposed load and distribute to the ground. Beside its firmness, exquisite details enhance architectural qualities and ideas. The architectural and structural theorists differently perceived the role of structure in defining spatial articulation, circulation, functionality and visual appearances. Lavine, for example, uses case studies of various house types to illustrate the functionality of the structural column in describing human activities. Subsequently, he shows how the ridge beams work as social center within a house. These characteristics make the space more meaningful.

According to literature, the architectural structure refers to the part of buildings, which carries and distributes the applied loads more efficiently and economically (Ekhlasi, & Norouziyan-Maleki, 2019). The designer should consider the direction of the load and align the elements to achieve a perfect composition. Considering from the classical era, this combination used to make the building more lucrative where crafting on structural surfaces, detailing, and technical correction were major concerns. For example, the Greek professionals worked with optical correction of slender forms. During the Gothic era, for supporting massive interior height they introduced a vaults system and the advanced technique of flying buttress. These

increase the overall visual aesthetics of the building. Pier Luigi Nervi (1891-1979) believes, ‘outer appearances of the good building are nothing but the visible expression of an efficient structural or constructional detailing’ (Charleson, 2014). The intellectual combination within structural and non-structural components not only makes the building eye-catching, but also ensures economic and environmental sustainability.

Until the Neoclassical era, the structure was used as a hidden component clad by different ornamentation and materials. The propositions of the modern period change the ideology and reinforce the thought of future development. The harmonious and purposeful relationship within the structure, space, and materials made a language to define aesthetics of architecture and structure. The utmost output experiences during the post-modern period and architects relied on the flexible nature of the form. Shell, Fabric, Ribbed, Folded plates, Framed, and Arch structures are magnificent creations that interpret the architectural ideology from different perspectives.

Nowadays, local professionals are doing cladding work rather than relying on the structural system. The concept was introduced by Semper during the mid-19th century when he illustrated it as the layering of surface and a component of spatial art (Schittich, Lang, & Krippner, 2006). The spirit shifted towards more embellishing stage that dominated industrially produced materials. That not only increases additional costing but makes the building unfriendly in respect of surroundings. The day-to-day experience of building’s structure described unmemorable facts; mostly constructions elements are concealed or nondescript by opaque façade panels, mirror glass, and so on. Even though the structural system of some buildings is exposed, but lack of synchronization with non-structural elements, prototype composition, or lack conscious of detailing make a poor combination (Charleson, 2014). A thorough exploration of interrelationship within these components could inspire professionals to rethink the current field practices.

The aim of the study is to critically synthesize the aesthetics of architecture and structure and their interrelationship to produce a meaningful form. The theoretical part illustrates different concepts and philosophies related to architecture and structural systems from an aesthetical perspective. The second part will review the relationship based on a timeline, and the study ended up by mentioning insights from local practices.

2. Theoretical understanding: Architecture, Structure and Aesthetics

Architecture is a purposeful domain and mingled of art and science which aims to innovate something new that must have aesthetic appeals from both functional and perceptual dimension. Vitruvius, an author, provided three elements *Firmitas* (Strength), *Utilitas* (Functionality), and *Venustus* (Beauty) which constituted good architecture. Enough sensitivity and skill are required for integrating constructional structure in defining the architectural beauty from a visual perspective (Elnimeiri & Gupta, 2008). Moreover, Margolius added the significance of structural correctness in creating a beautiful image. Material efficiency and forces of surroundings are a crucial part of this visualization (Corbusier 2013).

Structural considerations, on the other hand, are to design forms that can withstand applied loads efficiently and economically while also having a pleasing appearance and architectural features. The shape of forms will vary depending on the purpose, spatial requirements, and, in particular, the designer's concept, in which the engineer's job is to consider force direction to achieve a perfect balance among the mentioned issues. Structural elements, in this case, function as a part of a three-dimensional composition that can adhere to the fundamentals of good composition, such as unity, balance, harmony, movement, and focus. Faber mentioned those factors are fundamental for aesthetic satisfaction and Kular added geometric and

completed form, expression of static behavior, the ratio between structure and environment (Sparshott, 2019); Kollár, 2003).

Aesthetics, a Greek term, manifests a branch of philosophy, which is related to sensory perception and deals with the beauty of an object. It broadly covers two components 'emotional' and the 'intellectual' (Scruton, 2013). Those are associated with the subjectivity and objectivity ideology of an object. Scholars found the subjectivity is indefinable that related to an intuitive aspect of human personality. On the other hand, objectivity is the rational appreciation that considering functionality, materiality, exterior condition, etc.

Beautification and functionality depend on proper connectivity between structural and non-structural elements, and these also influence the external expression of the building (Macdonald, 2018). It has evident in the 'igloo' shaped and in 'mud' constructed built form, where all are self-supporting structures use as space enclosing surfaces (Figure 1,a). Alternatively, space-enclosing elements and structural elements can be separated, although these collectively influence the aesthetic. The Villa Savoye house, designed by the eminent architect Le Corbusier showed integration between the structural and non-structural elements that convey an aesthetical language (Figure 1,b). After that, this minimalistic combination appeared to be the most stylistic approach in architecture. During the post-modern period, the widespread use of precast concrete with steel framing defied conventional modern thought, creating a new vocabulary where structural elements proactively produce spaces. The practice turned out to be a striking trend in architecture, but very few engaged with the mainstream process.



Figure 1: A traditional house made with mud and straw (a), The Villa Savoye designed by Le Corbusier (b). Source: www.google.com

3. Methodology

The study has reviewed the documents collected secondary sources to find out the interrelationship between architecture, structure, and aesthetics. Most of the research articles, papers, and related documents download from Google Scholar and PubMed for authentication. Finally, some buildings from the local area have presented as examples to figure out architect's and engineer's notions about aesthetics and design. Discussion with local professionals conducted for an in-depth understanding of structural considerations.

4. Finding and analysis

4.1 Paradigm shift: a path towards new era

During the mid-17th century, the industrial revolution, political instability, and social reformation brought changes in the society that impacted physical development massively. Ideologies of post classical phase, such as democratic views, free-market economy, industrialization processes questioned the decorative pattern of the constructions. Additionally, the emergence of science and technological advancement voices a new attitude against the classical order.

For example, the exposed Greek columns introduced a new way where the resurgence of classical elements makes an elegant aesthetical look. It manifests a new genre and formative method to integrate the structural elements in enhancing visual appearances. During that time, architects approached ancient styles and embraced advanced materials, such as reinforced concrete, cast-iron frame, and portland stone. The methods turn into an architectural corollary to re-create brand new order.

The French architect Claude Perrault questioned the irrational veneration and timeless nature of the ancient theories. The exaggeration of decoration is nothing but illusory, which he mentioned unnecessary to include in the design. Simple geometry with an ordinary structural system could be ideal for articulating efficient space. Following this, Soufflot exercised the idea of expressive structure in designing the outer skin of buildings. In church, an order developed through repeating free-standing classical portico that rarely ornamented.

4.2 1830-1910:

During the early 19th century electro-mechanical advancement instigated many social movements. These directly influence the work of professionals, such Henri Labrouste (1801–1875), a prominent French architect, first designed a large-scale public building with exposed structural iron frame, which brought a revolution to make large span building. Until the late 18th century, decorations of balustrades, decorative hardware used as ornamental building materials, but Labrouste introduced ‘truthfulness of construction’, where the decoration of structural elements reinforce the aesthetic views (Labrouste et al., 2012). His mentor, Durand, in the light of rationalism, first introduced the application of analytical and methodical design process based on an axial grid, later, that functioned as a base for the modern functional architecture of the 20th century. Following the grid pattern of Durand in spatial organization, the exterior surfaces are perfectly aligned with the division of internal space. Ornamentation is utilized as a complement to structure and support functional requirements. The translucent facades expose the inner arrangements, and Labrouste uses the quality symbolically for breaking the embellishment of the classical pattern. The process systematically unties three interrelated aspects, which are the organization of spaces, outer screen’s character, and the structure of building.

The Crystal Place is another revolutionary establishment that emerged from an unconventional process. Following the production-line method, the entire building was an output of industrial product, where all elements were produced in industry and assembled on the site. Sir Joseph Paxton showed mastery of using the building materials from an unorthodox dimension. The steel used for large span for its functional requirements and translucent screen made it visually attractive.

4.3 1910-1970:

Adaptation of functional approach, simplicity, the truthfulness of form, materials, expression, less ornamentation, and minimalistic approaches become popular. All these include technical considerations of structure in the process of design. Falling Water is one of his unique creations that merged with surroundings by extended floor slab and the exposed column. The structural system enhances the visual beauty. Similarly, Le Corbusier formulated an alternative perspective to integrate structural innovations with architectural thought. Villa Savoye is an example that represents a different ideology of architects. The post slab structural system provides scopes for the free plan, ribbon window for ventilation, and light and flexible façade. The array of free-standing pilotis uplifts the ground level and carries the loads jointly with the floor where the combination instigates minimalistic aesthetics. Afterward, the visual expression of this structure turns into a principle of modern architecture. Local architects have also used this structural system to design region-based architecture.

Faculty of Fine Arts, University of Dhaka, Bangladesh is a perfect example, where architects link structural simplicity with the environment and introduce a new genre for this tropical context. In the other part of the world, new practices have evolved. The combination of light-weight steel and glass proactive for addressing many issues, such as land scarcity, commercialization, and functional needs; as a result, a new form of comes with its elegance, skyscrapers or tall building, this groundbreaking revolution manifests new aestheticism.

4.4 1970-onwards:

During the late 20th century, the region-centric development reinforces the thinking broadly. Extensive use of Reinforce Cement Concrete (RCC) scopes to create different shapes, particularly, free-flowing or generative form developments in respect of environment have been introduced. This ideology reinforces a new genre in architecture where the structure itself is using for space making. Shell, Fabric, Folded plate or Catenary structures are some alternative approaches of rigid and monotonous structural systems. Internationally acclaimed professionals work with these fluid forms in all regions of the world, and influence the local practices. These systems eliminate the extra non-structural elements, and the structural features directly contribute to functional and aesthetic dimensions.

On the other hand, the architectural structures are environmentally and socially conditioned and broadly depend on geographical and climatic conditions, the adjacent landscape, and the intensity of sunlight, wind, and other related factors (Borev, 1985). In many ways, the utilitarian and artistic requirements of society guide the development of architecture. People are more focused on context-specific methods of design, where climate change and sustainability have given priority. The main aim is to get maximum benefits by minimum intervention. This ideology reflects in the work of many eminent local architects, such as Charles Correa, BV Doshi, Mazharul Islam.

5. Insight from local structures

In Bangladesh, professionals began working with the true expression of materials, formal expression of structural system, climatic considerations, and all of these as part of aesthetic from the early days of the post-modern period. Mazharul Islam is a notable architect among them, popularly acclaimed as a master of regional modernism, was fascinated by local tradition and climate. His works show true respect for construction materials. Furthermore, structural features use as part of functionality that enhances the visual appeal. In Dhaka Art Institute, the free-standing vertical post and extended plane distributed the applied loads, and climatically maintain indoor-outdoor relationship (Figure 2,a) that also enhances visual

appearances. Overall, no additional components were used to enrich aesthetic appeal. The same commitment found in the works of venerable architects, Bashirul Haq, who worked with the true expression brick and emphasized the



Figure 2: Dhaka Fine Arts Institute (a), Local apartment building (b). Source: Author. visual beauty.

Last two decades, the field is experiencing different kinds of practices which dominated by RCC construction. Many are working with true expression of RCC materials and compose with exposed brick, although these are questionable from climatic perspective.

A study of local structures reveals that nearly all of them are covered in a variety of colorful tiles, paints, and other low-cost finishing materials. Aluminum Composite Panel (ACP) is typically used in apartment buildings, although, it is both costly and environmentally damaging (Figure 2, b).

6. Conclusion

According to literature, the rejection of classical practices, and the mechanical and industrial revolutions, widen the boundaries of architectural practices. The professionals move towards more minimalistic thinking rather than unnecessary decoration on the interior or exterior surfaces. Mainly they explore the subtle relationship of structural and non-structural elements to make the building aesthetically eye-catching. Structural engineers were more concerned by its aesthetics appearances and align with the architect's thoughts. Rational thought and other modernist propositions guide their ideology regarding the use of structural and non-structural components. The post-modern era experiences an unorthodox mode of practice that introduced freeform ideology. Additionally, exploration of technical properties of materials brings forth diversified flexible forms and shapes.

Notably, the trend is missing in the local practices in many areas, such as Bangladesh. In most cases, professionals show apathy toward integrating the structural components as part of architectural aesthetics. The study finds that engineers alleged the architect's lacked enthusiasm separates the structure from the aesthetic of the building. All are obsessed with various cladding materials. On the other hand, architects blame the engineer's lack of knowledge on modern structural systems that restrict experimental design thinking. The prototype post-lintel structural system is using widely, which limits the thought process. The surveyed buildings show the exterior design is similar except for some finishing materials. Even there are no different forms have found.

Overall, cladding with bricks and tiles at the outer surface, adding extra elements for compositional purposes and multiple colors are common. These not only disregard the material authenticity but promote an ugly appearance. Critical appraisal of those buildings reveals many technical issues related to materials and structure that could be minimized by thoughtful integration within architecture, structure, and aesthetics.

References

- Borev, Y. (1985). *Aesthetics a Textbook*.
- Charleson, A. (2014). *Structure as architecture: a source book for architects and structural engineers*: Routledge.
- Collins, P. (1998). *Changing ideals in modern architecture, 1750-1950*: McGill-Queen's Press-MQUP.
- Corbusier, L. (2013). *Towards a new architecture*: Courier Corporation.
- Elnimeiri, M., & Gupta, P. (2008). Sustainable structure of tall buildings. *The Structural Design of Tall and Special Buildings*, 17(5), 881-894.
- Kollár, L. (2003). Aesthetic aspects of the design of engineering structures in the education. *Periodica Polytechnica Civil Engineering*, 47(1), 85-94.
- Labrouste, H., Bélier, C., Bergdoll, B., Le Cœur, M., Bressani, M., Grignon, M., . . . Van Zanten, D. (2012). *Henri Labrouste: Structure Brought to Light*: The Museum of Modern Art.
- Macdonald, A. J. (2018). *Structure and architecture*: Routledge.
- Sadeqi, S., Ekhlassi, A., & Norouzian-Maleki, S. (2019). An analysis of structural aesthetics in architecture case study: Taj-Ol-Molk Dome, Jāmeḥ Mosque of Isfahan, Iran. *SN Applied Sciences*, 1(6), 1-10.
- Schittich, C., Lang, W., & Krippner, R. (2006). *Building skins*: Birkhäuser.
- Scruton, R. (2013). *The aesthetics of architecture*: Princeton University Press.
- Sparshott, F. E. (2019). *The structure of aesthetics*: University of Toronto Press.