Architectural Dimensions and Beyond

www.adb.reapress.com

Arch. Dim. Bey. Vol. 3, No. 4 (2026) 278–285.

Paper Type: Original Article

The Role of Synergy between Structural Technology and Aesthetic Expression in Shaping Contemporary Iranian Architecture: A Comparative Analysis of Three Selected Works

Elnaz Behnoud*

Department of Architecture, Tabriz Branch, Islamic Azad University, Tabriz, Iran; elnaz.behnoud@iau.ac.ir.

Citation:

Received: 14 June 2026 *Revised: 29 September 2026* *Accepted: 07 November 2026*	Behnoud, E. (2026). The role of synergy between structural technology and aesthetic expression in shaping contemporary Iranian architecture: A comparative analysis of three selected works. *Architectural dimensions and beyond, 3*(4), 278-285.

Abstract

The evolution of contemporary architecture and the increasing complexity of design and construction processes have highlighted the growing importance of interaction among artistic creativity, structural technologies, and construction management. Achieving high-quality architectural outcomes requires the integration of aesthetic considerations and architectural concepts with technical and construction requirements from the early stages of the design process. A lack of coordination among these components may hinder the realization of architectural ideas and adversely affect the overall quality of the final outcome. In this regard, the present study focuses on the concept of synergy among structural technology, aesthetic expression, and construction management, examining how the interaction of these factors influences the formation and realization of contemporary Iranian architectural works. Methodologically, the research adopts a descriptive-analytical approach based on library studies and a comparative analysis of three architectural case studies: Azadi Tower, Tabiat Bridge, and Milad Tower. These cases were selected based on their distinctive characteristics in terms of structural innovation, architectural expression, national significance, and technical and construction complexity. The analysis was conducted along three main dimensions: artistic expression, structural technology, and construction management. The findings indicate that in prominent architectural works, structural systems extend beyond their conventional load-bearing functions and serve as influential elements in shaping visual identity, organizing space, and enhancing the overall architectural experience. Furthermore, interaction and coordination among architectural decisions, structural solutions, and construction requirements facilitate the realization of creative concepts and complex forms while improving the quality of the construction process. Ultimately, the study emphasizes the need for an integrated and interdisciplinary approach to architectural design and construction and proposes a conceptual framework for strengthening collaboration among architects, structural engineers, and construction management professionals.

Keywords: Structural technology, Aesthetic expression, Synergy, Construction management, Contemporary Iranian architecture.

1 | Introduction

Architecture has long been shaped at the intersection of art and engineering; a realm where structural logic and aesthetic expression continually seek a meaningful coexistence. Nevertheless, in the course of modern

Corresponding Author: elnaz.behnoud@iau.ac.ir

https://doi.org/10.48314/adb.v3i4.71

Licensee System Analytics. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0).

and contemporary architectural evolution, these two fields have gradually drifted apart in many instances, operating as relatively independent systems. Consequently, either the formal expression of architectural works has been weakened when confronting structural constraints, or the structure has been sidelined as a purely technical and hidden element detached from the aesthetic experience, a situation that has limited some of architecture's creative potential in producing complex and meaningful spaces [1].

In recent decades, advancements in digital technologies for architectural design and the development of novel approaches in structural engineering have provided the context for redefining the relationship between form, structure, and the construction process. The emergence of approaches such as parametric design, digital fabrication, and computational engineering has strengthened the possibility of creating a common language between the architect and the structural engineer; a language in which structure acts not merely as a load-bearing system, but as a form-generator and part of architecture's aesthetic logic [2]. Within this framework, structural constraints can also be interpreted not as obstacles, but as catalysts for design creativity and innovation. From a theoretical perspective, contemporary architectural literature emphasizes the importance of convergence among design, technology, and construction, considering it a prerequisite for elevating the quality of complex architectural projects. Meanwhile, approaches such as integrated design and Building Information Modeling (BIM) have played a significant role in narrowing the gap between design and execution stages and enhancing coordination among architects, structural engineers, and project executors [3]. Furthermore, studies in contemporary Iranian architecture emphasize the necessity of paying attention to the interaction between construction technology, architectural identity, and artistic expression in the formation of prominent works [4].

Accordingly, contemporary architecture requires interdisciplinary and integrated approaches more than ever before; approaches in which the boundaries among architectural design, structural technology, and construction process management systematically blur. In such a context, the synergy of these three domains can lead to the creation of spaces that simultaneously possess functional, structural, and aesthetic qualities. From this perspective, the dialogue between structural technology and artistic expression not only leads to elevated spatial quality but also provides the possibility for forming novel and contemporary spatial experiences. Therefore, this study aims to investigate and explain how this interaction is formed in contemporary architecture and to analyze its role in developing interdisciplinary approaches in the design and construction of architectural spaces. Focusing on three prominent examples of contemporary Iranian architecture, this research attempts to provide a conceptual framework for the simultaneous analysis of "artistic expression," "structural technology," and "construction management", a framework that can be used as a basis for design decision-making and enhancing the quality of architectural projects.

2 | Research Background

Previous studies in the field of interdisciplinary architecture indicate that multiple efforts have been made to bridge the gap between aesthetics and structural logic. In early approaches, the concept of "tectonics" emerged as one of the fundamental theoretical frameworks, where structure is viewed not merely as a load-bearing system, but as an honest and readable expression of construction logic. In this view, the connection among form, material, and structure has been regarded as part of architecture's artistic expression [5]. With the expansion of digital technologies in contemporary architecture, research approaches have shifted toward computational, parametric design, and digital fabrication. In this framework, digital tools act as a medium between the architect and the engineer, enabling the production of complex forms based on structural logics. Studies in this field show that computational design not only aids in generating innovative forms but also allows for the simultaneous optimization of structure and architecture [6].

On the other hand, research related to construction management, project integration approaches, and BIM emphasizes the importance of coordination across design, engineering, and execution phases. These studies demonstrate that a lack of coordination between design and execution teams is a primary factor causing the gap between conceptual ideas and construction reality. Conversely, integrated approaches can improve

decision-making quality and the execution of complex projects by creating a continuous information flow [7]. Domestic studies also emphasize the importance of interaction among construction technology, artistic expression, and executive processes. Iranian architecture researchers believe that a major challenge in contemporary projects is the disconnect between conceptual design and constructability, and bridging this gap requires an interdisciplinary perspective and synergy among architects, structural engineers, and project managers [8]. Despite the theoretical richness in each of these areas, a research gap persists regarding the simultaneous integration of "artistic expression," "structural technology," and "construction management" within a coherent analytical model. This research endeavors to bridge this gap and provide a conceptual framework to explain the dialogue among these three domains in prominent projects of contemporary Iranian architecture.

3 | Research Methodology

The present study is classified as applied-theoretical in terms of its objective, and descriptive-analytical in nature and method. The overall research approach is based on qualitative analysis and case studies, attempting to explain the concept of "dialogue between structural technology and artistic expression" in contemporary architecture through the investigation of prominent interdisciplinary examples. In the first step, the theoretical foundations of the research were gathered through library and documentary studies. This section includes reviewing literature related to interdisciplinary architecture, tectonics, modern structural technologies, computational design, and the role of aesthetics in the design and construction process. Sources used included books, domestic and international scientific articles, and reputable studies in the field of contemporary architecture [9]. In the second step, to empirically analyze the subject, case studies were selected based on specific criteria. These criteria included the national and symbolic significance of the project, the degree of innovation in the structural system, the diversity of technologies used, the quality of architectural expression, and access to reliable and analyzable documentation. Accordingly, projects were chosen where the interaction among structural technology, artistic expression, and the construction process is prominently visible. Data analysis was conducted along three main axes:

I. Structural technology.

II. Artistic expression.

III. Construction management.

During this process, each case study was examined qualitatively, and the mode of interaction between structural logic and formal expression was analyzed. The role of modern technologies, including digital design and construction process harmonization approaches, in realizing architectural ideas was also considered. Finally, data derived from theoretical studies and case analysis were compared using a comparative method to extract common patterns and effective components in forming synergy among art, structure, and construction management. The output of this analysis is a conceptual framework to explain the role of interdisciplinary approaches in enhancing the quality of contemporary architectural design and execution.

4 | Basic Theoretical Framework of the Research

To elucidate the concept of "dialogue between structural technology and artistic expression" in contemporary architecture, the theoretical framework of this research rests upon three main areas: tectonic theory in architecture, digital and parametric design approaches, and integrated project management theories. These three areas cover the conceptual, technological, and executive dimensions of the interaction between art and structure, respectively. First, tectonic theory is considered the conceptual foundation of this research. In this view, structure is not merely a technical system for force transfer, but possesses an expressive quality that plays a decisive role in shaping architectural identity. Frampton defines tectonics as the "poetics of construction", where the logic of construction, materials, and form unite into a meaningful totality [9].

Accordingly, structure can be read as a carrier of meaning and part of architecture's artistic expression rather than a purely hidden functional element. Second, digital and parametric design approaches provide the technological context for realizing this interaction. In these approaches, design is shaped through computational and algorithmic logic, enabling the production of complex forms based on structural data. Kolarevic demonstrates that digital manufacturing technologies reduce the boundary between design and production, facilitating integration among form, structure, and the construction process. In this framework, technology is regarded not only as a tool for realizing form, but as part of the architectural idea-generation process. Third, construction management theories and project integration approaches elucidate the executive dimension of this interaction. From this perspective, the success of complex architectural projects depends on early coordination among the designer, structural engineer, and construction manager. Approaches like BIM and integrated project delivery show that process integration can minimize the gap between design and execution and elevate the final project quality.

Accordingly, the theoretical framework of the present research is anchored in the synergy of these three domains and strives to explain the interaction among artistic expression, structural technology, and construction management as an integrated conceptual model: a model that can serve as the basis for analyzing case studies in contemporary Iranian architecture.

5 | Analysis of Case Studies

5.1 | Tehran Azadi Tower

The Azadi Tower is one of the exemplary cases of blending artistic expression, structural logic, and construction management in contemporary Iranian architecture (Architect: Hossein Amanat – 1970). The arch-like form of this monument, inspired by Iranian architectural patterns, is shaped upon a reinforced concrete structural system, demonstrating a coexistence between modern tectonics and Iranian architectural identity [5].

From an aesthetic perspective, geometry based on Iranian proportions, the use of white stone, and precise grid patterning have transformed the tower into a national architectural icon. This artistic expression was realized within the heart of a complex structural system comprising three-dimensional arches and a concrete shell controlled with rigorous geometric precision. From an executive perspective, the project required a high level of coordination among design, execution, and quality control, particularly in facade stonework and the precise execution of arch geometry. These features indicate that realizing the final form would have been impossible without cohesive and controlled construction management [4].

5.2 | Nature Bridge (Pol-e Tabiat), Tehran

Nature Bridge is one of contemporary Iran's most significant socio-architectural structures, where the structure directly translates into spatial expression and user experience (Architect: Leila Araghian – 2014).

With its three-level structure and curved steel structural system, this project represents a clear example of convergence among form, structure, and movement experience. From an artistic expression perspective, the fluid and organic form of the bridge establishes visual and movement continuity between two urban spaces (Taleghani and Abo-Atash Parks), providing a multi-layered experience of movement and pause. From a structural technology perspective, employing tubular steel beams, complex structural analyses, and 3D modeling-based design enabled the realization of non-linear geometry and free forms [2].

In the realm of construction management, the use of prefabricated components, phased execution, and precise coordination among the client, designer, and contractor played a decisive role in the project's successful realization. Consequently, the structure plays not only a load-bearing role but also shapes spatial identity.

5.3 | Milad Tower

As one of Iran's tallest structures, Milad Tower stands as a prominent example of infrastructure-urban projects characterized by high structural and managerial complexity. Standing at approximately 435 meters, the tower comprises a central concrete core combined with a steel structure at its head, designed based on advanced lateral load analyses, specifically wind and seismic forces. This project utilized a slipform concrete core system, enabling continuous execution at height.

Structural design was conducted based on dynamic analyses and seismic behavior control, while connecting the steel head section to the concrete body required complex engineering details [10].

In this framework, the structure is not merely a resistant system, but plays a direct role in shaping the tower's final form. The tower's form consists of a simple, vertical body and a multi-faceted volume at the head housing cultural functions and urban viewing decks. This formal differentiation shapes the project's architectural expression based on functional-structural logic. Here, aesthetics are derived not from decoration, but from technological and structural logic, an approach aligned with the concept of tectonics in architecture [9].

Milad Tower ranks among the country's most complex construction projects in terms of construction management. The multitude of stakeholders, large project scale, special executive conditions at height, and the need for coordination among numerous contractors all underscore the necessity of an integrated management structure. This project demonstrates that on a grand scale, the simultaneous realization of structural, functional, and aesthetic requirements is impossible without integrated construction management.

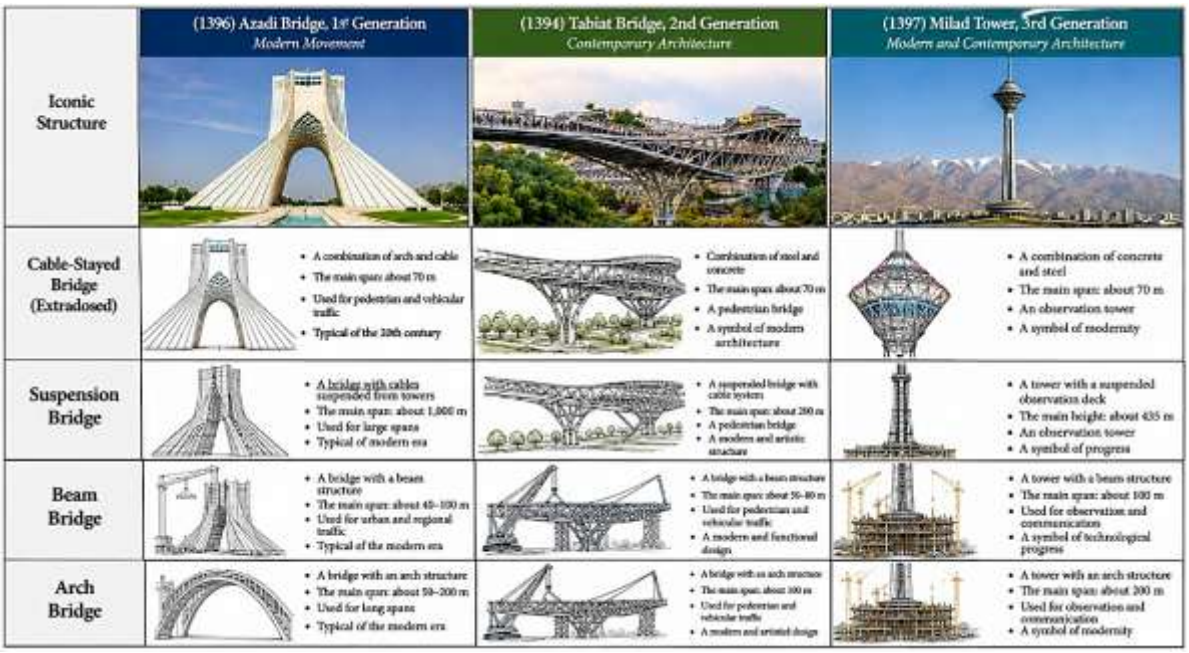


Fig. 1. Analysis of the case studies.

6 | Synthesis of Case Analysis

In-depth analysis of three prominent contemporary Iranian projects (Azadi Tower, Nature Bridge, and Milad Tower) reveals that successfully executing an architectural work at national and urban scales requires establishing a dynamic and synergistic dialogue among the three pillars of "artistic expression," "structural technology," and "construction management." Although formed across different historical periods and with varying approaches, each of these projects embodies tectonic concepts and integrated construction processes. The following table provides a comparison of these three cases based on the three-fold criteria of the research's theoretical framework.

Table 1. Comparative comparison of case studies based on the research theoretical framework.

Project	Scale	Type of Art–Structure Interaction
Azadi Tower	Landmark structure	Integration of Iranian geometry with modern concrete
Tabiat Bridge	Urban structure	Structure as a form of architectural expression
Milad Tower	High-rise structure	Structural Technology as an element of architectural identity

7 | Integrated Analysis and Results Derived from Cases

Analyzing these three works yields the following patterns regarding the interaction of art, structure, and construction management:

I. Transition from traditional to digital tectonics: in the Azadi Tower, form-structure coordination was shaped through classical mathematical calculations and precise on-site concrete formwork. Conversely, Nature Bridge represents a new era where "parametric and algorithmic design" served as a common language between the architect and structural engineer, enabling the construction of non-linear organic forms.

II. Structure as aesthetic expression (structural honesty): in all three examples, the structure is not concealed behind a skin. In Azadi Tower, the concrete shell is the facade itself; in Nature Bridge, steel trusses form the visual identity; and in Milad Tower, the exposed concrete shaft and the steel structure of the head define the final form. This observation corroborates Frampton's tectonic theory [9], which views structure as the primary agent of the "poetics of construction."

III. The vital role of management structure in form realization: all three projects demonstrate that without planned and coherent construction management, creative designs remain on paper. The geometric complexity of Azadi Tower, workshop fabrication of Nature Bridge components, and slipform concrete pouring of Milad Tower's shaft all required integrated management from design through execution (ranging from special material procurement to quality control and safety management) [11].

Ultimately, this analysis proves that in contemporary Iranian architecture, the success of large-scale projects hinges on an interdisciplinary perspective; one where structural engineers and construction managers stand alongside the architect from the earliest ideation phases so that technology and management facilitate and reinforce artistic expression.

Table 2. Integrated analysis and results derived from case studies.

Case Study	Artistic Expression (Aesthetics)	Structural Technology (Engineering)	Construction and Execution Management
Azadi Tower	Symbolic integration of traditional Iranian architectural geometry (Sassanian and Islamic influences) with modern morphology	Application of prestressed reinforced concrete, complex three-dimensional shell geometry, and an integrated stone façade	Traditional craftsmanship-based management, specialized stone-carving workshops, and close coordination between designers and construction teams on site
Tabiat Bridge	Organic and fluid form, creating dynamic, multi-level spaces that encourage social interaction through pedestrian-oriented architecture	Three-dimensional steel space-frame structure with hollow tubular sections, supported by advanced analyses of dynamic loads and wind forces	Digital and parametric modeling, off-site prefabrication of structural components, and phased installation using heavy-duty cranes
Milad Tower	Modern urban symbolism, characterized by symmetrical polygonal geometry at the tower head and the vertical elongation of the shaft	Slip-formed concrete core, heavy steel structure at the tower head (crown structure), and structural systems designed to resist seismic forces and strong winds	Large-scale project management, coordination among multiple domestic and international contractors, and management of construction risks associated with high-rise operations

8 | Conclusion

This study was conducted with the aim of redefining the relationship between artistic expression, structural technology, and construction management in contemporary Iranian architecture.

Findings from the analysis of case studies (Azadi Tower, Nature Bridge, and Milad Tower) indicate that the success of architectural projects at urban and national scales necessitates moving beyond a single-dimensional and traditional view of the design and construction process. In contemporary architecture, structure is no longer a hidden or purely load-bearing element; rather, it acts as the expressive language of the work and the primary medium for manifesting aesthetics (tectonics).

Conversely, realizing these complex forms is impossible without utilizing modern tools such as parametric design and BIM, alongside applying multi-layered, integrated construction management. This trinity (art, structure, and management) forms the core of successful contemporary architecture. Furthermore, the findings revealed that the success of contemporary Iranian architectural projects depends less on technological complexity and more on the quality of interaction among the architect, structural engineer, and project manager.

Recommendations for future research:

I. Formation of interdisciplinary working groups from phase zero: it is recommended that in public and large-scale projects, structural engineers and construction managers join the architectural team from the earliest conceptualization stages.

II. Interdisciplinary education in universities: revising the curricula of architecture and civil engineering programs to familiarize architects with modern construction technologies and engineers with architectural aesthetic concepts.

III. Development of an integrated digital platform: mandating the use of digital project management systems to bridge conflicts between artistic design and structural constraints in Iranian construction sites.

Authors' Contributions

All aspects of the research and manuscript preparation were carried out by the author. The author has read and approved the final version of the manuscript.

Funding

Not applicable.

Data Availability

All data supporting the reported findings in this research paper are provided within the manuscript.

Conflict of Interest

The author declares that they do not have any conflict of interest.

Consent for Publication

The author confirms consent for the publication of this work.

Ethics Approval and Consent to Participate

This article does not contain any studies with human participants performed by the author.

References

[1] Mirgozar, L. S. S., Norouz, B. V., Mansouri, B., & Zaimaran, M. (2019). Narrative of the other: Approaching "the other", studying Iranian contemporary architecture (from architects' point of view). *Bagh-e nazar*, *16*(77), 59–74. https://www.sid.ir/paper/381019/en

[2] Oxman, R. (2017). Thinking difference: Theories and models of parametric design thinking. *Design studies*, *52*, 4–39. https://doi.org/10.1016/j.destud.2017.06.001

[3] Sacks, R., Eastman, C., Lee, G., & Teicholz, P. (2018). *BIM handbook: A guide to building information modeling for owners, designers, engineers, contractors, and facility managers*. John Wiley & Sons. https://doi.org/10.1002/9781119287568

[4] Bani-Masoud, A. (2021). *Contemporary architecture in Iran: From 1925 to the present*. Independently Published. https://books.google.az/books/about/Contemporary_Architecture_in_Iran.html?id=bCGWzQEACAAJ&redir_esc=y

[5] Falamaki, M. M. (2012). *Formation of architecture in Iran and west experiences.* Faza Press. https://www.sciepub.com/reference/225951

[6] Hermann, C. (2004). Architecture in the Digital Age: Design and manufacturing. *Nexus network journal: Architecture & mathematics*, *6*(2), 131–134. https://doi.org/10.1007/s00004-004-0025-4

[7] Smith, R. E., Mossman, A., & Emmitt, S. (2011). Editorial: Lean and integrated project delivery special issue. *Lean construction journal*, 1–16. https://doi.org/10.60164/thpzpuygk

[8] Golabchi, M., & Zeinali, A. (2014). Archetypal architecture (fundamental sustainable patterns). *The international conference on human, architecture, civil engineering and city (Icohacc 2015)*, Tabriz, Iran. Civilica. (**In Persian**). https://civilica.com/doc/410049

[9] Sanabria, S. L. (1997). Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture by Kenneth Frampton. *Technology and culture*, *38*(4), 992–995. https://doi.org/10.1353/tech.1997.0029

[10] Chalipour, A., Noorzai, E., Golabchi, M., & Hosseini Nourzad, S. H. (2026). Uncovering key success factors for enhanced office-site communication through digital twins. *The TQM journal*, *38*(6), 1274–1308. https://doi.org/10.1108/TQM-04-2024-0146

[11] Rahnama, N., Noorzai, E., & Golabchi, M. (2023). Interaction and effects of dangerous and hidden points on firefighter's health during fire overhaul using the PLS-SEM technique. *Facilities*, *41*(3–4), 265–279. https://doi.org/10.1108/F-02-2022-0019