

APPLICATION OF MODERN STRUCTURAL SOLUTIONS FOR SMALL ARCHITECTURAL FORMS IN EDUCATIONAL DESIGN PROJECTS OF SECOND-YEAR STUDENTS

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The design of small architectural forms plays a crucial role in students' educational projects. It represents the first independent project in which students develop their own concepts, integrating aesthetics with functionality and practicality. Small architectural forms (SAFs) contribute significantly to shaping an aesthetic and functional urban environment. Bus stop pavilions, as one of the primary types of SAFs, enhance passenger comfort while waiting for transport and influence the overall appearance of urban spaces. Various design solutions for such pavilions can be tailored to specific district characteristics, climatic conditions, and the architectural style of the city. However, during the educational design process, students often struggle with conceptualizing a bus stop complex due to a lack of understanding of the structural role in its formation.

The objective of this study is to analyze the most common structural solutions for bus stop pavilions, identify their characteristics, advantages, disadvantages, and explore real-world applications. To facilitate implementation in student design projects, four primary structural solutions are proposed:

1. Prefabricated reinforced concrete structures, composed of monolithic or precast elements manufactured under factory conditions and assembled on-site. These structures feature a strip or slab footing for stability, load-bearing walls with reinforced concrete supports, and a flat or sloped roof for efficient rainwater drainage. The primary advantages of these structures include high strength, durability, and resistance to mechanical damage and vandalism. However, their substantial weight complicates transportation and installation, and they offer limited opportunities for design modifications.

2. Metal frame structures with polycarbonate coverings, which provide a sense of reliability and traditional design, often associated with a retro aesthetic. These pavilions consist of a metal frame made from steel or aluminum profiles with an anti-corrosion coating, a polycarbonate or metal roof with a polymer finish, and transparent or semi-transparent walls that enhance visibility. Key advantages include lightweight construction, rapid assembly, adaptability in design and dimensions, and relatively lower costs compared to reinforced concrete structures. However, they are less durable, as polycarbonate panels degrade over time, losing transparency and becoming more susceptible to damage. These modular structures allow for easy component replacement, increasing their functional lifespan.

3. Wooden pavilions, though less common, offer distinct advantages. They feature a wooden load-bearing framework and a roof covered with shingles or asphalt-based materials, often incorporating decorative elements such as carvings or artistic painting. The main benefits of wooden structures include aesthetic appeal, environmental sustainability, and the potential for unique, customized designs. However, they require regular maintenance, are less durable than metal and concrete counterparts, and are more vulnerable to weather conditions. These structures are typically installed in ecological or historical zones, where they function as self-sufficient decorative elements within the urban landscape.

4. Glass pavilions with metal frames, which are widely used in European cities due to their contemporary aesthetic. These structures consist of a lightweight metal framework, often aluminum or steel, combined with tempered glass or triple-glazed panels for the roof and walls, ensuring maximum visibility. Their primary advantages include modern design, excellent transparency, lightweight construction, and quick assembly. However, they are costly, susceptible to vandalism, and provide limited protection from wind and cold. These structures integrate seamlessly into the urban environment and are particularly suitable for historical and cultural settings, where their transparency allows them to blend into the surroundings, functioning as “invisible” architectural elements.

The structural solutions that define the visual and functional character of SAFs are directly linked to architectural styles (such as classicism, modernism, and high-tech) and contemporary design trends, including bionic architecture, minimalism, and eco-design. One of the central challenges in urban planning is the formation of a city’s architectural identity. The incorporation of distinctive structural and stylistic elements in SAFs can serve as a recognizable “signature” that highlights the cultural and historical context of a region. Furthermore, SAFs fulfill interactive and communicative functions, fostering engagement between residents and the urban environment. The integration of contemporary art objects, interactive elements, and digital installations within SAF systems presents new opportunities for enriching public spaces and enhancing the urban experience.

Thus, structural solutions for small architectural forms play a pivotal role in shaping form, style, and the aesthetics of the urban landscape, while simultaneously enhancing functionality and comfort. They bridge the gap between technical infrastructure and decorative elements, shaping the overall image of a city. When considering cultural context, environmental sustainability, and innovative design methodologies, SAFs emerge as a fundamental component of modern urban design. Future research should further explore the process of form generation through a structural-functional approach.