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DEVELOPING A DESIGN FRAMEWORK FOR DISASTER RESILIENCE FLOOD EVACUATION CENTRE IN MALAYSIA

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Abstract

The flooding phenomenon in Malaysia is generally given an advanced warning time for the residents and the disaster officials to mitigate and prepare methods of evacuation. Victims will be navigated to designated public buildings for protection and safety. Schools and community halls which are often chosen as emergency shelters are actually spaces and structures which are designed for other purposes. Recent researchers revealed problems of ineffectiveness in the spaces of these evacuation centres. Key issues that are causing spatial conflicts include uninhabitable facilities, inadequate space planning, environmental health risks, insufficient basic services and poor relief execution. The research methodologies used are qualitative in nature. Firstly, qualitative data are extracted from document analyses of official documents, shelter guidelines and frameworks, following with a case study of flood evacuation centres which informed the physical conditions and spatial quality of the centres. The observation method is used to examine the design standards, functional spaces and alternative solutions that are contributing to the resilience of the centre. Finally, semi-structured interviews are carried out among disaster experts in Malaysia which will determine the resilience factors of the designs and spaces of the centre. This method also identifies detailed measures of resilience by analysing critical design considerations of the selected buildings in order to develop the final design framework.

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Keywords: Design framework, disaster resilience, emergency shelter, evacuation centre, flooding, spatial quality.



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1. Introduction

Malaysia has been hit by one of the worst flood events in the history of natural disaster in Peninsular Malaysia at the end of year 2014, namely in the states of Kelantan, Terengganu, Pahang and Johor. As reported by the National Disaster Management Agency or NADMA, 2015, the most challenging and significant flood among the affected states was the flood event in Kelantan, December 2014, which was considered to be a ‘tsunami-like disaster’ (Su-Lyn, 2015) in which 202,000 flood victims were displaced and evacuated in several evacuation centres across its 10 districts (PAM, 2015).

Following to the disaster occurrence, our former Prime Minister, Datuk Seri Mohd Najib Razak had made a press statement in January 2015, ‘The flood had caused infrastructure damage estimated at RM 2.9 billion. To address the flood problems, the government has allocated over RM 8.9 billion for the east coast’s flood recovery efforts as part of 2015 budget revision that included rehabilitation activities and welfare programs for the victims, repairs and reconstruction of basic infrastructure’ (Akasah & Doraisamy, 2015). As a result, floods have brought various challenges physically, environmentally and economically, not only to the society, but also to the government and our built environment.

Public spaces that are selected to serve as evacuation centres play an important role in the disaster phases of preparedness and response (Bashawri, Garrity, & Moodley, 2014). Public schools and community halls which act as temporary accommodations are naturally existing structures that were designed for its own functions, however being forced to become shelters during the emergency phase of disaster. The Malaysian National Directive No. 20 (MNSC 20, 2012) clearly states that the government seeks to provide flood victims with a safe and healthy living environment in the evacuation centres. At the moment, a majority of the evacuation centres comply to the needs of the victims, but there is also a high number of centres which need space modifications and structural improvements to withstand future disasters (Yazid, Hussin, Wan Daud, Abdullah, & Salleh, 2014; PAM, 2015).

2. Problem Statement

In Malaysia, hundreds and thousands of evacuees may gather for shelter and safety. The affected victims that are evacuated into these centres come from different backgrounds, religions and cultures (UNHCR & IOM, 2010). They are either scared, confused or stressed and are probably experiencing loss. The total number of evacuees and the total area of areas occupied by the evacuees often clash, causing problems of crowdedness (Said, Gapor, Samian, & Abd Malik, 2013) and lack of quality in the occupied spaces (Padlee & Nik Razali, 2015). In this research, problems identified are mainly due to the ineffectiveness of the flood evacuation centres revealing problematic spatial conditions such as follow; building uninhabitability (Quarantelli, 1980; FEMA, 2012; HM Government, 2014), lack of basic services & facilities (Said et al., 2013), insufficient space management (PAM, 2015), environmental health risks contribution (NSW Government, 2011) and poor relief operation in the evacuation centre (Kumar, 2014; Yazid et al., 2014).

3. Research Questions

The research questions of this research are:

- What are the minimum shelter design standards in a flood evacuation centre?
- What are the current space allocations and designs in a flood evacuation centre? To what extent have the centres in Malaysia comply to the shelter standards?
- How can these standards and spaces be formed to create resilient factors in a flood evacuation centre?

4. Purpose of the Study

One of the priorities highlighted in the recent disaster framework, Sendai Framework for Disaster Risk Reduction or SFDRR (UNISDR, 2015) is to enhance disaster preparedness for effective response and to build back better for recovery, rehabilitation and reconstruction. This research proposes to utilise the disaster resilience framework which has been established by Michel Bruneau for the development of community disaster resilience in 2004 (Bruneau, 2004), which is the ability to absorb disasters and to recover from the effects of a flood event, as clearly defined in the framework (Renschler et al., 2010), towards the problems identified in the current flood evacuation centres. Furthermore, this research is also a move to revise the current evacuation centre planning which is briefly written in the Malaysian National Security Council Directive No. 20 report (National Security Council, 2012) and also to provide actions of improvement to the current state of evacuation centres.

5. Research Methods

The table 01 below summarises the research questions, objectives, methodologies and methods of analysis.

Table 01. Research summary

| Research questions | Research objectives | Research methodologies | Methods of analysis |
|---|---|----------------------------|--|
| What are the minimum shelter design standards in a flood evacuation centre? | To determine the shelter design standards in current flood evacuation centre | Document analysis | Content analysis and validation survey with disaster experts |
| What are the current space allocations and designs in a flood evacuation centre? To what extent have the centres in Malaysia comply to the shelter standards? | To determine the designs and spaces provided (and its compliance to shelter standards) in current flood evacuation centre | Case study | Crosschecking with building checklist and thematic analysis site observation |
| How can these standards and spaces be formed to create resilient factors in a flood evacuation centre? | To define the resilience factors of the centre and to give measures of resilience to centre. | Semi-structured interviews | Transcribing interviews for construct validity and reliability |

5.1. Review the literature

The research process started with reviewing important literatures to develop a comprehensive understanding (Bowen, 2009) of the disaster resilience framework for a flood evacuation centre. Using this understanding, variables that are significantly affecting the building resilience levels are identified. Extensive literature references are obtained from various sources and they are among journal articles, official shelter guidelines and other forms of literature. These literatures were read thoroughly and mindfully. They involved identification of issues and problems, key arguments, suggestions, methods and theoretical approaches of areas of concern.

5.2. Identifying variables

During the preliminary stage of scanning relevant literatures on the subject of disaster shelter, it showed insufficient amount of information on shelter design considerations which is partly discussed in various literatures. This however has been countered by an excessive analytical reading of the shelter guidelines and assessments. A number of variables are identified and tabulated. The variables in Table 2 are the special kind of concepts (Babbie, 2009) which have shared expectation and supported this research influencing the research outcome. Hence, it is used as a guideline to formulate the design framework.

Table 02. Variables of the research

| Variable | Items |
|----------------------------------|---|
| Shelter design standards | Physical planning; Covered living space; Design; Construction (The Sphere Project, 2011) |
| Perceived space, Spatial quality | Space & distance; Proxemics; Territory; View; Internal space; Transition space; Built and human capacity (Lawson, 2001; Acre, 2017) |
| Functions | Space modification; Structural improvement; Methods of retrofitting (FEMA, 2012 ; UNISDR, 2015) |
| Resilience properties | Robustness; Redundancy; Resourcefulness; Rapidity (Bruneau, 2004) |

5.3. Sample and data collection

Tables 3 and 4 shows the selection of sample and tools to analyse the data for each research method.

Table 03. Sample and data collection

| Methodology | Sample | Data Collection |
|-------------------|---|---|
| Document analysis | 30 documents (shelter guidelines, shelter assessments and resilience assessments) | It is known that shelter guidelines that were gathered from different regions do include information on resilience for the benefit of shelter risk assessments. An important follow-up is whether or not these design standards are suitable with the concepts of resilience and possibly, what is being done during the assessment, for which this documentation will help to indicate measures of disaster-resilience. This analysis has been validated by 10 selected disaster relief and shelter experts. |
| Case study | 6 selected flood evacuation centres among schools and community halls | A research protocol is developed for the case study method shown in Figure 1 which gives a clear outline of the methods and procedures used (Yin, 2009). |

| | | |
|----------------------------|---|--|
| Semi-structured interviews | 10 selected disaster relief and shelter experts | The findings of the two above methodologies will be discussed extensively with selected experts to develop the design framework for disaster resilience evacuation centre. This method attempts to determine the key resilience measures, to calculate the weight of each factors and to rate the resilience level of the centres studied. |
|----------------------------|---|--|

Table 04. Research protocol for case study

| Methodology | Sample |
|----------------------------|---|
| Research questions | What are the current space allocations and design in a flood evacuation centre in Malaysia? Are these centres functioning well? |
| Research objective | To evaluate the functions and conditions of the spaces provided in the current flood evacuation centres. |
| Research sites | Six selected flood evacuation centres in districts of Kuantan, Pahang; Johor Bahru, Johor and Pasir Mas, Kelantan. |
| Participants | Building operators, the state's Social Welfare Department and the district's Disaster Management Agency |
| Methodology | Site observation |
| Methods of data collection | <ol style="list-style-type: none"> 1. Observation checklist 2. Field memos 3. Informal conversations |
| Data analysis | Thematic analysis |
| Unit of analysis | Shelter design consideration, resilience measures |

6. Findings

Based on the variables and items analysed, the conceptual design framework for a disaster resilience flood evacuation centre shown in Figure 01 is the initial proposed framework in this research. It is developed through a network of interlinked concepts that together provide a comprehensive understanding of what this research is trying to achieve (Jabareen, 2017). This framework signifies the needs of an actual effective flood evacuation centre due to many reasons. Firstly, it contributes a significant list of design criteria of selecting buildings or spaces, in detail, to serve as flood evacuation centres. Second, the aims of the centre are not only to provide good living environment through the design and spaces, but more importantly, it includes the key resilience factors in the centre. This will cover the space modification, structural improvement and retrofitting options during the recovery and the mitigation phase of disaster. Additional examples of resilience measures are as follow;

- Access and connectivity to alternative areas of safety
- Evacuation centres to benefit at time of peace, not only during disasters (multi-purpose usage)
- Design to adapt to local conditions
- Design to reduce the vulnerabilities
- Design to restore the rights and dignities of the affected families
- Exploration of skills and local workmanship

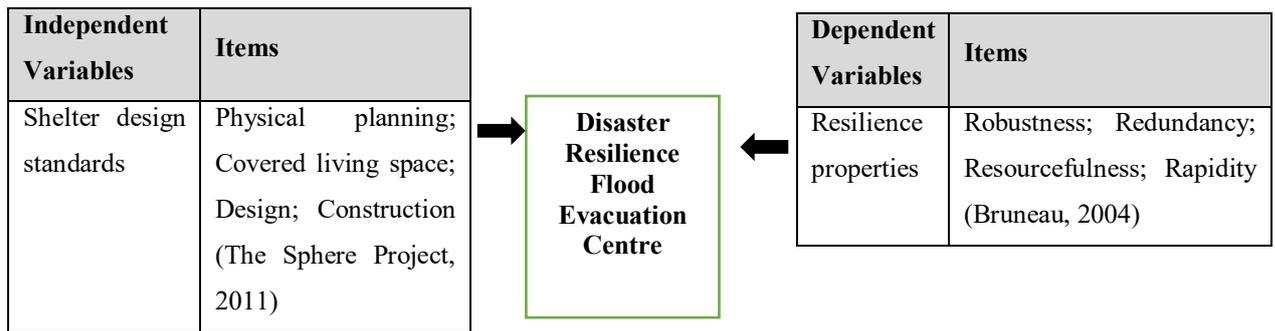


Figure 01. Conceptual design framework

7. Conclusion

This research aims to define the resilience of the flood evacuation centres through an evaluation process on the design and the spatial quality of the allocated spaces. Results for the document analysis suggested that the compliance of design standards in the selection of evacuation centre is a very important aspect to incorporate disaster-resilience elements into the design process. Followed by case study or site observation which proposed a building checklist template in order to determine the functional spaces, design, circulation and alternative solutions. And finally, interviews with disaster experts advanced the research by identifying key resilience factors for the development of the design framework. The proposed assessment is an outcome which offers a screening tool to calculate the weight of each resilience factors in the evacuation centres as well as to provide actions of improvement to the current state of these centres.

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