



The Importance of Designing Temporary Shelters in Times of Crisis With an Approach to Prefabricated Movable Structures

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Abstract

The speed of provision and establishment of housing for the survivors of accidents is an important issue in crisis management, the simplest solution for temporary housing is light and mobile structures that can be implemented and used in any place and situation. Temporary housing must be flexible. It should be sufficient against the special conditions of any environment, and it should have good transportability, installation and execution speed. The current research is a quantitative method with a descriptive-analytical nature and it tries to identify design solutions and Effective on safety and security. After examining the living conditions after the accidents, a prefabricated structure sample will be presented that is suitable for the accommodation conditions after the accidents in each region. The National Building Code was carried out and loaded in Etabs software based on topic 6 of the National Building Regulations and its earthquake load was calculated according to the standard 2800, fourth edition and in the area with a very high earthquake risk, and these results indicate that this structure It is ready to serve in any region under any conditions and can reduce the costs of temporary accommodation and short-term settlements through the use of these structures. This structure can be adapted to the architectural features and climatic conditions and the quality of life promotes.

Key words: Movable Structures, Prefabricated, Temporary Shelter, Critical Conditions

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Extended Abstract

Introduction

In designing temporary shelters, it is essential to view them as part of the overall reconstruction plan for the area, guiding them towards the ultimate goal of permanent housing. The best design for temporary housing is one that can be easily upgraded to permanent housing with minimal changes and in a short time frame. Tents pose various problems, such as lack of insulation against weather elements, wind, and rain, as well as space limitations. Therefore, the ideal design for temporary housing should not only provide insulation against weather conditions and be suitable for various climates but also be resilient against aftershocks and offer a viable solution to space shortages. The shortage of skilled labor and the failure to adhere to building standards due to high costs and the urgency of immediate housing needs in earthquake-prone countries like Iran have led to disastrous outcomes in the past, resulting in significant loss of life and material damage. Prefabrication is an innovative construction method aimed at minimizing on-site construction activities and transferring many possible tasks to the factory, ensuring the creation of a quality product, enhanced safety, reduced need for skilled labor on-site, and shortened delivery times.

Data and Methodology

The research method is descriptive-analytical, aiming to identify effective design strategies for safety and security through rational inferences based on regulations and empirical examination of solutions used in post-disaster housing design. Initially, it defines and compares the characteristics inherent in prefabricated structures and temporary accommodations, followed by identifying and categorizing effective design strategies. After examining living conditions post-disaster, a sample prefabricated structure will be presented that is suitable for post-disaster housing. The designed structure features non-restrained joint connections, with leak control conducted according to national building regulations. It has been modeled in the Etabs software based on the sixth chapter of the national building regulations, considering loads such as wind, snow, and uneven snow, with earthquake loads calculated according to the fourth edition of standard 2800 in a region with very high seismic risk. These results indicate that this structure is ready to serve in any region under any conditions.

Results and Discussion

Based on the studies conducted on post-disaster housing design, numerous issues have been identified in the design of such structures. Some of these issues include the large volume of containers, lack of economic feasibility, temporary nature, and the inability to be used for extended periods. However, by designing mobile and prefabricated structures, these can be quickly transported to the desired location, and with appropriate measures, they can be utilized for the medium-term accommodation of affected individuals. The proposed design is based on a foldable structural system. These lightweight, prefabricated spatial structures occupy minimal space when closed and can be easily stored, while when expanded, they cover a wide area and also bear loads. Therefore, they hold a significant advantage over conventional structures. These types of structures not only fulfill the functions of standard buildings but also possess the ability to change geometric shapes. In the open and foldable structures or pantographs, the building unit is referred to as a double plate, which consists of two uniplates connected by a joint. Each



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double plate is considered a foldable structure in itself, and the assembly and connection of these units are based on the defined geometry of the main foldable structure. In the pantograph structural mechanism, the basic element consists of double plates with flexible configurations. The variable configuration of the double plates is made possible through linear members at both ends of the joint, which connect to adjacent linear members via special mid-segment connections. This allows for rotational movement in the plane of the rods relative to each other, enabling the assembly to transform from a linear form in the collapsed state to a three-dimensional form when expanded.

Conclusion

Our country is constantly exposed to numerous natural hazards and risks. This underscores the necessity of designing structures with a high safety factor. Structures must be able to be constructed quickly, safely, and in accordance with the diverse climates of our country, allowing for rapid deployment and setup. These factors have made the use of new structural systems increasingly important. This research proposes a mobile and quickly transportable structural design based on the principles of post-disaster design. Prefabricated structures, due to their rapid construction capabilities, can be more economically and qualitatively suitable than current methods. The proposed structure is designed for quick transport and can be set up and dismantled in various locations. This structure also considers the qualitative aspects of people's lives, as many affected individuals spend months in tents and containers until permanent housing is constructed, leading to adverse psychological and physical effects. This structure can serve as a camp immediately after disasters and is a suitable alternative for short-term accommodation until reconstruction is completed. Based on analyses in the Etabs software and structural and form analysis, it demonstrates acceptable stability and architectural quality. In addition to ensuring safety, it can serve as a temporary housing solution for disaster-affected individuals in a timely manner, with two design samples mentioned for rapid and medium-term accommodation.

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