

Studies on Modular Emergency Buildings and Conservation

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Abstract As opposed to permanent housing, emergency housing is temporary and may be moved to different locations as needed since it is constructed of shipping containers that have been specially manufactured for this purpose. People ignore temporary housing due of its inefficiency and transient nature. Portable housing has various issues such as limited room or office space, poor comfort and inefficient use of resources. This study focuses on human population increase as construction scarcity of land, natural catastrophe response, demands for shows rooms production and building sustainability, and temporary housing comfort and security. Its modular design fits the needs of temporary housing (showrooms) while meeting the needs of industrial manufacturing. A last point strategic reserve and re-use improve product eco-friendliness.

Keywords: *emergency buildings, conservation, modular design, temporary housing*

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1. Introduction

The assembly building originated as a result of advancements in building construction. Since the 1970s, numerous nations and regions have selected diverse growth pathways and techniques based on a variety of natural and human events and qualities as some attributed of this to the building sector was not started until late 1980s [1]. In 1968, Japan pioneered the idea of prefabricated housing. The manufacturing system of medium and high-rise residential structures was introduced in 1990 hence Modular construction can dramatically improve efficiency in construction, through factory production of pre-engineered building units and their delivery to the site [2], with a component-based, industrialized production mode, high production efficiency, flexible internal structure of residential buildings, and adaptability to diverse resident demands. Emergency housing is distinct from permanent dwelling. Its features include limited occupied area, quick installation, and inexpensive cost. First, temporary or emergency housing may be utilized to relocate populations after natural catastrophes such as the erupted

Wuhan COVID 2019 disaster response and recovery [3]. Reestablishing housing is a critical factor for understanding recovery processes, whether one is addressing the phenomenon at the household or community level. [4], which is crucial in restoring social order, stabilizing emotions, and restoring trust in life. Second, in the case of shows rooms/offices relocations cooperated with ease and transferred to another place for a similar purposes in both rural and urban setup and how an electronically connected world will shape cities and urban relationships of the future [5]. Third, emergency structures may suit the demands of construction and operating personnel who are remote from the city. Fourth, Emergency Buildings has successfully improved the issue of refugee resettlement in disadvantaged nations. Sheltering provides safely and comforts however, owing to the temporary and wasteful nature of temporary housing, it is often overlooked. This study compares the benefits and drawbacks of tents, assembly plate homes, and container houses. The combination form, usage mode, and value of temporary housing are examined and validated through analysis and comparison. And this research examines design patterns that fulfill high living comfort criteria while increasing temporary housing's ecological sustainability as indicated in Figure 1.



Figure 1. Process of various production elements and sustainability

2. Analyses of the Merits and Demerits of Various Types of Temporary Housing

The firm has patented a modular construction method. Each room is prefabricated at the factory, brought to the site, and connected to the rest of the structure. Construction time is shortened, resources are conserved, and the building quality is superior to conventional building methods. As the top It can learn from building performance (mechanics, thermal insulation, sound insulation, fire) personalization, standardization, and socialization), and costnew technology (energy saving and environmental protection, renewable cycle, intelligent Reform hotel, school, hospital, rural, cultural, and tourist building construction systems. and innovate technology, manner, and service for users. "Structure" is crucial. Insufficient living circumstances will have long-term physical and psychological effects on both the end user and the environment. The absence of systematic sustainable design causes challenges like single space mode, chaotic operation, low comfort and low ecological efficiency and we lack a systematic procedure for identifying attributes of environmental problems [6]. Emergency service projects have significant construction demands and a short design and construction duration. The traditional civil building technique can't match the demand. Traditionally, civil building is done layer by layer from top to bottom in civil engineering and building

construction [7]. In the lack of identifiability and privacy, individuals become psychologically marginalized. It is conceivable that over time, residents may disagree likewise intervention citizens may be more neutral (less likely to disagree [8]. As a consequence, improving temporary housing comfort is critical to meeting diverse duties. Emergencies houses ranges from Tents, assembly plate homes, and container houses are temporary housing and the system industrialized building has thrived since the nineteenth century in Europe and America ,then subsequently spreads across the other parts of the world [9] . In other regions of the globe, prefabricated buildings, often known as "modular structures," are employed in emergency therapy schemes. Clemson University in the United States, for example, is studying if it is possible to link containers in series to create fast response therapy facilities via its "architecture + health" project. The advancement of this technology has been described as "the future of fast deployment of health care." [10]. The containers modular offers modest storage capacity, easy placement, quick assembly, cheap cost, and reuse. Disadvantages include lack of weather resistance, single purpose facility, inadequate living and sanitary conditions, and inability to use for extended periods. The spread of resistant bacteria is facilitated by poor hygiene [11]. Installation is quick and the function space is enough. Its construction requires a competent construction crew and expensive material costs. Not enough reuse value after recycling. A lot of money is required to sustain it. In

recent years, container homes have emerged as a rapid solution to the housing issue. Container homes have high structural integrity and are resistant to earthquakes and deformation. It also has high sealing performance and is easy to disassemble and reassemble. A patio with superior drainage may also be used. Construction of containers follows a standardized worldwide standard of [12], however Designed to hold massive weights, stack in high columns, and withstand harsh circumstances - weather, salt corrosion, etc. Adding new containers, which can be stacked up to 12m high when empty, is straightforward. Transportation Transshipment of prefabricated modules is simple, globally accessible used shipping containers, however the Construction is straightforward and requires minimal work force labors. Shipping containers are a tenth of the cost of typical wood steel and concrete structures. Ideal for multi-story homes or offices, delivering a huge useable area in a compact footprint Why A container home may be erected 40% quicker than a comparable conventional home. Unlimited potential for difficult sites Prefabricated with interconnecting segments, hence they are designed and made differently. It's self-contained and based on a room. Other systems' dimensional differences will not hamper construction completion or general use [13]. However youji technology modular building system driven as below through the realization of modular building reflecting to the processing steps, such as sound insulation performance modules, such handling of concrete slabs that are difficult to stop the horizontal propagation of noise, applying partition-structure The isolation layer can effectively prevent the horizontal propagation, through the isolation layer can effectively prevent the horizontal propagation of noise whereas the building system is certified as STC 55B(floor)sound proof by Viapac. The structural system is certified by TUVSUD BS476: part 21: 1987 to meet the 90Minute partition fire rating required for Singapore housing as a set example.

3. Modularity and Emergency Structurers

Pre-assembled buildings and container structures provides superior hygienic conditions and seclusion. At the same time, the living pattern eliminates unsanitary issues in the surroundings that may have transmitted illness if not properly addressed as seen in Figure 1. Modularization and sustainable emergency housing realize industrial manufacturing, folding and disassembly. It also considers the environment, human psychology, and other factors to produce a productive living area. First, modularizing temporary housing functional area increases construction speed and enables site assembly .however The advanced world experience in the construction of modular buildings is analyzed The advanced world experience in the construction of modular buildings is analyzed [14]. Second, the emergency/temporary building's functional area is comprehensive to fulfill people's basic comfort and privacy demands, and modular manufacturing may be done according to the house's purpose. Third, temporary housing is reusable, improves production and

storage efficiency, and reduces costs via recycling. Fourth, temporary housing is easily installed. Modular temporary housing is compact for storage yet expands to suit everyday needs. However, it has the following features: Pre-assembled houses and container dwellings are more sanitary and private. [15] Moreover, as seen in Figure 1, the housing layout removes unhygienic conditions that may have caused sickness. Industrial manufacture, folding, and disassembly are achieved via modularization. It also analyzes the environment, human psychology, and other elements. First, modularizing temporary housing speeds up construction and facilitates site assembly. It also has a large functional space to meet people's fundamental needs for comfort and privacy, and modular manufacturing may be done according to the house's purpose. The construction is strong, safe, and durable due to the welding connection. Most enclosures are made of cultured steel plate. Third, temporary housing is recyclable, improving manufacturing and storage efficiency, Temporary housing plays an important role in providing secure, hygienic, private, and comfortable shelter [16]. Fourth, temporary housing is simple. Modular temporary housing is easy to store and extend. But it has these features: The container is built with a steel skeleton and a color steel composite board wall. The mainframe beams and columns are built using cold-formed steel welding. The six sides of the wall are welded using cold-formed steel at varied intervals to ensure the wall's strength, top and bottom plates, and strength [17], Prefabricated tension-only concentrically braced beam-through frames (BTFs) have received popularity for low-rise steel buildings in low to [18] moderate seismic regions.

4. Design and Discussion

4.1. Comprehensive Space Module

A permanent living space module and a folding enclosing plate are included in the design. Display Hs, lounge and toilets are divided by folding and sealed plates in the folding factory prefabricated house module. The display hall is located at one end of a factory-built foldable module. The kitchenette is located across the room. The kitchen used to take advantage of the permanent construction of the main body. The toilet is permanently installed in the folding factory prefabricated home module. The permanent structure is divided into two portions, with the upper levels separated by clapboard. Lower the layer space fits the requirements of the toilet and other sanitary items. The top level comprises the kitchenware unit, which is accessible through the shaft components. It is also linked to the top and lower floors to accommodate toilet usage eve in the proposed floors and elements (Figure 2). Coupled with proposed Interior modular prefabricated movable, sanitary ware, overall cabinet, and other essentials underneath the lavatory module floor is a built-in high-strength plastic toilet box, which is utilized until the urban water supply and sewage infrastructure is completed. Following completion of the repair, the toilet drain pipe may be immediately linked to the municipal sewage system. The structural design of emergency constructions must assure safety while also being built quickly [19].



Figure 2. Show various elements of the structure

4.2. Diverse Forms of Combination

Modular manufacturing may minimize production and [20] storage costs while increasing efficiency. Customized factory-assembled cranes for outdoor use. Small pipes are kept for wards. Using boxes to create large horizontal and vertical usage areas. The fixed living space module is a structural component of the modularization housing unit, stabilizing the overall unit and supporting the roof enclosure. Because of the standard manufacturing method, the modularized temporary show rooms unit is accomplished and the procedure of installation and disassembly is simplified to the best. The guard board in a standard dimension and folds into fixed space modules. After unfolding the smallest folding module unit, a basic set.

4.3. Simple and Fast Assembly and Disassembly Mode

Aside from providing a guarantee of flawless operation, this modularization housing will also provide for easy and speedy installation, and will even be able to eliminate the need for expert employees, as it can be assembled and disassembled with just a few basic tools. When the factory prefabricated house module is in the folded form, it should be expanded to accommodate the demands of the project. To begin, turn the cooker around the shaft 180 degrees by passing it through the square hole that has been saved and connected to the center rear panel. The sealing plate is then moved around the shaft, resulting in the formation of closed bathrooms and kitchens. There is a reserved interface beneath the bottom board, and the toilet is supplied with an upper water and sewage pipe that is incorporated into the toilet. If the necessary conditions are met, it is possible to connect it directly to the metropolitan pipe network. If not, it should be pre-deposited light plastic water storage containers in order to be used simply and temporarily.

Tank in the toilet, as well as the sewage tank. As a result of the side wall panels being folded into a shaft that can be opened vertically and horizontally, the square disand kitchen were created. The open side walls are fastened together with bolts and pins, and the space between them is sealed with a u-shaped or l-shaped interface and embedding tape to keep out the elements. There is a foldable seat allocated for the exterior side of the floor [21], and the internal ground maintenance level may be altered depending on the circumstances on the site. Prefabricated plexiglass windows may be installed immediately on the building's ends to create bright walls, which can be seen from the outside. A bedplate that can be folded around a shaft may be placed on the outside side of the bedroom, which can be used to construct furniture after it has been stretched to its full size. As a result, the complete modularization housing complex will be converted to a standard residential setting. Following the installation of modularization housing, we must first remove both ends of the box wall panels and then fold the retaining boards around the shaft in the order in which it was enlarged. Return to the manufacturer prefabricated home module measuring **21.9** meters long, **14.6** meters wide, and **4.8** meters high (length, breadth, and height) After joining the cupoles of ship containers. Finally, we may utilize the box cover board that was

previously removed to close the two ends of the box. This board can then be sterilized and stored, accomplishing the effect of recycling and reusing. The structural design of emergency constructions must assure safety while also being built quickly [19]. We can also reflect to graph of critical path that tidely applied reflects Figure 3, as well as Figure 4 shown finished products.

4.4. Easy to Recycle, Reserve and Reuse

Aside from ensuring faultless functioning, this modularization housing will also allow for simple and quick installation, and will even be capable of eliminating the requirement for qualified workers. needed for a stable skilled workforce at the manufacturing facility [22], as it can be assembled and disassembled with just a few basic tools. We should increase the size of the factory-built housing module in the folded state, specify when it is required to be used To begin, turn the cooker around the shaft 180 degrees clockwise. via the square hole that has been designated and attached to the center rear [23] panel Then, A rotating sealing plate is used to create closed bathrooms by rotating the plate around the shaft. kitchens. The toilet is fitted with an upper water and sewage pipe that is built into the toilet. Moreover, the reserved interface is located underneath the bottom board. If the condition is accessible, it should be used. It has the capability of being directly linked to the municipal pipe network [24]. If this is not the case, in order to utilize It is recommended that light plastic water storage be predeposited for convenience and temporary use. [25] The modular unit may be flexibly changed and combined to meet user needs. The box may be used alone or with the wall panel. Various horizontal and vertical orientation combinations give huge usage space. It may be stacked up to three layers thick, that leads have the potential to dramatically enhance chip performance, functionality,

4.5. Recycling, Conserving and Reusing

The three R's – reduce, reuse and recycle – these are the keys for the sustainable design every developer opting for as the sources of helps and assistance in a sustainable construction industry to achieved a fruitful lasting development. all helps in waste reduction [26]. They conserve natural resources, landfill space and energy. Plus, the three R's save land and money communities must use to dispose of waste in landfills [27]. The Sustainable Development Goals (SDGs) and the Paris Agreement on Climate Change call for substantial transitions in every nation that will need complementing initiatives. [28]. And the distinctions between the three Recycling is the process of reusing an item's basic ingredients to create a new product. This is a time-consuming process. Reusing means using an item as is To improve retrieval capability [29], As a result, it is more environmentally friendly. Recycled products include glass fibreglass and insulation produced from newspaper or plastic bottles. Used things include furniture and clothes. While easy to assemble, it is also easy to disassemble [30]. It is simple to construct and dismantle. After replacing or repairing many damaged or missing components, the unit housing may be used to modules and to be replaced or repaired at different times [31]. The

storage capacity of such a housing ranges from smaller containers to the larger ones . Reusable can effectively reduce construction costs, avoid waste and modularization

housing demolition, thus accelerate the reconstruction speed can encourage systemic change that will accelerate adoption [32].

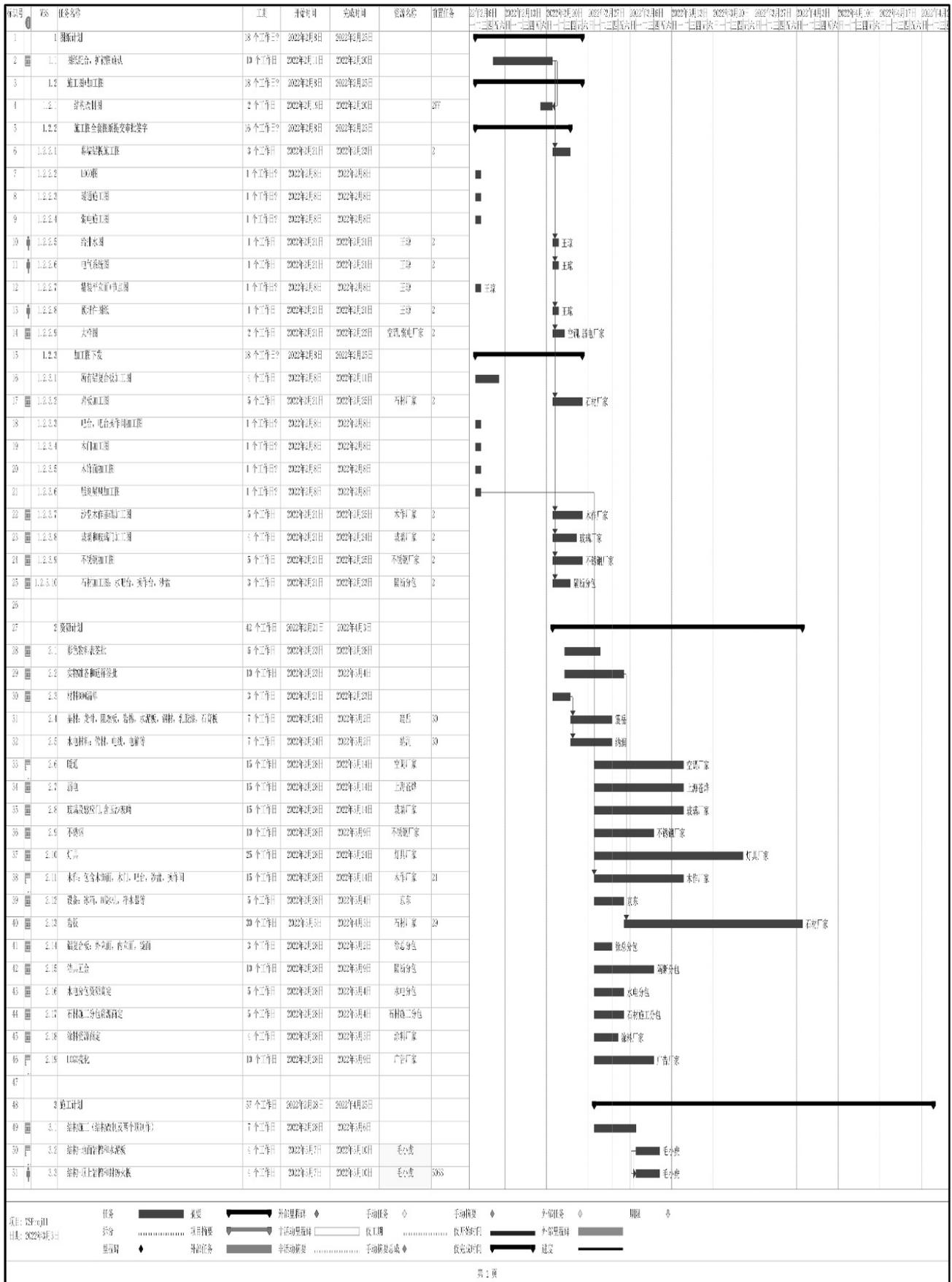


Figure 3. Show work flows critical path followed in construction and fabrication

<p>An artist's impression of the 10m –storey extension, was due to be complete by June of that year.</p>	
<p>Extension wing of Crowne Plaza Changi Airport Hotel Number of rooms 243</p>	
<p>Size of each room 28 Sqm. Productivity Gains, 40 % Fewer workers needed on site .</p>	<p>3-4 days To construct one storey, compared with 14-21 days for other conventional methods and Overall productivity boost of about 45 %</p>
<p>Other technical data</p>	
<p>Location</p>	<p>Changi, Singapore</p>
<p>Units</p>	<p>243</p>
<p>Storey</p>	<p>10 stories</p>
<p>Installation</p>	<p>26 days</p>
<p>Completed</p>	<p>2016</p>
<p>Developer</p>	<p>QUE</p>
<p>Architects</p>	<p>WOHA Architects</p>
	
	

Figure 4. Showing the finished Crowne plaza

5. Conclusion

The presented contribution investigated important engineering topics related to the determination of The company has lots of achievements in construction the modular edifices across the nation and abroad of which summarized Data of Changi Airport Crowne Plaza Extension, Singapore as it most paramount landmark building jazes it both local and international buddies where as the hotel and it entire rooms are built and fixtures added overseas, then shipped here to be assembled for the Crowne plaza Changi Airport hotel extension. This fabricated pre-finished volumetric construction method allows for a strict quality control in the factory conditions, and saves times and manpower onsite the below can be the attributed to it success firstly The steel structures of the rooms are manufactured in a fabrication plants in Shanghai.

In another factory there, the rooms are fitted out and finished, complete with carpet, lights shelving and even bathtubs, secondly The complete rooms were shipped to Singapore.thirdly The rooms are stacked together and installed on site.fourthly Minister of national development Lawrence Wong is shown one of pre-finished rooms that has been installed. The fittings, from carpet to lights were already present when the rooms arrived Singapore,sprout out clearly significant of The concept suggests modular prefabricated housing that may be swiftly erected and removed. Single space mode, unhectic function, optimizing the comfort, ecological efficiency, etc. have been successfully improved. This allows for more efficient deformation, loading and unloading as well as partitioning of the temporary housing. The features of Periodic usage will reflect efficiency, and finally sustainable temporary house building will be established.

Conflicting Interests

The authors disclose no conflicts of interest with relation to this paper's publication., however All authors contributed to the (a) idea and design, (b) writing or editing the article for essential intellectual content, and (c) approval of the final version.

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