

**A Conceptual Framework for the Innovative Design of Temporary Accommodation  
for Flood Victims in Tha Korpai Community, Warin Chamrab  
Ubon Ratchathani Province, Thailand**

Phudis Hompikul  
Ubon Ratchathani University, Thailand  
Email: phudis.arch@gmail.com

**ABSTRACT**

Tha Korpai community in Warin Chamrab, Ubon Ratchathani Province, Thailand, adjacent to the Mun River, contains 187 houses located at the foot of the Democracy Bridge. The area is affected by floods every year by low pressure or tropical storms during the rainy season. In particular, Ubon Ratchathani is the last province where the water masses of the Mun River and the Chi River converge before flowing into the Mekong River. There is a large drainage dam from the north of the province to the Mun River to prevent floods in the rainy season. However, floods often damage housing and habitats. Every rainy season, residents of nearly 70 villagers are displaced on the roadside at the foot of the Democracy Bridge. After flood, the residents need housing-either building new ones or repairing the old ones. Nowadays, architects and designers have created innovative shelters to help people to cope with natural disasters, both in terms of design and the use of effective materials. The purposes of this study were: (1) to conduct a case study research on the characteristics and patterns of temporary accommodations of the flood victims in Ubon Ratchathani province, (2) to study temporary accommodations available in Thailand and abroad, and (3) to identify existing problems and important factors to create a conceptual framework and innovation for management of temporary accommodation suitable for the areas in Ubon Ratchathani. This study was expected to generate information on the primary needs of the post-disaster survivors, the innovative solutions, and actions taken upon flood victims particularly in providing temporary accommodation with effective design for flood victims.

**Keywords:** *innovative design, conceptual framework, temporary accommodation, flood victims, Ubon Ratchathani Province*

**1. Introduction**

Each year, riverside communities in Ubon Ratchathani Province are affected by flooded rivers. The water level is constantly increasing, flowing across the streets and flooding people's houses on the banks of the Mun River in Warin Chamrap District of Ubon Ratchathani, as indicated by the flood statistics in Table 1. Officials annually report more than 70 people to stay in temporary shelters.

**Table 1:** Previous Records of Flood Statistics on Maximum Water Volume Each Year at the Foot of the Democracy Bridge (2013-2017)

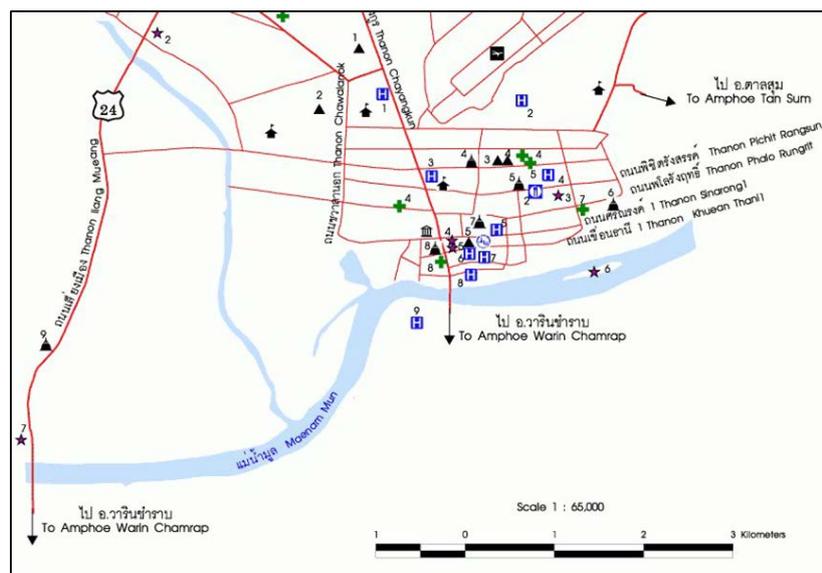
Year	2002 (maximum)	2013	2014	2015	2016	2017
Water level (M.)	10.78	9.20	5.50	5.00	6.94	7.70

Source : The Hydrology and Water Management Center for Lower Northeastern Region, Ubon Ratvathani, Thailand

Officials also report lack of housing and utilities necessary for daily living resulting from limited construction materials and labor, a lack of technical knowledge in construction of proper house style, and delayed transportation of materials and equipment from government agencies (Civil Engineering Department, Chiang Mai University, 2006). The housing patterns of the residents are not hygienic and do not respond to practical living. These affect physical and mental health of the flood victims and therefore demand long-term solutions from authorities concerned (Department of Health Thailand, 2011).

Based on the researcher's field survey of temporary housing after the flood, it was found that the condition of the temporary houses had leaking roofs due to low quality materials from limited budget. The researchers also identified the existing problems in temporary housing for victims in Thailand and in other countries after natural disasters. The social and geographical areas were referenced to the solutions taken for habitats for flood victims in Ubon Ratchathani.

**Figure 1:** Areas Affected by Floods along the Banks of Mun River



**Figure 2:** The area after rain and flooding in Ubon Ratchathani Province



## **2. Research Objectives**

There were three objectives in the study:

- (1) To conduct a case study research on the characteristics and patterns of temporary accommodations of the flood victims in Ubon Ratchathani province,
- (2) To study temporary accommodations available in Thailand and abroad, and

(3) To identify existing problems and important factors to create a conceptual framework and innovation for management of temporary accommodation suitable for the areas in Ubon Ratchathani.

### 3. Temporary Accommodations in Thailand and Other Countries

#### 3.1 Temporary accommodation for flood victims in Tha Korpai community, Warin Chamrab, Ubon Ratchathani Province, Thailand

When a flood occurs, all affected households will migrate to nearby highways, community offices, or tents provided by government agencies (Kittiampon, 2006; Tassanamit, 2012). People use public utilities from nearby places like gas-station bathrooms. After that, they build temporary housing by using a temporary building structure provided by the municipality. The structure consists of wood and steel rods, and villagers will use the materials provided to install the structure. They use accessible materials in the area such as a vinyl sheet, a canvas, an advertising sheet, a zinc sheet—all having limitations in durability, heat absorption, and moisture protection. Therefore, the characteristics of temporary houses depend on construction skills of each household. From the researchers’ interviews with villagers, they needed a standard home and fast construction materials that were stable, strong, and easy to assemble.

**Table 2:** Materials Used in Temporary Housing in Thailand

Materials used in temporary housing in Thailand								
Structure	House							
	1	2	3	4	5	6	7	8
Column	steel							
Beam	wooden							
Ground	wooden							
Wall	canvas - zinc							
Roof	wooden-zinc							

Source: The researchers’ collected data

The general characteristics of temporary shelters in Ubon Ratchathani Province are wooden and steel structures, which are accessible in the community areas. They are built on the edge of the Democracy Bridge which connects the districts of Ubon Ratchathani and Warinchamrab. The area is rough and steep. A typical temporary house is surrounded

by canvas and roofed with zinc sheets. Sanitary facilities are shared toilets provided by the government agencies. Some people use toilets at the nearby gas stations or public buildings.

**Figure 3:** Temporary Accommodation for Flood victims in Tha Korpai Community Warin Chamrab District, Ubon Ratchathani Province, Thailand



**Figure 4:** Materials Used in Temporary Housing in Thailand



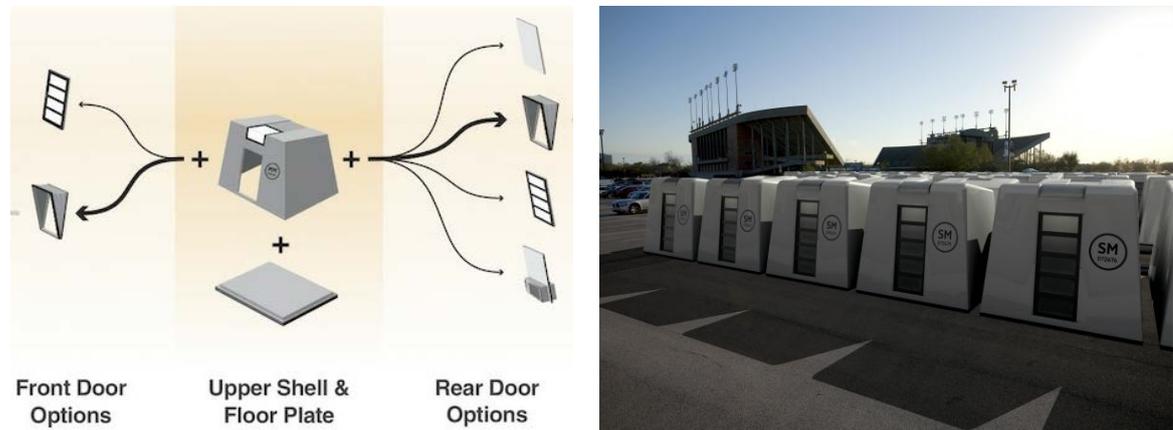
**Figure 5:** Mobile Toilets for Victims Provided by Government Agencies



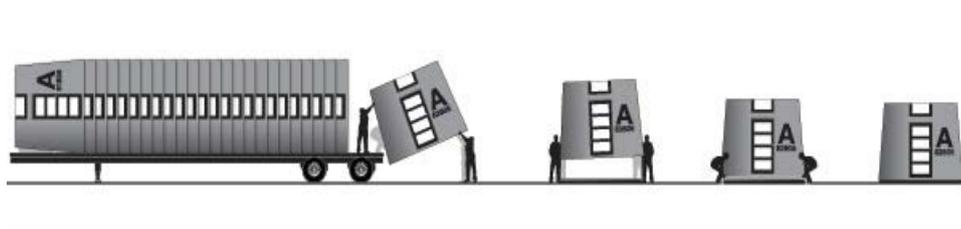
### 3.2 Innovative Temporary Shelters of Flood Victims in Thailand and Other Countries

#### 3.2.1 The Reaction Housing System, Thailand

**Figure 6:** The Reaction Housing System, Thailand



**Figure 7:** The Reaction Housing System, Thailand



The Reaction Housing System is an emergency accommodation designed for people to live normally. The living space can be adjusted to create a rest area. The building can accommodate about four people. It is fully equipped with utilities—water and lighting systems with external access points. The rugged construction material can sustain earthquakes or wildfire. The interior of the building is comfortable with an air conditioning system. The houses are easy to transport and assemble. There are only two pieces: the base (floor) and the house (wall + roof). The building is designed for the Reaction Housing system using aluminum as non-toxic material. Composite materials and building components are recyclable (Kuma, 2014).

### 3.2.2 Hex House, USA

**Figure 8: Hex House**



Architects for Society (AFS) have designed a temporary shelter for victims known as the 'Hex House' due to its hexagonal shape. It is designed to be long-term housing. The cost of construction is not high. Building components are easy to set up and moved easily and sustainably. The basic components of this shelter include: galvanized steel pipe, structural insulated panel (SIP), floor and roof. In addition, the hexagonal shape enhances the stability of the house. Roofing is a self-support that is locked to the tongue joints to create a strong and stable structure. Each shelter can be installed adjacent to each other to build a larger shelter. There is also a system of rainwater storage that can be trapped through the gutter which filters the water into the water tank to be pumped back into the house. The ventilation system is installed on both sides of the house while electricity is provided by the solar panels. The interior space is designed to look modern with gypsum walls, bamboo flooring, ceramic tile in the bathroom, and kitchen cabinets made of bamboo. It is a very useful shelter for disaster victims, and can last for 15-20 years (Designhub, 2016).

### 3.2.3 La Matriz, Peru

**Figure 9: La Matriz**



As a result of global warming, people living in Peru's coastal areas have been hit by natural disasters and are constantly facing dry weather. Students from the Pontifical Catholic University of Peru (PUCP) in Peru developed emergency, temporary shelters for those affected by the disaster (Klijn, 2012). This shelter is called 'La Matriz'. It is shaped like an Inuit house with a self-supporting structure. It is lightweight, sturdy and easy to install. The exterior of the building is covered with a layer of foam to help reduce heat loss, while the exterior is made of interlocking aluminum sheets to reflect sunlight. Some panels can also be opened to allow air to circulate and maintain internal temperatures. The 'La Matriz' can be stored in a flat shape for easy transportation by a boat or helicopter. The shelter accommodates eight people; it can be assembled and installed within four hours.

### 3.2.4 Lofty, Portugal

**Figure 10:** Lofty



Studio Muda, a design studio in Portugal, has designed a simple, easy-to-use, lightweight refueling shelter that can be dropped from a plane. The building can be moved by hand or transported by car. This shelter comes in a triangular structure similar to a marquee designed to float like a parachute. The frame is made of four lightweight bamboos stretched with nylon mesh. In transportation, the building parts are dropped from an airplane in wooden crates containing essential materials. Canopies made from canvas give protection from the sun, heat and rain. The height of the roof also allows the air to flow in easily (Designhub, 2016).

3.2.5 Living Shelter, Singapore

**Figure 11:** Living Shelter



Singapore architects WY-TO have created a shelter called 'Living Shelter' for disaster victims in the Asian Pacific. This shelter is affordable, easy to move, and can be easily dismantled without the use of complicated tools. Using a Folding Mechanism, the design is inspired by the theme of the kampong village in Southeast Asia. The structure and walls are strong enough for all weather conditions. It can be installed on uneven floors and can be recycled; it gives privacy and security. The shelter uses energy from solar panels on the roof. There is a water storage system and folding facilities, such as beds, shelves, tables and small furniture that can be moved. All interior furniture is made of lightweight materials. The 'Living Shelter' prototype was showcased at the Architecture Biennale 2016 in Venice, Italy (Designhub, 2016).

3.3 Comparative Analysis of Five Designs of Temporary Housing

The researchers made a comparative analysis of five designs of temporary housing as shown in Table 3.

**Table 3:** Comparative Case Study by Researcher

No.	Concept Design	The Reaction Housing System	Hex House	La Matriz	Lofty	Living Shelter
1	Area management	Good	Best	Average	Average	Good
2	Facility	Best	Best	Best	Best	Best
3	Unit Expansion	Good	Good	Average	Average	Good
4	Construction and material selection	Best	Best	Good	Best	Best
5	Management and Transportation	Best	Best	Best	Best	Best
6	Applicable	Good	Average	Average	Good	Best

(1) Space Allocation: Hex House has the best living space, as each unit can be connected so that the space can be clearly defined while La Matriz and Lofty have a hard-to-use shape. The distance from the floor to the ceiling is not even.

(2) Ventilation: all temporary houses provide comfort by using insulation materials (temperature control) and having openings designed for ventilation or airflow.

(3) Space Constraint: La Matriz and Lofty are more difficult to assemble than the other two due to their inferior plane, Hex House and Living Shelter. It is not designed to be added vertically, which is necessary in the case of limited construction space.

(4) Construction and Material Selection: La Matriz is the most cost effective with the use of materials from factory production. While with Lofty, Hex House and Living Shelter, people can use commercially available materials.

(5) Management and Transportation: all houses can be used by residents even after the disaster.

(6) Limitations of in Design Temporary Housing Designs:

**Hex House** requires a large area for installation which is not suitable for a limited area.

**La Matriz** uses rare material; its space and shape may look unfamiliar to people in some geographical areas.

**Lofty** uses material to create space. Its shape may look unfamiliar to people in some geographical areas.

**Living Shelter** appears suitable for application in different geographical areas. Living space is similar to that of a normal home. However, there could be limitation in space for addition of housing units.

#### **4. Conceptual Framework for Design Criteria for Temporary Housing**

To obtain a conceptual framework for design criteria for temporary housing in the areas in Ubon Ratchathani, the researchers collected three qualitative data from local victims in three aspects:

(1) Documents and innovation research related to disaster cases in Thailand and other flood areas in other countries. Data include building designs, materials selection and construction methods. (Shigeru, 2001; Ternaux, 2011; Dent, 2014, Yasukata, 2014; Designhub, 2016)

(2) Various aspects of temporary housing in need of improvement, such as living space, utility requirements or construction methods. (Kuma 2014; Yakutaka 2014; Designhub, 2016)

(3) Social, economic, and environmental conditions that affect the design of temporary housing (Kittiampon, 2006; Tassanamit, 2012; Kuma, 2014; Klijn, 2012)

It was expected that the obtained data by information search and interviews would help create a set of design criteria suitable for temporary housing in Ubon Ratchathani.

**5. Results of the Study**

The researchers interviewed residents of eight temporary houses from 70 households and analyzed the interview data into three factors: (1) the use of space, (2) factors affecting the living space, and (3) daily living problems.

**5.1 The Use of Space**

The findings are as follows:

5.1.1 Most houses use compact, foldable, and lightweight furniture because of limited space available in the home. There is one central area used for resting and eating during the day and for sleeping at night.

5.1.2 The proportion of the traffic in all houses is less than 25% because of inadequate living space. There is overlapped area of bedroom, living room and dining room. The space is not enough to meet the needs of the activity.

5.1.3 A practical design for improvement of space should focus on area expansion to accommodate the varied number of residents.

**Table 4:** Use of Space in Six Houses

Use of Space	1	2	3	4	5	6	%	Rank
1. The use of folding furniture	1	0	1	1	1	0	66.67	2
2. Less than 25% traffic area	0	0	0	0	0	0	0	3
3. Overlapped area	1	1	1	1	1	1	100	1
4. Need expansion	0	1	1	1	0	1	66.67	2

**5.2 Factors Affecting the Living Space**

As shown in Table 5 below, the researchers found factors affecting the living space as follows:

5.2.1. The number of residents. The varied number of family members affected the size of the living space. For example, Family 3 had 6 members sharing 2 bedrooms. A family with 2-3 members like parents and children were able to have their bedroom.

5.2.2. Relationship of family members. The senior member used the living room outside, while letting the daughter and grandchildren sleep in the bedroom, as in the case of Family 1. In Family 2, the father, the mother and the son shared the living area while the child slept in the bedroom. Family 3 had parents and teen children in separate areas. Family 4 was large and had to share the living area but separate the sleeping area.

The family size affected the use of living area for eating and resting during the day and for sleeping at night.

5.2.3. Gender and age. Some older residents, both men and women were concerned about the structural strength of the structure to withstand the storm. The temporary building materials were sensitive to vibration.

5.2.4. Construction budget. The interview data revealed that the government agencies allocated only 10,000 baht per a housing unit. Some victims had to use their money to enlarge the living space. Construction budgets resulted in dramatic increases in size of the house and its living space. The terrace was used for cooking and having meals. The living area usually had overlapped functions like resting, eating and sleeping.

5.2.5. Construction. Based on interview data, government agencies helped with a limited budget and construction materials with a few builders. Volunteers also joined to help build temporary houses, often with limited knowledge in construction. Construction quality depended on the skills of builders.

5.2.6. Time for construction. Since flood victims urgently needed shelters during floods time, temporary houses were built in urgency and often resulting in non-standard or substandard housing.

**Table 5:** Factors Affecting the Living Space in Six Houses

Family	1	2	3	4	5	6
1.Number of residents	3	3	2	4	2	2
2. Members	Father/ Mother/ Children	Father/ Mother/ Grandchild	Husband/ Wife	Father / Mother / Daughter / Son / Grandchild	Husband/ Wife	Brother / Brother
3. Gender	Male/ Female/ Male	Male/ Female/ Female	Male/ Female	Male/Female/ Female/Male/ Female	Male/ Female	Male/ Male
4. Age of Family Head	68	51	22	55	57	54
5. Construction Budget (USD)	320	320	320	320	320	320
6. Construction	Self-build	Self-build	Self-build	Self-build	Self-build	Self-build
7. Construction Period (days)	3	7	3	3	5	2

### 5.3 Daily Living Problems

The researchers identified daily living problems from interview data as follows:

5.3.1 High daytime temperature. The researchers found that a house with high temperature had a roof and walls zinc-plated with a window on one side. The ventilated home had a high ceiling and windows on both sides, allowing air to flow in and cool the house.

5.3.2 Moderate night time temperature. The temperature at night was cooler than day time. Most activities at night were watching TV, chatting and sleeping in the living area.

5.3.3. Ventilation. The floor height was about half a meter and other houses were very close. The tight surrounding blocked the air flow, causing poor ventilation.

5.3.4. Leakage. Rain water leaked from the roof due to incomplete roofing or poor roof joints.

5.3.5. Security. Most houses did not have sturdy doors and windows. As a result, residents did not feel secured or safe.

5.3.6. Toilets. Temporary houses had poor quality toilets. The municipality did not provide sufficient toilets for flood victims. Most public toilets were located nearby, including those at the gas station.

**Table 6:** Daily Living Problems

Family	1	2	3	4	5	6
1. Daytime temperature	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum
2. Night Temperature	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3. Ventilation	Poor	Poor	Poor	Moderate	Poor	Poor
4. Rain splash / leak	Poor	Poor	Poor	Poor	Poor	Poor
5. Security	Poor	Poor	Poor	Poor	Poor	Poor
6. Toilet	lack	lack	lack	lack	lack	lack

From the analysis as shown under Sections 5.1-4.3, flood victims in Ubon Ratchathani Province experienced limitations in temporary housing , particularly the size of living space and problems affecting their daily living. The temporary houses required a practical design to cope with three major limitations: (1) foldable furniture, (2) traffic less than 25%, and (3) overlapped areas of functional use.

## 6. Discussion and Conclusion

The results of the study reported in Section 5 indicated insufficiency in temporary housing in terms of living space, construction and proper housing design. These limitations were to determine a conceptual framework for the innovative design of temporary housing for flood victims in Tha Korpai community, Warin Chamrab, Ubon Ratchathani Province, Thailand.

Data obtained from the researchers' interviews with flood victims, documents and statistics from social work organizations shed light on what to be considered for a practical design for temporary housing as follows:

### 6.1. Management and Transportation

#### 6.1.1 Management

- Temporary houses should be designed prior to the disaster
- Reusable

#### 6.1.2 Transport

- The building parts should be simple and light and can be easily transported in trucks without damage.

### 6.2. Construction and Material Selection.

#### 6.2.1 Construction

- The building to be completed within one day.
- Residents can build or assemble their own living units with minimal construction skills.
- Construction steps to be simplified with the use of basic tools. Temporary shelters after floods should withstand the impact of rain storms. The shape of buildings, structures and materials and joints should be suitable for the locals (Supawadee, 2004).

#### 6.2.2 Material

- The main structure of the house, including pillars, beams and roofs, must be durable. These should be prepared before the disaster, including steel pipes, plastic, wood, insect protection devices and the like.
- Secondary structures such as walls, roofs, doors and windows should be of local materials.
- Materials must be re-used if moving or disassembled. Main materials must not absorb or collect heat.

### 6.3. Use of Space.

-The living area must be divided to minimize overlapped areas. Closets and storage for valuables should be in the bedroom. A cooking area should be adjoined to the dining area or the dining area adjoined to the living area. The living area can also be used as a sleeping area at night.

- The bedroom must be at least eight square meters or the narrowest width should not be less than 2.50 meters. (Ministerial Regulation No.55, B.E. 2543 (2000). Issued pursuant to the Building Control Act, B.E. 2522 (1979). 1. Publication Date: 28 July 2000)

- One house must consist of areas for sleeping, keeping valuables, resting, cooking and dining. All areas must be separated in functions.

### 6.4. Facilitation for Comfort

- Good ventilation
- Access to system utilities
- Safe for life and property
- Comfortable throughout the day and at night with moderate temperature.

#### 6.5. Expansion

- One house should contain functional areas for one family of a least four members.
- With a large family of 5-10 members, the house can be expanded to include more living areas without damaging the main structure.

With considerations of 6.1 to 6.5 above, it is expected that they can help create a conceptual framework for the innovative design for contemporary houses in time of need. Such considerations should enable residents to cope with limitations in temporary housing as reported by the researchers in the case of flood victims in Tha Korpai community, Warin Chamrab, Ubon Ratchathani Province, Thailand.

### 7. Acknowledgements

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### 8. The Author

Phudis Hompiikul is working at Ubon Ratchathani University, Thailand. His research work focuses on community management and flood risk management.

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