TEMPORARY RESIDENTIAL DESIGN ANALYSIS TYPE OF HEX HOUSE FOR DISASTER SURVIVAL IN INDONESIA

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Abstract

Temporary shelter (huntara) is an effort to fulfill basic human needs for survivors after a disaster. Shelters aim to provide protection with dignity, a sense of security and comfort, fulfillment of social needs, and easy access to finding a livelihood. The research object refers to the Hex House Type shelter design. This study aims to determine the feasibility standard indicators that are met by the design. Design feasibility indicators are measured through the "six key eligibility criteria" approach based on the concept formulation of Jo Da Silva and C.Crook. The research method uses a qualitative approach with descriptive analysis. Data sourced from document review. The results obtained, the Hex House design in general meets the indicators to be implemented in Indonesia.

Keywords: ***Shelter design, feasibility indicators, Hex House, Indonesia***

1. INTRODUCTION

Indonesia is included in the Asia Pacific region which often experiences natural disasters. The National Disaster Management Agency (BNPB) recorded 5,402 disaster events in 2021 (BNPB, 2022). The Government of the Republic of Indonesia is responsible and has authority in implementing disaster management through the rehabilitation and reconstruction process (UU Number 24 of 2007). One of the basic needs of disaster survivors that must be met is a place to live or shelter. The intended occupancy is in the form of temporary residence and/or permanent residence.

The temporary shelter design applied to survivors so far is considered to be less comfortable and safe. In general, shelters are given a rectangular shape with the layout adjusted to the available land. Shelters are built and divided into sections with the same area. The kitchen and toilet washing rooms (MCK) are built separately from the main building. A design like this raises several problems found in evacuation, including; insecurity, lack of privacy, sexual harassment, acts of violence, health problems, psychological burdens to the form of housing and materials as its constituents (Santoso, et al, 2016, Widayatun & Fatoni, 2013, Rusmiyati & Hikmawati, 2012).

Based on the initial review, the Hex House type shelter design concept is considered to be able to reduce some of the problems above. This is because the intended shelter concept has adequate space, bedrooms, kitchens, bathrooms, living rooms and terraces in one building. A more in-depth study is needed to see opportunities for its utilization in Indonesia.

2. LITERATURE REVIEW

The Big Indonesian Dictionary (KBBI) Online (2022), defines survivors, the origin of the word sintas, as people who are able to survive. The Cambridge online dictionary (2022) defines "a person who continues to live, despite nearly dying". The word survivor or survivors, the designation for the subject, is equivalent to the word survivor, rightly pinned on people who are able to rise and survive.

2.1. Design

Design embodies the value of beauty in the form of composition, arrangement design, something special in artistic design (Encyclopedia of The Art, in Sachari & Sunarya, 2000). Rosemann (2000) explains that design is described as explorative and innovative, transcending both methodological and theoretical knowledge structures where it explores multiple truths so that it is "non-cumulative". Based on this definition, design is understood as the design of objects of artistic value resulting from unlimited exploration and innovation.

2.2. Eligibility Indicators

Temporary shelters (huntara) are part of the emergency response program in the post-disaster recovery process. Shelters or shelters can be inhabited by survivors because they are designed according to the customs and traditions of the local community. A shelter is said to be livable if it fulfills several indicators of the requirements for the establishment of a livable building. The intended indicators aim to make the structuring of the building object from the planning, the process of forming, to the erection of the residence acceptable in accordance with the applicable regulations. Da Silva (2007) in his research with Crook, stated that the feasibility of a dwelling is determined by 12 mutually supportive quality standards. These standards can be seen in table 1.

Quality Livable	Hunt Component											
	Shape (area, height)	Foundation	Order	Roof	Wall	Gable Roof	Window	Door	Partition / Bulk	Additional Buildings (extensions)	Site Plan (layout / Location)	Floor
Structure	√	√	√								√	
Weather Resistance	√											√
temperature	√											
Ventilation	√											
Lighting	√										√	
Privacy	√											
Vector Control												
Safety (fire & poisoning)											√	
Security												
Cook	√									√		√
Water & Sanitation											√	
Room	√										√	

Table 1. Shelter Feasibility Indicators and Shelter Components

In the table above, Da Silva assesses that each indicator and component is interrelated in the formulation of a residential plan, so that its quality is guaranteed to be occupied. Ensuring the implementation of adequate quality will fulfill the achievement of the objectives of the key criteria

for realizing a decent dwelling. The criteria referred to are protection of environmental conditions, comfort, dignity, household activities, health and safety (Da Silva, 2010). An overall summary of the key criteria and their supporting components can be seen in Figure 1.

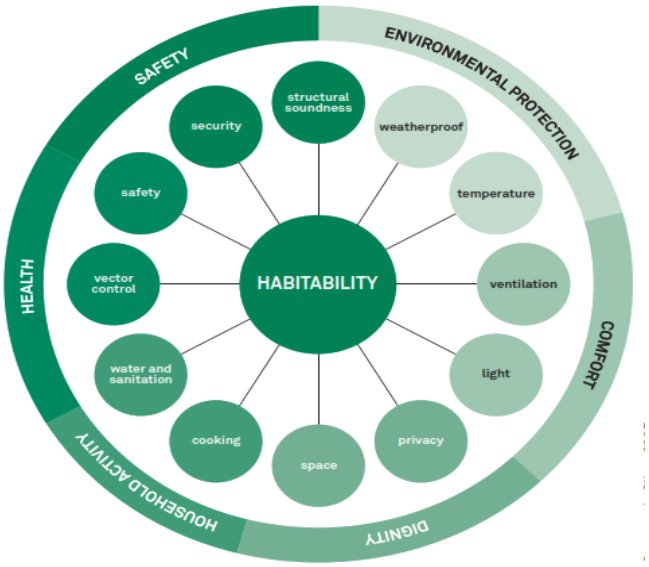
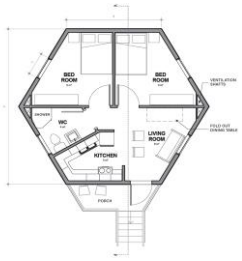


Image 1. Key Criteria and Shelter Components

2.3. Hex House

Architects for Society, a non-profit organization, based in Minnesota, United States of America, has carried out a series of designs and found a standard model for post-disaster housing for a family and even a large-scale community. The residential prototype offered is hexagonal in shape with an average size of 40 m2/unit. Shelters that can be flat packed using the disassembly method, low production costs, and offer efficient use with various combinations to suit your needs and conditions. Structural materials are constructed using Structural Insulated Panels (SIPs) which can be used for up to 20 years. Production per unit is estimated to cost $15,000 to $20,000 (Mc Knight, 2016).

"The Hex House" can be used as a temporary or permanent residence. That's because, the building structure is a pre-fabricated product that can be applied efficiently, can be packaged flat and easily assembled at the intended location.The ability of a structure that can be modified and expanded as needed makes this design concept worth considering (Architects for Society, 2022). The intended design can be seen in Figure 1.



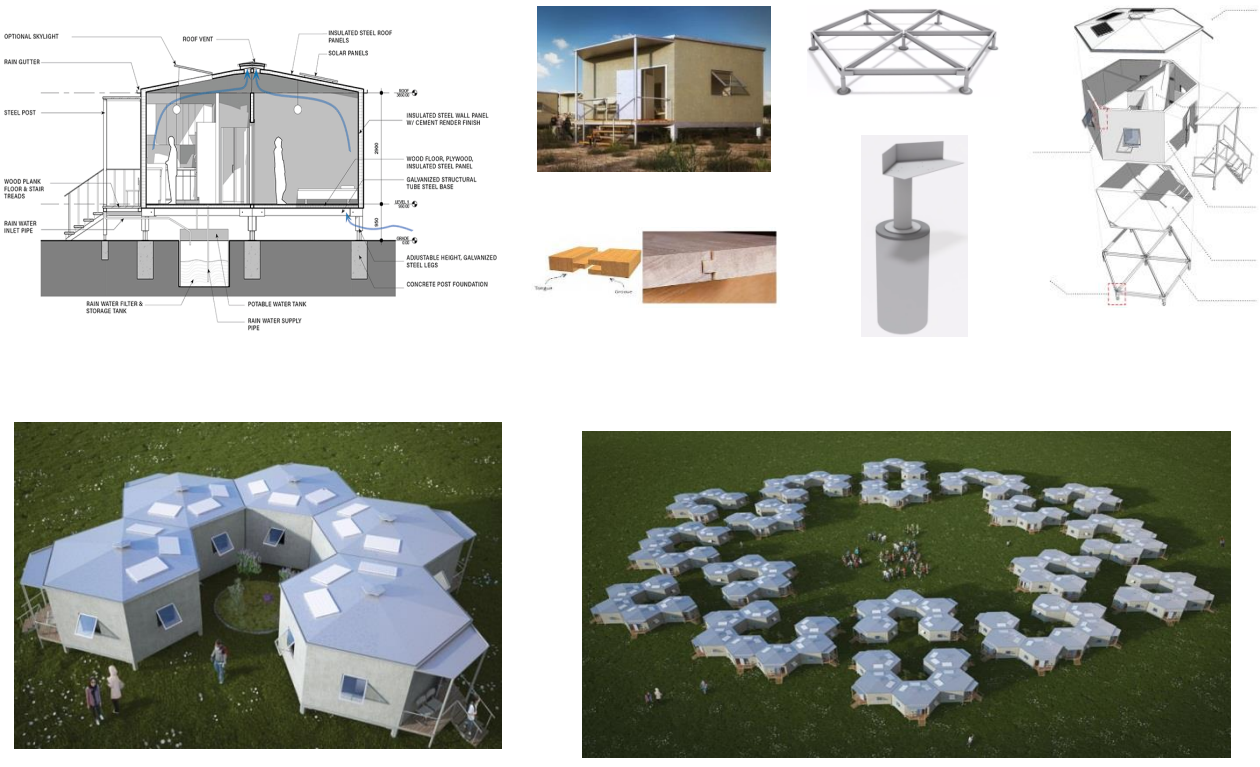


Figure 1. Hex House Design and Components

2.4. Climate and Characteristics of Indonesian Society

Indonesia is an archipelagic country that has a changing climate due to its position on the equator. This equatorial country is included in the tropical climate category which causes almost all of its areas to have high temperatures and rainfall at several points of location, so that Indonesia has two seasons, namely dry and rainy (Aldrian, 2014). Previously, De Wall conducted intensive research on several cities in Indonesia, thus finding cities based on a daily average temperature of 28ºC (De Wall, 1993, in Karyono, 2001). Occupancy that is applied in the territory of Indonesia, of course, takes into account the elements of the local climate and culture.

Indonesian society is known as a multicultural society which understands that differences in ethnicity, religion and culture do not make it divided, but remain in one sense of nationality. KBBI interprets multiculturalism as a sign of a community or personality in carrying out its habits of more than one culture. In essence, multiculturalism exists in individuals who interact with each other with their unique culture. This uniqueness eventually merges into a single unit that is owned by a community with uniform patterns of habits that are carried out based on the norms and laws that apply in their midst (Mahfud, 2011, in Mahardhani & Cahyono, 2017)

3. RESEARCH METHOD

The research method uses a qualitative-descriptive approach to examine the design of the Hex House which can be used as shelters. The design will be analyzed using standard indicators of occupancy feasibility based on Da Silva and Crook's formula. Data collection was carried out in the form of literature review and observations via the internet.

4. RESULTS AND DISCUSSION

The visuals and material components of the Hex House were identified and considered based on their document review analysis. The said consideration has a classification; no, enough, and good. Identification of feasibility considerations can be seen in the following indicator tables:

Table 2. Protection / Environmentally Friendly

Livable Quality	Hunt Component	Classification
Structure	Form	Well
	Foundation	Well
	Order	Well
	Roof	Well
	Wall	Well
	Site Plan	Well
Weather Resistance	Form	Well
	Roof	Well
	Wall	Well
	Gable Roof	Not
	Floor	Well
temperature	Form	Well
	Roof	Well
	Wall	Well
	Gable Roof	Not
	Window	Well

In Table 2, technically, in general, classification considerations show "good" because the proper components are fulfilled. Just because the roof does not have a gable concept, for the key criteria of protection or environmental friendliness, this is not fulfilled.

Table 3. Convenience

Livable Quality	Hunt Component	Classification
Ventilation	Form	Well
	Gable Roof	Not
	Window	Well
	Door	Not enough
Lighting	Form	Well
	Window	Well
	Door	Not enough
	Site Plan	Well

In Table 3, the ventilation in the design is considered as a window. This design originates from the regional culture with the four seasons, from which the design company originates. However, this ventilation can be categorized as not fixed, because it is used open and closed. Same with the use of doors that can be used as ventilation. There is only one door in this building, so that the openings for air exchange and light are classified as lacking.

Table 4. Dignity

Livable Quality	Hunt Component	Classification
Privacy	Form	Well
	Window	Well
	Door	Well
	Partition / Bulk	Well
Room	Form	Well
	Site Plan	Well

In Table 4, it can be seen that the classification has good consideration for all components. The criteria for dignity require guarantees of privacy with a closed room according to their needs, so that all activities of the occupants are not easily seen and heard from outside.

Table 5. Household Activities

Livable Quality	Hunt Component	Classification
Cook	Form	Well
	Gable Roof	Not
	Window	Well
	Space Expansion	Not enough
	Floor	Well
Water and Sanitation	Roof	Well
	Site Plan	Well

Table 5 shows the existence of different classifications. Cooking activities require comfortable air circulation, usually this is obtained from one of the saddle-shaped roofs. The space that is formed is smaller than the other spaces. So that there is little possibility of expanding the room.

Table 6. Health

Livable Quality	Hunt Component	Classification
Water and Sanitation	Roof	Well
	Site Plan	Well
Vector Control	Wall	Well
	Gable Roof	Not
	Window	Well
	Door	Well
	Floor	Well
Safety (Fire & Poisoning)	Order	Well
	Roof	Well
	Wall	Well
	Gable Roof	Not
	Site Plan	Well

From a health standpoint, as shown in Table 6, almost all of the components are under good consideration. Materially, the builders and the sanitation system support hygiene behavior in the dwelling.

Table 7. Safety

Livable Quality	Hunt Component	Classification
Safety (Fire & Poisoning)	Order	Well
	Roof	Well
	Wall	Well
	Gable Roof	Not
	Site Plan	Not enough
Security	Wall	Well
	Window	Well
	Door	Well
Structure	Form	Well
	Foundation	Well
	Order	Well
	Roof	Well
	Wall	Well
	Site Plan	Well

In terms of safety criteria, as shown in Table 7, the overall consideration is classified as good. Walls and roof are joined and locked together using Tongue & Groove (T&G) joints which form a sturdy structural “shell”. The wall material uses a Structural Insulated Panel (SIP) system or better known as a sandwich panel, which is coated with cement and painted. This connection is tightened and tightened using a mechanical system. Doors and windows of a certain size are placed on a wall measuring 3 mx 4 m. In the structure of the building, the walls are attached to steel trusses arranged in a hexagonal shape, with six supports around them and one support in the middle. Supports as "legs" that are installed on a concrete foundation, can be arranged its height adjusts to the needs of residents and functions as a flood anticipation. Apart from the gable roof, the site plan is a "less" consideration. This is because the design of adjacent buildings allows for fires to occur. However, because the wall building materials use SIPs, which can dampen or slow down the flames, the possibility of fire can be anticipated.

5. CONCLUSIONS AND SUGGESTIONS

5.1. CONCLUSION

a. In general, the Hex House building almost meets the key eligibility criteria for temporary shelter, with analysis based on document review.
b. With a modular concept, the Hex House type dwelling has an area of 39.4 m²/unit close to 40 m²/unit, with residents' activities being carried out in a dignified manner, reducing the chances of endemic diseases emerging, safe and comfortable, and reducing opportunities for threats to safety. Because in addition to supporting materials that can reduce the possibility of fire and poisoning threats, building foundations can be moved up and down to anticipate flooding.
c. The Hex House type shelter concept can be built in tropical climates, with changes to the roof frame and the addition of vents as part of the embodiment of ventilation in the building.

5.2. Suggestions

Based on the conclusions, the design of the Hex House type shelter can be used as a consideration for policy makers in handling shelter assistance for disaster survivors in Indonesia. It is necessary to adjust the construction materials used in the said building and the construction concept, in order to reduce production costs. In addition, more in-depth research is needed on the Hex House design concept so that later it can be applied in disaster management in Indonesia.

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