A Study of Living Conditions in Post-Tsunami Houses: The Case of the Moklen Ethnic Minority in Phang Nga Province, Southern Thailand

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ABSTRACT

The catastrophic Indian Ocean tsunami on 26 December, 2004 was the first of its kind in the modern history of Thailand. The damage was extensive, covering six southern provinces. Phang Nga Province reported many casualties with many properties were damaged especially in housing. Ethnic minority groups of *Chao Lay* living in Southern Thailand were also badly affected. Since their homesteads were located along the coast, severely affected by the tsunami. Various sources of assistance were provided to rebuild houses to support a more modern way of life. However, due to the particular lifestyle and culture of the Chao Lay, the post-tsunami houses created a mismatch in living conditions. A field survey of post-tsunami housing of the Moklen, a sub-group of Chao Lay, in 2013 showed that 10 years after the tsunami, a number of villages altered the houses dramatically to adapt to their style of living. The current issue requires an understanding of the housing impact on the Moklen, and a case study has been conducted on their post-tsunami living conditions in Tungwa village. The main 3 objectives of this research are;

1. To investigate living conditions of post-tsunami housing of Moklen people
2. To analyse adaptation of provided housing and influence of post-tsunami houses on the living conditions of the Moklen people using a case study of Tungwa village
3. To propose and improve post-disaster housing design process regarding Chao Lay ethnic minority

This research used methodologies of interview and field survey, semi-structured interview with key informants to understand post-tsunami housing in Thailand and ethnic minority of Chao Lay such as local government officer, related organizations, designers, village headman and villagers. Field survey conducted in affected Moklen villages to collect information by observation; taking photographs, taking notes, measuring house, and drawing of furniture and living equipment in order to record living conditions of residents. The household survey of 40% of residents in six Moklen villages to understand overview of living conditions of Moklen people and 70% of residents (49 of 68 households) of Tungwa village which is the case study of this research.

The overview of post-tsunami housing assistance is mostly under government management, with 74% of proposals for house construction and renovation being submitted

to the government. In addition, the three types of house design were provided by the Department of Public Works and Town Planning, with other government departments being responsible for construction in the affected provinces. A second form of housing assistance is from NGOs providing direct assistance. The final form involves a government organisation with an NGO providing assistance to people with land issues and includes the Chao Lay in particular. Due to conflicts with government departments and the private sector, the Land Commission was established to solve the land problem by proving land tenure before the tsunami and the date a land title was issued. The effect of land conflict also leads to policy making for the rehabilitation and resolution of lifestyles and the ethnic minority culture of the Chao Lay, in particular, giving precedence to the consideration of land conflict issues to provide housing security. The construction project in Tubpla village reveals the indigenous knowledge applied to Moklen ethnic houses, with rituals and beliefs, and body-based units of measurement used in construction, as well as the implementation of techniques such as building components being bound together with rattan rope. These factors represent the importance of the Moklen culture and living conditions in the pre-tsunami period. The change in livelihoods and living conditions is represented by land use at village level. The area available to support livelihoods has decreased due to private sector land tenure. The cemetery area is only small because it was not given priority by local government. The village area has moved because of the land tenure nearby and the policies. The post-tsunami pattern of settlement has changed the village level from houses scattered around the area into a planned orderly arrangement. The houses are larger than before the tsunami and common areas and facilities support community activities, including utilities to improve living conditions.

To understand the influence of post-tsunami housing on Moklen people. The research found that ten years after the tsunami, the residents are experiencing some difficulties with living conditions. The rebuilding process changed the house types from single-storey in the pre-tsunami period, to houses with high stilts post-tsunami. In general, the rebuilt houses are capable of supporting the residents' basic living requirements; however, some of them experience difficulty in creating additional space on the ground floor owing to the lower ceiling height and low quality control of construction, despite the houses being designed with optional space on the ground floor. The study also found that three aspects affect living conditions: village layout, housing space, and building materials. The village layout in rows of houses limits air ventilation as they block each other's wind flow and decreased of

window number, and limited space causes difficulties for livestock. The living space on the higher stilt level is inconvenient for some villagers, especially the elderly, who are accustomed to the pre-tsunami living environment, and some households are living only in the additional space created on the ground level. In addition, some building materials have been damaged by termites and rain, making it dangerous to live on the stilt floor. The post-tsunami houses affect space use for residents, especially elderly people accustomed to living in a Moklen house. Such people are very sensitive to the environment, and the new house design forces them to use inappropriate spaces or change their traditional lifestyles. Even though the design was planned in accordance with the traditional Moklen house and residents participated in it, some factors should be reconsidered to improve living conditions.

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LIST OF ABBREVIATIONS AND ACRONYMS

ALRO	Agriculture Land Reform Office
CODI	Community Organization Development Institute
CUSRI	Chulalongkorn University Social Research Institute
DANIDA	Danish International Development Agency
DDPM	Department of Disaster Prevention and Mitigation
DMCR	Department of Marine and Coastal Resources
DOL	Department of Lands
DPT	Department of Public works and Town & Country Planning
NGO	Non-government organization
TAO	Tambon Administrative Organization

CHAPTER 1: INTRODUCTION

1.1 Research background

The catastrophic Indian Ocean tsunami on 26 December, 2004 was the first of its kind in the modern history of Thailand. The damage was extensive, covering six southern provinces. Phang Nga Province reported many casualties—4,224 killed, 5,597 injured, and 1,733 missing (GISTDA, 2005). In addition to the loss of life, many properties were damaged—407 villages or 4,806 houses damaged (Department of Disaster Prevention and Mitigation, 2006). Ethnic minority groups of Chao Lay living in Southern Thailand were also badly affected.

The ethnic minority Sea Gypsies known as Chao Lay[1] consist of three sub-groups: Moklen, Moken, and Urak Lavoy. They live nomadic lives on the sea in Thailand, using a boat as both their home and vehicle to move between islands. In the monsoon season, to avoid the strong waves temporary houses were built on the beaches. A few decades ago, they began to permanently settle on the coast (Arunotai, 2008).

Since their homesteads were located along the coast, many villages were severely affected by the tsunami. Various sources of assistance were provided to rebuild houses to support a more modern way of life. However, due to the particular lifestyle and culture of the Chao Lay, the post-tsunami houses created a mismatch in living conditions, although such rebuilding has had little negative impact on the Thais who had prior experience of living in modern houses. The modern design of the houses is different from the Chao Lay's traditional housing, requiring residents to modify or change their lifestyle to fit in with the post-tsunami houses.

The Moklen sub-group of Chao Lay was hit hard by the tsunami as the majority of them had settled on the coast of Phang Nga. A field survey of post-tsunami housing of the Moklen in 2013 showed that 10 years after the tsunami, a number of villages altered the houses dramatically to adapt to their style of living. The current issue requires an understanding on adaptation of provided house and the housing impact on the Moklen, and a case study has been conducted on their post-tsunami living conditions in Tungwa village.

[1] "Chao Lay" is from the Thai language, derived from words *Chao* meaning *People* and *Talay* meaning *Sea*. It has two meanings; the first meaning refers to people who live near the sea as fishermen and the second is an ethnic minority who use the Austronesian language and live in the sea.

1.2 Research objectives

As mentioned above, in order to understand the living conditions of Chao Lay, the objectives of the research include an overview of post-tsunami housing in Thailand. The ethnic people have been affected by the rebuilt houses and their management. Traditional lifestyles are compared to living conditions in post-tsunami houses, together with changes and adaptations ten years after the tsunami, in order to understand the problems with living arrangements as well as the cultural aspects. The case study of Tungwa village explores the whole design and construction process and the housing influence which has resulted in problems with livelihoods. Finally, the study aims to propose improving design process for people with distinctive cultures as follows:

1. To investigate living conditions of post-tsunami housing of Moklen people
2. To analyse adaptation of provided housing and influence of post-tsunami houses on the living conditions of the Moklen people using a case study of Tungwa village
3. To propose and improve post-disaster housing design process regarding Chao Lay ethnic minority

1.3 Research methodology

The research methods used consist of primary data, secondary data, and analysis.

1. **Primary data**: this research used methodologies of interview and field survey, semi-structured interview with key informants to understand post-tsunami housing in Thailand and ethnic minority of Chao Lay such as local government officer, related organizations, designers, village headman and villagers. Field survey conducted in affected Moklen villages to collect information by observation; taking photographs, taking notes, measuring house, and drawing of furniture and living equipment in order to record living conditions of residents.

The field surveys focusing on living conditions of post-tsunami villages in the Phang Nga Province. Information about the recovery process, living conditions, and problems was gathered by observation and interviewing villagers in the affected area The living conditions of the Moklen Tungwa village were used for a case study, collecting data using recorded interviews with Moklen households, also included interviews with related organisations and architects involved in post-tsunami housing management, as well as the design concept and construction process. To deal with the lessons learnt from the construction project of the Moklen ethnic house, and the process was recorded not only to understand the building culture, but also the traditional housing of Moklen people. An overview of post-tsunami housing by focusing on ethnic groups of Moklen in the Phang Nga Province to clarify understanding on

the houses provided—housing management, characteristics, and living conditions. In addition, to observe the living conditions of 10 sample of households in six Moklen villages and the following details were recorded: the plan of post-tsunami houses, housing conditions, and space use and data collection of the Moklen houses in each community. Post-tsunami house plans were prepared to analyse the living conditions, house extensions, and building use. The details of interviews and field surveys as shown in table 1.

2. **Secondary data**: data collected from publications, documents, research studies, and reports are divided into two parts: The Chao Lay ethnic minority and post-tsunami housing in Thailand. For Chao Lay ethnic minority, the data reveals details of Moklen traditional lifestyles and housing. In post-tsunami housing in Thailand, the data provides records of house design, housing management, and other issues. Primary data was also used in the research process to analyse the effect of post-tsunami houses on residents after living there for ten years.

3. **Information process**: the research process was designed to understand the pre-tsunami and post-tsunami housing conditions of the Moklen in Tungwa village, as well the recovery process, concept of design and construction, and the effect of the rebuilt houses on villagers. Field survey of 6 Moklen villages will be analysed in area use and building use in overview of living conditions that shows through living elements and extensions, a case study was selected to understand in-dept in livng condition by change of livelihoods with interview with change of land use and housing patterns. The records of livng conditions, an adaptation with interview of villagers to analyze problems and influence of provided house to residents' living conditions.

Table 1. Interviews and field surveys conducted in this research

Field survey	Date	Affiliation	Place	Topics
1st	Oct 2013	- Villagers in affected area in Phang Nga province	Phang Nga	Overview of living conditions in post-tsunami houses
	Mar 2013	- Tungwa village headman	Tungwa village, Phang Nga	Change of livelihood after the tsunami
2nd		- Chumchonthai foundation	Bangkok	Concept and process in post-tsunami housing assistance
		- Community Organization Development Institute (CODI)	Bangkok	Concept and process in post-tsunami housing assistance
3rd	Oct 2013	- Villagers in affected area in Phang Nga province	Phang Nga	Overview of living conditions in post-tsunami houses
4th	Nov-Dec 2013	- Villagers' of Tungwa village	Phang Nga	Living conditions in post-tsunami house: the case of Tungwa village (10 of 68 houses)
5th	Jan-Feb 2014	- Tubpla headman and villagers	Tubpla village Phang Nga	Moklen traditional livelihoods and housing
		- Villagers' of Tungwa village	Tungwa village, Phang Nga	Living conditions in post-tsunami house: the case of Tungwa village (49 of 68 houses)
6th	Oct-Nov 2014	- Moklen people who lives in post-tsunami house	Phang Nga	Post-tsunami housing for Moklen people (7 villages)
		- Designers of Tungwa village's post tsunami housing project	Bangkok	Design concept and construction process of post-tsunami housing for the village
7th	Sep-Oct 2015	- Villagers of post-tsunami house for Moklen people	Phang Nga	Living conditions in post-tsunami houses in 6 Moklen villages (10 samples)
8th	Jan-Feb 2016	- Villagers of post-tsunami house for Moklen people	Phang Nga	Living conditions in post-tsunami houses in 6 Moklen villages (40% of all households in each village)

1.4 Research scope

The scope of the research area is Phang Nga Province, where the majority of Moklen have settled along the coast of three sub-districts: Bang Muang, Takuapa, and Tai Muang. This research was conducted in the post-tsunami housing projects of six communities: Tubtawan, Soi Willy, Soi Malteser, Bangkaya, Tungwa, and Tubpla, with Tungwa village being chosen for the case study. Post-tsunami housing has severely affected almost all communities, with changes to house appearance or settlement patterns.

1.5 Literature review and research originality

The research for this thesis is mainly in two parts: the ethnic minority of Chao Lay and post-tsunami housing. Similar research studies are reviewed to update and increase the understanding of post-disaster housing in countries which have experienced it.

The majority of studies on **the ethnic minority of Chao Lay** are by groups of ethnographers, anthropologists and linguists. Of the three sub-groups of Chao Lay, Moken, Moklen, and Urak Lavoy, Moken has received the most attention as their traditional lifestyle still persists, while Moklen is explained as a related sub-group of Moken since it has a similar name. For example: *"Rings of Coral"*, *"Moken Folktales"*, and "*Moken: Sea Gypsies of the Andaman Sea, Post-War Chronicles"* by *Jacques Ivanoff*, and *Moken and Semang: 1936–2004, Persistence and Change" (1997)* by *Hugo Adolf Bernatzik*. Certain studies such as "*Sea Dyaks (Sea Gypsies) in Thailand (1998)"*, and by the Chulalongkorn University Social Research Institute (CUSRI), who have been working on the ethnic minority of Chao Lay since before the tsunami, provide an overview of the original lifestyle, traditions, and indigenous culture. These researches show relevant information of livelihoods and especially living conditions of pre-tsunami period of Chao Lay people.

Since the 2004 Indian Ocean tsunami, the Chao Lay has received more attention from the outside world since they were greatly affected by it. Researchers have focused on issues occurring after the tsunami, such as insecurity of housing and livelihood, and cultural sensitivity. Relevant research directly relating to a Moklen sub-group is provided by "*Turbulance in Koh Phra Thong*" (*2006*) and "*The linkage of socioeconomic data of communities and protected area management planning: The Moken community, Surin Islands and Urak Lavoy community. Tarutao National Park*" (*2006*).

However, in terms of architecture and settlement patterns, it was often mentioned as a part of Chao Lay culture but because of the nomadic life in the sea does not have any obvious housing culture, as inland people have developed housing over a long period of time, as shows

in the relationship between buildings and the environment. A significant research study, *"Moken's way of life"* (2006) by CUSRI describes the settlement sequence of Moken in the Surin Islands. The research contributed to an important work useful to this thesis, entitled *"Dynamics of the Moken Village in the Surin Islands, Thailand."* (*2010*) by *Suzuki*, which indicates that post-tsunami housing influenced the Moken people, a sub-group of the Chao Lay in the Surin Islands in Phang Nga Province. The study showed that the orderly planning and density of housing arrangements did not match the traditional lifestyle. The houses have since been modified or moved to the sea as in the past.

The 2004 tsunami in Thailand was the first time a disaster had caused widespread damage along the coastal area and covered six provinces at once. There are research studies on several issues relating to **post-tsunami housing in Thailand**. The main issues of interest include community based and conflict after the tsunami, for example, *"Post-Tsunami Reconstruction and Tourism: A Second Disaster? Tourism Concern"* by *Rice* (*2005*) and "*Land Tenure, Land Conflicts, and Post-Tsunami Relocation in Thailand"* (*2006*), and Tungwa Moklen village is a model for solving land conflict that should be acknowledged "*Community Rights and Interest of Thai Society"* (*2006*). Another issue that was raised is participatory process in post-tsunami housing, in *Partipatory Development Plan for Baan Namkhem Community in Phang Nga province by Atsawakowitwong and others*, (*2007*) shows the management of post-tsunami housing which proposed to express the importance of establishing of Bottom-up development.

Of utmost relevance is "*Research on the Sustainability of Permanent Accommodation for Tsunami Victims*" (*2007*) by *Sthapitanonda et al.*, focusing on physical changes and satisfaction to evaluate post-tsunami housing. The evaluation between two approaches of housing management: management with and without participatory of residents, the reserch found that residents participating in the project were satisfied with the house, although it took time. The research proposes policies and guidelines for designing post-tsunami houses in the future, and includes the Moklen villages of Tungwa and Bangkaya. However, this research is not directly concerned with their different cultures, as they were considered as being part of Thai culture. Housing design and the construction process are described in this research to provide an understanding in overview of post-tsunami housing in Thailand. However, because of the turbulence occurring at the time, the record of post-tsunami housing construction is limited, especially in cases where a participatory process is used. A record by architects involved in the design and construction of post-tsunami housing in some affected areas, *"Sea Sand Sad*

Tsunami Project", January–February 2005, although brief, visualises housing design with a concept which is very useful for analysis.

Moreover, there are other research studies on post-disaster housing, and the current trend of post-tsunami housing prioritises sustainability, and focuses on how post-tsunami housing does not successfully accommodate residents. Barakat (2003) indicates that post-tsunami housing is not concerned with humanitarian issues, particularly those involving different cultures, as people have various religious beliefs, traditions, livelihoods, and lifestyles. As a result, post-tsunami housing should be considered by participation and process, not merely physical production.

Barenstein and Pittet (2007), for their research study on the importance of housing culture in Tamil Nadu shows that sustainability comes with local construction knowledge and technology. The improved socio-economic status of residents is also more likely to decrease disaster impact in the future than post-tsunami housing provided by agencies. Focusing on the lives of ethnic groups in post-disaster housing provided by the government in Turkey, Oliver (2006), states that extensions were built to support the traditional lifestyles of residents.

A research study by Boen and Jigyusu (2005) points out that the cultural issue is very important and for their example of cases in Indonesia, modern housing provided by the government has affected the population in many ways, since modern planning is not related to traditional lifestyles. Jigyasu and Upadhyay (2013) studied the physical tranformation of reconstructed settlements in Marathwada, India and reported that changes or extensions in many functional areas related to the culture of residents which cannot be accommodated by the reconstructed houses. These studies all show that physical changes pose problems for residents in reconstructed houses provided by recovery organisations.

1.6 Structure of thesis

The first chapter begins with an introduction to the background of the research and its important objectives and methods. A literature review of previous research is presented in relation to post-tsunami housing in Thailand, and the ethnic minorities of Chao Lay, including similar case studies in other disaster prone countries.

The second chapter focuses on post-tsunami Thailand in order to understand the effect of project management on house appearance and living conditions, particularly those houses provided for ethnic people. The current situation and policies regarding ethnic minorities of Chao Lay are also examined.

The third chapter introduces the ethnic minority of Chao Lay and its sub-groups, with in-depth details of the characteristics of the Moklen traditional lifestyle and housing culture, taking Tubpla Moklen village as a case study. A construction project to comprehend the features of Moklen ethnic houses was studied, including the situation of Moklen houses and difficulties in conserving building culture. This chapter is used to compare current living conditions in post-tsunami housing.

The aim of **the fourth chapter** is to understand the post-tsunami housing of Moklen people in Phang Nga Province, also aims to understand how post-tsunami housing management affect features of post-tsunami housing. At the end of the chapter, six case studies were undertaken, and one was chosen for specific study in the following chapters.

In **the fifth chapter,** the changes in livelihoods and living conditions of Moklen people are studied, using Tungwa village as a case study. This chapter aims to understand the overall image of how the tsunami affected the village by studying land use and village layout before and after the disaster. Changes in livelihoods and living conditions are used to support the in-depth study of living conditions in post-tsunami houses in the next chapter.

The sixth chapter focuses on the case of Tungwa village and the changes in livelihood and living conditions and, in particular, the whole process of pre-tsunami and post-tsunami house design and construction. House changes and adaptations for solving the problem of living conditions are analysed. This chapter provides an understanding of the improved living conditions, design process, and construction, which is then concluded in the final chapter.

The seventh chapter summarises the research findings, and provides suggestions on how to improve living conditions through the design and construction process for disasters in the future by considering distinctive cultures.

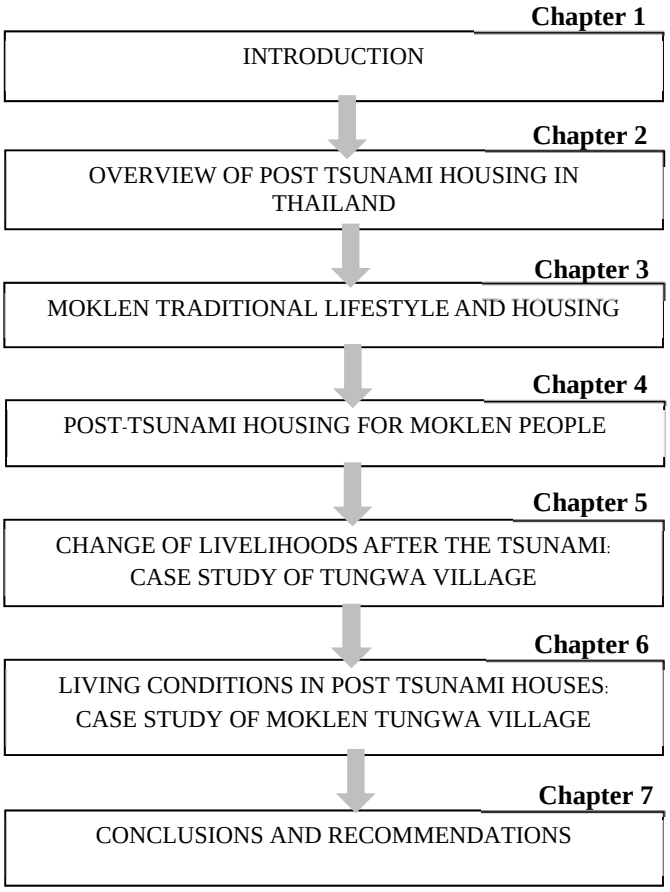

Figure. 1. Thesis structure

CHAPTER 2: OVERVIEW OF POST-TSUNAMI HOUSING IN THAILAND

2.1 Province

The 9 Richter earthquake on 26 of December 2004 had a central depth of 28.9 kilometres in the Indian Ocean, at the coordinates of latitude 3.298 N and longitude 95.778 N on the west side of northern Sumatra. The origin was around 580 kilometres from Phuket. At 7.10 am in Indonesia, the tsunami waves moved rapidly at a speed of 500 kilometres per hour and reached Aceh and Phuket at 9.38 am (local time). The ten-metre-high waves blew into the Andaman coasts. This was the first tsunami disaster in Thailand since records began (Office of Natural Resources and Environment Policy and Planning, 2005). The damage covered six provinces along the Andaman coast: Phuket, Ranong, Phang Nga, Krabi, Trang, and Satul.

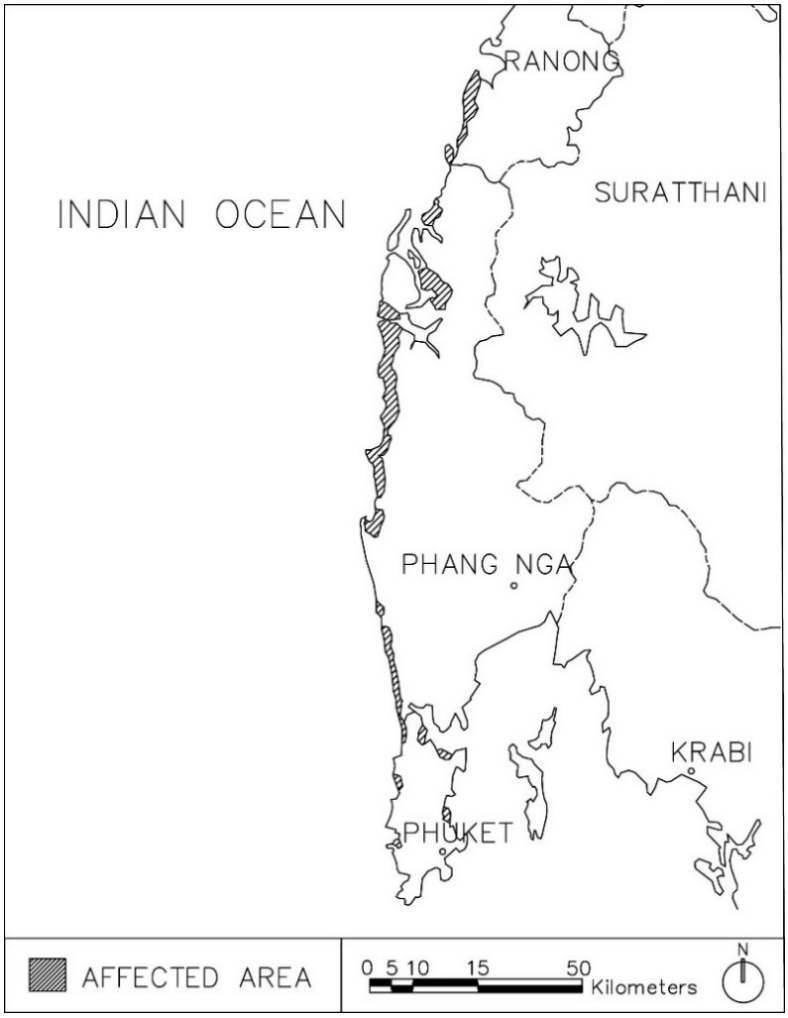

Figure 2.1 Affected area of the tsunami

Source: Department of Public Works and City and Country Planning

http://www.dpt.go.th/Tsunami/

A summary of the damage caused as a result of the tsunami produced by the Department of Disaster Prevention and Mitigation (2006), concluded that the total killed, including both Thai and foreign tourists, was 5,395, with 2,817 missing and 8,457 injured. The loss of property was valued at 14,938 million baht and 4,806 houses were damaged (table 2.1). Economic loss was valued at 13,101 million baht, the majority of which related to fishery at 1,808 million baht.

Table 2.1 Affected area, damage, and losses

Affected area (province)		**Number of victims**		**Number of houses damaged**		
Province	**Number of affected villages**	**Households**	**Human**	**Whole house**	**Part of house**	**Total (houses)**
Phang Nga	69	4,394	19,509	1,904	604	2,508
Krabi	112	2,759	15,812	396	262	658
Phuket	58	2,613	13,065	742	291	1,033
Ranong	47	1,509	5,942	224	111	335
Trang	51	660	1,302	34	156	190
Satul	70	82	2,920	2	80	82
Total	**407**	**12,017**	**58,550**	**3,302**	**1,504**	**4,806**

Source: Department of Disaster Prevention and Mitigation, Ministry of Interior

http://www.dpt.go.th/Tsunami/

2.2 Overview of post-tsunami housing in Thailand

The Ministry of Interior's Department of Disaster Prevention and Mitigation reported that after the tsunami, 4,110 permanent house construction proposals were received. Of this figure, the Thai Government were required to build 3,558 permanent houses with a construction budget of around 100,000 baht for each, while a further 552 cases obtained compensation of 30,000 baht. Several government organisations were assigned to deal with such construction in the affected areas[2] (Department of Public Works and Town and Country Planning, 2006).

Two organisations were mainly involved in post-tsunami housing projects namely, the Land Department (DL) and the Department of Public Works and Town and Country Planning (DPT). DL provided support on land issues by operating on damaged or lost land documents while the DPT worked on rehabilitating affected areas by examining strength of building

[2] Information updated on 31 July 2006

structures and planning for community rehabilitation and infrastructure support, including land readjustment for development, especially in the provision of house designs.

Three post-tsunami house designs were provided with different details and space arrangements. Type-A is two-storey house with a floor area of 32 sqm; Type-B is single-storey house with a floor area of 43 sqm; and Type-C is a stilt house with a floor area measuring 58 sqm (Figure 2.2). These house designs were applied by the government departments responsible for house construction in the affected provinces, while planning came under the responsibility of the DPT.

Figure 2.2 Post-tsunami house designs by the DPT

Source: Department of Public Works and City and Country Planning

http://www.dpt.go.th/Tsunami/

The Royal Thai Air Force was responsible for building 161 houses in four villages of the Ranong Province. The Treasury Department took responsibility for the construction of 453 houses in Phang Nga Province in the Takuapa District and Bang Muang Sub-District. The National Housing Authority took responsibility for house construction in Trang Province,

using a design for 33 houses derived from Type-A. The Royal Thai Navy was responsible for constructing 104 houses in Phuket Province, 80 houses for Hua Laam village in Krabi, and 2,778 houses on Pi Pi Island (Department of Public Works and Town and Country Planning, 2006).

In addition to the support from government departments, both domestic and international assistance was provided from the NGO, charity organization and private sector. The house designs differed, according to the organisation involved in the design process and construction. For example, many villages, including Nam Khem in the Bang Muang District of Phang Nga Province were assisted by various organisations (figure 2.3). Pru Tiew village was supported by the Rotary Club, Baan Pak Jok in Koh Pra Thong was supported by Lions Club International, Malteser International in the Bangsak area etc. However, there is no substantive record of the number of post-tsunami houses built by the various organisations, since the properties were offered to the villages directly without local government being informed.

Figure 2.3 Provided houses support by NGO;
Pru Tiew village (left), and Baan Pak Jok in Koh Pra Thong (right)

In addition, the government's Community Organizations Development Institute (CODI)[3] has the main role of providing housing for low-income people in Thailand. CODI provided assistance for post-tsunami housing construction and repairs to damaged houses, including community rehabilitation by promoting participation in house design and planning in accordance with community lifestyles.

[3] The Community Organization Development Institute (CODI) is a government organization established under the Federal Act in 1999, and now under the supervision of the Ministry of Social Development and Human Security.

In particular, CODI had an important role to support the villages or communities who faced land issues such as the “tenant house group”, which was formed by people who had rented houses in the village for a long time but did not have a census registration and therefore lacked proof that they were living in the community. Examples of these are the Baan Mankong project 1[4] (Figure 2.4) and Baan Mankong project 2 in Nam Khem village. In addition, CODI supported development and rehabilitation by establishing a community management organisation as a mechanism for coordinating aid. CODI also provided housing aid for people with land conflicts caused by limitations in the assistance provided by other government departments.

Figure 2.4 Baan Mankong project 1 in Nam Khem village by CODI

Source: Chumchonthai Foundation

[4] The Baan Mankong project is a model used by CODI to support low-income people in having their own house. The meaning of Baan Mankong is security in housing.

2.3 Conflict after the tsunami

After the tsunami, land conflict problems affected the housing construction in many villages since the Andaman Sea and its coastal areas are key areas of marine natural resources and come under the supervision of governmental departments. In addition, the beautiful sea and beaches have become famous tourist attractions, creating interest for investors in tourism development. Many villagers cannot return to their land, especially those who previously lived near the coastal areas, including Thai fishermen and Chao Lay. Since there was no evidence of land ownership because they had settled for a long time on government land such as that of the National Parks, Land Department, Treasury Department, or land in the private sectors where the land titles overlap with land tenure of communities.

To deal with the issue of land conflict, the government appointed a Land Commission to solve the issue in six provinces. The commission was chaired by Mr Surin Pigulthong (Field Marshal) and CODI was appointed secretary. As a result, 1,156 households in 13 communities were approved to live on the land permanently in 2006 (Chumchonthai, 2015).

However, even though the land conflict problem was resolved by proving the settlement period, despite the appointment of the committee, problems in the private sector still exist in certain areas, such as the Rawai community in Phuket Province and Tubtawan village in Phang Nga Province. There have been many cases where communities have conflicted with government departments: 44 have conflicted with the Forestry Department, 27 with the Department of Marine and Coastal Resources, 24 with the Department of National Parks, 27 with the Department of Land, 8 with the Marine Department, and 8 with the Treasury Department.

Table 2.2 Land conflict areas

Province	**Number of affected communities**	**Number of affected households**
Ranong	2	156
Phang Nga	7	411
Phuket	10	1,465
Krabi	7	210
Trang	2	16
Total	28	2,258

Source: Andaman Community Rights and Legal Aid Center in 2006 (Tsunami: Waves of Reform, 2015)

2.4 Policies regarding the ethnic minority of Chao Lay

Accoding to Agenda of Director of the Subcommittee, integration policies to rehabilitate lifestyles and resolve ethnic minority of Chao Lay problems[5]. The land conflict issue mentioned above mainly affected the Chao Lay after the tsunami because their peaceful way of life was heavily reliant on nature. Their lack of knowledge on the law caused difficulties in keeping their traditional lifestyles, as the declaration from the Department of National Parks concerning the preservation of aquatic animals and tourism affected the Chao Lay because they were unable to continue their traditional livelihoods. Particularly, a major problem is housing instability since more than 25 communities have no land documents and some have conflicts with the private sector, including 15 cemeteries, and sacred areas for worship. Most of the conflicts are in areas where the policy of large scale tourism causes overlay, as well as those related to the sea and the use of traditional fishing equipment.

These vulnerable groups should be protected to maintain their cultural diversity and human rights. Several issues were raised in relation to cultural sensitivity, livelihoods, and residential security and restrictions, to find ways of sustaining their distinctive lifestyle. As a result, on 2 June 2010, the Ministry approved in principle the policy to rehabilitate the livelihoods of Chao Lay. The Ministry of Culture assigned responsibility to the relevant authorities to bring the plan into action, consisting of short and long-term measures as follows:

To provide security on housing and preparing Community Land Titles for special cultural districts of ethnic of Chao Lay within six to twelve months. In addition, residential rights were to be proved through aerial photographs and means other than just documentation. In particular, the Land Commission was appointed to fix the problem by proving the land for Chao Lay under the responsibility of the Ministry of Interior and the Ministry of Natural Resources. Chao Lay are allowed to fish or collect sea resources, and the original fishermen are able to make a living in parks and other conservation areas. In addition, since the water-way entrance of the village is closed due to it overlapping the tourist areas, fishing policies are in place under the the responsibility of the Department of Natural Resources and Environment, and the Ministry of Agriculture and Cooperatives[6].

[5] Agenda of Director of the Subcommittee, integration policies to rehabilitate lifestyles and resolve ethnic minority of Chao Lay problems. No. 2/2013 on Tuesday, November 5, 2013 at 14:00 pm. At Room 101, 1st floor, Prime Minister's Office, Government House.

[6] The policies also cover other aspects such as helping to restore the health facilities, troubleshooting for nationality groups with no identification, promoting education for children, and tackling ethnic bias

However, according to reports not much progress has been made due to structural problems involving several agencies. The solution therefore requires the cooperation of the public and private sectors, as well as the ethnic of Chao Lay themselves. On 1 March 2013, the Prime Minister signed an appointment for the Board of Directors Integrate Policies to Rehabilitate Lifestyle and Resolve the Chao Lay's Ethnic Problems.

2.5 Chapter conclusion

In 2004, the Indian Ocean tsunami had a widespread effect on coastal areas, covering six provinces of Southern Thailand with Phang Nga being the most affected. The overview of post-tsunami housing assistance for damaged houses, mostly under the supervision of the Thai Government, can be estimated at around 74%. The house designs provided by the Department of Public Works and Town and Country Planning consisted of three types, and were constructed in each of the affected provinces under the direction of several departments. Post-tsunami houses were also provided directly by other agencies. Moreover, the government under CODI had an important role in pushing through the post-tsunami housing projects for people affected by land problems. Such issues include Thai people who were living in the area and rented houses, and people who had land conflicts with the private sector and government departments, in particular, fishermen and the Chao Lay or Sea Gypsies. A Land Commission was established to consider land tenure before the tsunami. This action was taken not only to solve land conflict issues in many areas but also for policy making to rehabilitate livelihoods and resolve problems faced by the ethnic minority of Chao Lay. The policies include several social issues faced by the Chao Lay such as housing security and the limitation of livelihoods in areas that overlay the government departments and private sectors.

by promoting community language and culture. In addition, a long-term policy of one to three years in which to consider special cultural districts conducive to ethnic groups with a cultural specificity.

CHAPTER 3: THE MOKLEN ETHNIC MINORITY AND THEIR HOUSES

3.1 Ethnic minority of Chao Lay in Thailand

Ethnic minorities in Thailand are scattered over several regions. For example, *Hill Tribes* have settled in the mountainous area of the Northern and Western regions, *Khmer* and *Soai* in the East, and *Phuthai* and *Yuan* in the Northwest. In Southern regions *Chao Nam*, *Orang Laut*, and Chao Lay have settled on the coastal areas and islands (Kruahong, 1973, 2–3). Chao Nam[7] or Chao Lay[8] settled on coastal areas of the Indian Ocean and Andaman Sea. They migrated and have settled in Ranong, Phang Nga, Phuket, Krabi, and Satul and due to their small numbers, they are scattered in many places. These ethnic minorities are not well-known and have not received attention from the outside world.

There are research studies referring to the origin of the Chao Lay which indicate that in the past they lived along the Yangtze River Basin in China, and then migrated south down the Khong River to the Indochina Cape and wandered among the islands to Myanmar and Cape Malay. According to reports, old equipment and traditional items were discovered, leading to the presumption that Chao Lay are Malay people (Pern B. R., 1965, cited in Kruahong, 1998).

Chao Lay is from Southern Thailand means derived from Sea People. The Chao Lay traditionally lived in the sea and spent most of lives on a boat, which they used as both a house and vehicle to work on islands in the Andaman Sea. Since this is a nomadic life, they were known as Sea Gypsies (Arunothai, 2014: 28). Their livelihoods were mostly related to the sea, such as diving or trapping shellfish, shrimp, crab, and other sea resources. More recently, the Chao Lay have settled permanently on the coastal areas and islands, becoming employees of the tourist industry or working in occupations unrelated to the sea, such as gardeners, construction workers, shop assistants, etc. (Arunothai, 2014: 29).

Nowadays, there are 41 Chao Lay communities in Southern Thailand consisting of 2,758 households, with an approximate population of 12,000 scattered around five provinces on the Andaman Sea coast. There are five communities in Phuket, 20 in Phang Nga, three in Ranong, 10 in Krabi and three in Satul (Chumchonthai Foundation, 2012: 11). Chao Lay has three sub-groups namely, Moken, Urak Lavoy and Moklen, each with a different culture.

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[7] "Chao Nam" in Thai means "Water people". *Chao* meaning people and *Nam* meaning water. However, because *Nam* has a negative meaning so *Chao Lay* is more acceptable (Sirindhorn Anthropology Centre, 2014: 49).

[8] "Chao Lay" in Thai, is derived from Chao meaning people and *Talay* meaning sea.

Three sub-groups of Chao Lay have a comparable language and culture, however, there are differences in the details. For example, although they use an Austronesian language, it is similar for the Moklen and Moken, while the Urak Lavoy have an obvious dissimilar language. Regarding the type of boats, they use for their livelihoods, the Moklen and Urak Lavoy use a dredge boat with plank gunwales, while the Moken, use a *Kabang* created from wintergreen wood. This boat has a roof since it travels further out to the sea than the other two sub-groups. Nowadays, Moklen and Urak Lavoy are permanently settled and also work in coastal fisheries, gardens, and other employment. Moreover, they have adopted other cultures and often refer to themselves as Thai Mai or New Thai. However, the Moken still maintain more of their traditional culture than the other sub-groups (Thongtaweewiwat, 2006).

The settlements of Chao Lay in Thailand can be roughly defined by clusters of sub-groups (Figure 3.1). The Moken still retains the traditional lifestyle relating to the sea. Most of them have settled on the islands in Phang Nga Province such as Lhao Island, Sin Hai Island, Surin Island, and some in Rawai village in Phuket Province. The Moken population stands at approximately 2,100. The Urak Lavoy has settled in the provinces of Satul, Phuket, and Krabi, with a population of approximately 6,200. The last sub-group is Moklen who have settled along the coastal areas, blending their lifestyle with that of the Thai people. There are 20 villages in Takuapa and Tai Muang districts in Phang Nga Province. The population is approximately 3,700 people (Chumchonthai Foundation, 2012: 11–12).

Figure 3.1 Location of Chao Lay settlements in Southern Thailand

Source: Sirindhorn Anthropology Centre, 2015

3.2 Moklen traditional lifestyle

The Moklen has received less attention than other sub-groups since it has been on land for so long that the traditional culture is disappearing since it has been integrated with that of the region. In addition, the Moklen are located away from tourist areas or deep inland without any common points of interest.

3.2.1 History of Moklen

In contrast to Moken, the origin of Moklen is related to slave history as evidenced by the construction of the temple at Nakorn Sri Thammarat. The Moklen were taken as slave labour, causing a strained relationship of being governed. The tenth month ceremony is an example: Thais will give sweets and things for the Moklen to use as offerings to the spirits of their ancestors, which is similar to the past relationship of slave merchant and Moklen (Ferrari, et.al, 2005).

3.2.2 Religion and beliefs

The Moklen traditionally are animists who believe and pay respect to spirits of ancestors and nature, especially those lurking in the sea and forest. Their faith in holy fathers is central to the community; for example, *Porta Sampan* in the Moklen Bang Sak area, *Porta Luang Jak* of Moklen Lumpi village, and so on. Cemeteries are important to the Moklen and traditionally, when someone dies *Bohmoh* who is the spiritual leader of the Moklen people, finds a place under a tree for burial. The Moklen are buried in a cemetery with other members of their family and the rites are always held at the same place. After the tsunami, many Moklen village cemeteries became land conflicted.

Nowadays, following their settlement on land, the Moklen have adopted other religions such as Buddhism, Islam, or Christianity, due to the influence of the local population. For example, Buddhist altars can be found in many houses in Moklen villages. There has been an increase in Christianity, especially following the tsunami when new houses were built for residents by Christian, such as the Moklen communities in Baan Nam Khem and Tubpla. However, as they continue to believe in ancestral spirits, porcelain cups for worship can still be seen hanging in the houses.

3.2.3 Traditions and rituals

Moklen rituals are associated with religion and beliefs, including ceremonial offerings to spirits of ancestors and nature, as with the Moklen in Kukkak Sub-District. Ceremonial

offerings are held at the shrine, where flags are bound to a pole and a shaman (medium) will climb up it to contact the spirits.

In the fourth month of the lunar calendar, a ritual is held at the shrine for ancestor worship. The offerings are placed on a litter, there is glutinous rice roasted in bamboo joints, food cooked from tortoises and chickens, includes liquor, desserts, betel, incense, and candles; this is to give respect and common spirit. After rituals finished at the shrine, they will continue into the night when the *Bohmoh* go to each house. During the tsunami, the breakage and loss of ancestral cups meant a lack of central integration for the ritual activities of the family (Sirindhorn Anthropology Centre, 2015).

The fifth lunar month ceremony involves taking an oath at the shrine to ask for success, and in the tenth month, the Moklen perform another ceremony where they take a bowl to the temple for merit and bring sweets to the house, although this is actually a Thai ritual. Moreover, the Moklen also have rituals associated with rice cultivation and the holy spirit of nature is summoned at the shrine to bless and preserve the rice grains. However, such ceremonies are now rare as the rice culture is slowly disappearing (Sirindhorn Anthropology Centre, 2015).

3.2.4 Livelihood

Nowadays, several Moklen villages no longer have traditional livelihoods with the sea, and some households turn to other work such as becoming gardeners or other employment. However, certain groups living close to the sea and forest continue to be involved in diving for clams and leeches or fishing with the use of equipment such as nets and traps. The Moklen have diverse lifestyles and in the past some communities grew rice on the coastal plain. The animals are freely raised in the village.

In the past, Moklen fishermen had a fulfilling lifestyle as they had rice and plenty of seafood. However, with the expansion of the tin mines and coconut plantations, Moklen turned to other work, such as on rice farms, to provide for necessities and share some of the landowner's benefits.

After the tsunami, many affected communities are less involved in fishing. This is because many fishermen died during the tsunami, and relatives who lost family members are afraid to go out to sea, not only for their safety but the potential loss of their boat and equipment, especially the decrease of sea resources because of changes after the tsunami. In addition, fishing is not something that can be done all year, especially in the monsoon season when it can be dangerous to sail. Thus, they collect sea resources along the coast out of season, and also take other jobs. The younger generation of Moklen prefer to earn a regular income.

3.2.5 Landownership

Originally, most of Moklen people have no own land and lack of knowledge in landownership, in history, some of them were provided land from Thailand dynasty. However, Moklen sell the land as kind of people do not collect property and necessity to support family in modern way of life. Also, the right on land based on village headmen, some cases Moklen people were allowed own land or use but after change the headman, the right on land changed. A case study in Baan Tungdab in Koh Phrathong (Ferrari et.al, 2006), Phang Nga province, the landownership of Moklen can be transfered in two ways, originally, when the landowner dead, the land will be own by youngest child of family who take care and live in the house with them. Another way of land transfer was initiated in a conservation that it should be used after the tsunami. The land can be transferred to a family member such as a case of a brother of landowner that can own a part of land with the conditions of taking care child of owner, in case they still too young. However, it seems there is no certain rule after the house type change to be modern and the land transfer in universal concept gradually influent to them.

3.2.6 Moklen houses

Traditionally, Moklen houses were built on stilts as this method offered protection from animals and wildlife. Nowadays, with environmental changes, it is not necessary to raise the floor as before, which was also less convenient. The stilt house also provides advantages because Southern Thailand has a long rainy season, which causes high moisture in the air. Creating a house on the ground gives poor ventilation, and the area under the stilt floor is also beneficial to animals (Figure 3.2). Moklen traditional housing used local, natural materials, depending on the area, such as tree trunks, mangrove forest trees, bamboo for the walls, and nipa palm leaves for the roof (Figure 3.3).

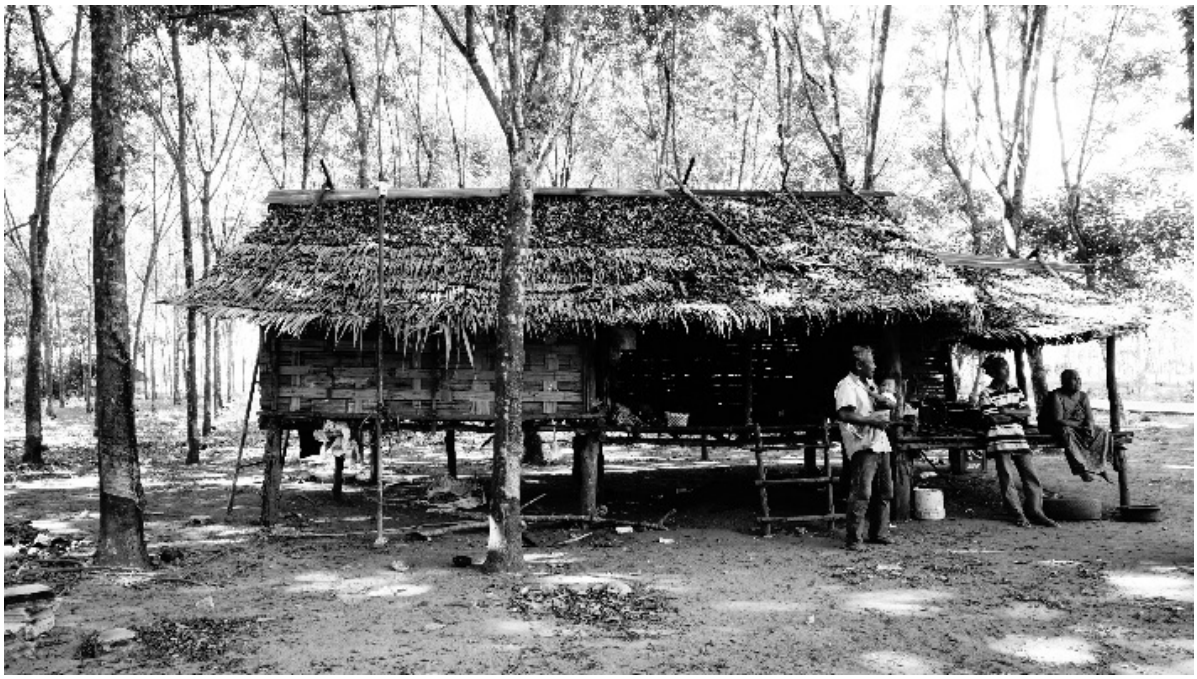

Figure 3.2 Moklen ethnic house

Figure 3.3 Kitchen area with shelf and bamboo floor (left), Bamboo floor steps (right-top) and joint details (right-bottom)

The Moklen house represents tropical architecture, as the raised floor with its porous components helps ventilate air, and the thatched roof does not accumulate heat. The porous bamboo wall also benefits residents, especially at night when the Moklen often set a fire in the house to smoke out mosquitoes and other insects. However, this is unsafe, and the government does not support it as the fire may destroy the house and surrounding area. The use of electricity has been suggested instead.

The functional areas of the Moklen house is divided according to the preference of family members. Parents are usually in the front area and children in the room behind. The Moklen place importance on daughters since the size of the house is based on the number of daughters in the family, and sometimes the room has a door. In some houses the extra room is used for storage, especially if the family is involved in rice agriculture, when the room is used to store rice. The kitchen is at the back of the house and there is a fireplace inside for cooking (Figure 3.4).

The Moklen family regarding on her daughter in house extension as the number of rooms refers from them. The house extension often extends in the short house span. The room will be added between bedroom and kitchen. Also, when there is an marriage of their daughter, she can decide to split the house or living with their parents. Oppositely, the son usually sleeps with his parents, then when they grow enough they will build their house in the area or leaving to other places.

Another special characteristic of the Moklen house is the eaves area with built-in shelves which is created within the structure of the building before the bamboo walls are added. In the past, Moklen houses had no front porch, but nowadays many houses have this addition, and it is used for work and family meetings. There are two stairs at both the front and back of the house for separate use of functional areas, living area at the front and kitchen at the back of the house for example when there are guests visit. In addition, in the Moklen believe the number of stairs' steps are odd number such as 3 steps or 5 steps.

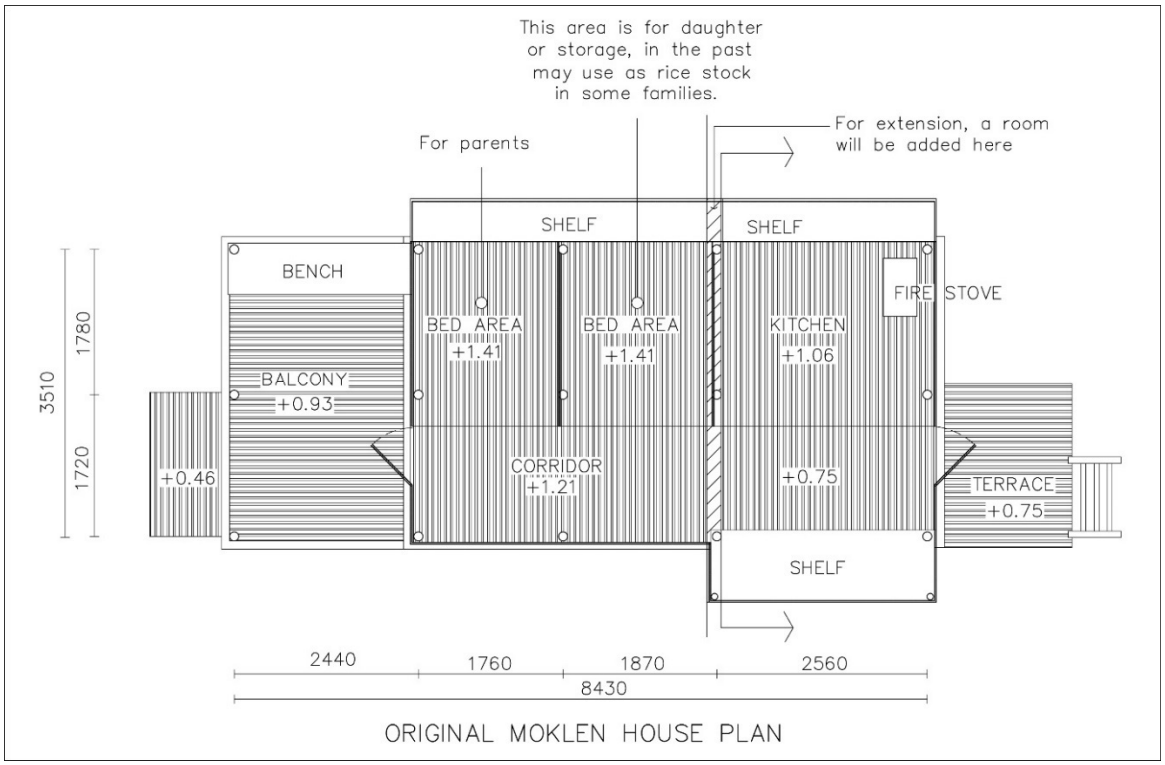

Figure 3.4 Original Moklen house plan (based on a Moklen house in Tubpla village)

Nowadays, the number of Moklen houses has decrease due to the rarity of materials and permission being required from the landowner. The lifespan of the house is relatively short since it is not a permanent structure, as well as needing frequent repair. The modern Moklen houses look like other houses in Southern Thailand, with modern materials used in construction. Sometimes agencies provide assistance with the building of a new, more permanent house.

3.3 Building technology used in Moklen ethnic houses

The 2004 Indian Ocean tsunami was a serious event for the Moklen, affecting their houses and land (Chumchonthai Foundation, 2012). Some villages relocated inland for future safety, but others have retained their original livelihoods but are being transformed by modernisation. Moklen ethnic houses are fast disappearing, and as such, life-changing. The house styles are simple and temporary, but uniquely and originally developed by the Moklen's indigenous knowledge and techniques. This section aims to present their housing culture.

3.3.1 The construction of a Moklen house

A field survey of Moklen villages in the Takuapa and Tai Muang Districts of Phang Nga Province in 2013, found that most of the Moklen house forms had changed. Traditional Moklen houses can be found in Tubpla village in the Tai Muang District (Figure 3.5). The construction project began with the idea of creating a house to support visitors to the village also support ecotourism project[9]. With the support of the village leader, a newly built house was created through the collaboration of elder Moklen and skilled villagers. The construction of a traditional Moklen house preserves the cultural aspect of Moklen ethnicity still further. The project started at the end of February and was finished by the middle of March 2014 (Figure 3.6).

3.3.2 Tubpla Moklen village

The Tubpla community has a current population of around 900, of which more than 80% are Moklen. The tsunami in 2004 caused the deaths of seven Tubpla villagers. Several vessels were shipwrecked, and equipment and livelihoods were destroyed. However, although houses in the community were not damaged, the tsunami still had an effect. Due to the loss and damage caused, organisations provided aid to the affected community, and the Rotary Club provided new two-storey prefabricated houses—permanent blockhouses to replace the traditional Moklen houses (Chuchart, interview, 2014). Modernisation has also had an impact by changing the appearance of the Moklen house.

[9] The ecotourism project was initiated in 2011 by the village leader who was accustomed to working with mangroves nearby, and saw the potential in terms of natural. The concept of the ecotourism project is to promote tourism in the village. This project will be beneficial to the community in creating jobs and promoting economic recovery. The ecotourism project is supported by two NGOs, who have jointly prepared a programme for developing the Moklen community with the intention of economic recovery and sustainability by supporting activities of ecotourism such as study trips to different areas and joint building projects.

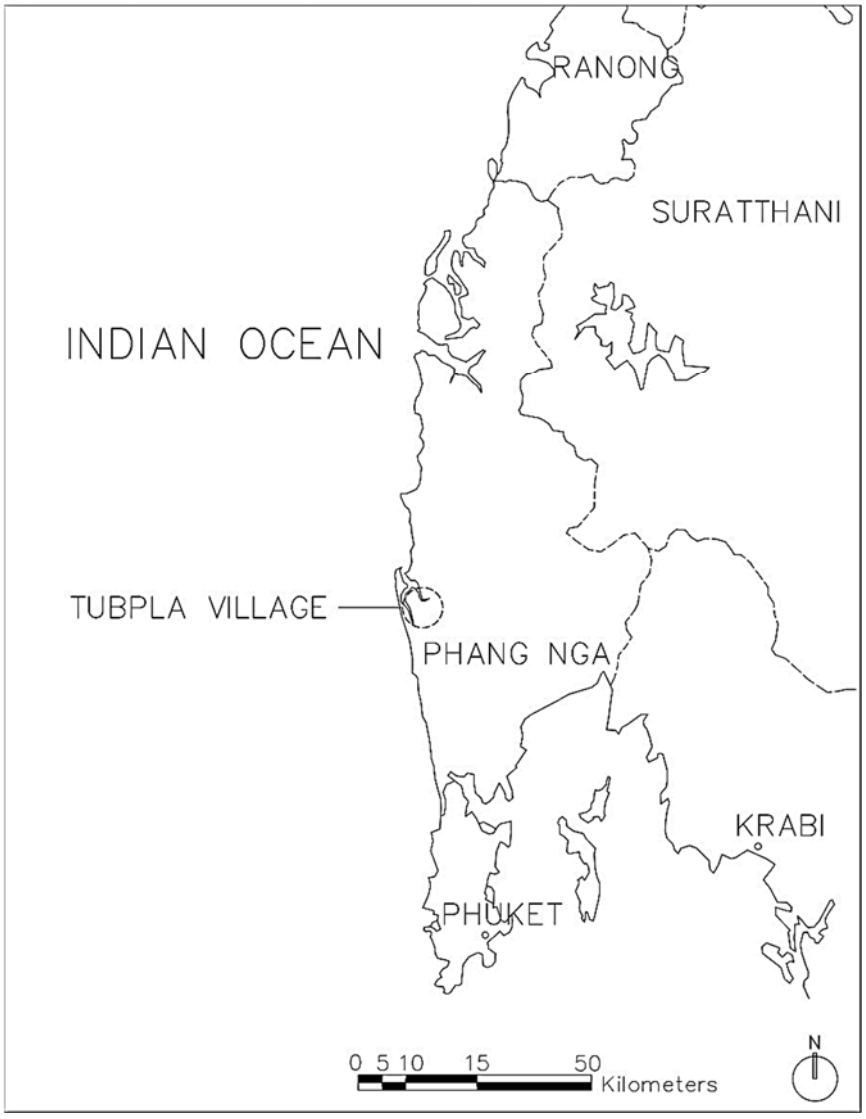

Figure 3.5 Location of Tubpla village

In addition to the impact of the tsunami, urban development has also affected many Moklen communities due to their locations. A new access road is rapidly changing the village, bringing influences in the form of modern conveniences and readily available house building materials. This may be due to the fact that the Moklen ethnic houses made from natural materials are not durable and subject to a change in values of the Moklen people. Meanwhile, the application of knowledge and materials is also used in combination with modern house construction.

Figure 3.6 Construction project of Moklen ethnic house

The construction materials originally came from the accessible mangrove area known as Pa Kongkang Klong Thung Maprao, and the restrictions subsequently imposed, created limitations in building the Moklen house. Following the issue of the Reserved Forest Act in 1954 (Kittipat, interview, 2014), resources from mangroves came under the Department of Marine and Coastal Resources, and wood cutting in large quantities for construction is illegal, unless prior authority is obtained from an officer of the department.

Currently, the situation in the *Klong Mapraw* mangrove forest means that it is not able support the construction of a Moklen house. Certain kinds of tree such as the *Taboon* (Xylocarpus), which is used for the main construction is difficult to find since the Forestry Department strictly prohibits this kind of tree cutting. In the past, investors cut a large number

of trees to make scaffolding for construction, such as *Samae* (Avicennia) and *Prong* (Ceriops), while villagers also used them for fishing equipment, causing a rapid reduction of trees in the mangrove area. In addition, each kind of tree has a different use in house construction (Table 3.1).

Table 3.1 Construction materials and sources

Material	Component	Type of material	Source	Owner
Wood	Main component	Taboon (Xylocarpus), Fad Dok Dang (Lumnizera), Samae (Avicennia)	Mangrove forest	Department of Marine and Coastal Resources (DMCR)
	Sub-component	Samae (Avicennia), Prong (Ceriops), Tua (Bruguira)	Mangrove forest	DMCR
Bamboo	Floor and wall panels	Pai Paa (Bambusa Bambos (L.) Voss), Pai Kreab (Melocanna humilis Kurz)	Neighbourhood	Private landowner
Rattan	Rattan rope	_	Neighbourhood	Private landowner
Nipa palm	Roof Panel	Chak Sakoo (Metroxylon sagu), Chak Talay (Nypa fruticans Wurmb)	Market	_
Wood stripper	Ridge	Ta-khian (Hopea odorata)	Neighbourhood	Private landowner

3.3.3 Features of a Moklen house

Architectural form

- Floor plan

There are two types of Moklen house, according to the number of pillars. Six pillars create a small design, and are easy and quick to build. Nine pillars provide the standard house type with a width of around four metres and five metres in length. A rectangular shaped area is arranged and managed by the elevated floor inside, with walls adapted following accordance with the requirements of the house owner. The intention is to create a central house for visitors to the community, and thus the area in front of the house is open to support activities. The house consists of a living area, sleeping area,

and kitchen, while a patio (nork charn) is used for work during the day (Figure 3.7). The Moklen gives priority to daughters, with the size of the house depending on the number of daughters, and can be expanded by adding to the sleeping area.

- House dimensions

At present, Moklen houses usually have a floor level height of around one metre, with the space underneath used for keeping animals. However, in the past, houses were built in the forest so it was built higher to prevent danger from wild animals, and the height of the floor level was approximately 1.60–1.70 m. The total height of the house is generally around 3 m., and the highest level at the top of the gable roof is approximately 4.50 m., with the roof sloping at nearly 40 degrees.

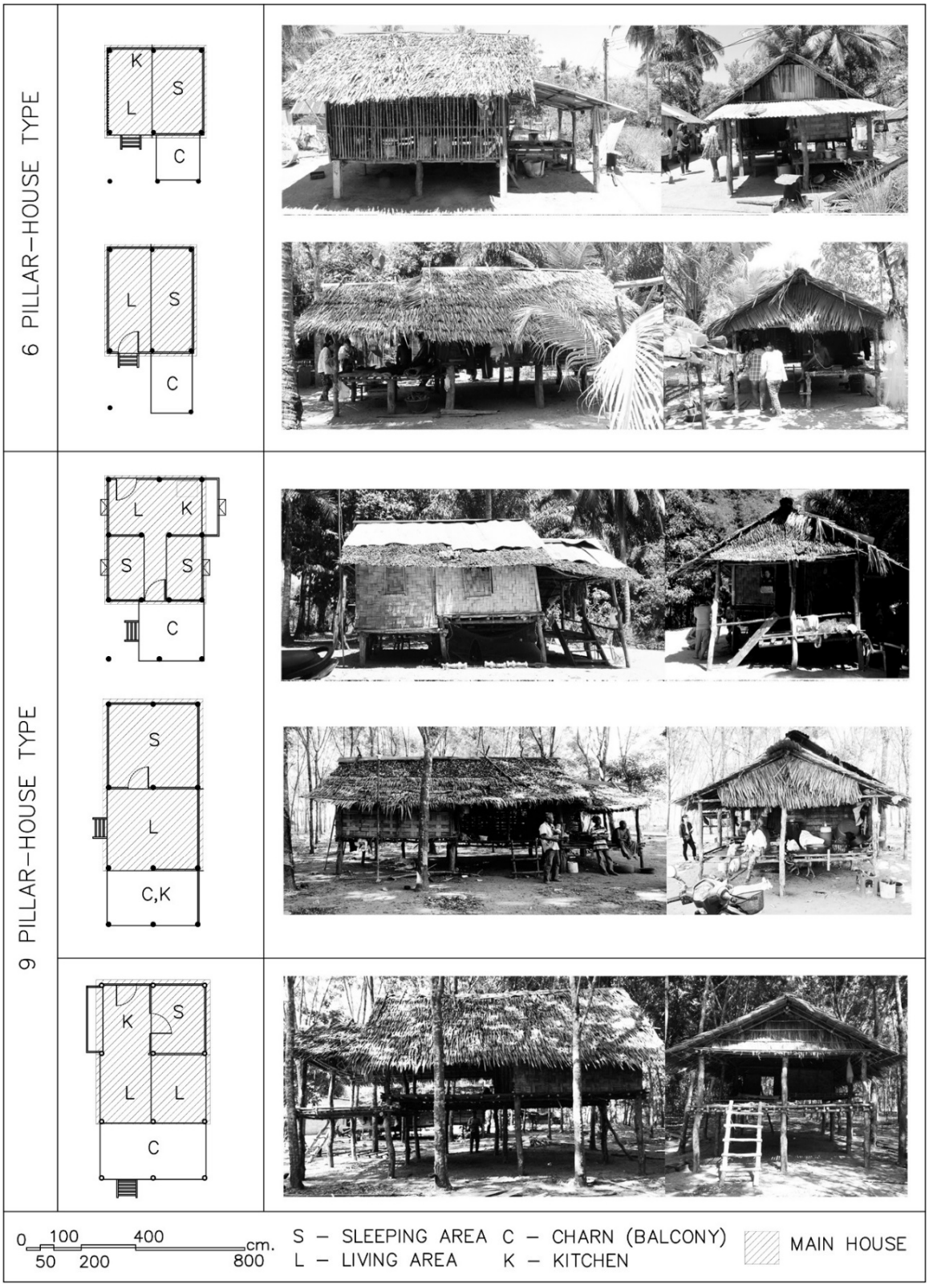

Figure 3.7 Types of Moklen houses in the area

The house construction projects are at the bottom of the picture.

3.3.4 Construction process and techniques

The construction materials collected, and wood cut from mangroves show that the Tubpla community has a deep understanding of the area. They know the best locations for cutting wood, the grouping of trees, and types of wood suitable for construction. However, some construction materials cannot come from nature like before, so it is necessary to request permission and purchase them from landowners. At the preparation stage, lengths of material are prepared before assembly. The past method has changed since the components are now prepared in sizes, which fit perfectly with the assembly and construction. However, for this particular construction, the builders chose to cut the timber after installation. Other components are prepared such as weaved bamboo walls, roof units, etc.

Construction process

The process of construction of the Moklen ethnic house is as follows (Figure 3.8):

- The main pillar at the centre of the house is the most important component. A ritual takes place at the main pillar hole to ask for protection from the spirit of the place, and this pillar is then used as a reference for the rest.
- Wooden scaffolds are used to make the *pae wien* (roof beam) around the house to strengthen the whole structure frame. The same scaffolds will then be moved up to be used for the roof structure.
- The main floor structure is installed, paving the roof units, to prevent rain from coming in and provide shade when working on the floor structure. Next, a plain wall frame is made, including a shelf structure, followed by the installation of pre-prepared bamboo walls and doors.
- The front patio is an important element of the Moklen ethnic house. When the building is complete, a *nok charn* is added by joining the pillars to the main building.

Construction techniques

The principle of the Moklen house is a bundle structure where dual components are bound together by rattan rope in order for them to be attached to another component, as detailed in Figure 3.9. The Moklen have mostly continued to keep the traditional forms and methods of construction as well as using original equipment such as axes and machetes. However, modern equipment such as a saw is used to make things easier.

Data collected from the beginning of the whole process was documented and revealed the conditions necessary to construct a Moklen ethnic house, and potential problems involved. This is useful for future local resource management planning during the construction process. The budget for the house construction is shown in Table 3.2.

Table 3.2 Cost of Moklen ethnic house construction

Item	**Description**	**Cost** (Thai baht)
Cost of Materials		
Wood cutting (main component)	Labour cost, fuel, and equipment	12,000 (340 USD)
Wood cutting and other (sub-component)	Labour cost, fuel, and equipment	12,800 (263 USD)
Roof panels and other	Roof panels (300 pieces) , fuel, and equipment	6,400 (182 USD)
Labour Cost for Construction		
Main construction	Pillars, floor, and roof structure	17,200 (488 USD)
Sub-construction and details	Flooring, wall installation, and roofing	8,300 (235 USD)
		56,700 (1,610 USD)

Figure 3.8 Construction process of the Moklen ethnic house

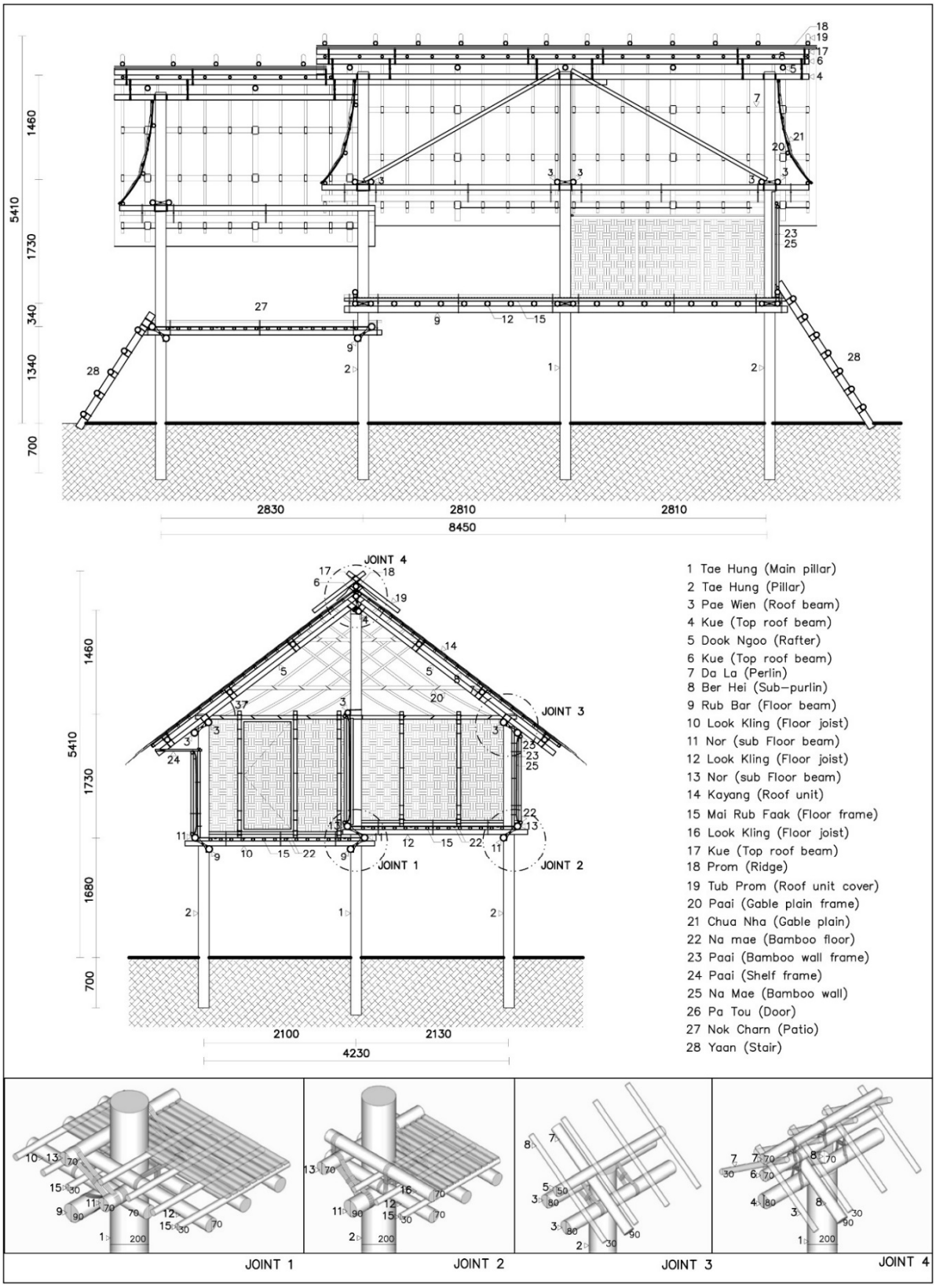

Figure 3.9 Construction process and joint details of the Moklen ethnic house

3.3.5 Design methodology

Body-based units of measurement

Body-based measurements are used in the construction of Moklen houses. The knowledge of using parts of the body in building design has been passed from generation to generation. It is used for designing house plans and measuring the size and length of components. According to research, the Moklen use units based on the hand (H), arm (A), and other parts of the body (B). For example, the measurement from the navel to the floor, etc., as summarised below (Table 3.3).

Table 3.3. Moklen scale measurements using body-based units

		Moklen (elder)	**Moklen**	**Other (Thai)**	**Length (cm)**
			Body height (L)		165
1	H-1	_	Kor	_	2.5
2	H-2	Da Lui Ngan	_	Niew	10
3	H-3	Ar Eu Kam	_	Kueb	14
4	A-1	_	Hut	Sok Klom	35
5	A-2	_	Hut	Sok Shee	46
6	A-3	Ar Hut	_	Sok	47
7	A-4	Per Ark	Per Ark	_	67
8	A-5	Da Da	Krung Ar Pak	Krung Wa	88
9	A-6	Ar Pak	Ar Pak	Wa	170
10	B-1	_	_	Met	100

The elder Moklen still use their own language for the names of measurement units, while since merging with the Thai culture, the younger generation include international measurement units. The knowledge of body-based units of measurement is apparent in the construction project. The units used in the construction of a Moklen house are shown with grey bars. It was also found that each generation of Moklen use different measurements such as (A-3), which is a unit that elder Moklen use, while later generations use (A-2).

Application of units for building forms

- Floor planning

The floor planning of a Moklen house is determined by the arrangement of pillars: nine pillars with three pillars in a row, and three pillars in a column. Wood measured in the required length is used as a ruler for planning the house. The width of the plan is nine times the length of (A-2), with the length twelve times (A-2) to form a rectangular shape. The width and length of the house are divided in half to arrange a span of nine pillars. The pillar holes are prepared and the pillars inserted into the ground.

- Height planning

Height planning for a Moklen house is determined by the length of the pillar and depth of the pillar hole. Three rows of pillars consist of side pillars; nine times the length of (A-2) and centre pillars; twelve times the length of (A-2). All of the pillars are inserted into the prepared hole in the ground at a depth of (A-4). The difference in pillar length; three times the length of (A-2) and the distance of the pillar from the ground, create the slope of the roof 4½x (A-2), at 37 degrees. At floor level, there is no definite principle involved, although it is based on the requirements of the house owner. However, the height of the house owner can be used to determine the level of floor height, which needs to be a minimum of 165 cm.

An interesting result from the study is that Moklen use a proportion of the length of 9x (A-2) and 12x (A-2), both in floor and height planning for a traditional house.

Application of units for building components

The body-based units are applied to the building elements A-2 (Ar Hut, Hut, Sok Shee 46 cm) for measuring the length of the pillar 9x (A-2) and 12x (A-2), and most of the main structural components for the floor and roof will be prepared longer than 1x (A-2) to serve as a space for binding them together. For example, the layout of a building 9x (A-2) and 12x (A-2) long, uses prepared wood measuring 10x (A-2) and 13x (A-2) long, respectively (Table 3.4).

Table 3.4 Length of components using body-based units of measurement

	Moklen	English	Length
1	Tae Hung	Pillar	12x (A-2), 9x (A-2)
2	Pae Wien	Roof beam	13x (A-2), 10x (A-2)
3	Kue	Top roof bean	13x (A-2)
4	Dook Ngoo	Rafter	6x (A-2)
5	Da La	Purlin	13x (A-2)
6	Ber Hei	Sub-purlin	7x (A-2)
7	Rub Bar	Floor beam	13x (A-2)
8	Nor	Sub-floor beam	13x (A-2), 5x (A-2)
9	Look Kling	Floor joist	5x (A-2)
10	Na Mae	Bamboo floor	4 1/2 x (A-2)
11	Ka Yang	Roof unit	4x (A-1)

The measurement applied to the roof units is A-1 (Hut, Sok Klom, 35 cm) and the length of the roof unit is 4x (A-1). Such length contributes to the structural support of the roof units. The unit (H-3) (Ar Eu Kam, Kueb, 14 cm) is used to overlap the distance between the roof units (Figure 3.10). When construction is complete, the following major units will have been used in the design of a Moklen house: A-2 (Ar Hut, Hu, Sok Shee, 46 cm); A-1 (Hut, Sok Klom, 35 cm); H-3 (Ar Eu Kam, Kueb, 14 cm); and A-4 (Per Ark, 67 cm). The Moklen use body-based units for measurement by simple estimated speculation; this is because the elbow is a medium scale that can be applied to both short and long.

Moklen ethnic house construction shows the start of the building process and explains how traditional Moklen form is retained. This also includes the rituals and concepts of construction, and provides knowledge on the access of resources in the selection of construction materials. In particular, the use of body-based measurement units and the application of ten different units for design and construction. The study also shows the different uses for various units in each generation, and found that the most used is the (A-2) and (A-1) or elbow. This is the basic unit of measurement used in almost all parts of the construction process. In addition, the ratio of 9x (A-2) and 12x (A-2) is used both in floor and height planning.

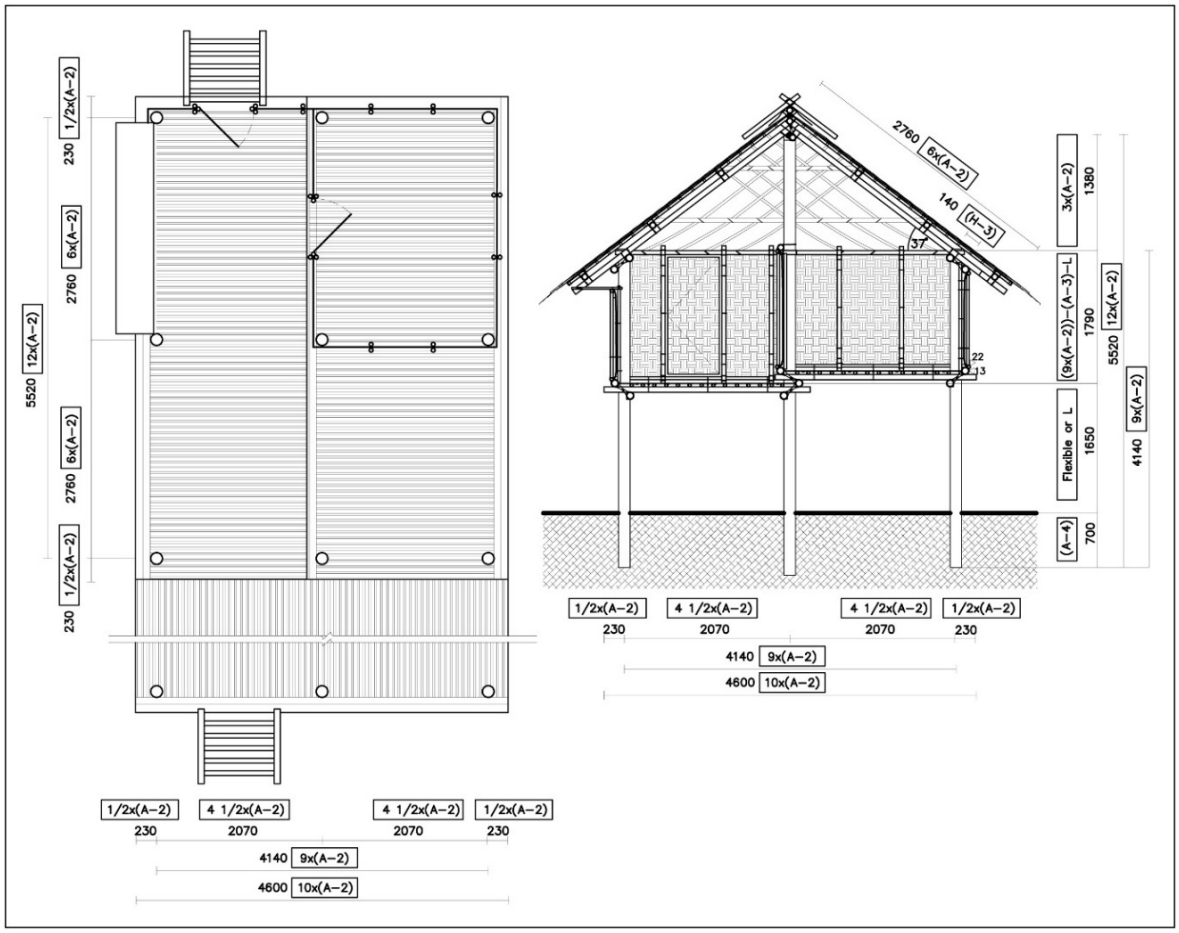

Figure 3.10 Application units for floor and cross-sectional plan of the Moklen ethnic house

However, the results from the survey in July 2015 found that one year after the house was constructed, its function not only support the residents but many visitors as well. Some parts of the house have deteriorated, especially those in frequent use such as the balcony, where the bamboo floor is broken and the rattan ropes are torn. The inside pediment of house was also damaged. In addition, both front and back stairs had been broken on several occasions. At this stage, the condition of the house and durability of construction materials should be collected in order to conserve the house further.

Durability of structure and material

It is not only necessary to have adequate knowledge of the type of materials to use but also the lifespan of each different material, since this affects house maintenance frequency. An interview with a Moklen villager shows that each construction material has a different level of durability as show in Table 3.5.

Table 3.5 Durability of structure and materials

	Materials	**Duration**	**Remarks**
Structure			
Main Structure	Wood	5-10 years	- based on destruction by insects and termites - based on type of wood - the humidity of the ground
Sub-Structure	Wood	10 years	- without insects or termites
Components			
Floor	Bamboo	2-5 years	- based on frequently used area
Wall panel	Bamboo	10 years	
Roof Panel	Palm leaves with bamboo	3-8 years	- based on type of palm leaves Chak Sakoo (Metroxylon sagu) 7-8 years Chak Talay (Nypa fruticans Wurmb) 3 years
Ridge	Wood bark	5 years	
Other			
Rattan rope	Rattan	5 years	- depending on size and frequency of load of the structure

This construction shows that knowledge is passed through the generations, and also shows the construction management of a Moklen house under present conditions. This information will be useful for retaining knowledge of Moklen traditional house construction in the future.

3.4 Chapter conclusion

The Chao Lay is a past vagabond of the sea, using their boats as a house to live in. Nowadays, the Chao Lay has settled permanently on land. Moklen, a sub-group of Chao Lay, have distinctive religions, ritual, livelihoods, and housing culture. The Moklen ethnic house represents vernacular architecture, made from natural materials of the surrounding area and developed in accordance with the local environment and tropical climate of Southern Thailand.

The Moklen ethnic house construction shows how the building process begins and how the traditional Moklen form is retained. This also includes the rituals and concepts of construction. In particular, the use of body-based units of measurement in construction and house design includes specific techniques, demonstrating the knowledge passed down the generations. In particular, it shows the pre-tsunami living conditions.

The tsunami impact caused changes in the characteristics of the Moklen house when they were replaced by modern style houses. Other changes are caused by current conditions such as the influence of modernism and limitations of accessible construction materials owned by the government and private sector. Moklen houses today have changed as the structural details are reduced, resulting in decreased house strength. In addition, modern materials are used for convenience, causing the house value to drop. As to the current situation of the Moklen house, there are guidelines for conservation, planning, repairing, and construction. With the cooperation of related organisations, the community forest can be supported, ecotourism promoted, and cultural activities encouraged in the village, including design ideas integrated with modern style houses to retain knowledge of the Moklen.

CHAPTER 4: POST-TSUNAMI HOUSING FOR MOKLEN PEOPLE

Since Moklen villages along the coastal area in Phang Nga Province were affected by the tsunami, seven projects in four sub-districts were selected to produce an overview and clarify how post-tsunami housing has affected the living conditions of Moklen people. To understand the issues involved: rehabilitation, house characteristics, and use of the area were considered in the study.

A preliminary damage survey report of Moklen villages after the tsunami shows that around 16 villages affected by the tsunami[10]. It caused death of villagers and house damages. Of these, many housing heavily damaged almost of house were destroyed. There were 10 villages the houses were reconstructed; Soi Ongkarn, Soi Willy, Bang Sak (Tubtawan), Bangsak (Malteser), Bang Sak, Ban Ban Rai, Bangkaya, Tungwa, Ban Pak Jok, Ban Tung Dab. There ere two villages the houses were provided by organizations even though there was no house damage as in Tubpla and Lumpi village. Also almost of the residents still lived in the rebuilding villages. However, the Moklen people who used to live on island decided to move in land as in Ban Pak Jok. In addition, A village relocated to the new housing project prepared in safer place and not far from original location as in Bangkaya village.

4.1 Post-tsunami housing of Moklen people

The seven surveyed communities in four sub-districts (Figure 4.1), are Soi[11] Ongkarn in Nam Khem village, Bang Mung Sub-District, Takuapa District; Tabtawan village, Soi Malteser and Soi Willy in Bangsak Sub-District, Takuapa District; Bangkaya village and Tungwa village in Kuk Kak Sub-District, Takuapa District; and Tubpla village in Lamkan Sub-District, Tai Muang District.

[10] A preliminary damage survey report of Moklen villages after the tsunami in *Turbulance in Koh Phra Thong* (2006) shows that around 16 villages affected by the tsunami.

[11] *Soi* means lane, side street, or alley in Thai.

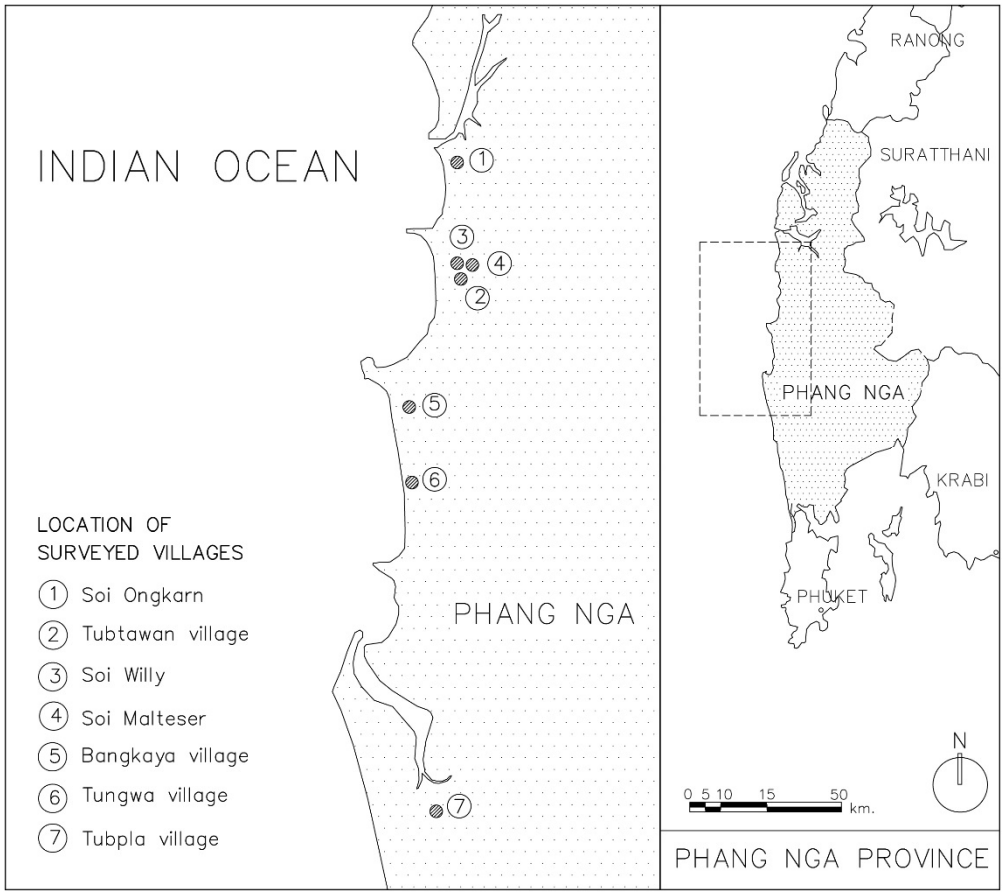

Figure 4.1 The location of Moklen villages

Soi Ongkarn community is in an alley of Nam Khem, which is a large fishing village and the most severely affected because of its high population density. The majority of villagers are Thai. After the tsunami, the village received assistance from the government and houses were constructed by the Thai Army. The pre-fabricated house design provided by the Department of Public Works and Town and Country Planning had a construction budget of around 100,000 baht per house. Single-storey houses measuring 6x6 m and 4x9 m were provided to the villages. The villagers cannot choose the house, it was built based on land size and form also the limited budget the houses turned to be attached houses to safe construction budget.

Tubtawan village is located in an area known as Bang Sak. After the tsunami, the village experienced land conflict with the private sector, limiting the amount of assistance they received from aid organisations and the government. Assistance from an NGO[12] and CODI

[12] Chumchonthai Foundation is an NGO for development which promotes and supports poor people in the city and rural areas where the community is the dominant force in decision making and solution

supported the participatory process. The house design, based on a Moklen traditional house was created using the self-build construction method. This stilt house combined modern and natural materials.

Soi Malteser was so called since Malteser International assisted in construction of village. The villagers chose a stronger house type and had the highest construction budget in the area of 300,000 baht per house. The 31 houses were built from reinforced concrete and building contractors were used in addition to self-build construction support. The high stilt floor house was designed to support future activities and extensions.

Soi willy[13] village was supported by the private sector by collecting donations to build the houses, and villagers also participated in the rebuilding process. When choosing this type of house, consideration was given to durability. The single-storey house was constructed on the ground using concrete blocks, with a budget of around 200,000 baht. This type of house is commonly found in Southern Thailand.

Bangkaya village was relocated from Laem Pakarang (Coral cave) which was severely affected by the tsunami. Out of 80 house, 52 are Moklen. The house was adapted from a pre-fabricated house design from the Department of Public Works and Town and Country Planning with support by the Royal Crown Property Bureau and the private sector, and constructed by the Thai Army. The relocated village is around 2 km away from the original area, but safer. The villagers made the decision together to relocate and all households moved to Bangkaya. Modern planning provided the village with infrastructure and facilities. The land is owned by the Treasury Department so that people can live without paying rent on the land with the condition that the house is passed down only to family. This means that in effect, the land is still owned by the villagers. The budget for the house was around 100,000 baht.

Tungwa village planned to relocate to Bangkaya village but it was deemed too far from the original area (Thongtaweewattana, 2006), so they decided to live on the original land. Since the village had the same conditions of land conflict as Tubtawan village, Tungwa village used the same house design but with different materials. Modern planning and infrastructure was included in the rearrangement of the village, as well as facilities support. The house structure is concrete, with a wooden upper ground floor, and the budget was around 130,000 baht.

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implementation, including innovative improvements in the lives of communities with the collaboration of various partners from both the public and private sectors.

[13] The name of village is taken from Willy Cothney, who provided post-tsunami houses for the villagers.

Tubpla village was not directly affected by the tsunami. It is located in a mangrove area, deep inside a colonnade of mangrove trees. However, eight villagers died working outside the village. In addition, the Moklen houses in the village looked temporary as they were built from natural materials. The French Rotary Club provided pre-fabricated housing to the village, for the construction of 34 houses with a budget of 150,000 baht.

Figure 4.2 Post-tsunami housing for Moklen people; Soi Ongkarn (top-left), Tubtawan village (top-right), Soi Malteser (centre-left), Soi Willy (centre-right), Bangkaya village (bottom-left), and Tungwa village (bottom-right)

Table 4.1 Type of rehabilitation for Moklen villages

	Village	Type of rehabilitation	Land ownership	Main organisations	Participatory level
1	Soi Ongkarn	Rebuilding	Owned by villagers	Central Government Royal Air Force	–
2	Tubtawan	Rebuilding	Some conflict with the private sector	Chumchonthai Foundation CODI etc[14]	House design House type selection Self-build construction
3	Soi Willy	Rebuilding	Owned by villagers	Private sector German Foundation	House type selection Self-build construction
4	Soi Malteser	Rebuilding	Owned by villagers	Malteser International	Self-build construction
5	Bangkaya	Relocation (Planning)	The Treasury Department	Crown Property Bureau Royal Air Force private sector	Discussion on relocation
6	Tungwa	Rebuilding (rearrangement planning)	conflict with the Department of Lands (DOL)	Chumchonthai Foundation CODI etc[15]	House design House type selection Self-build construction
7	Tubpla	Rebuilding	Agriculture Land Reform Office (AlRO)	French Rotary Club from	–

4.2 Assistance structure for post-tsunami housing

From a survey of seven Moklen villages, the different types of houses were based primarily on the conditions of landownership. There are three categories of government and private sector organisations.

Firstly, the Soi Ongkarn community received direct assistance from the government. Since it is located in the Nam Khem village, which was affected the most and where the inhabitants were mostly Thai fishermen who were considered to be part of the village. Two types of pre-

[14] Many organisations were involved in the project such as SOS and foundations who donated construction support, as well as the Four Regions Slum Network.

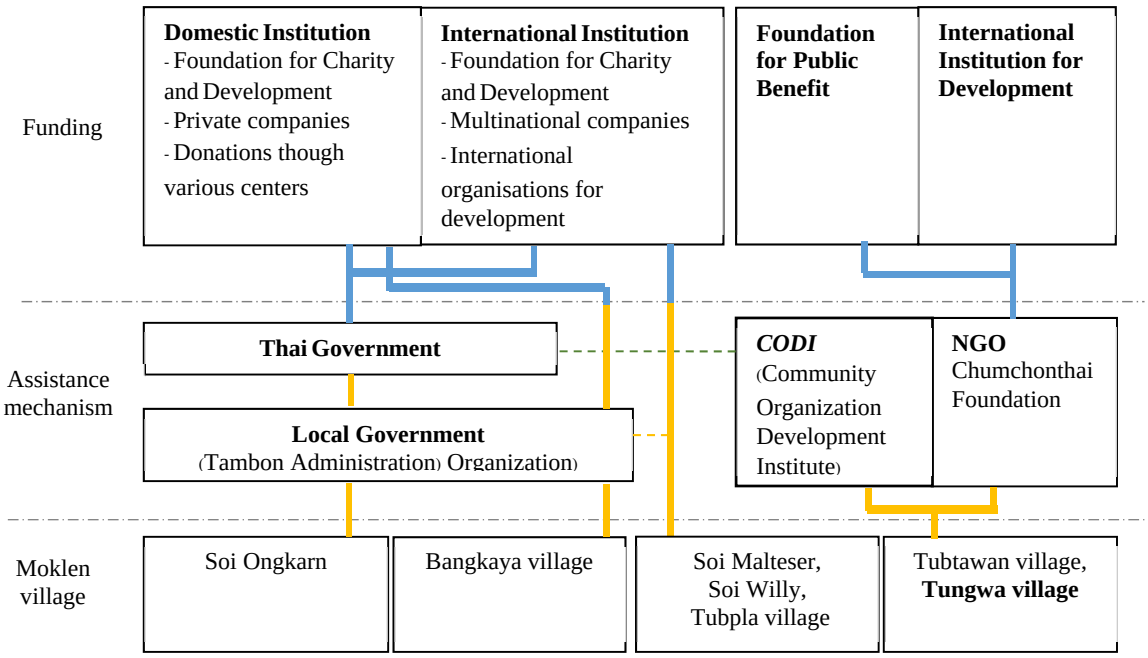
[15] As in Tubtawan village, 21 organisations supported the project for the Tungwa community (Thongtaweewattana, 2006).

fabricated houses, detached and row (also known as box houses), were provided by the government, and the community was not involved in the design and construction.

Secondly, communities which received direct assistance from both international and domestic organisations were those scattered in locations away from node areas or passageways. These are Soi Malteser, Soi Willy, and Rotary Tubpla village. The house designs provided by aid organisations are diverse, mainly consisting of core houses with high stilts, except Soi Willy which had single-storey houses on the ground. In terms of participation, there are different levels such as discussion in village relocation, most communities were assisted by building contractors and self-build construction support. The community in Soi Willy also provided their opinions on self-build design and construction.

The final form of assistance was jointly provided by the government organisation CODI together with the Chumchonthai Foundation which is an NGO. This form of assistance was used for communities with land conflicts namely, Tubtawan and Tungwa villages, since it allowed communities to participate in the recovery process, especially design and construction. The house design was integrated into the traditional Moklen house and self-built using volunteers (Fig. 4.3)

Figure 4.3 Diagram of assistance mechanism of post-tsunami housing for Moklen people



Source: derived from Atsawakowitwong et al. (2011)

4.3 Characteristics of the post-tsunami house

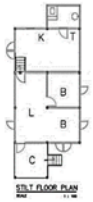
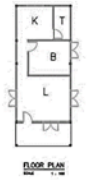
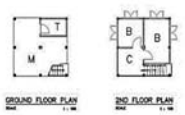
The characteristics of post-tsunami housing in seven communities are different in form, structure, functional area, and construction materials. However, some house types are categorised by floor level—single-storey and high stilt floor. The single-storey houses are in Soi Ongkarn, Soi Willy, and Tubtawan. The high stilt floor houses are situated in the communities of Soi Malteser, Tungwa, Bangkaya, and Tubpla. The houses have a high sloping gable roof with long eaves.

Structure: Three communities have houses with a concrete structure namely: Soi Ongkarn, Soi Willy, and Soi Malteser. A mixed structure of concrete for the ground floor and wood on the second floor was used in Tubtawan and Tungwa villages, and a steel structure for houses in Bangkaya and Tubpla villages.

Functional areas: Single-storey houses were provided, consisting of living area, bedrooms, kitchen, and toilet. The high stilt houses are mostly core houses where the ground floor is pre-prepared for extensions, depending on the needs of the residents, such as bedrooms and toilet. Tungwa is different as they used a combination of a design pre-prepared for all functions and a stilt floor at a high level to support an extension.

In terms of construction, most of the houses used industrial materials. The two projects in Tubtawan and Tungwa villages used natural materials. The characteristics and house plans are shown in Table 4.2.

Table 4.2 Post-tsunami house characteristics

	House characteristic	House plan	Floor area (sq.m.)	Structure / Materials
Tubtawan village			72.28	Column: prefab RC Ground floor: concrete (kitchen) Wall: masonry concrete block 2nd floor structure: timber 2nd floor wall: waived bamboo Roof structure: timber Roofing material: fiber cement tiles
Sol Willy			60	Column: prefab RC Floor: concrete with tiles Wall: masonry concrete block (plastered) Roof structure: steel Roofing material: fiber cement tiles
Sol Malteser			59.4	Column: prefab RC Ground floor: concrete Wall: masonry concrete block 2nd floor structure: RC 2nd floor wall: RC Roof structure: steel Roofing material: fiber cement tiles
Bangkaya village			60.9	Column: Prefab RC Ground floor: concrete (kitchen) Wall: masonry concrete block 2nd floor: column timber 2nd floor structure: timber 2nd floor wall: cement board Roof structure: timber Roofing material: fiber cement tiles
Tungwa village			127.75	Column: prefab RC Ground floor: concrete (kitchen) Wall: masonry concrete block Column: timber 2nd floor structure: wooden structure 2nd floor wall: timber Roof structure: timber
Tubpla village			46.08	Column: steel Ground floor: concrete Wall: masonry concrete block 2nd floor structure: RC 2nd floor wall: Shera wood Roof structure: steel Roofing material: fiber cement tiles

4.4 Area and building use in post-tsunami houses

A field survey of six communities in Phang Nga Province was carried out to understand how the houses are used, and record living conditions by interviewing 60% of all households in each community. According to the field survey, patterns can be categorised into two settings: original and planned. In this subsection, a record of the area indicates which lifestyle activities relate to each pattern.

Area use

Where patterns were based on the original setting, the number of houses increased as each post-tsunami house was built to support small households separated from the extended family, but there are some shared functions in certain cases, showing that family relationships exist. As to area use, original lifestyles can be retained such as with support activities of livestock in the surrounding area. Some functional areas had extensions added to accommodate and solve kitchen or litter problems from various activities; leisure, work, or a meeting place was built for drying food such as fish or sweets—for use in in the tenth month ceremony. It also includes cooking with a fireplace and stove for grilling seafood.

There are two communities where modern planning has been provided, namely Bangkaya and Tungwa villages. The new location is safe as it is inland, away from the sea but not too far from the original area where they still owned land. Even so, the limited area has caused difficulty for some fishermen who need space to make and place large quantities of traps as they still have land which can support such activities. The conditions for long-term living mean housing. For the Tungwa community, modern planning has affected space and building use due to the limited area provided, and also restricts activities to support lifestyles. However, some activities can be supported such as livestock and fish ponds and litter is added under the stilt floor (Fig. 4.4).

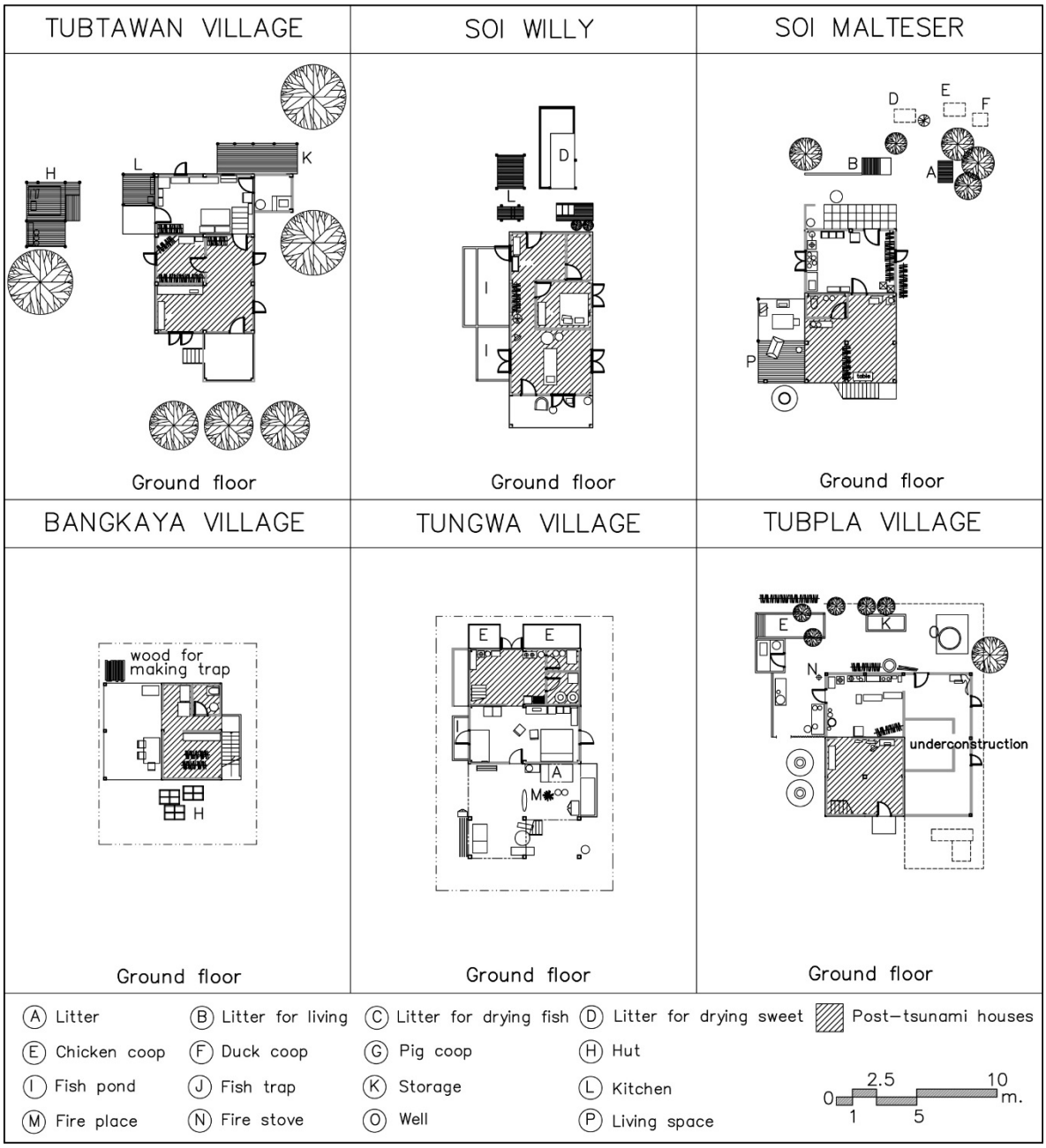


Figure 4.4 Examples of area use for the post-tsunami house

Changes and extensions

According to a field survey in 2015, residents in each community had traditional pre-tsunami houses. Bangkaya village was the only community where the pre-tsunami houses were constructed using concrete blocks as shown in Figure. 4.5. Since the tsunami, a modern housing style has been adopted since the villagers of Bangkaya are better able to adapt the houses than residents in other communities.

Moreover, each community has a different pattern of change. The rebuilding communities have a variety of extension patterns and use of materials. It was found that natural materials can be used for extensions combined with knowledge of building a Moklen house to create spaces according to traditional characteristics. The communities with limited lot areas have houses with similar changes in pattern sequence according to the industrial materials used for main structure and lot area. Tungwa villagers have no extensions outside the main house structure of house (Fig. 4.6).

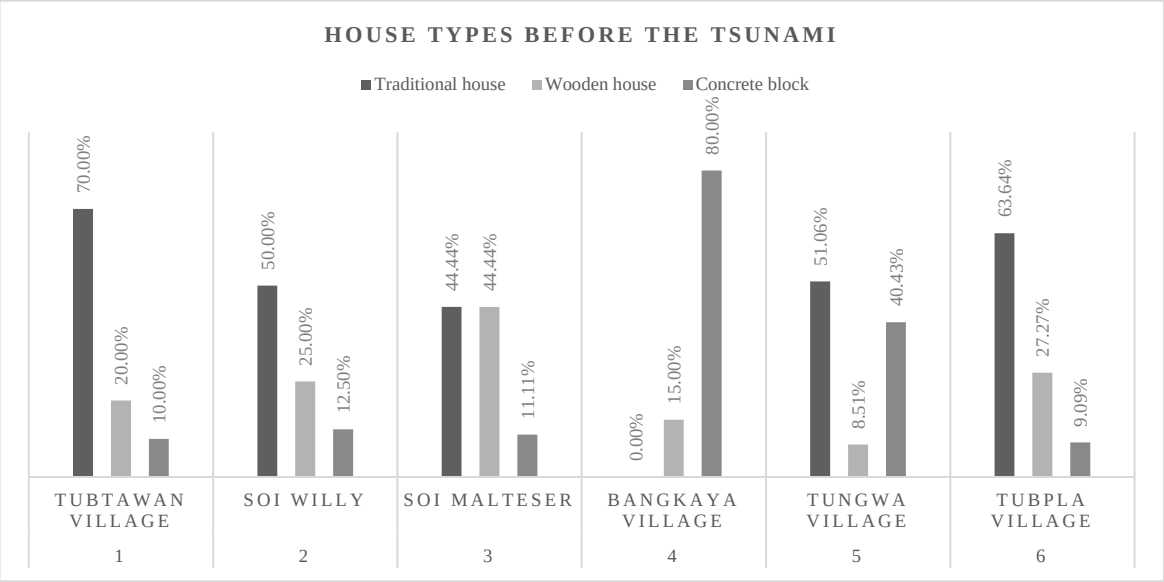


Figure 4.5 House types before the tsunami

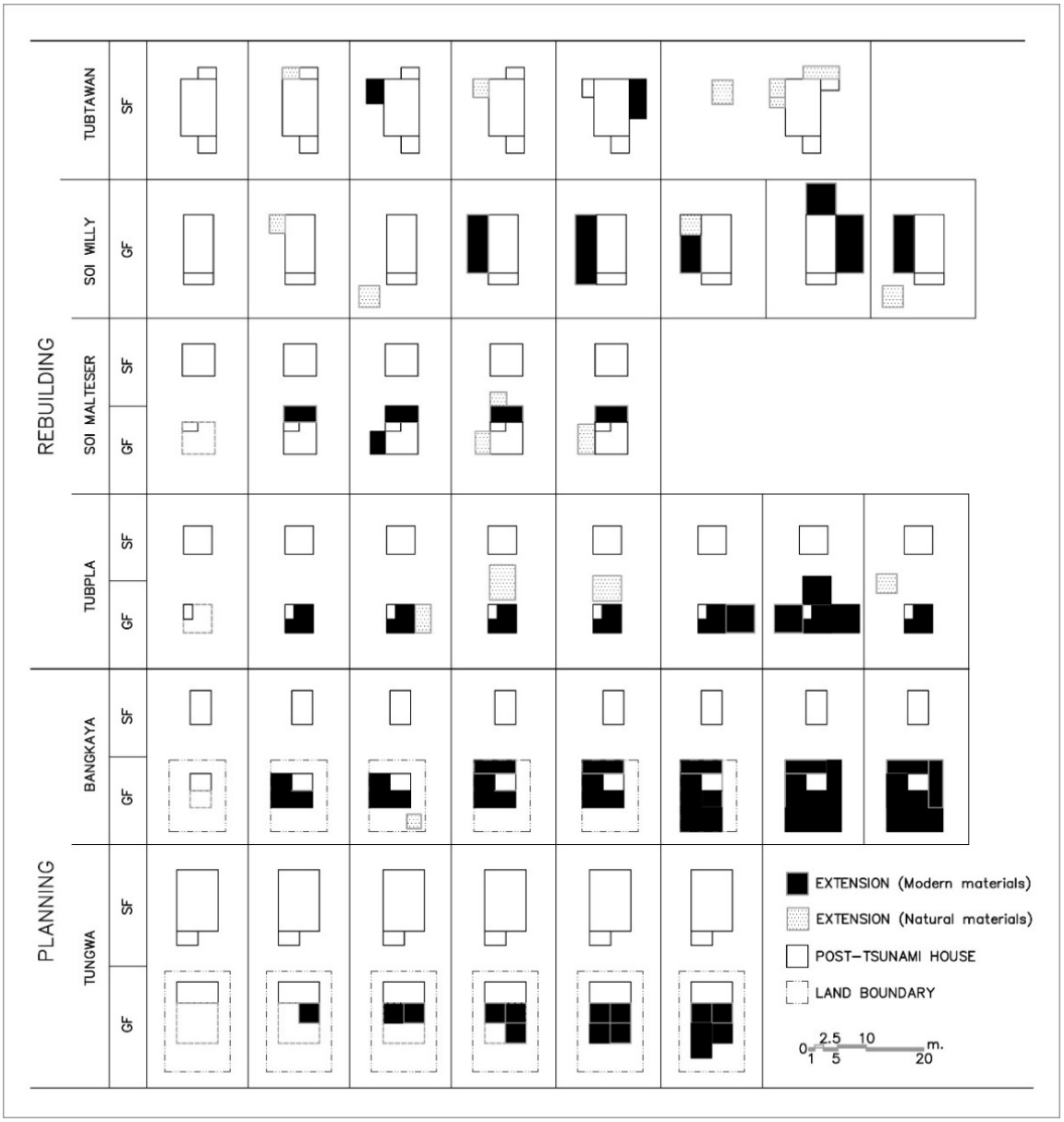


Figure 4.6 Extension patterns

4.5 Chapter conclusion

An overview of assistance in post-tsunami housing for Moklen people, shows that only one of the seven projects was built with the assistance from the government, while one project was built with aid from the private sector, three from other agencies, and two projects jointly with help from CODI and an NGO. This indicates limited accessibility, particularly concerning land conflict, which is an issue restricting the receipt of direct assistance from the government. However, the government organisation CODI, with the help of an NGO, supported post-tsunami housing for those villages affected. The participatory process is important for ethnic minority people.

Characteristics of post-tsunami houses for Moklen people vary according to the assistance provided. However, there are four projects where the houses are adequately designed for living and three projects designed as core houses where ground floor space is provided for multi-purpose use as well as supporting extensions in the future. Houses are designed with industrial materials and provide functional areas to support modern lifestyles. The participatory process has influenced the house design in projects supported by CODI, where the villagers proposed their requirements for the house and community and to the architect. The house design integrates well with the traditional Moklen house. The house in Tubtawan village is the most similar to the Moklen house, while in Tungwa village the house has tall stilts with a higher floor area than the others.

In terms of living conditions, it can be considered that the houses built in their original setting are be similar to those before the tsunami apart from changes to their appearance, as can be seen by the extensions made to support living and solve certain problems. The surrounding space can also be used to support such changes. In some villages, the limited space of the lot area restricts certain activities and there is less space for extensions.

In this chapter, various factors have affect post-housing in the villages; Land conflicts, house styles, and limited area for extensions is analysed in the next chapter by using Tungwa village as a case study, especially participatory process in house design.

CHAPTER 5: CHANGE OF LIVELIHOOD AFTER THE TSUNAMI DISASTER: CASE STUDY OF TUNGWA VILLAGE

The Indian Ocean tsunami in 2004 was the first natural disaster of its kind in Thailand. The limited experience of providing aid to tsunami victims and handling the long-term recovery process makes the study particularly interesting and relevant, especially regarding the post-disaster management of residential issues. This research aims to study the changes in living conditions after the tsunami and understand the problem of land conflict which has affected the livelihoods of the most vulnerable and marginalised groups in coastal society.

The *Chao Lay* community was most affected by land conflict, since they are an ethnic minority with limited security of land tenure, making them particularly prone to land grab and displacement. In this research, the Tungwa community was chosen as a case study because the majority of its population is Moklen, whose livelihoods and culture have been based on land much longer than other *Chao Lay* subgroups. The study of land conflict in the Tungwa community provides an important insight into the multiple dimensions and social problems inherent in post-disaster residential recovery for non-egalitarian societies.

In this study, a questionnaire-based household survey and semi-structured interviews with key informants were employed to collecting in-depth information for comparing the living conditions and land tenure challenges before and after the tsunami. Aerial photographs were also used to triangulate the information gathered by survey and interview. The questions asked via household survey and semi-structured interview referred to changes in land use and living conditions to understand the land conflict affecting the residential area, housing conditions, and economic livelihoods based on the use of natural resources. In addition, patterns of houses and living conditions were elicited to analyse the challenges. The research results provide an essential lesson for future post-disaster residential planning and management, and better understanding of land conflict to provide long-term security for the *Chao Lay* and other marginalised groups in the future.

5.1 History and livelihoods of the Tungwa community

5.1.1 Brief history

Historically, four Moklen communities lived in this area, namely Tungwa Nok, Tungwa Nai, Bangkaya, and Bang Niang (Figure 5.1). The settlement history of the Tungwa community in Tungwa Nok goes back to a Moklen woman who had claimed land ownership

in the area. She was joined by four families looking for work in the tin mining business around 50 years ago (Thongtaweewiwat, 2006). They preferred the location because it was easy to reach by road, and not far from the sea, making it an ideal place for the Moklen to settle.

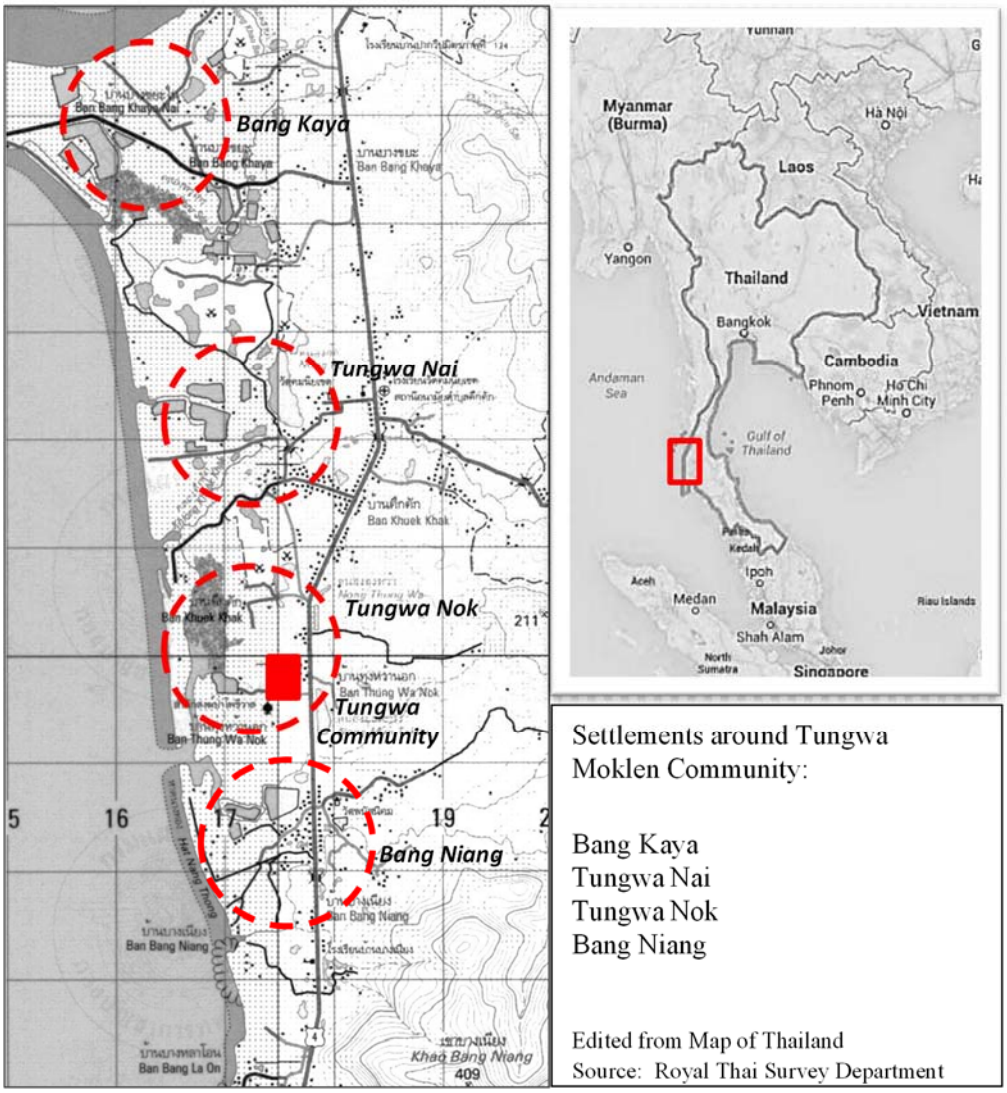


Figure 5.1 Moklen communities in the area and location of the Tungwa community

Ten years before the tsunami, there were Moklen migrants and others from elsewhere in the village because of its convenient coastal location for fishing and day labour. Villagers from Tungwa Nai moved to the community because the land they were previously living on had been sold by the relatives who owned it, so they needed to find a new place. Another group moved from the Bang Niang area after they had been evicted by the official village headman. Thus, the community grew from an early settlement of only four families through migration from other villages and the relocation of nearby communities to a larger, culturally heterogeneous community of 40 families prior to the tsunami in 2004.

5.1.2 Pre-disaster livelihoods and living conditions of the Tungwa community

Like most Moklen communities, the residents of Tungwa lived a simple life close to the sea, and near a river mouth which provided a freshwater supply. While most men had their primary occupation in the tin mines, and in rubber and coconut plantations, the collection of sea products such as shellfish as well as natural materials from the surrounding jungle provided a supplemental means of subsistence (cf. Larish, 1992).

The people of Tungwa had a great sense of community and kinship, with the shaman (called *Por Ta*) acting as the spiritual centre of their animist beliefs. A shrine was used to hold regular community ceremonies, most of which related to worshipping the spirits of the sea (Kwan, interview, March 2013).

The major areas of importance for the livelihoods of the Moklen were the beachfront, mangrove forests, cemetery, and residential area. The beachfront, locally called *Nha Had*, was used to support their economic livelihood, and simple huts were built there as temporary shelters for fishing activities. The mangrove forest, called *Papang*, was another important natural resource providing livelihood support. Spiritually, the cemetery[16] near the village (called *Pa Plew* or *Tung Hua Ting*), which covered an area of about 80 *rai* (12.8 ha) played an important role (Hong, interview, March 2013). The residential area was built along the road for easy access to jobs outside the community. The bide-structure houses were made from natural materials, such as bamboo, rattan, and nipa palm leaves, obtained from mangrove and adjacent forests. Each house consisted of a kitchen, living room, and slightly elevated sleeping area, providing sufficient space for the extended family. The houses had a raised basement to protect their inhabitants from rodents and other animals, with a terrace or *charn* in front of the house, and plenty of open space around the house. Prior to the tsunami, the Moklen of Tungwa raised livestock for sale, and most families had their own semi-commercial home gardens.

5.2 Post-disaster response and recovery in Tungwa community

Damage to the Tungwa community and the evolving land conflict

The seaside location of the Tungwa community made it particularly vulnerable to the 2004 Indian Ocean tsunami. The power of the tsunami waves killed 42 people, carried away or destroyed 18 fishing boats, destroyed all valuables, and washed away around 40 houses. Among the people who died was the spiritual leader of the community, *Por Ta*. Hence, the

[16] In contrast to their Thai Buddhist neighbours who cremate their dead, the Moklen bury their deceased relatives and plant a coconut seedling on the burial place (Bristol, 2010).

disaster affected the community both materially and spiritually. After the tsunami had ravaged their community, Tungwa villagers had no officially acknowledged evidence or documents to claim their landownership rights, since they had no prior knowledge of landownership issues, believing the land belonged to everyone for shared living. Rice (2005: 16) quotes the community leader as follows:

> *"I have no idea who owns the land, but I have lived here since I was born. Our ancestors are buried here. My children were born here. It is our home. We are not intruders and will not be going anywhere. Assistance will soon end and we want to resume our livelihoods as soon as possible. We don't want anything, just our land."*

The Sub-District (*Tambon*) Administrative Organization (TAO) at that time planned to move the Tungwa residents to Baan Bangkaya, a residential project set up to support tsunami victims. While the surviving Tungwa community members were living in temporary shelters, a sign was put up on their village site stating that a public hospital would be built there with funding from the German Government (Bristol, 2010). It later turned out that this was an attempt by district and provincial authorities to seize the public land (Rice, 2005; Bristol, 2010). In order to prevent the area from being taken over, community members—with support from NGOs—decided to get back on the land and start building new houses as quickly as possible. Following the involvement of the Board of Subcommittee on Land Issues, a land-sharing option was agreed between the conflicting parties. It was verified that the community had inhabited the area before the issuance of title deeds for public purposes in 1969. On this basis, the Tungwa community was allowed to return to their original residential area. However, the land was divided, with 16 *rai* (2.56 ha) going back to the community in the form of a renewable collective land lease, while 10 *rai* (1.60 ha) was claimed by the local government for non-specified public use. In their effort to wrest the community's customary land from the control of the government and private sector, they were supported by the Chumchonthai Foundation, the Danish aid agency DANIDA, the United Nations Development Programme (UNDP) and volunteer architects, who helped in the design process. Villagers participated actively in the layout of the settlement and design of individual houses. Various agencies as well as CODI provided financial support to rebuild the houses on the original residential land. Overall, 21 organisations participated in this rehabilitation project.

The land-sharing agreement between conflicting parties and the consultative reconstruction process was hailed as "Thailand's first post-tsunami, shoreline land-sharing scheme" (Rajah 2006: 30), an "exemplary initiative", and a "model project for all the tsunami-affected communities involved in fighting for their rights over land disputes in Thailand" (Rice 2005: 16). However, the land conflict with the local administration and private sector has never been fully resolved, and is discussed further in subsection 5.3.

5.3 Post-disaster livelihoods in the Tungwa community

The tsunami had a massive impact on people's livelihoods. Most boats used to make a living from fishing were lost, and according to community members' accounts, there was no adequate help in terms of boat donations as in neighbouring Thai communities. *"They didn't give us boats for every community member. And some of the boats they gave us had no engines."* (Hong, interview, November 2013). Many community members had to change to other ways of fishing, such as using nets close to the shore. Nearly ten years after the tsunami, most boats have broken down and several community members have not been able to afford the fuel costs of fishing. *"Sometimes, if we want to go fishing by taking the boat to the sea, we have to share the costs of fuel with friends."* (Nate, interview, November 2013). The village survey found that the percentage of Tungwa community members with a substantial livelihood from fishing decreased from 36% to 18% during the post-tsunami recovery phase. Other activities, such as the collection of crabs and freshwater clams in the small mangrove area, have instead become a primary means of subsistence (Figures 5.2a and 5.2b). Many villagers turned to miscellaneous employment both on a daily or monthly income basis. They are employed as gardeners, cleaning maids, construction workers, as well as being a hotel or municipal employee. However, job opportunities outside the village have become more difficult to find as a motorbike is required to get to the workplace. *"If you don't have a vehicle to go to work, there is no place to find a job."* (Nate, interview, November 2013). Around 10% of the villagers were unemployed at the time of the survey because the job market has become increasingly difficult, especially for the Moklen people.

Figure 5.2a. Moklen man from Ban Tungwa collecting crabs (Photo by A. Neef)

Figure 5.2b. Moklen woman from Ban Tungwa collecting freshwater clams with her child (Photo by A. Neef)

Nearly ten years after the tsunami, the Tungwa community continues to rely on natural resources for making a living. The beachfront area is still used for fishing, but the ecology and structure of the shoreline has changed. "*In the past we could just walk into the water from the shore and it was not necessary to use a fishhook. Now the stream and the ocean floor have changed, thus we need different fishing gear.*" (Nate, interview, November 2013). In addition, the Moklen cannot build huts on the beach as in the past, due to new tourist developments. The mangroves or *Papang* continue to be a major place for collecting shellfish and crabs, but the villagers are afraid that adjacent tourist developments will soon constrain their access (Hong, interview, January 2013).

The area of the cemetery has been substantially reduced and the Ministry of Defence has notified the community that they can only use an area of 15 *rai* (2.4 ha) for their cemetery. On the other hand, the community has received a number of public facilities, such as a daycare centre, a children's playground, a football field, and the Chao Lay Cultural Center which serves as a museum and tourist attraction. While the Moklen people acknowledge the value of these public facilities established with the help of various national and international organisations in the post-tsunami rehabilitation process, they do not think these constitute adequate compensation for the substantial loss of livelihood opportunities and the infringement on their cultural assets as a result of the tsunami.

5.4 Change of living conditions following post-disaster recovery land use

Aerial photographs were used as the basis for analysing livelihood changes in the Tungwa community. The land use is depicted at various times: 1986, 2002, 2004, and 2009, with particular emphasis on three elements namely, the livelihood area of the community, the cemetery area, and development projects—mainly for tourism purposes (Figure 5.3).

The aerial photograph from 1986 shows the community settlement with the livelihood area relatively intact. The community was conveniently located along the main road and had full access to the mangroves and beach front, which gave them almost unlimited opportunities for fishing and collection of marine life for subsistence. Most of the area along the beach consisted of coconut groves and forests, with very few tourism-related buildings. The area of the cemetery cannot be determined exactly, but is based on the narratives of community leaders.

The aerial photograph from 2002, two years prior to the tsunami, shows the substantial developments undertaken between 1986 and 2002 in and around the community. Some houses in the north of the village had to move southwards because of a claim to ownership of the adjacent land. Several beachfront resorts limited the accessibility to the shoreline towards the south, as they wanted minimum interference from the Moklen so that their guests remained undisturbed.

The aerial photograph from 2004 shows the Tungwa community area just before the tsunami. The livelihood space had been greatly reduced due to the development of various resorts. The large resort pictured in the centre of the photograph, south of the temple, had carved out a significant portion of the mangrove area and further blocked community members' access to the sea (Hong, interview, March 2013). Further resort development along the shoreline created additional strain on the livelihoods of the community. Most of the tourist resorts would be greatly damaged or completely destroyed by the tsunami.

The aerial photograph from 2009 shows the village area five years after the devastating tsunami. While livelihood opportunities along the shoreline were reduced due to beachfront resort development, the Tungwa community could still use the mangrove area, as the tourist resort, which had substantially compromised access to the mangrove area, was not rebuilt. The green area between the beach and village remained undeveloped or was used as plantation land by private land owners. The Sub-District (*Tambon*) Administrative Organization (TAO) drastically reduced the cemetery area of the community in accordance with notification from the Ministry of Defence. According to a local NGO supporting the community, the cemetery

has been regularly cleared and its size reduced further by the authorities (Chumchonthai Foundation, interview, 2013).

5.5 Changes to village facilities and family housing

Another set of aerial photographs have been used to analyse the changes in physical living conditions of the Tungwa community. The photographs depict the residential area at various times: 1986, 2002, 2004, and 2009 by considering three elements namely, the village layout, residential houses, and community facilities (Fig. 5.4).

The aerial photograph from 1986 shows the characteristics of the community and the distribution of housing. At that time, there were only seven or eight houses, with trails connecting them, and each house having a sizeable open space and built in the traditional Moklen style.

The aerial photograph from 2002 shows the condition of the Tungwa village two years prior to the tsunami. The number of houses had increased to about 45 due to the migration as described in subsection 3.1. The settlement had become much denser and the open space around the houses reduced, but there were still large trees and extended home gardens. The settlement had become a mix of Moklen traditional houses and more contemporary houses constructed with industrial materials.

The aerial photograph of 2004 shows the condition of the community a few weeks after the tsunami. The water from the tsunami waves had already dried up, but the devastation is clearly visible. Only three houses were left standing, with all the others completely destroyed, leaving 42 inhabitants dead. The vegetation around the houses was also severely affected, all home gardens had perished and nearly all domestic animals had been killed.

The aerial photograph from 2009 shows the village five years after the tsunami. The community layout was drastically changed, the buildings had been neatly organised in rows, with each house sharing an equal area of land, but with considerably less space than in the pre-tsunami period. All houses display the same design with a high basement, gabled roof, and modern construction materials, resembling typically Thai rural houses in this coastal region (Figure 5.5).

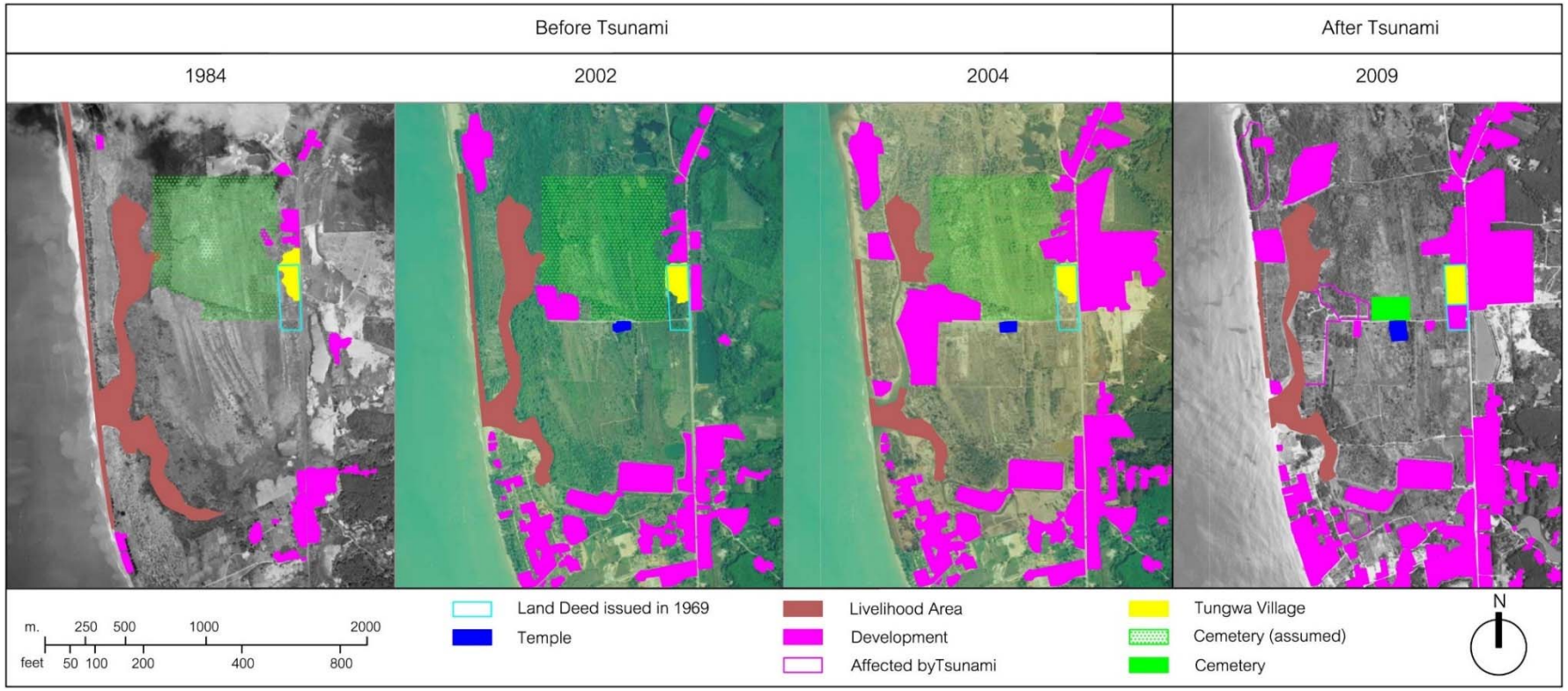


Figure 5.3 Change of Land use by the Tungwa community

Source: Based on the aerial photograph of the Royal Thai Survey Department (*RTSD*)

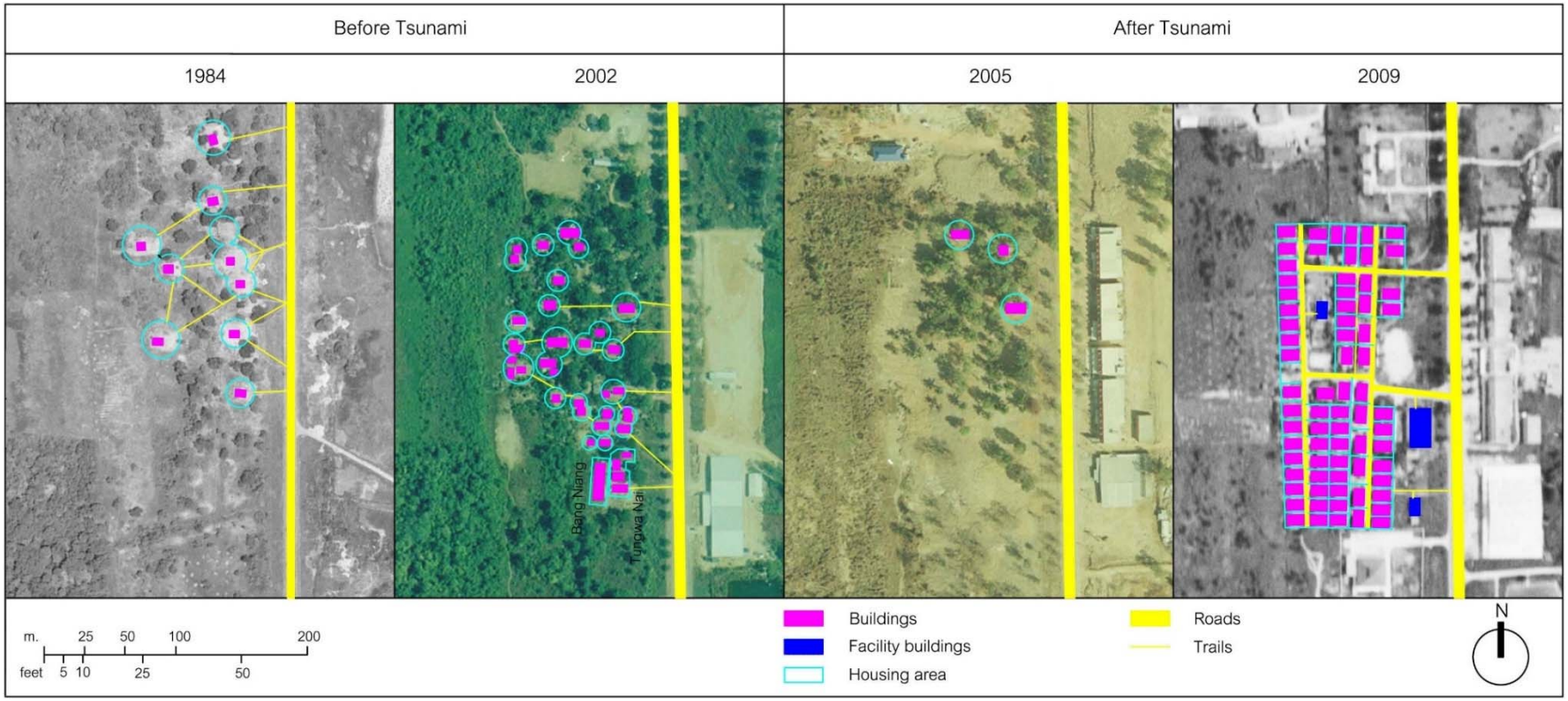


Figure 5.4 Change of village and housing of Tungwa community

Based on the aerial photograph of the Royal Thai Survey Department (RTSD)

Figure 5.5 The post-tsunami standard housing design in the Tungwa community (Photo by A. Neef)

In summary, the tsunami and post-disaster events dramatically altered the physical living conditions of the community. Individual family living space has been diminished, and the increased density affects the well-being of the community members who now have less space to rear farm animals as in the pre-tsunami period. The dense village design also negatively affects the ventilation of the houses. In addition, changes in house characteristics demanded a considerable adjustment from the Moklen who were not used to high basements.

Due to the reduction of livelihood opportunities for the Moklen, social problems have spread in the community; gambling, alcoholism, and drug use—even by children, has become common.

5.6 Status of land conflicts involving the Tungwa community in 2013

During our three field visits to the community, and enquiries to households in 2013, it was found that land conflicts continue to affect the livelihoods and security of Moklen people. Although it has been proven that residents of the Tungwa community have lived in the area long before the issuance of title deeds, the land is still owned by the government and the community's residential rights depend on the regular renewal of a temporary communal land lease. The issuance of a permanent community land title deed—based on an initiative by the government of former Prime Minister Abhisit Vejjajiva, and adopted by subsequent administrations—may offer better security of tenure, but it is unclear whether this will happen any time soon, given the notoriously slow speed of implementing new land policies in the

country. Meanwhile, Tungwa community members are worried about signboards advertising (public) land for sale to private developers and demarcation poles suggesting the further expansion of tourist resorts (Figures 5.6a and b).

Figure 5.6a. A sign board advertising land for sale in the customary cemetery grounds of the Tungwa community (Photo by A. Neef)

Figure 5.6b. Moklen community leader showing a demarcation pole set up in a tourist resort (Photo by A. Neef)

The Moklen community leader revealed his fears and frustrations about the ongoing land conflict during an interview in January 2013:

> *"I am worried about the new generation for they will surely not be able to access any resources in the sea and on the shore. Now we face many difficulties with regard to fishing and searching for food in the sea or on the beachfront because we are told by Thai resort workers not to enter the area as this would make their guests unhappy. […] Our lives have ended after the [tourism-related] development and the tsunami. […] We still have some land to live on, but we only have permission for five years, after which it has to be renewed. We were asked [by the local administration] to sign some documents related to the land, but we denied to do so, as we were afraid of being fooled."*

This statement is an expression of the Moklen community's frustration about the rising pressure of tourism development on their socioeconomic livelihoods and distrust of the local government.

The conflict regarding the cemetery area also continues to affect the community. According to information provided by the Chumchonthai Foundation (interview, November 2013), the cemetery area has been decreasing every year (Figure 5.7a). This was evidenced during our visit in January 2013 when extensive land clearance with heavy machinery was taking place around the cemetery area (Figure 5.7b).

Figure. 5.7a. Signboard allocating 15 *rai* (2.5 ha) as community cemetery land (Photo by A. Neef)

Figure. 5.7b. Land clearance on the communal cemetery land of the Moklen community (Photo by A. Neef)

Having lost their spiritual leader and community shrine in the tsunami, the infringement on the Moklen's customary cemetery area by local authorities and private developers constitutes another significant loss of cultural identity and heritage.

5.7 Chapter conclusion

Since the traditional livelihoods of Moklen people in the Tungwa community were dependent on close access to the sea, they were particularly affected by the tsunami, which claimed a high number of their lives. Post-disaster reconstruction of the residential area had to be done hastily, as the Moklen risked being relocated to other areas by the local authorities. Although the design of the community rehabilitation scheme was done in a consultative manner, the Moklen could not resist the subsequent tourism development threatening their resource-based livelihoods. After the withdrawal of external assistance from foreign donors and Thai NGOs, as well as the absence of a supportive legal and institutional framework, the Moklen find themselves exposed to increasing local pressures in this prime tourism area, where land prices have skyrocketed after the rehabilitation of infrastructure in the post-tsunami recovery process.

The major conclusion from the study is that consultative forms of participation in the post-disaster reconstruction process at local level are no substitute for the deeper empowerment of marginalised people through a legal framework which recognises their long-established customary rights, respects their cultural heritage, and considers both their immediate and long-term livelihoods. Communal land ownership would give the community a stronger sense of security and cultural recognition, but political will at local and national level towards establishing permanent land rights for marginalised ethnic groups appears to be lacking.

CHAPTER 6: LIVING CONDITIONS IN POST-TSUNAMI HOUSES: CASE STUDY OF THE MOKLEN TUNGWA VILLAGE

The research in this chapter is aimed at understanding of the pre-tsunami and post-tsunami housing conditions of the Moklen in Tungwa village. It also aims to understand the recovery process, concept of design and construction, and the effect of rebuilt houses on villagers. A field survey was conducted in Tungwa village, Phang Nga Province covering a total of 30 days in 2013 and 2014. The data recorded the living conditions of 49 houses from 68 households. In order to understand the problems of the rebuilt houses, various changes and adaptations of the units by the residents were analysed following semi-structured interviews.

6.1 Damage and changes in livelihood in Tungwa village

The tsunami resulted in the death of 42 villagers, and there were approximately 220 reports of casualties with damage to 18 ships as well as fishing equipment. The three-metre-high tsunami swept away the majority of houses in the village. The village currently consists of 68 Moklen and three Thai families. Before the tsunami, the community made their living by fishing and raising animals for sale. The field survey in 2013 revealed that after the tsunami, fishing output decreased from 36 to 18%, and villagers had to seek daily and monthly employment as gardeners, construction workers, hotel staff, and employees of local government in order to earn a stable income. The survey also found that more than 10% of villagers are jobless. The average household income is 5,000–15,000 baht (154–460 USD) per month (Attavanich et.al, 2015).

After the tsunami, local government planned to relocate the community to a safer place. However, as the proposed relocation destination was further inland and 5 km from the original location, the community refused to relocate and remained in the same village (Thongtaweewiwat, 2006). At the time, Tungwa village was experiencing land disputes since there was no evidence to confirm villagers' rights to the land, and consequently they received no direct assistance from the government. Since it was important to preserve the way of life and traditional livelihoods of the fishermen, an NGO and CODI (a government organization) provided the main rebuilding support. Eventually, the committee established to solve the problem of land conflict, confirmed the settlement period and occupied areas by the use of aerial photographs, which showed that the community had been settled before the land deed for public use was issued in 1969. In negotiations between stakeholders of the land, a

compromise was reached and the community was permitted to live within 1.6 ha of the original land; a decrease from the previous 2.56 (Kaewkuntee, 2006). Fig. 6.1 shows the area of land occupied by Tungwa village before the tsunami as well as the remaining area after part of it was returned to the local government (Attavanich et.al, 2015).

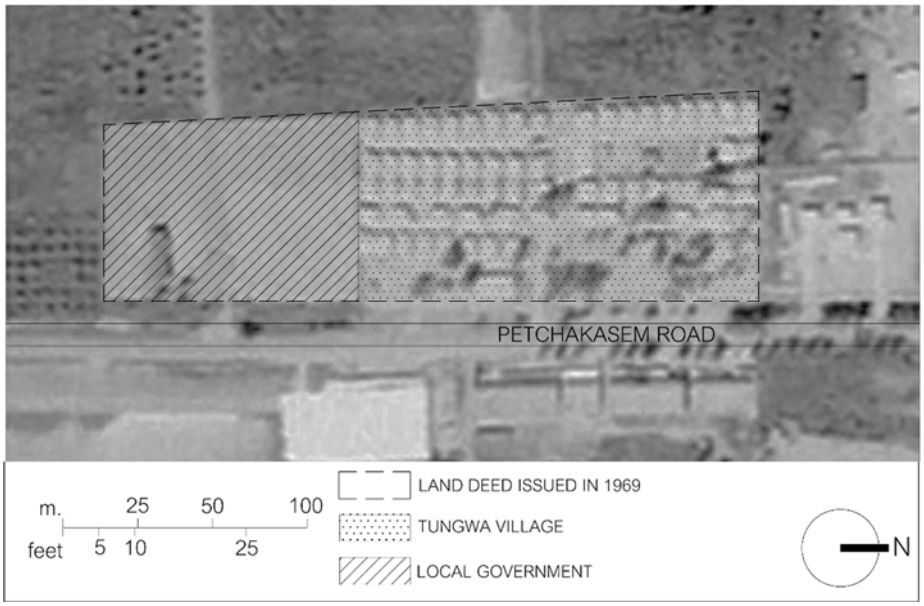


Figure 6.1 Land tenure of Tungwa village before and after the tsunami

6.2 Construction of post-tsunami housing

6.2.1 Style of pre-tsunami housing

Before the tsunami, Tungwa's Moklen community settled in the area because the location is close to the sea, providing villagers with a livelihood. Being located near the main road, other jobs are easily accessible during the fishing off-season. Before the tsunami, the population of Tungwa village had expanded to 40 families, with those from neighbouring areas also migrating to it. Fig. 6.3 shows the village layout, with houses surrounded by trees and open spaces for outdoor activities. An interview showed that there were two types of pre-tsunami houses; **the Moklen ethnic house** is traditionally built from natural materials. The major characteristic is the stilt house setting with the floor raised about 0.7–1.0 m from the ground. This post-beam structure is made from timbers bound together by rattan rope or nails, with walls and floor composed of weaved bamboo. The thatched gable roof is constructed from panels of nipa palm leaves (Attavanich and Kobayashi, 2015). The functional areas are separated by steps to form different levels, and Moklen ideas and cultural beliefs are incorporated into the building. Among the 49 villagers who were interviewed for the field survey in Tungwa village, 28 lived in this type of house before the tsunami. Another house

type is the **concrete-block house** which is commonly found in Southern Thailand, since it is more durable and stronger than the Moklen ethnic house as well as being modern, and a number of concrete-block houses were built in Tungwa village a few years before the tsunami. This type of house is single-storey, and constructed using reinforced concrete columns, masonry concrete-block walls, and fibre-cement roof tiles, with a bathroom to support the modern lifestyle. The field survey showed that among the 49 interviewed villagers, 13 lived in this type of house before the tsunami. The survey of house types showed that some Tungwa villagers have changed to live in the modern housing style; however, most of them (around 57%) lived in a traditional Moklen house.

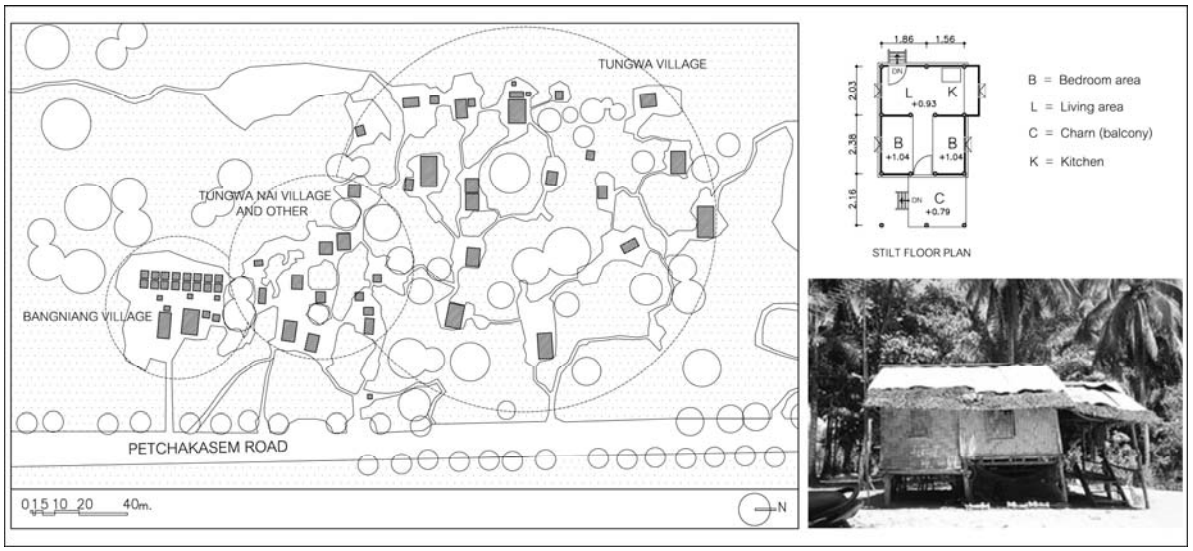


Figure 6.2 Tungwa village before the tsunami (based on a 2002 aerial photograph from the Thai Royal Survey Department) and a traditional Moklen house (photo provided by author)

6.2.2 Design of post-tsunami housing

The master plan for rebuilding was based on information obtained from the residents regarding pre-tsunami housing in the original village layout. The design process involved participation of the residents to determine the residential and common areas, including requests for facilities to support village activities. In addition, a design infrastructure was provided to improve living conditions (Fig. 6.3).

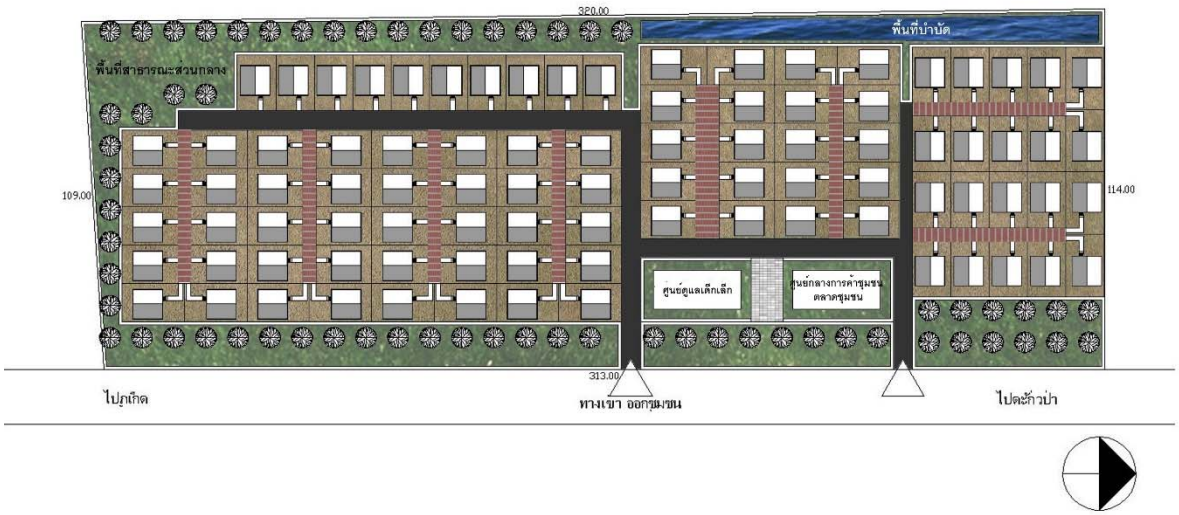


Figure 6.3 Design of layout plan of Tungwa village before and after the land compromise

Source: Montawee Jirawattawee

As the conditions of the village were crowded, the design concept aims to provide more space by raising the stilt floor higher than that of the pre-tsunami house type to reduce the potential impact of tsunami waves. The house design took into account the needs of residents and two types of houses were proposed by the architects, each with different space arrangements (Sea Sand Sad Tsunami project, 2005). A budget was established of 130,000 baht (3,330 USD) per house, which was sufficient for construction. The two house designs are; **Type A**, where the concept of the ethnic house is integrated with a modern design. The stilt floor is raised above the ground to a height of 1.70 m and industrial construction materials are used instead of natural. The stilt floor area consists of a balcony, living room, and bedroom, while the toilet and kitchen are located at ground level. The total floor area is 78.75 m^2 (Fig. 6.4).

Another is **Type B**, a two-storey core house design with an upper floor raised to a height of 2.50 m, and a ground floor which has a multi-purpose open space that can also be used for extensions in the future. The house has similar functional areas to Type A, but the space arrangement is different. The total area is 119 m^2 (Fig. 6.4). The villagers voted to construct Type A houses. However, the construction site was limited following the compromise reached regarding the land conflict issue. The idea of a stilt floor offers the option for future extensions at ground level. The upper level was finally set at a height of about 2.00 m, with a total floor area of 127.75 m^2 (Fig. 6.4).

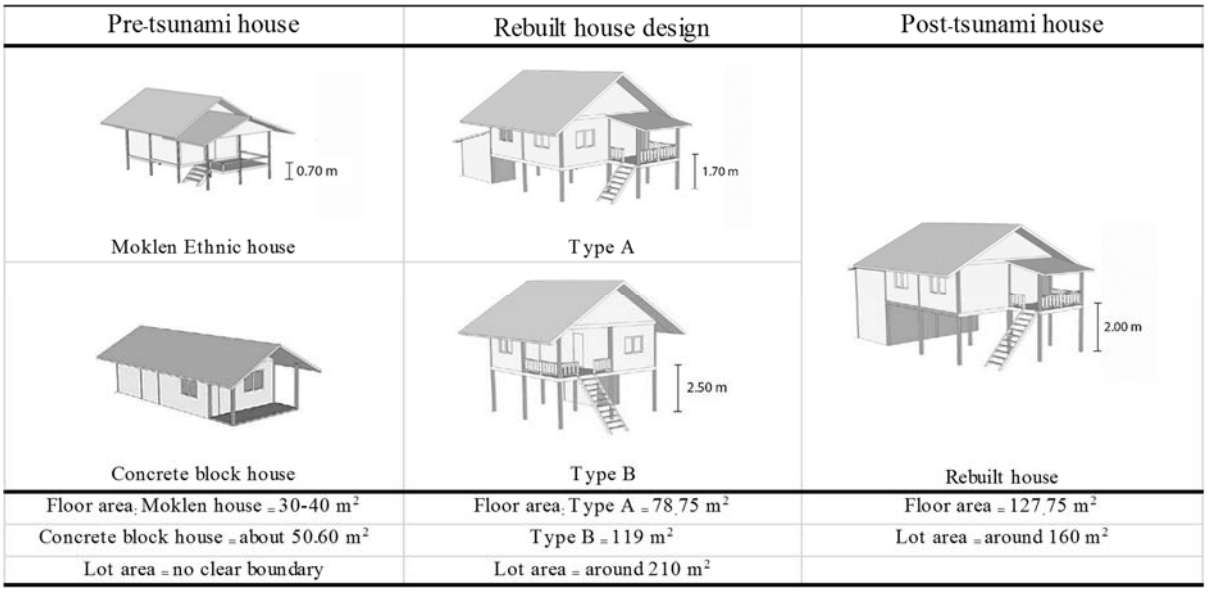


Figure 6.4 Housing transition in Tungwa village

6.2.3 Construction of post-tsunami housing

The construction process involved a group of experienced volunteers. Each household took part in the installation of walls and decisions on the positioning of doors and windows, with the variations in wall patterns reflecting their needs and preferences. All houses have fewer windows than the original design. Guidelines for living in a rebuilt house ensured that the roof height remained at the same level to maintain a clear view of the village. Moreover, large families are allowed to extend their living space on the ground level under the main house to prevent poor ventilation, and extensions outside the building are not allowed. However, the village land is uneven, which makes it difficult for the stilt floor to remain level from the ground. As a result, the houses have different ceiling heights. A total of 71 post-tsunami houses was built in Tungwa village, arranged in five rows (A–E in Fig. 6.5). The villagers chose a new

house based on the original location of their previous residence. Other buildings included a community pavilion (currently used as a cultural centre), football field, day care centre, as well as infrastructure facilities (electricity, water supply, and drainage). Each post-tsunami house consists of a balcony, living room, and bedroom on the stilt floor, with a bathroom and kitchen located on the ground floor (Fig. 6.4, right). The house structure is a mix of concrete pillars and blocks on the ground floor and wooden structures for the stilt floor. The roofing material consists of fibre-cement sheets. The total area measures 127.75 m^2.

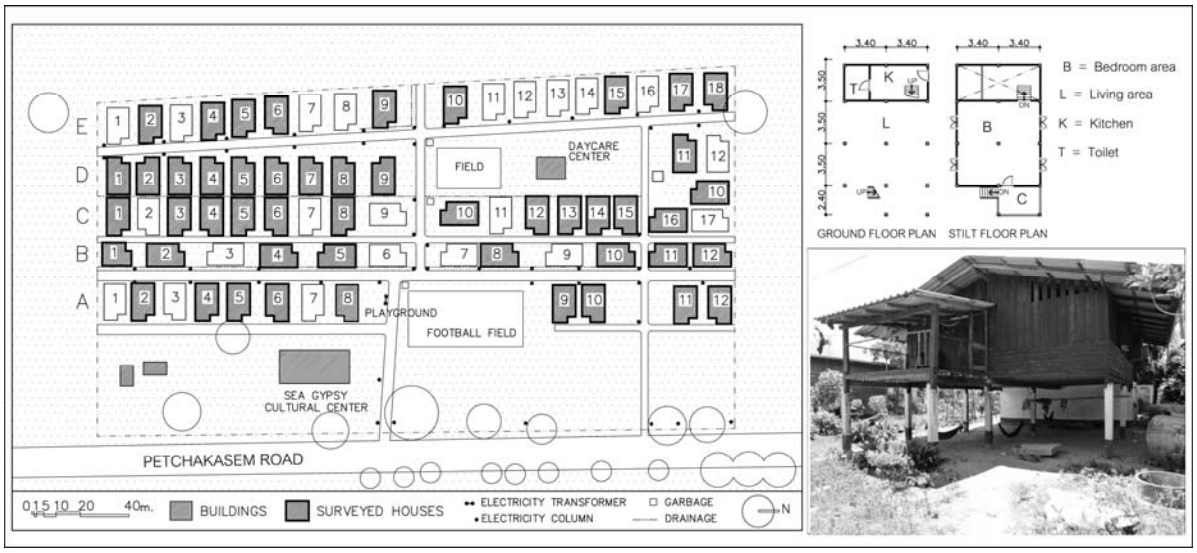


Figure 6.5 Tungwa village after the tsunami (based on a 2009 aerial photograph from the Thai Royal Survey Department) and a photograph of the rebuilt house (taken by the author)

6.3 Living conditions

The field survey collected data on current housing conditions concerning the changes after the tsunami, and satisfaction and dissatisfaction among the residents to understand the problems residents face as they live in the rebuilt houses. The conditions of the village as shown in Fig. 6.6. House with stilts floor space, extentions on ground floor space, living space of the ground floor, the stilt floor space was left unused, the deterioration of house and low quality of building elements.

Figure 6.6 House and living conditions in Tungwa village (taken by the author)

Changes after the tsunami

The study revealed certain patterns of change for windows and stairs, with additional partitions on the stilt floor and walls added to extend the ground floor living space. Table 1 shows the survey information collected for each post-tsunami house: pre-tsunami housing type, family structure (the majority are nuclear families consisting of parents and children), ceiling height of the ground floor (i.e., the clear space between ground level and the bottom of the floor joists), floor area, and changes and extensions. The patterns of change are shown in Figure 6.7.

Changes were made to the building components in many of the 49 houses in the survey. In seven houses, window positions were modified, and stairs had either collapsed or been removed. Partitions were added for bedrooms and storage on the stilt floor in 46 houses. Space on the ground floor was extended in 34 houses to serve a wide range of functions and provide a living room, bedroom, kitchen, and storage. Some houses created additional space under the balcony or opened a shop in the extended space.

Table 6.1 Changes and extensions in post-tsunami housing in Tungwa village.

	House number	Age of head of household	Family members	Household structure	Pre-tsunami house type	Ceiling height (m)	Extended area (m^2)	Floor area after extension (enclosed space, m^2)	Partitions (stilt floor)					Components					Extension (ground floor)						
									Bedroom	Storage	Multipurpose	Empty space	Other	Change window	Add window	Remove stair	Broken stair	New stair	Living	Bedroom	Storage	Multipurpose	Kitchen	Empty space	Other
1	A2	44	4	NF	B	1.98	_	78.75	1																
2	A4	70	4	GP+nephew	A	1.94	33.25	110.25		1										2	1				
3	A5	48	4	NF	A	1.83	49	127.75		1						1				2	2				
4	A6	46	7	2NF	B	1.78	_	78.75		1															
5	A8	41	4	NF	A	1.88	49	127.75	2										1	1	1			1	
6	A9	38	5	NF+nephew	B	1.38	_	78.75	1	1															
7	A10	35	2	NF	A	1.45	_	78.75		1							1								
8	A11	80	3	NF	A	1.58	_	78.75	1			1													
9	A12	50	1	Alone	A	1.51	_	78.75	1																
10	B1	40	1	Alone	C	2.15	12.25	91	1			1												1	
11	B2	43	4	NF	A	1.94	36.75	115.5				1					1			1		1		1	
12	B4	30	6	NF	A	2.08	24.5	103.25	1	1				1			1			1	1				
13	B5	56	7	GP+2NF	A	1.83	45.5	124.25				1					1			2					1
14	B8	35	3	NF	B	1.72	33.25	110.25	2					1					1		1		1		
15	B10	54	3	NF	A	1.63	_	78.75	1					1											
16	B11	34	4	NF	A	1.63	_	78.75	1					1											
17	B12	43	3	NF	A	1.63	_	78.75	2					1											
18	C1	47	3	NF	C	1.96	36.75	115.5	1					1					1					2	
19	C3	57	3	NF	A	2.25	36.75	91		1		1						1		1					
20	C4	44	4	NF	A	1.96	12.25	115.5		1						1				2		1			
21	C5	50	2	NF	A	1.96	36.75	103.25		1										1					1
22	C6	59	2	NF	A	1.97	24.5	127.75								1			1	2		1			
23	C8	54	6	GP+NF+nephew	A	2.13	12.25	91		1										1					
24	C10	36	4	NF	B	1.97	49	127.75	1							1			1	1					2
25	C12	42	4	NF	B	1.89	33.25	110.5	2											1	1	1			
26	C13	45	4	NF	B	1.92	_	78.75	1					1											
27	C14	28	1	Alone	B	1.74	24.5	103.25	1		1									1			1		
28	C15	51	4	NF	A	1.70	_	78.75		1															
29	C16	32	1	Alone	B	1.70	12.25	91		1											1				
30	D1	32	4	NF	A	2.18	_	78.75	1			1													
31	D2	29	4	NF	B	1.98	_	78.75	1	1															
32	D3	29	5	NF	A	1.97	49	127.75												3				1	
33	D4	37	4	NF	A	2.08	_	78.75	2																
34	D5	37	6	NF+nephew	B	1.98	24.5	103.25	2															2	
35	D6	40	6	2NF	_	2.08	49	127.75	1										1	2	1				
36	D7	58	6	2NF+nephew	A	2.08	_	78.75	2																
37	D8	33	6	NF+brother	A	2.05	12.25	91		1										1					
38	D9	47	5	NF	A	2.00	24.5	103.25	1											1	1				
39	D10	43	2	NF	A	2.10	24.5	115.5			1	1							1	1		1			
40	D11	29	3	NF	B	1.76	_	78.75		1															
41	E2	34	5	NF	A	1.94	36.75	115.5	1										1	2					
42	E4	29	5	NF	C	1.96	24.5	103.25												1					
43	E5	32	6	2NF+nephew	A	1.98	_	78.75	1								1								
44	E6	43	4	NF	C	2.08	24.5	103.25	1													2			
45	E9	43	6	NF	A	2.02	24.5	103.25	1					1					1	1					
46	E10	43	4	NF	B	1.94	49	127.75	3										1				1		2
47	E15	41	4	NF	_	2.10	36.75	103.25		1	1								1					1	
48	E17	43	4	NF	C	1.82	45.5	124.25		1									1	1		1		1	
49	E18	42	3	NF+nephew	A	1.77	_	78.75	2																

Pre tsunami house: A = Moklen house, B = Concrete block house, C = Other

Family structure: NF = Nuclear family, GP = Grandparent

Nuclear family is a family consisting of two parents and their children, but not including aunts, uncles, grandparents, etc.

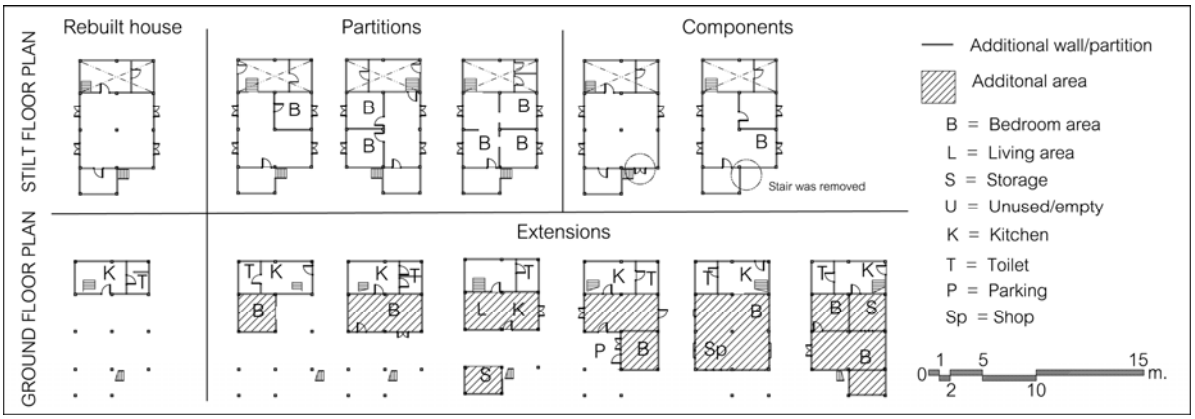


Figure 6.7 Examples of the changes to post-tsunami housing in Tungwa village

The current study compared the collected data with previous data compiled by Sthapitanonda et al. (2006), who investigated the changes in post-tsunami housing in Tungwa village after a year. The houses with additional partitions on the stilt floor have increased from 77.3 to 93%, with extensions on the ground floor significantly increasing from 9.1 to 69.38%.

Level of satisfaction among residents

The questionnaire found that 23 of the 49 respondents were dissatisfied with their rebuilt house. Twelve respondents were satisfied with their rebuilt house, and seven respondents have neutral feelings regarding the housing situation. The reasons for this are shown in Table 6.2.

Table 6.2 Responses from residents regarding rebuilt houses in Tungwa village

Reasons for reaction towards rebuilt house		
Dissatisfaction	**23/49**	
- Hot temperature in the house	9/23	39.1%
- Inconvenient to move between the stilt floor and ground floor	7/23	30.4%
- Material deterioration	5/23	21.7%
Satisfaction	**12/49**	
- Bigger house	3/12	25%
- Frequent repairs not required	2/12	16%

Residents who were dissatisfied with living in a post-tsunami house explained that their reactions were based on the high interior temperature, inconvenience of moving from the ground floor to the stilt floor, and material deterioration. The residents who complained about

high temperatures in the house were mainly elders and women who mostly stay at home, while some residents did not comment on the temperature issue since most of them work outside during the day. To cope with the high temperature in the house, they stay on the ground floor in the daytime and sometimes use electrical appliances. Most respondents who find it inconvenient to move between the two floors are the elderly, those accustomed to living in a single-storey house, or families with small children. The biggest inconvenience for such respondents involves going downstairs to use the bathroom during the night. Moreover, material deterioration is a cause of resident dissatisfaction since parts of the stilt floor, stairs, balcony, and walls are constructed using wood, which is prone to damage by rainwater and termites. In addition, five respondents intend to stop using the space on the stilt floor when enough additional rooms have been built on the ground floor for their daily living requirements.

6.4 Factors affecting living conditions

Use of the overall space and its rearrangement by residents was analysed to assess their effect on living conditions.

6.4.1 Liveability of residents

The study found that post-tsunami housing in Tungwa village shows many different patterns of space usage by the residents on the stilt floor as well as the ground floor (Fig. 6.8). Space usage refers to areas for daily functions, offered by partitions or an open plan design. Fig. 6.8 shows mainly sleeping space, living space, and storage space on the stilt floor, while multi-purpose activities are carried out in the kitchen, living room, sleeping area, storage, and shop spaces on the ground floor. It can be seen that the ground floor is flexible for accommodating a variety of functions as well as new family members. However, there are ten houses where the stilt floors have been left unused or used as storage, namely houses C3, D10, C6, D3, C4, C5, E2, B5, C15, and A12 as shown in Fig. 6.8. The study also found that among the 49 houses in the survey, seven have distinctive patterns of space usage (numbers 43–49 in Fig. 6.6) The ground floor is mostly non-functional in these houses, as they have ceiling heights below 1.70 m. However, the two houses where residents use the ground floor, even though the ceiling is very low, are A11 and A12 (Fig. 6.8). The residents in house A11 (Fig. 6.9, Fig 6.10), are an elderly couple aged 80, who have difficulties getting up to the stilt floor, as does the 50-year-old resident of A12. These residents lived in a Moklen house before the tsunami.

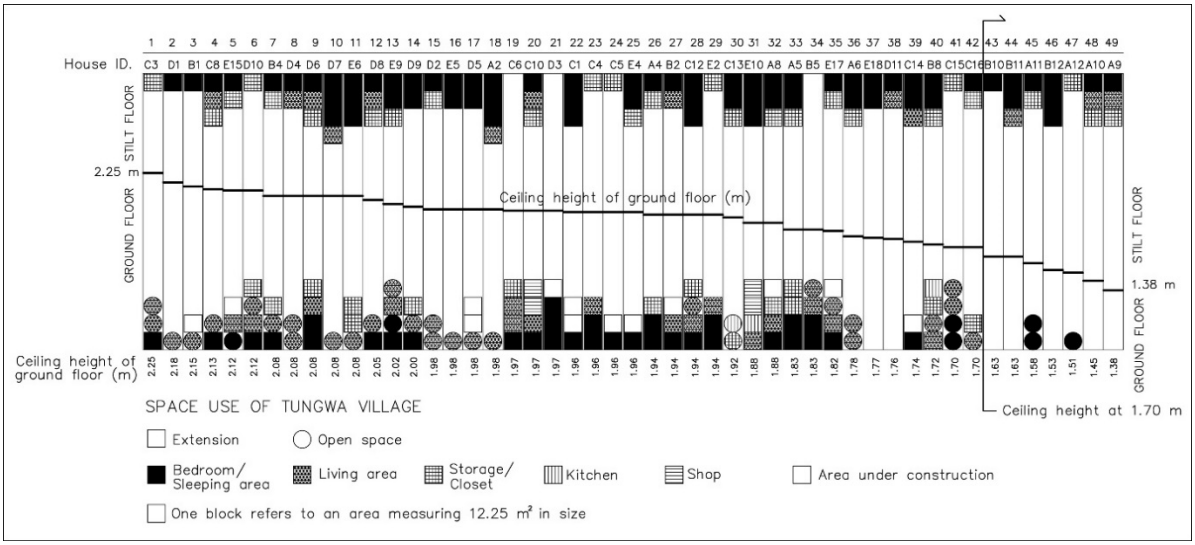


Figure 6.8 Relationship between the ceiling height of the ground floor and space use of rebuilt houses in Tungwa village

6.4.2 Factors affecting living conditions

In addition, the study found that three aspects of housing design affect living conditions: village layout, housing space, and building materials.

Village layout: the lifestyle of the Tungwa Moklen community in the pre-tsunami period was tied to the environment, such as with surrounding trees providing shade for work and leisure. The overall layout of the rebuilt Tungwa village is tidy and modern, although the limited availability of land affects the space between houses, and the row arrangement blocks wind flow, resulting in ventilation problems. The limited area also affects livestock, especially the raising of pigs due to bad odour and the serious lack of hygiene in small spaces. House E9 shows the limited use of surrounding space for a fish pond and a chicken coop (Fig. 6.9).

Housing space: as the rebuilt house design based on the traditional Moklen house is bigger, it can better accommodate the villagers' lifestyles as it is not much different from that of the pre-tsunami. A toilet was also added on the ground floor to improve the living conditions of ethnic people with better hygiene. In the finished rebuilt houses, the stilt floor was prepared as an empty space, for subsequent reconfiguration by the residents to provide bedrooms, living areas, and storage. On the ground floor, the high ceiling heights and open space provide flexibility and can be used as a living area or kitchen, or for parking and storing vehicles, as well as stocking supplies and supporting the extended family. However, a gap in lifestyle is also indicated in certain cases. For example, in house E9, the elderly residents are accustomed to the pre-tsunami living environment; sleeping on litter and setting a fire to use the smoke as

an insect repellent at night. Moreover, because the bathroom is on the ground floor, the high ceiling height and steep stairs cause difficulties for some residents with bedrooms on the stilt floor.

Building materials: compared to the traditional Moklen house which was made from natural materials, modern materials such as concrete were used in the rebuilt houses for the structure of the ground floor to support the strength and durability of the building. However, the rebuilt houses are made from wood which is used for the main structure of the stilt floor, walls, and elements, and after ten years some parts of the houses show signs of serious deterioration. In addition, the change of roof material to fibre-cement tiles affects the heat inside the house since the large area of roof plain on the bigger houses affect heat transmission. In addition, the low steep slope of the roof results in limited space beneath it, which retains heat in the house. In addition, the Moklen houses with stilt floors have small gaps in the bamboo floor and walls which help the air to pass through the house, taking heat from the building.

6.4.3 Space rearrangement by residents

During the ten years spent in their post-tsunami houses, residents have tried to solve the problems regarding their living conditions by adding partitions, extensions, and components.

Partitions: the purpose of installing partitions on the stilt floor is mainly to create bedrooms. The survey revealed that some residents intend to use the bedrooms for young family members. Such space is traditionally related to the Moklen house and used for storage, or to accommodate daughters. However, the partitions cause ventilation problems and the bedrooms are used for storage instead. For example, a bedroom in house A6, C15 and D10 is used for storage, while the resident in house C15 (Fig. 6.11) and D10 (Fig. 6.12) has decided to live on the ground floor only.

Extensions: the study showed that space on the ground floor is beneficial to some residents, since it provides room for extensions to accommodate growing families when young family members marry or relatives move in. Some elderly residents and families with small children, who find it inconvenient to move up and down the stairs, especially when using the bathroom on the ground floor at night, have decided to live on the ground floor. Moreover, some residents, such as those in house E9, live only on the ground floor without using the stilt floor. However, a ground floor ceiling height of below 1.70 m makes it difficult for residents to create additional usable space.

Components: the limited areas around the house and windows were reduced for the rebuilt house design, which has resulted in ventilation problems. Many residents moved windows to the front of the house during the construction process. The deterioration of some components has also led to changes in living space. For example, the stilt floor in house D3 (Fig. 6.13) collapsed as a result of damage by termites and insects. Owing to safety concerns, the resident decided to move down to live on the ground floor. Furthermore, damage by rainwater to the outside stairs, resulting in their subsequent removal, has made it inconvenient to use the stilt floor. Moreover, the low quality of stairs, most of which were built by the residents themselves, means that they are no longer safe to use.

Figure 6.9 Examples of space usage for post-tsunami houses in Tungwa village

Figure 6.10 Living conditions of house number A11

Figure 6.11 Living conditions of house number C15

Figure 6.12 Living conditions of house number D10

Figure 6.13 Living conditions of house number D3

6.5 Conclusion of this chapter

In general, the rebuilt houses are capable of adequately supporting the residents' basic living requirements, including the provision of utilities and facilities. This type of housing was designed to provide flexibility for various activities and long-term living arrangements, especially built-in options for extensions in the future. However, some of the houses cannot support their residents. Moreover, non-professional construction or modifications by the residents themselves have resulted in deviations from building standards, and this also affects the living conditions of some residents.

Three aspects affect the living conditions of the post-tsunami house: village layout, housing space, and building materials. The row layout of the houses blocks wind flow, and the small plots mean there is limited space between them, with a decrease in the number of windows causing ventilation problems. The surrounding area also has an effect and limit the livestock area. The height of the stilt floors in the housing space has negatively affected the elderly and families with small children because of the inconvenience of using the stairs. The low ceiling of ground floor affects space use since residents cannot use the area. The stilt floor is a wooden structure which has become damaged or even collapsed after ten years, and some residents have decided to live on the ground floor only, resulting in inefficient use of space as well as the use of different materials causing high temperatures inside.

The post-tsunami houses affect space use for residents, especially elderly people accustomed to living in a Moklen house. Such people are very sensitive to the environment, and the new house design forces them to use inappropriate spaces or change their traditional lifestyles. Even though the design was planned in accordance with the traditional Moklen house and residents participated in it, some factors should be reconsidered to improve living conditions.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

7.1 Summary of research findings

This study indicates the influence of post-tsunami houses on people who have distinctive lifestyles such as the Moklen. A case study of Tungwa village shows that the house has affected residents in many ways. The result of the study leads to recommendations for the future design and improvement of living conditions.

Chapter 1

To indicate the importance of research, this chapter begins with an overview of the damage to housing after the 2004 Indian Ocean tsunami. Post-tsunami housing construction assistance did not take into account the needs of residents, in particular, those with distinctive lifestyles and culture such as the ethnic minority Chao Lay. This caused problems due to the gap between traditional lifestyles and post-tsunami housing. The literature review highlights the importance of Chao Lay's culture on post-tsunami housing in Thailand, and similar research studies represent the many adverse effects of planning and house design. Houses were consequently adapted by changing the use of functional areas or making extensions to support traditional lifestyles. The objective of this research is to better understand post-tsunami house design with a view to improving the living conditions for the benefit of post-disaster housing in the future.

Chapter 2

The overview of post-tsunami housing assistance is mostly under government management, with 74% of proposals for house construction and renovation being submitted to the government. In addition, the three types of house design were provided by the DPT, with other government departments being responsible for construction in the affected provinces. This shows that large scale housing management in Thailand has a limited budget and rapid construction methods. The second form is from NGOs providing direct assistance. In order to receive either of these two forms of assistance, land ownership is the main criteria. The final form involves a government organisation with an NGO providing assistance to people with land issues and includes the Chao Lay in particular. As settlements along the coastal area also concern the livelihoods of fishermen, there were conflicts with government departments and the private sector. The Land Commission was established to solve the land problem by proving land tenure before the tsunami and the date a land title was issued. This process later became a model for resolving land conflicts in many affected areas. The effect of land conflict also leads

to policy making for the rehabilitation and resolution of lifestyles and the ethnic minority culture of the Chao Lay, in particular, giving precedence to the consideration of land conflict issues to provide housing security.

Chapter 3

The location of Moklen settlements in coastal areas meant that severe damage was caused to housing in the tsunami, and this is represented by their distinctive traditional lifestyles. In particular, the construction project in Tubpla village reveals the indigenous knowledge of Moklen ethnic houses, with rituals and beliefs, and body-based units of measurement used in construction, as well as the implementation of techniques such as building components being bound together with rattan rope. These factors represent the importance of the Moklen housing culture. In terms of architecture, the Moklen house is vernacular architecture that its design based on tropical climates where hot and humid. The Moklen house built from natural materials with stilt floor around 0.70-1.00 m from the ground, steep slope of gable roof for drainage and long eaves protecting rain splash to the wall. House elements of weaved bamboo wall and floor allow good air ventilation. The rectangular plan with functional areas and space arrangement of balcony, sleeping area, storage and kitchen, each are separated by low steps. This chapter provide understanding of traditional house and living conditions in the pre-tsunami period.

Chapter 4

An overview of the post-tsunami houses for Moklen people indicates the accessibility to housing assistance. Only one of the seven projects received assistance from the government. One project was assisted by private sectors, four projects were assisted by NGOs and another two by CODI in conjunction with NGOs, due to land conflict. The involvement of different organisations affected house design due to varying construction processes, budgets, and levels of participation. Tubtawan and Tungwa villages participated in the design.

All six housing projects have different features, with the majority being modern style houses built with the use of industrial materials. three projects were designed ready to live in while another three were core houses. The floor areas were also different, with an average size of around 60 sqm. Tungwa village has additional space on the ground floor which affect the floor area are twice as high as those in other villages.

There are two village layout patterns; those reconstructed based on the original setting, and others planned. Since there was no change in land size for the post-tsunami houses built in the original setting, residents were able to continue with their livelihoods, such as raising livestock

or making litter for many using the space for a living area, drying food, and preparing sweets for tenth month ceremony. In some houses, a room was added for a family member, kitchen, or living area. Such changes can support adaptation as well as the existing traditional lifestyles of Moklen people. The villages of Bangkaya and Tungwa were planned and consequently, the limited space of the lot area affected some activities such as the raising of livestock or storage of fishing equipment. Both villages consist of core houses which provide flexibility in area use. The study also found that not every villager lived in traditional houses before the tsunami, a village had modern style houses before the tsunami which can be assumed that they are able to adapt themselves to the new house. The lifestyle of residents in Tungwa village has also been affected by the limited size of the lot area since most of them lived in a Moklen house before the tsunami. To understand design process with community based due to participatory process, house characteristic and rearrangement in modern planning, Tungwa village was selected as the case study for in-depth analysis.

Chapter 5

The change in livelihoods and living conditions is represented by land used and village level. The area available to support livelihoods has decreased due to private sector land tenure. The cemetery area is only small because it was not given priority by local government. The village area has moved because of the land tenure nearby and the policies that allow villagers live in government's land changes in each period.

The post-tsunami pattern of settlement has changed the village level from houses scattered around the area into a planned orderly arrangement. The houses are larger than before the tsunami and common areas and facilities support community activities, including utilities to improve living conditions.

This chapter shows the changes resulting from development of the land by the private sector, and the land policies of local government, especially since the tsunami, when problems with land conflict have led to housing insecurity. These findings help to clarify the issues faced by the Chao Lay after the tsunami.

Chapter 6

Tungwa village was used as a case study in order to understand the influence of post-tsunami housing on Moklen people. Ten years after the tsunami, the residents are experiencing some difficulties with living conditions. Research has revealed that the rebuilding process changed the house types from single-storey in the pre-tsunami period, to houses with high stilts post-tsunami. In general, the rebuilt houses are capable of supporting the residents' basic living requirements; however, some of them experience difficulty in creating additional space on the

ground floor owing to the lower ceiling height and low quality control of construction, despite the houses being designed with optional space on the ground floor. The study also found that three aspects affect living conditions: village layout, housing space, and building materials. The village layout in rows of houses limits air ventilation as they block each other's wind flow, and limited space causes difficulties for livestock. The living space on the higher stilt level is inconvenient for some villagers, especially the elderly, who are accustomed to the pre-tsunami living environment, and some households are living only in the additional space created on the ground level. In addition, some building materials have been damaged by termites and rain, making it dangerous to live on the stilt floor.

7.2 Recommendations for Tungwa village

7.2.1 Discussion on the living conditions of Tungwa village

The living problems of Tungwa village are concluded in chapter 6. However, this sub-section relates to the processes involved.

Village layout: The planning included facilities to support community activities and utilities, resulting in better living conditions for the community. However, the modern and orderly pattern changed the sylvan environment of the village, and since the houses are close to each other, the wind flow is blocked, affecting the ventilation of the village. The limited surrounding space causes difficulties in keeping livestock. Moreover, extensions were only allowed in the main structure to provided good ventilation, and this has limited the possibility of adaptation for residents.

Housing: Even though the house design was developed from the original Moklen house and uses a similar area, it cannot accommodate the requirements of all residents, resulting in spaces not being fully utilised, especially on the stilt floor which was often left unused or used for storage. This is because the house pattern was changed from a low to high stilt floor due to limited land area and to reduce the impact of a future tsunami. Such design was not convenient for residents accustomed to the pre-tsunami house and affected elderly people and children who frequently need to use the toilet.

In addition, volunteers and owners participated in the construction of the main structure, resulting in different standards for each house, especially where ceiling heights were lower than 1.70 metres, as this caused difficulties when using the ground floor space.

Construction materials: It was decided to increase the house strength on the ground floor by using a concrete structure and natural materials such as wood on the stilt floor, to

accord with the characteristics of a Moklen house. However, ten years after the tsunami, the materials have deteriorated, affecting the use of the space. The stilt floor structure has been destroyed by insects and termites, and residents therefore decided to live on the ground floor.

7.2.2 Recommendation for post-tsunami house design in the future

The following are suggestions for improving the living conditions and resolving design issues in post-tsunami houses.

Village layout: There are problems with limited space surrounding the house, reconstruction of the building environment and landscape. In chapter 4, the surrounding area benefits from flexibility in the adaptation and support of livelihoods. However, limited surrounding space cannot be extended, but space sharing between houses is possible and should be encouraged.

Housing space: The space on the stilt floor is not fully utilised, and to solve this problem the supporting space is used and adjusted accordingly. In terms of different ceiling heights, the level of the ground floor should be adjusted to provide a space of at least 1.70 m. Adjustment of the balcony level, will provide an appropriate area for activities. In chapter 4, the stilt floor at a height of around 0.70–1.00 m. can be used as a meeting space, living space, or kitchen. For interior stairs, the distance between both floors can be divided by making a landing, that providing convenience for using the toilet, as well as being safer for elders and small children.

Construction materials: Aerated materials should be used for partitions to help ventilate the house and address the heat issue. Window sizes should be increased and positioned to assist good air flow. The use of modern roof materials is beneficial in reducing the angle of the slope but has caused problems with stagnant heat due to the low space, which transmit to the usable space. This is different from the original Moklen house which used natural materials and had a high sloping roof. To resolve this problem, insulation can be installed to improve heat transmission.

The wooden structure of the house easily deteriorates as a result of insects and rainwater. Better quality or durable materials should be used for building and future repairs to solve this problem as well as improving the safety aspect.

7.3 Recommendation for post-tsunami house design in the future

In designing post-tsunami housing for Moklen people, the following processes should be considered:

7.3.1 Preparation on land

The Chao Lay faced land conflict problems for a considerable time, although such problems have obviously been exacerbated since the tsunami. However, the resolution of land conflict problems has resulted in substantial policy making, and lessons have been learnt for future benefit. There are policies for the rehabilitation of the Chao Lay's culture and livelihoods in the short and long-term with the cooperation of government departments, in addition to dealing with land security concerns for housing. In the case of Tungwa, there are three types of changes, namely land use, livelihoods, and cemetery and housing area. Policy implementation can support the community and local government should also pay more attention to sustaining Chao Lay communities.

However, for those involved in post-tsunami housing design and planning, to avoid similar future conflict, lessons can be learnt from the tsunami in 2004. The case of Tungwa village provides information on how the land conflict problem can be solved. Proving land tenure by aerial photograph is an important process for ascertaining the exact boundaries to assist planning and housing design. The case study of Tungwa village shows the design process before the conflict was resolved, where the original layout of the house was changed in accordance with the needs of residents.

7.3.2 Data collection for design and construction

Data collection prior to design and construction is an important process for ascertaining living conditions in the pre-tsunami period. However, time is limited as the house needs to be constructed as quickly as possible. The pattern of systematic data collection contributes to the success of this process and will be useful for future disasters.

- **Village layout**: Aerial photographs, together with data from villagers has aided understanding of land use, settlement patterns, environment, and housing styles. In the case of Tungwa village, the sylvan environment and greenery supported the community, as well as providing a living for residents. The design was based on clusters of houses, relationships, and size of lot area allocated for each house.
- **House styles**: Data was collected from villagers regarding house styles. Chapter 4 contains information which indicates that each village has a different house style and living

conditions, even though they are all Moklen. For example, villagers in Bangkaya changed to a modern house style before the tsunami. In addition, the Moklen houses have been found to be diverse, such as the ethnic house and those which combine modern materials and concrete blocks. The living experience in different house styles affected residents' ability to adapt to post-tsunami house.

- **Pre-tsunami lifestyles**: Livelihood is the main criteria for people with a relationship with the sea, especially fisherman. Although many villagers now have other jobs, the collection of sea resources is still the primary occupation. Livestock and fishing trap construction also take place in some houses, and the area should be able to support other activities. As well as providing a livelihood, some villagers use the area for cultural activities such as cooking, traditions, or ceremonies. The planning and design of the house should not be considered as merely physical elements.
- **Residents' requirement**: Even though the collected data provided an understanding of housing and lifestyles, individual communities may have different requirements than before the tsunami. For example, in Soi Willy, a Moklen house is comfortable enough to support a good living but it is not durable, and looking underdeveloped caused residents chose the modern housing styles. The design should incorporate traditional, current and modern living.

7.3.3 Design and construction process

Planning and house design

Chapter 5, indicates that orderly planning, limited space surrounding the house, and orientation, affects living conditions. However, houses based on the traditional format can support the Moklen lifestyle as they are similar those in the pre-tsunami period. The Moklen house with a modern structure and materials provides strength, and includes a toilet for comfort and hygiene. The case of Tungwa also shows how to resolve the problem of planning in a limited area. It can be concluded that there are six principles of post-tsunami housing design for people with distinctive lifestyles as follows:

- Design to support better living conditions
- Design based on original housing styles
- Traditional and post-tsunami house design integration
- Design according to original lifestyles
- Design to support living conditions in the long-term
- Design resistant to tsunami

Participatory process

In instances where the community participated in the design and construction process, the house can support their requirements and feels homely[17]. In addition, they can learn about housing construction which helps them in repairing the house themselves.

Construction

Although the participatory process helps people to build houses they need and save costs but as shown in the case of Tungwa village, the construction is often low quality. In particular, the different ceiling heights of the ground floor mean that some houses cannot use the space as it is very low. Self-build construction also means that the owner can change the house, and with little time for construction, there was no final design strategy. A professional builder is therefore necessary to control the standard of construction, which not only helps to strengthen the house but ensures consistent quality.

7.3.4 Evaluation of living quality in post-tsunami houses

Since it is the first time a tsunami of such magnitude occurred in Thailand, there was little evaluation of living quality and response from residents to the houses. An evaluation by Sthapitanonda et al. (2007) shows that physical changes were made to the houses a year after the tsunami. However, it is a study of short-term changes compared to this study which shows the long-term changes in living conditions, including adaptations and problem solving, particularly in respect of house extensions and material deterioration. The record of changes and living conditions over many years will help in the understanding of the space use for residents, leading to improvements in future house design.

7.3.5 Education in post-disaster housing

The residents should be educated in appropriate house with importance of housing culture for housing design and improvement in the future. According to the traditional house design come accordance with tropical climate, the housing space and elements were created to support comfortable of users. The knowledge in construction that people can build by themselves also with appropriate of economic status because the materials can be found in nature surrounding area, however, in present, the material accessibility is limited also the Moklen ethnic house are not durable, as it needs to change elements and rebuilt every 10 years, in some villages the traditional houses can be built which help conserve the house and their knowledge. However, in some villages, it is difficult to keep on building also the changes of lifestyle to be more modern. The modern mateials should be used to support as the adventages

[17] This is a strategy used by CODI to strengthen the community.

of durability combinding with the indigenous knowledge of Moklen ethnic house. In addition, the house structure should be design considering to be strententh for the next disaster.

7.4 Recommendations for further research

A study on the comparison of post-tsunami houses for Moklen people, in chapter 4 the post-tsunami houses of Moklen people are selected to understand the living conditions by focusing on the use of the surrounding area and extensions. The study shows the lifestyles and culture evident in daily living, including solving space problems by making extensions. Understanding the living conditions for villagers is beneficial in post-tsunami housing design for Moklen people in the future.

The study of comfort factors, in this study the traditional house is compared to post-tsunami housing. However, the comfort factors should be scientifically proven to support the appropriate use of material in future house design.

Moklen house design in the modern context, in this study, the Moklen house can support the lifestyles of residents, especially those of Moklen elders, since they have certain characteristics and vernacular architecture appropriate for tropical climates. However, the Moklen house has restrictions, particularly in respect to the lack of modern materials and technology. The Moklen house design should incorporate traditional ideas with modern materials in order for it to be useful to Moklen people in the future.

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APPENDIX I

QUESTIONNAIRE

Information of questionnaire:

Name: Monsinee Attavanich

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Telephone: (+66) 089 412 0100

Purpose: 2004 Indian Ocean Tsunami affected the coastal area of Southern Thailand, include Moklen villages. As the distinctive culture, the house may cause difficulties because of gap of living between traditionaland modern. The post-tsunami houses provided to people, this research focuses on influence of house to Moklen people living in post-tsunami houses after 10 years. Your answers are useful source of information also improving the house in the future. It deeply appreciates for your cooperation.

Village: Tungwa village, Kukkak Sub-district, Takuapa district, Phang Nga provinc

Interviewee's name_____

House owner's name_____

Age_____

Address_____

What are your nationality / ethnic?

☐ Thai ☐ Moklen ☐ etc._____

1. General information

1.1 Do your family live here in the past?

☐ Yes ☐ No

If not? Where are you from?

☐ Tungwa Nai ☐ Tungwa Nok ☐ Bang Niang ☐ etc._____

1.2 When have you been here?

☐ Before the tsunami ___ years ☐ After the tsunami ___ years

1.3 Why have you been here?

☐ Look for a job ☐ Afraid of the tsunami

☐ Government management ☐ etc._____

1.4 How many family members in your house?

Before the tsunami ___ After the tsunami ___

_____

_____

1.5 Who are your family members? How old are they?

_____

_____

1.6 How many Moklen households here?

Before the tsunami ___ years After the tsunami ___ years

_____

_____

1.7 Is there any relation in this villages? Where are they?

_____

_____

1.8 Is there your neighbor from the old village live here? Where are they?

_____

_____

2. Pre-tsunami houses

2.1 Before Tsunami, how does your house like?

☐ Moklen ethnic house ☐ Wooden house with modern materials

☐ Concrete house with modern materials ☐ etc. _____

Datails_____

_____

2.2 Before Tsunami, did you have your own land?

☐ Yes ☐ No

Where?

_____

2.3 What are your house material? Name of plants?

_____

_____

2.4 Where and how do you get the materials?

_____

_____

2.5 Can you build a Moklen ethnic house?

☐ Yes ☐ No ☐ etc. _____

If yes, how do you know how to build?

_____

_____

2.6 How often and how do you maintain your house?

_____

_____

3. Post-tsunami houses

3.1 Who did provide house to you?

☐ Yourself ☐ Other organization ☐ etc. _____

3.2 After Tsunami, do you have your own land?

☐ Yes ☐ No ☐ etc. _____

Where?

_____

3.3 Where and how do you get the materials?

_____

_____

3.4 Who choose this house for you?

☐ Yourself ☐ etc. _____

3.5 Did you participate in house and village design?

☐ Yes ☐ No

How?_____

_____

3.6 Did you participate decision making in house design and village selection?

☐ Yes ☐ No

How?_____

_____

3.7 What is the house conditions How did your house be when you get it for the first time?

_____

_____

3.8 How many times did you improve your house?

☐ 1 time ☐ 2 times ☐ 3 times ☐ etc. _____

Why?_____

_____

How? (Example: room partition, house extension)

☐ Making room partition ☐ Room addition

☐ Moved door and window ☐ etc. _____

_____

_____

3.9 Do you like this house?

☐ Yes ☐ No ☐ Prefer an old house

Why?_____

_____

3.10 What do you want to improve the house?

_____

Why?_____

_____

3.11 Do you afraid of the Tsunami?

☐ Yes ☐ No

Do you feel safe now?

☐ Yes ☐ No

Why?_____

_____

3.12 Do you use house utilities such as electricity and water supply and sanitary system?

☐ Yes ☐ Used to ☐ No

If not, why do you not use?

_____

_____

Do you feel convenient?

☐ Yes ☐ No

3.13 Do you used village's facilities?

☐ Yes ☐ No

4. Work

4.1 Before Tsunami, what did you do to earn your life?

☐ Do fishing ☐ Labor ☐ etc. _____

4.2 If you did fishing, where and how did you go to get the sea resources? Write map, location

4.3 Now do you still work as the same?

☐ Yes ☐ No

If you did fishing, where and how did you go to get the sea resources? Write map, location

If not, why do you change your work, what is your work now and how do get to workplace?)

5. Activities

5.1 Before tsunami, what do you do in daily life (in the morning until the night)?

	6.00-12.00	12.00-16.00	16.00-20.00	20.00-6.00
Child				
Teenage				
Adult				
Elderly				

5.2 After tsunami, what do you do in daily life in the morning until the night?

	6.00-12.00	12.00-16.00	16.00-20.00	20.00-6.00
Child				
Teenage				
Adult				
Elderly				

6. Social issues

6.1 Before Tsunami, are there any ceremony and worship in village? What is ceremony and worship?

☐ 4th month ☐ 5th month ☐ 10th month ☐ etc. _____

6.2 What about the ceremonies and worship? Please explain

_____

_____

6.3 After Tsunami, are there any ceremony and worship in village? What is ceremony and worship?

☐ Same as before Tsunami ☐ Change from before Tsunami

How?_____

_____

6.4 Where are the ceremony and worship held?

_____

6.5 If there is a family member died, where is funeral place?

_____

_____

6.6 Do you have an ID card?

☐ Yes ☐ No

When?

☐ Before the tsunami ☐ After the tsunami

6.7 Do you have a social security insurance?

☐ Yes ☐ No

When?

☐ Before the tsunami ☐ After the tsunami

6.8 Do you have right to education?

☐ Yes ☐ No

When?

☐ Before the tsunami ☐ After the tsunami

6.9 Do you get the treatment service?

☐ Yes ☐ No

When?

☐ Before the tsunami ☐ After the tsunami

6.10 Do you know who is the owner of this land?

☐ Yes ☐ No

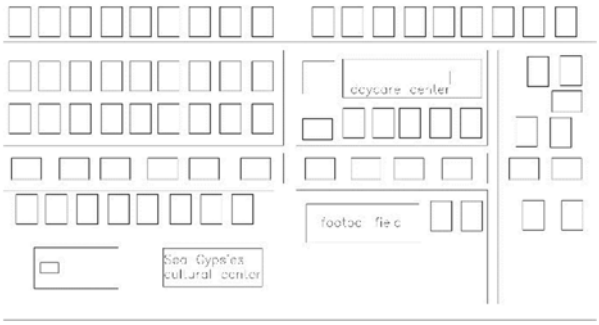
6.11 What do you concern about the future?

☐ Housing security ☐ Tsunami

☐ Moklen traditions will be disappeared ☐ etc. _____

_____

_____



Location of survey house

Before Tsunami, how does your house like?

_____

_____

How did the house improve? Example: room partition, house extension

_____

_____

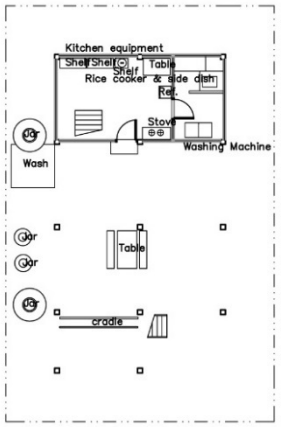
Write plan and living conditions

APPENDIX II

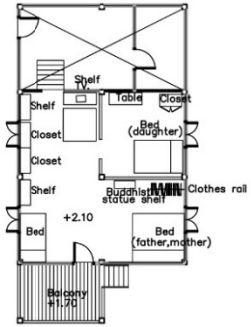
RECORDS OF LIVING CONDITIONS IN POST TSUNAMI HOUSES:

CASE OF MOKLEN TUNGWA VILLAGE

A2

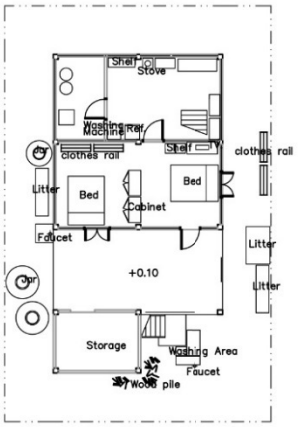


GROUND FLOOR PLAN

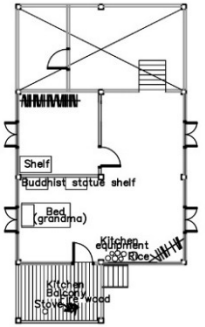


STILT FLOOR PLAN

A4

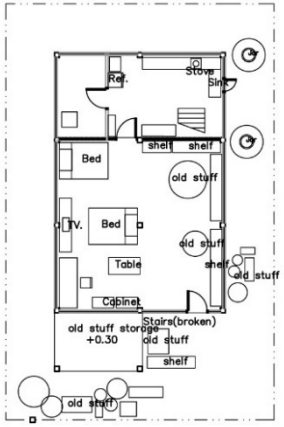


GROUND FLOOR PLAN

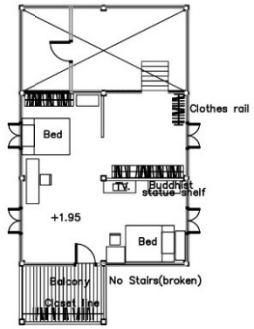


STILT FLOOR PLAN

A5

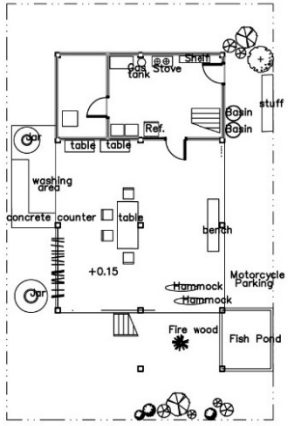


GROUND FLOOR PLAN

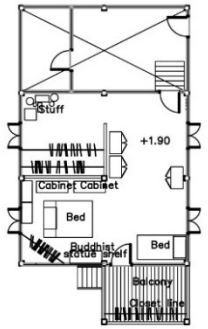


STILT FLOOR PLAN

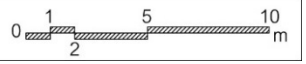
A6



GROUND FLOOR PLAN



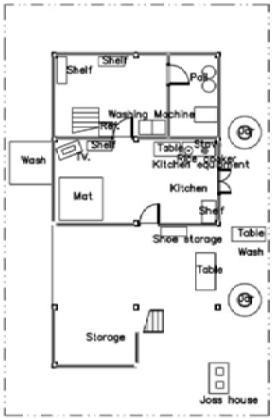
STILT FLOOR PLAN




A7
GROUND FLOOR PLAN
Concrete pond
STILT FLOOR PLAN
+2.06
Bedroom
Balcony
A8
GROUND FLOOR PLAN
Washing Basin
Ref.
Bedroom
Storage
-0.15
-0.15
0.00
Fish Pond
0.00
STILT FLOOR PLAN
Closet
1.85
1.85
1.85
1.85
Buddhist statue shelf
Bed (father/mother)
Storage Box
Balcony
A9
GROUND FLOOR PLAN
Toilet
Stove
Rice Gas Storage
Wood pile
Fire wood
Plastic tank
Hammock
STILT FLOOR PLAN
Dresser Clothes
Closet
Shelf
Buddhist statue shelf
Table
Dresser Clothes
Balcony
A12
GROUND FLOOR PLAN
Shower room
Sink
Old kitchen
Wood Pile
Washing
Litter
wood coconut
Fire wood
STILT FLOOR PLAN
Bed (Son)
Cabinet 3
Cabinet 2
Buddhist statue shelf
Cabinet 1
Balcony
Closet line
0
1
2
5
10
m


B1
B2
B4
B5
Washing
Table
Storage Box
Washing Machine
Litter
Clothes line
Clothes roll
Closet
T.V.
Dead person shelf
Bed
Balcony
Bench
GROUND FLOOR PLAN
STILT FLOOR PLAN
Stove
Cupboard
Ref.
Table
Motorcycle Parking
Bedroom (Son)
shoes shelf
Buddhist statue shelf
+2.06
Living area
Cabinet
Bed
Bed
No Stairs(broken)
Kitchen equipment
Bedroom (brother)
Stool
Stair(broken)
Wash
Bed (father,mother)
+2.20
pillow
Storage Room
+2.15
Bed (grandmother)
Bedroom
Litter
+0.15 Nephew's Room
Faucet Washing Area
Stairs (broken)
+0.15 Motorcycle Parking
+1.95
+1.95
0 1 2 5 10 m

B8



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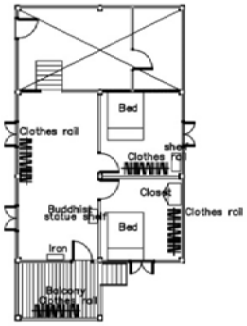
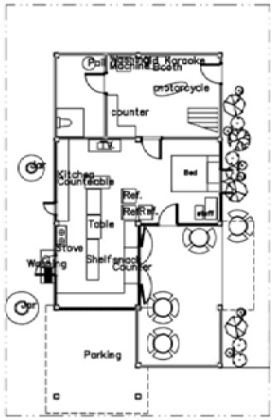
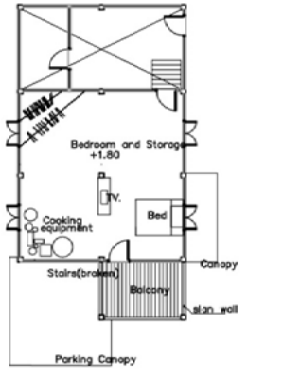


STILT FLOOR PLAN

B9

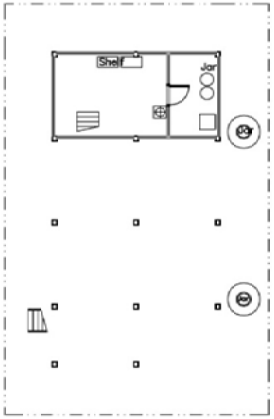


GROUND FLOOR PLAN

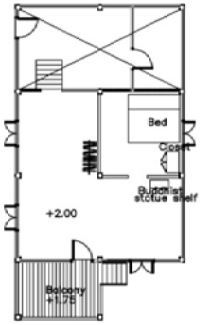


STILT FLOOR PLAN

B10

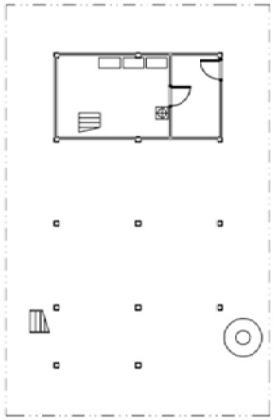


GROUND FLOOR PLAN

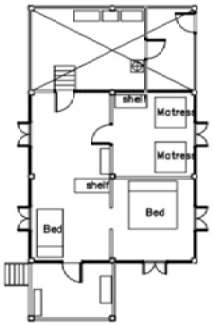


STILT FLOOR PLAN

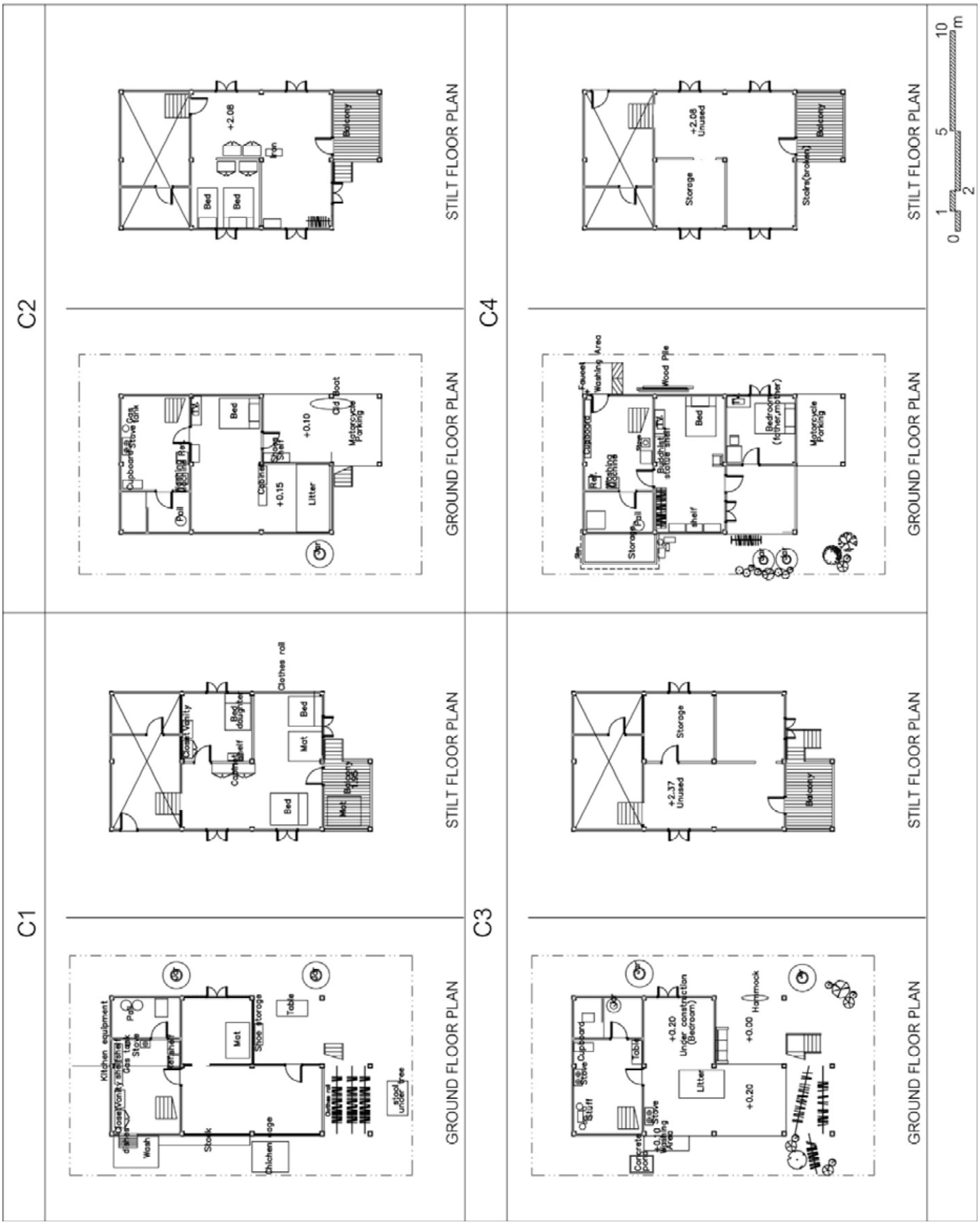
B12



GROUND FLOOR PLAN

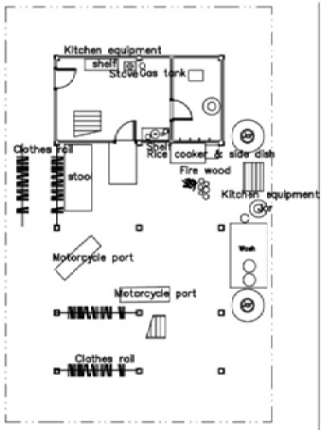


STILT FLOOR PLAN

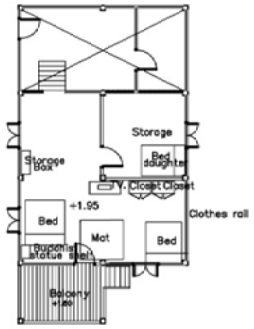

C1
GROUND FLOOR PLAN
STILT FLOOR PLAN
C2
GROUND FLOOR PLAN
STILT FLOOR PLAN
C3
GROUND FLOOR PLAN
STILT FLOOR PLAN
C4
GROUND FLOOR PLAN
STILT FLOOR PLAN
0 1 2 5 10 m


C5
C6
C10
C12
GROUND FLOOR PLAN
STILT FLOOR PLAN
GROUND FLOOR PLAN
STILT FLOOR PLAN
GROUND FLOOR PLAN
STILT FLOOR PLAN
GROUND FLOOR PLAN
STILT FLOOR PLAN
Bicycle
Bed (father,mother)
Clothes line
Balcony
Buddhist statue shelf
Closet
Pail
Table
Shelf
Stove
kitchen equipment
Gas tank
dishes
Mat
Closet
Bedroom Guest
stool
Clothes rail
Unused
No stair
Balcony
Washing Machine
Cashier
Stove
Ref.
Glass shelf
Stereo
TV.
Bed (Son)
Glass shelf
Ref.
Ice bucket
Shelf
Ref.
Box
Cashier
Ice bucket
Buddhist statue shelf
Closet
Storage box
Bed (father,mother, daughter)
Shelf (Cloth)
TV.
Balcony
Washing Basin
Table
Shelf
Stove
Shelf
Washing Machine
cooker
Ref.
Shelf
Storage
TV.
Bed
stool
clothes rail
Storage Motorcycle part
Closet
Buddhist statue shelf
Bed (Son)
TV.
Bed (Father)
Vanity
Bed (daughter)
Iron
Dead person shelf
Buddhist statue shelf
Table
Balcony
0
1
2
5
10
m

C12

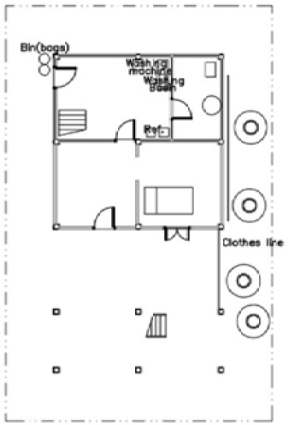


GROUND FLOOR PLAN

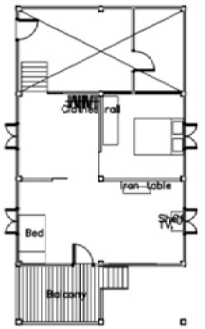


STILT FLOOR PLAN

C13

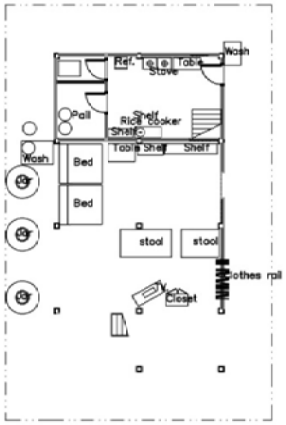


GROUND FLCOR PLAN

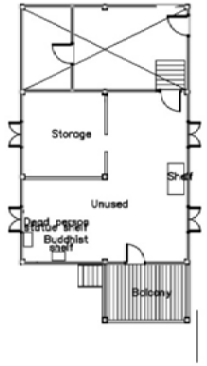


STILT FLOOR PLAN

C15

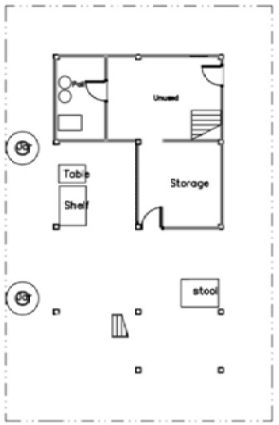


GROUND FLOOR PLAN

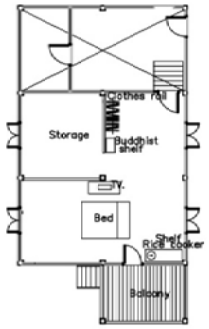


STILT FLOOR PLAN

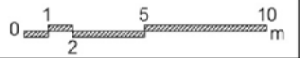
C16



GROUND FLCOR PLAN



STILT FLOOR PLAN

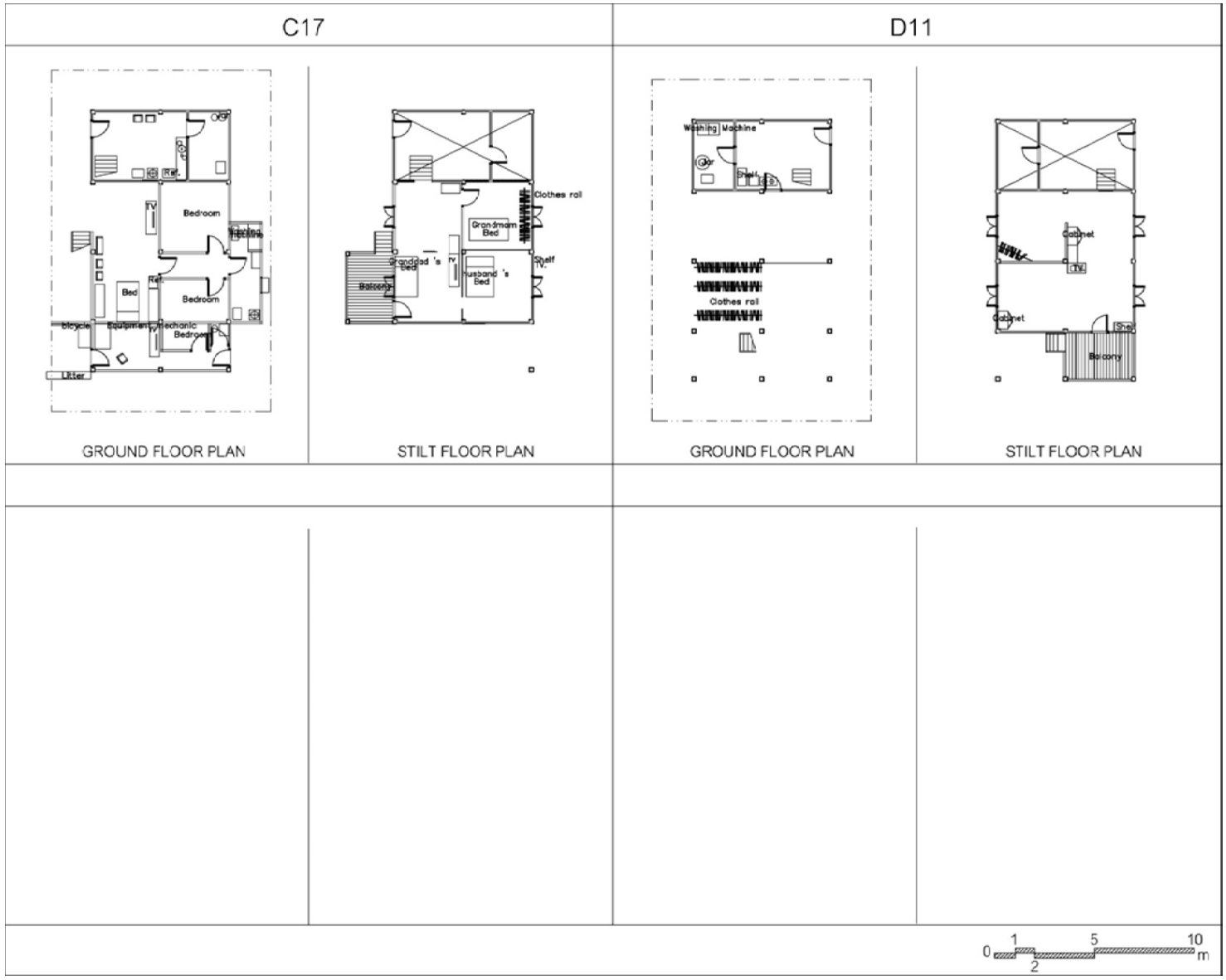



D1
Unused
Pail
Wash
Table
Clothes rail
Unused
Bed
Closet
stool
Balcony
+1.80
GROUND FLOOR PLAN
STILT FLOOR PLAN
D3
Shelf
Ref.
TV
Bed
Bed
Clothes rail
Bed
Bed
Cabinet
Cage
Unused
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
D4
Shelf
Shelf
Shelf
Shelf
Table
Cage
Bed
Clothes rail
Buddhist statue shelf
Dead person
Shelf
Shelf
+2.20
Rack
Balcony
+1.80
GROUND FLOOR PLAN
STILT FLOOR PLAN
D5
Shelf
Pail
Stove
Table
Wood
Under Construction
Clothes rail
Stool
Clothes rail
Clothes rail
Bed
clothes rail
Shelf
Buddhist statue shelf
Bed
Bed
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
0
1
2
5
10
m


D6
D7
Fire wood
Washing machine
Jar
Ref
Grandmom's bed
Buddhist statue shelf
TV
washing
Litter
Shelf/Gas tank
Shower room
Hammock
Washing
concrete pond/well
Dog bed
Jar
Buddhist statue shelf
(Daughter Bedroom) +2.20
+2.20
TV
+2.20
(Son Bedroom)
+2.20
(Grandmom Mattress)
Balcony
Litter
GROUND FLOOR PLAN
STILT FLOOR PLAN
GROUND FLOOR PLAN
STILT FLOOR PLAN
D6
D7
Shelf
Washing Machine
Shelf
Ref
Jar
TV
Bed
Closet
Litter
Stair
Bed (child)
Closet
Bed
Balcony
Gas Shelf
Henhouse
Jar
Bath
Shelf
Jar
Basin
Shelf
Litter
Kitchen
TV
Shelf
Closet
Clothes rail
Motorcycle port
Concrete pond
Jar
Clothes
Table
Litte
Basin
Concrete pond
Shelf
TV Cabinet
Clothes rail
+2.25
Buddhist statue shelf
Shelf
Balcony
+2.10
GROUND FLOOR PLAN
STILT FLOOR PLAN
0
1
2
5
10
m


E4
Ref. Shelf
Jar
Litter
Stair
Clothes rail
+2.10
Bed (child)
Clothes rail
Cabinet
Bed
Balcony
+1.20
GROUND FLOOR PLAN
STILT FLOOR PLAN
E5
Septic tank
Fire wood
Kitchen equipment
Bin(bags)
Pan rail
Shelf
Rice cooker & slide dish
Concrete pond
Basin
Concrete pond
Motorcycle part
Clothes line
Clothes line
Bin
Electric post
Floor(broken)
Clothes rail
Shelf
Bed
Bed
Shelf
Stair(broken)
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
E6
Jar
Concrete Pond
Storage pile
Litter
Motorcycle
Fire wood
Litter
Litter
Husband Bedroom)
clothes rail
+2.20
Buddhist statue
shelf
+2.20
(wife and niece)
(Mom and trass)
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
E9
Chicken coop
Chicken coop
Stove
gas tank
Stove
Shelf
Waste storage room
Washing Machine
Shelf
Loudspeaker
Pond
Litter
Bed (father, mother, child)
clothes rail
Shelf
Litter (grandma)
Slan
Fire wood
Hammock
Cabinet
Old kitchen
Cabinet
clothes rail
Day bed
Table
Bench
Storage
Shelf
Buddhist statue shelf
Bed (child)
Dead person shelf
Closet
Ancester cup
Bed (nephew)
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
0
1
2
5
10
m


E10
Concrete pond
Cooler
Basin
Washing Machine
Shelter
Ref.
Shelf
Cabinet
TV.
Clothes line
+0.10
Hammock
Clothes rail
Bed
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
E15
Shelf
Ref.
TV.
Washing Machine
Bed
Stair
Clothes rail
Buddhist statue shelf
Cabinet
Dead person
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
E17
Henhouse
Gas
Shelf
Washing dishes
Ref.
Place cooked
TV.
Motorcycle port
Mat
Bed
Concrete pond
Faucet
Concrete pond
Washing Machine
Washing area
Basin
Clothes rail
Press clothes
Stair
Bicycle
Litter
Shelf
GROUND FLOOR PLAN
Basin
Storage
Bicycle
+1.85
Shelf
Bed
Dead person
Buddhist statue shelf
Clothes rail
Balcony
+1.50
Basin
STILT FLOOR PLAN
E18
Shelf
GROUND FLOOR PLAN
Bed
Shelf
Buddhist statue shelf
Balcony
STILT FLOOR PLAN
0
1
2
5
10
m


C17
D11
Bedroom
Bed
Bedroom
bicycle
Equipment
Mechanic
Bedroom
Litter
Clothes rail
Granddad 's
Bed
Husband 's
Bed
Balcony
Shelf
TV
Washing Machine
Clothes rail
Cabinet
TV
Cabinet
Shelf
Balcony
GROUND FLOOR PLAN
STILT FLOOR PLAN
GROUND FLOOR PLAN
STILT FLOOR PLAN
0
1
2
5
10
m

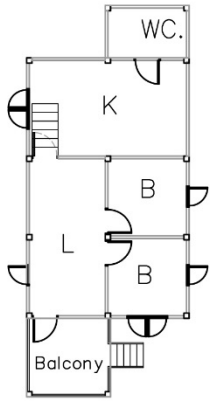
APPENDIX III

RECORDS OF LIVING CONDITIONS IN POST TSUNAMI HOUSES:

CASES OF MOKLEN VILLAGES IN PHANG NGA PROVINCE

TUBTAWAN VILLAGE

original



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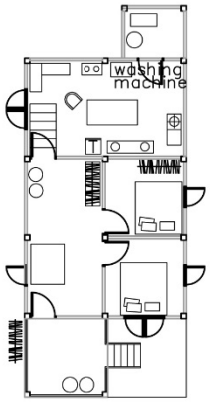

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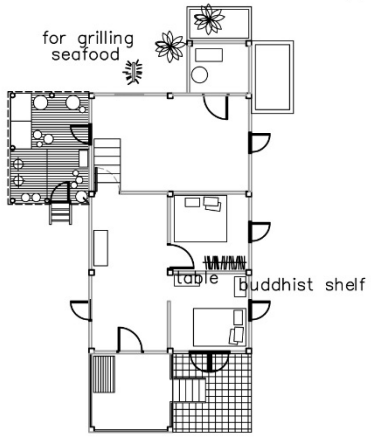

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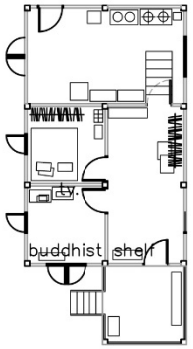

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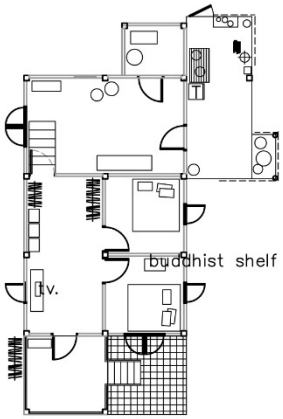

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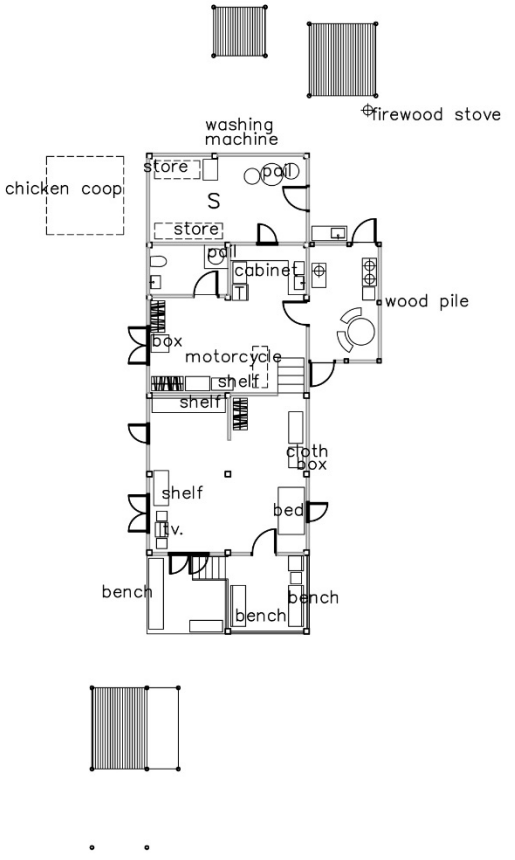
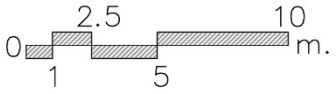
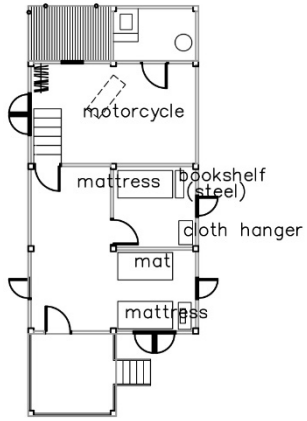




TUBTAWAN VILLAGE

6



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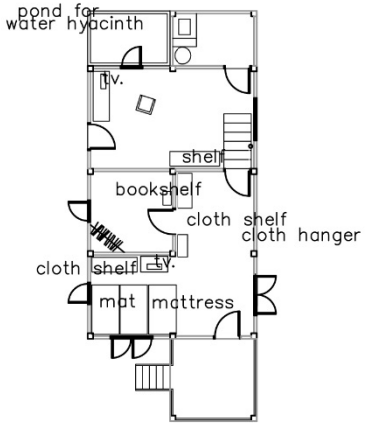

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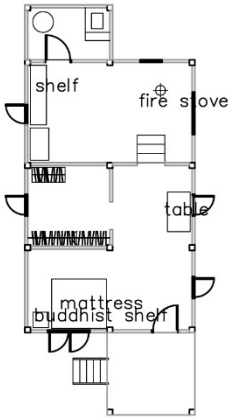

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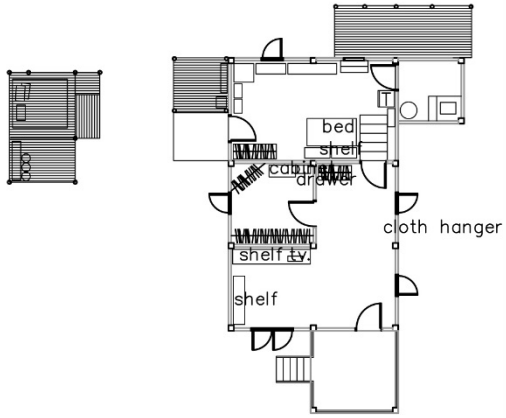

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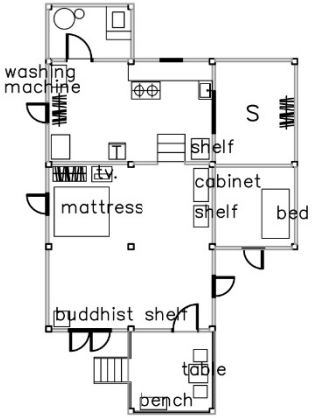
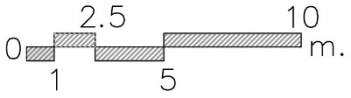
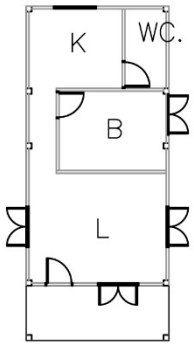




SOI WILLY

original



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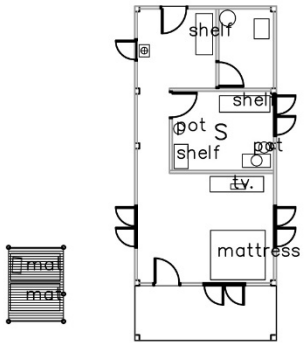

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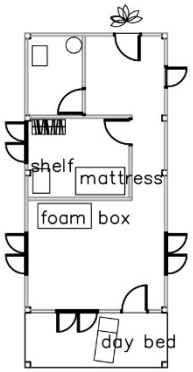

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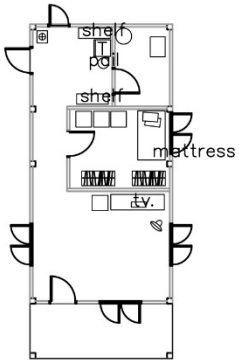

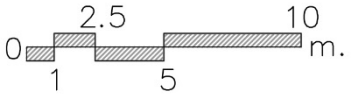

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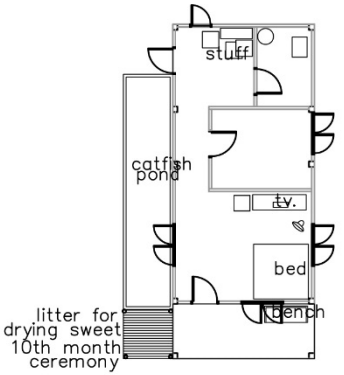

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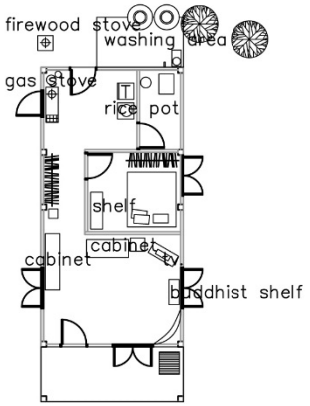

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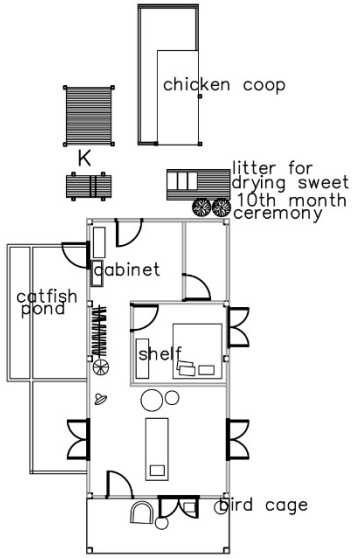
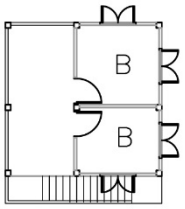
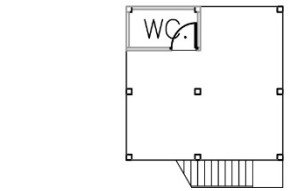


SOI MALTESER

original





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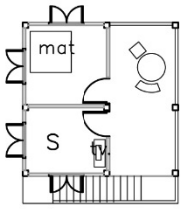

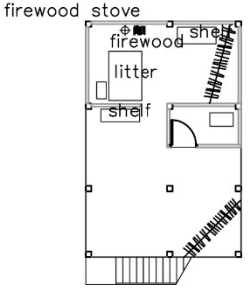

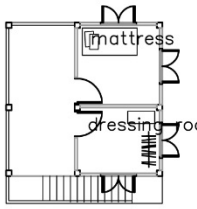

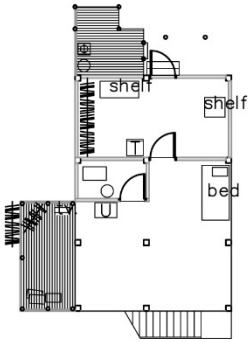

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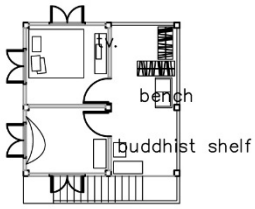
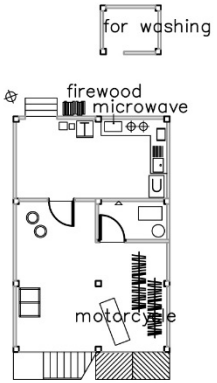


SF

GF



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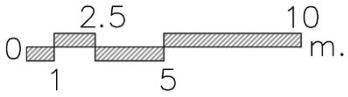
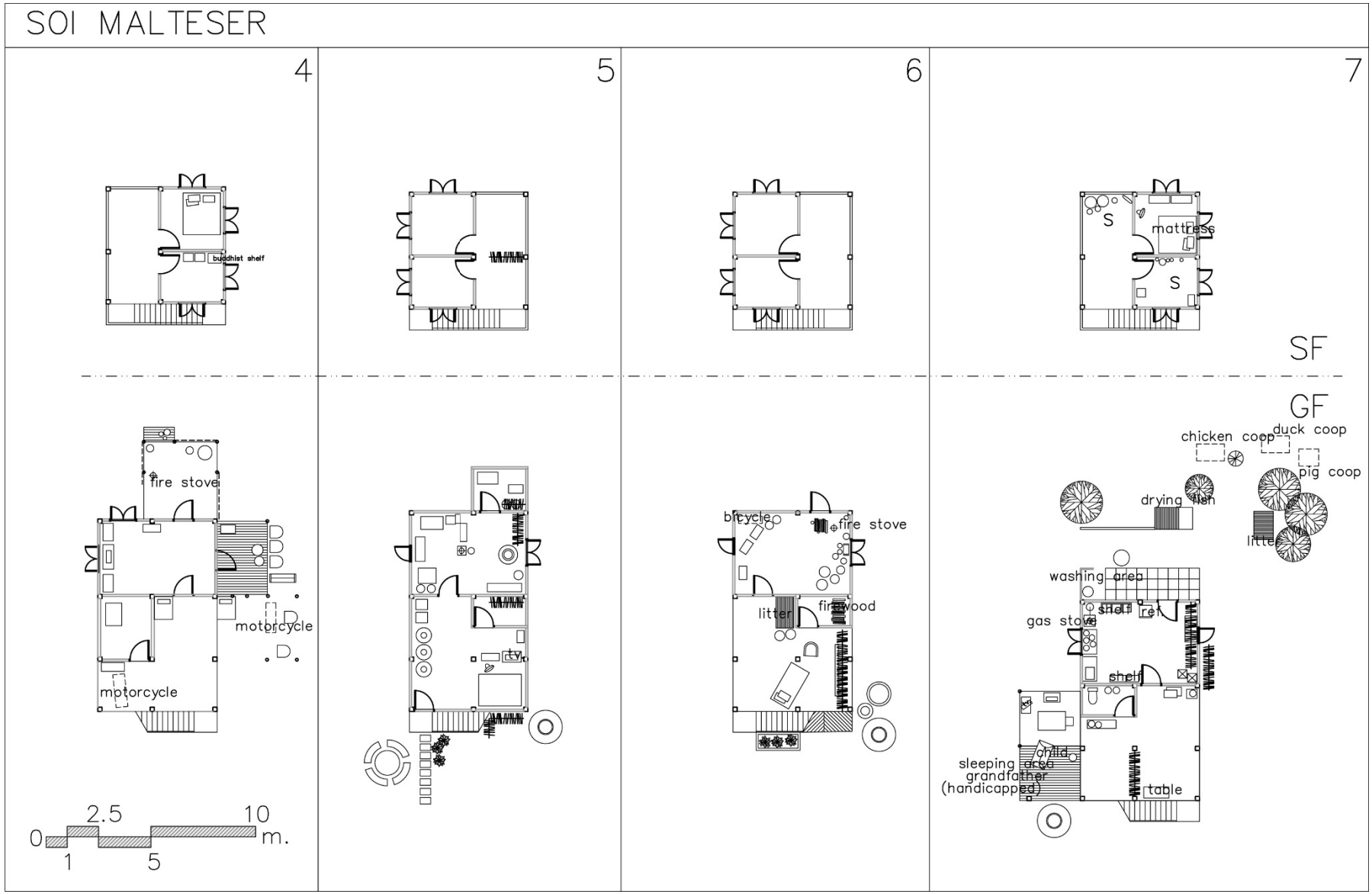
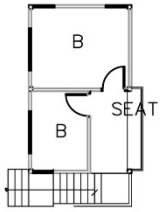


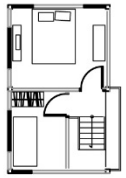
SOI MALTESER



BANGKAYA VILLAGE

original





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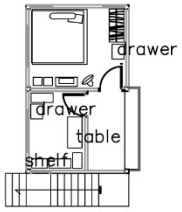

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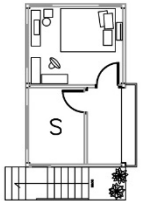
3



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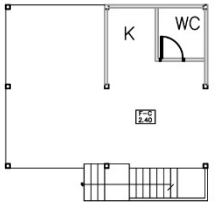

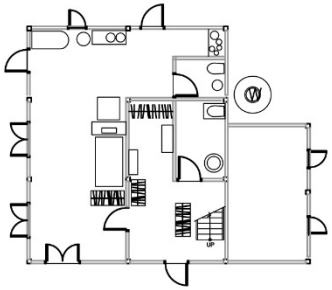

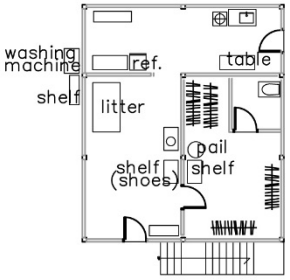

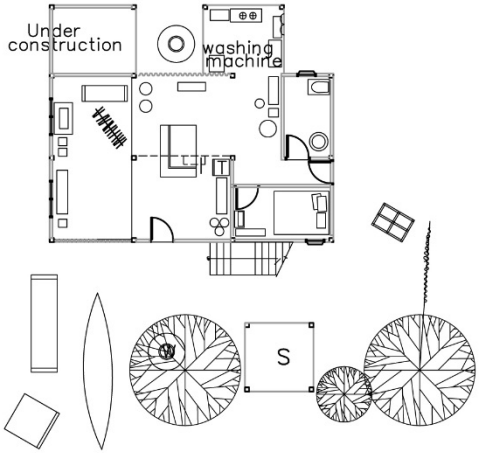

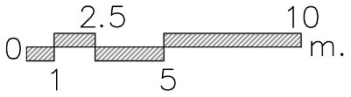

BANGKAYA VILLAGE

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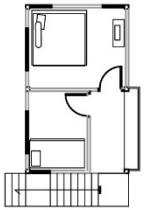

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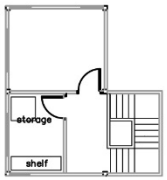

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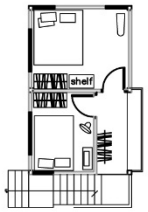

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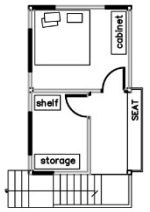

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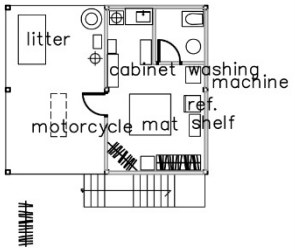

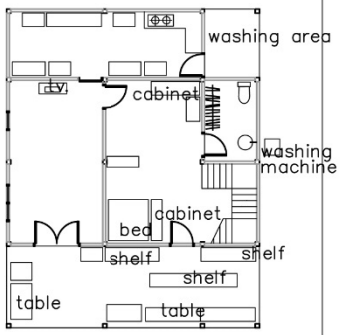

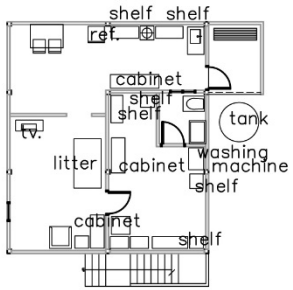

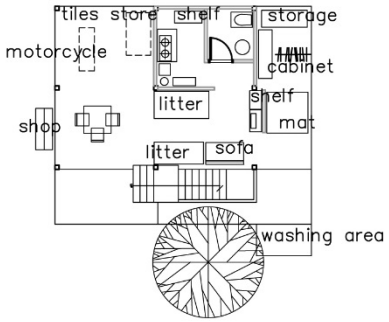

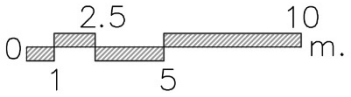

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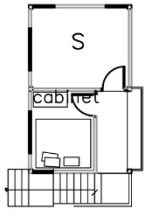

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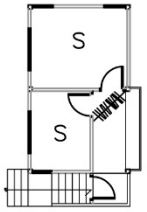

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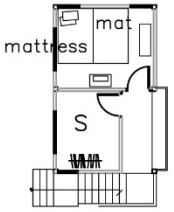

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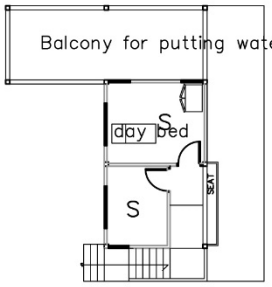

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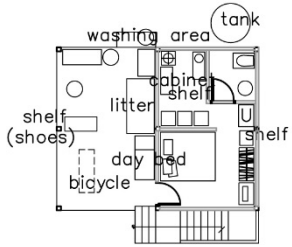

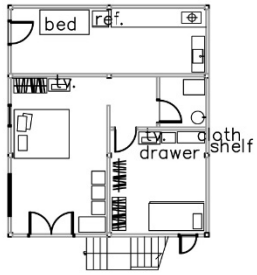

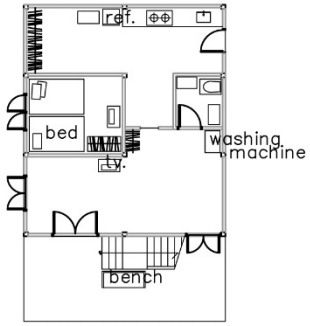

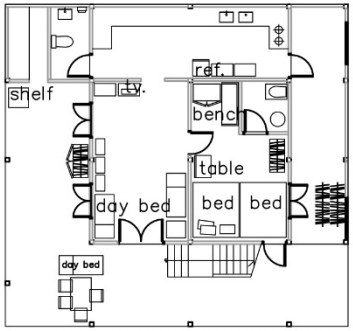

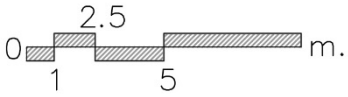

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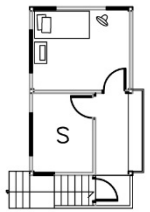

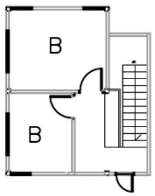

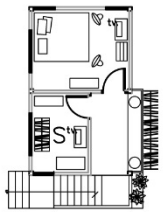

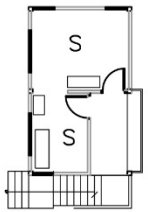

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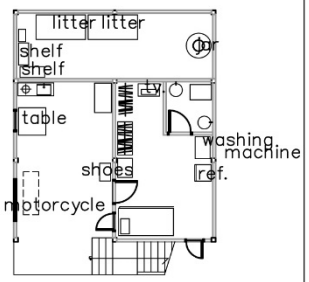

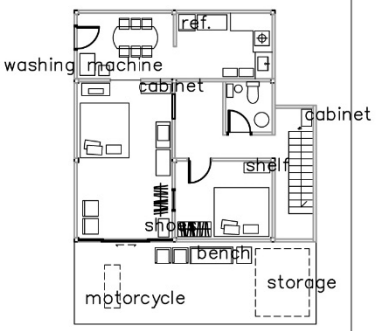

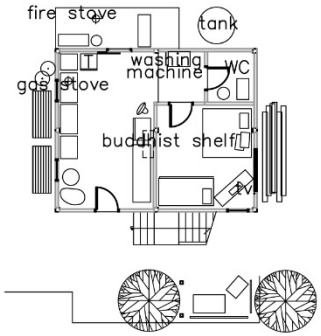

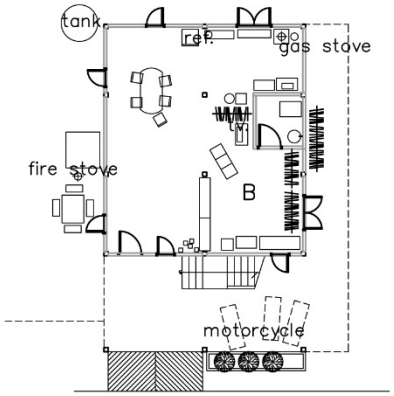

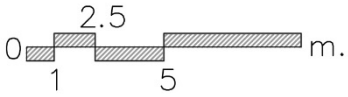

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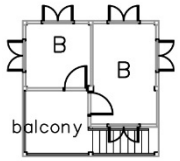

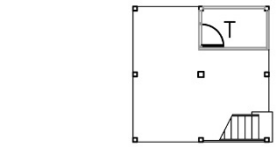

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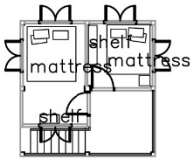

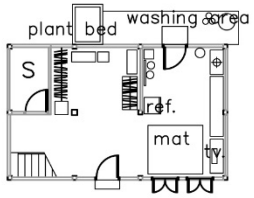

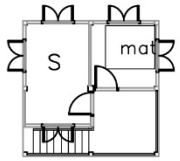

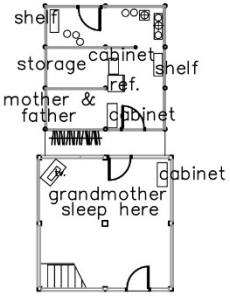

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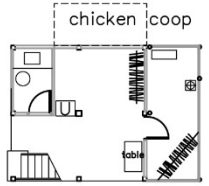

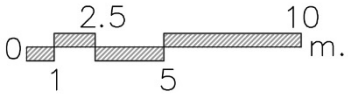

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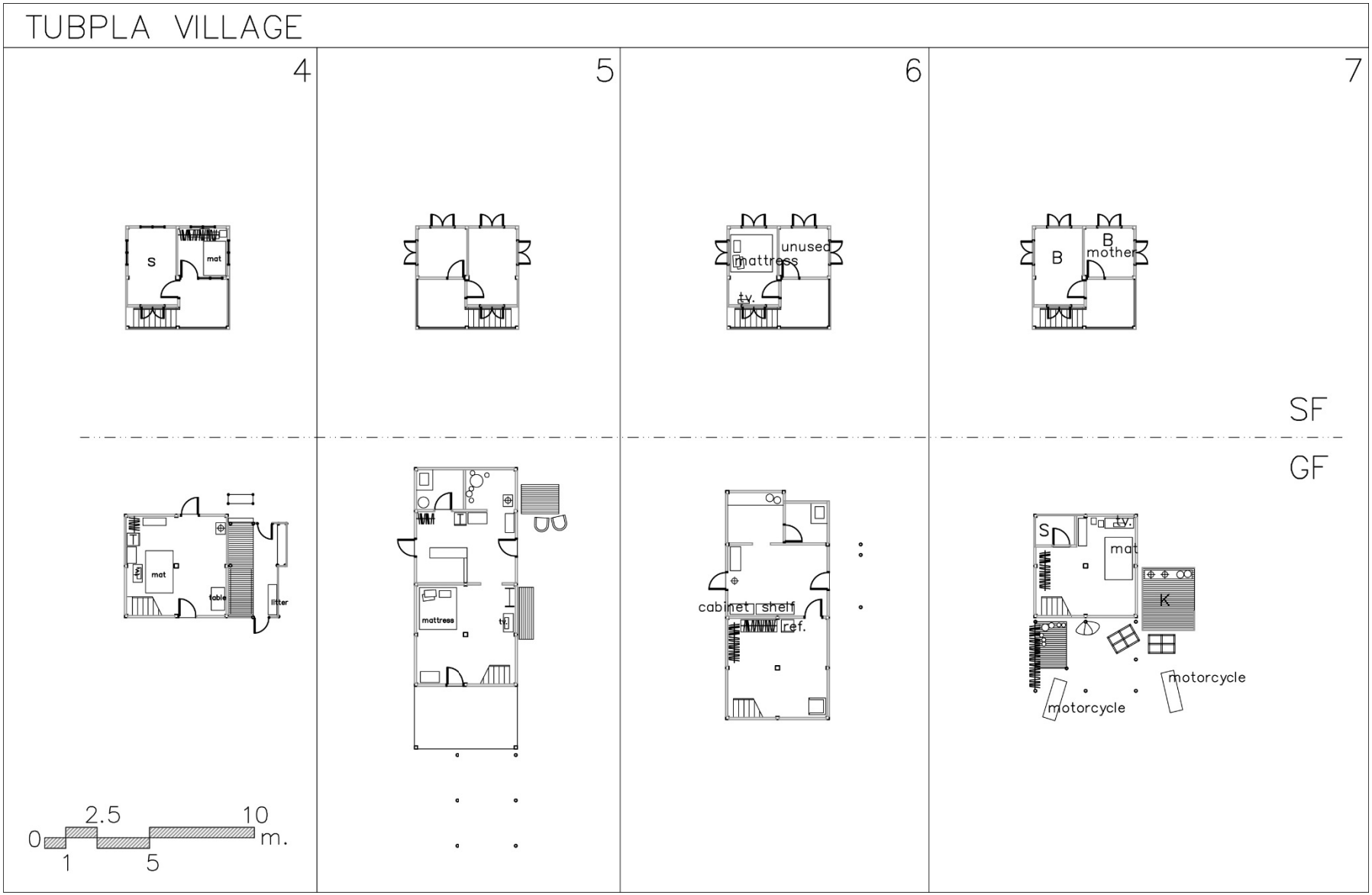

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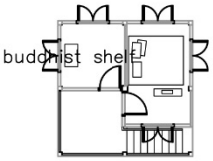

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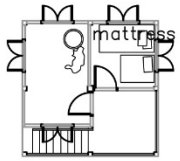

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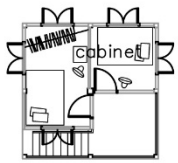

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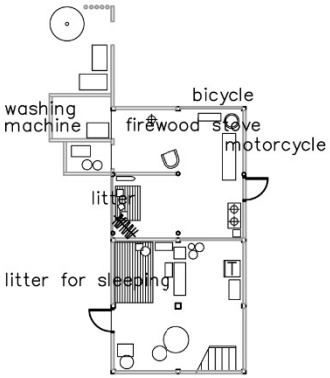

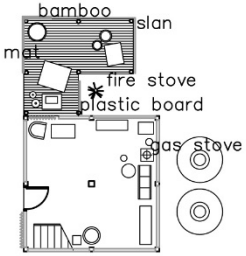

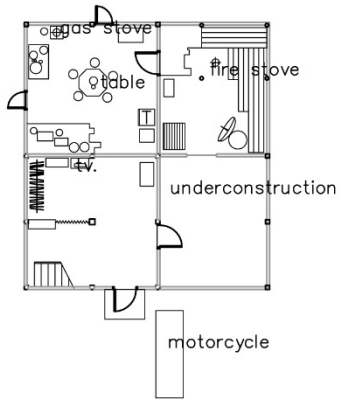

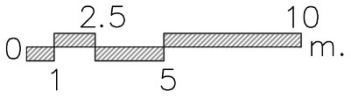

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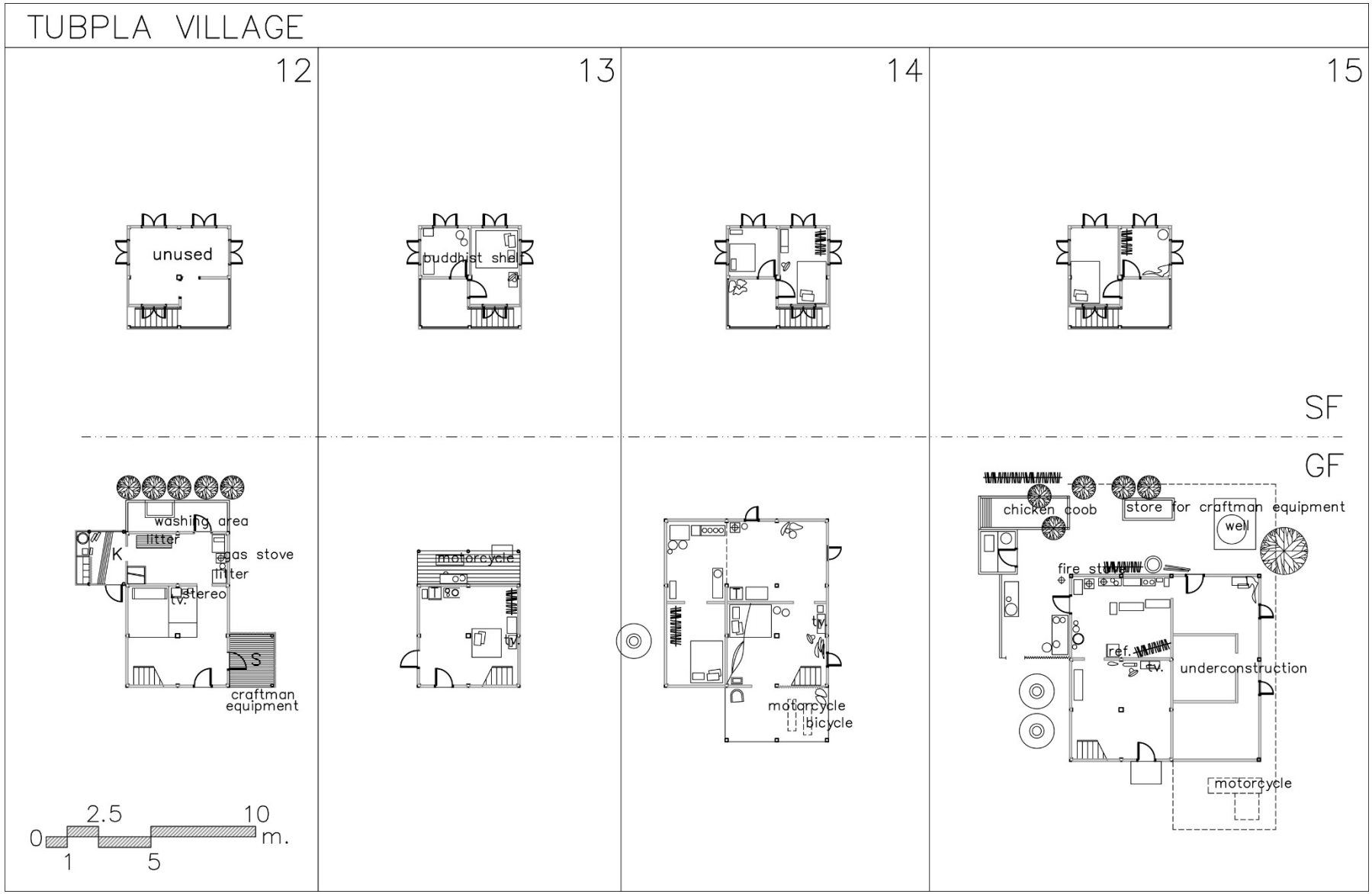

TUBPLA VILLAGE

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