2010 On Site Review Report

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by Brigitte Shim

Reconstruction of Ngibikan Village

Yogyakarta, Indonesia

Architect
Eko Prawoto

Client
Ngibikan Village Community

Design
2006

Completed
2006

Reconstruction of Ngibikan Village*

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I. Introduction

On May 27, 2006, an earthquake hit Indonesia in the region of Yogyakarta in the southern portion of central Java. The village of Ngibikan located less than 10 kilometers from the quake's epicenter was destroyed. More than 140,000 homes in the immediate region were severely damaged and there were over 5,700 deaths. With financial assistance from a local newspaper, and design input from a local architect Eko Prawoto, the villagers of Ngibikan, led by community leader Maryono reconstructed 65 homes in less than 90 days. The new homes are based on a vernacular building type, the *limasan* house with innovative modifications to ensure resistance from future earthquakes. The community rebuilt the physical fabric of their community which in turn helped to rebuild the togetherness or the *gotong royong* of this agrarian village.

II. Contextual Information

A. Brief Historical Background

The village of Ngibikan is located in a fertile agricultural region where rice has traditionally been the main source of livelihood for generations. Other crops such as soybeans, peanuts and corn are also grown in the area.

B. Local Architectural Character

Before the earthquake, the sight of many *limasan* homes was a common feature of rural Yogyakarta. The word *limasan* refers to a vernacular hip roof with a peak on top. A major characteristic of this house type is the design of the building's steep vertical frame or *duduran*. Other characteristics include an open veranda with an interior layout that has no permanent partitions. Over the years, the *limasan* Javanese houses needed rebuilding. Traditional materials such as wood were substituted for more substantial materials such as masonry without fully understanding how they would perform during a natural disaster. Before the earthquake, most houses in Ngibikan had a wooden structural frame sitting on a cement floor and were infilled with brick walls and clay tile roofs. Typically, the brick walls were full height and not reinforced resulting in a great deal of damage and human injury during the 2006 earthquake.

C. Climatic Conditions

Lying along the equator, Indonesia has a tropical climate, with two distinct seasons; wet and dry. The average annual rainfalls vary from 70 - 125 inches per year. The humidity level is

generally high, averaging about 80% during the summer months. Temperatures vary little throughout the year ranging from 26-30 C in Yogyakarta. The village of Ngibikan is located at latitude -7.9358333^{o} and longitude 110.3616667^{o}.

D. Immediate Surroundings of the Site

The village of Ngibikan is situated in a flat, broad plateau within Bantul Province, south of the city of Yogyakarta. To the north is a large mountain range dominated by Mount Merapi (*Gunung Merapi*) which means Mountain of Fire. Gunung Merapi is the most active volcano in Indonesia. In the immediate area surrounding Ngibikan village, every inch of land is used for either farming or small groupings of dwellings. Contained cultivated fields dominate this rural landscape. Even though the area is agricultural, this region is one of the most densely populated areas in Indonesia with roughly 1,600 people per square kilometer.

E. Topography of the Project Site

The large fertile plain that Ngibikan is located in has very little topography.

III. Programme

A. History of the Inception of the Project

The island of Java in Indonesia where the village of Ngibikan is located is on the boundary of three major tectonic plates - the Indo-Australian Plate, the Eurasian Plate, and the Filipino Plate in a region prone to volcanoes, earthquakes and tsunamis.

On May 27th 2006, an earthquake measuring between 5.9 - 6.3 on the Richter scale struck Bantul district. The tremors lasted 52 seconds and hundreds of aftershocks followed. Striking in the early morning hours, the earthquake trapped many people in their homes, and many buildings collapsed. The disaster claimed over 5,700 lives and injured between 37,000 - 50,000 individuals. The total amount of damages and loss was estimated at over $ 3.1 billion USD, which is much higher than the damage caused by the 2,004 tsunami. Much of the damage impacted buildings, with an estimated 30,000 homes in the area that needed to be rebuilt. The shallowness of the quake's epicentre contributed to widespread structural damage to the built fabric.

This reconstruction project that took place post-earthquake was initiated by the urgent need to rebuild homes for the local Ngibikan villagers. Given the prevalence of home-based industries in the region such as farming, handicrafts, ceramics and furniture workshops, the economic losses caused by destroyed or damaged homes was enormous.

B. How were the Architects and Specialists chosen?

The architect Eko Prawoto and the builder and community leader Maryono were known to each other prior to the 2006 earthquake. In 1996, Eko Prawoto, a local architect based in Yogyakarta worked for the Prima Karya construction company and met Maryono who also worked for the same company. In 2005, Maryono worked on several private houses design by Eko Prawoto. They had a good working relationship and after the devastation of the earthquake they continued to work together to rebuild Maryono's neighborhood within the village of Ngibikan.

C. General Programme Objectives

For the villagers in this region of Indonesia, their house is not only the center of their domestic life but also has a great deal of cultural significance representing their family within their community. The architect, builder and community agreed that the architectural form of the new buildings should respect, as much as possible, the former pre-earthquake village. The proposed house reflected the local character to the village and provided its residents with a sense of identity and pride.

D. *Functional Requirements*

The proposed new houses in the village of Ngibikan were based on a traditional *limasan* house type with three bays approximately 6 metres by 7.2 metres. This space is flexible and be able to be subdivided into a variety of configurations. The placement of every house within the village was determined by existing foundations of the pre-earthquake houses. It was essential that the new houses address the imperative of building safely in an earthquake prone region through a responsive structural design, careful selection of materials and thoughtful construction details. It was also essential that villagers with little or no construction experience could participate in building their own home.

IV. Description

A. Building Data

Total site area:	43,255 square metres
Ground floor area:	2,808 square metres
Total combined floor area:	2,808 square metres

B. Evolution of Design Concepts, including

Response to Physical Constraints - Siting, Climate, Plot Ratios, etc.

The rebuilt village of Ngibikan sits on the footprint of the existing village. The site infrastructure - pathways, irrigation systems and wells remained in place. The new buildings

resemble the existing buildings but new innovative features were added to better respond to natural disasters.

Response to User Requirements; Spatial Organisation

The traditional *limasan* house had a flexible interior layout with no interior walls and no permanent partitions. This flexibility allowed the villagers to use their space in a variety of ways responding to the agricultural cycle, changing family needs and social activities. The *limasan* house form also allows villagers to make additions to their home.

Purely Formal Aspects

Before the 2006 earthquake, the traditional *limasan* house was the model for most residential buildings in the area. These buildings were part of the area's vernacular heritage and handed down from generation to generation. The average age of a *limasan* houses was approximately 50 years old. It is estimated that in the area of Bantul where the most serious damage occurred, that over about 37,500 limasan homes were reduced to rubble, according to data obtained from the Persada Foundation. Of that total, only a small percent was rebuilt resembling their original form. The villagers of Ngibikan worked with Eko Prawoto and Maryono, their community leader, in building the *limasan* housing type, providing a link to their past and their heritage.

The creative skill and ingenuity of the villagers is evident through their customization of the vernacular housing type. Recycled doors, windows, decorative motifs were added by villagers to make each house an expression of their own personality.

Landscaping

The village is located in a lush equatorial climatic zone which results in three agricultural cycles each year for their crops. There is a broad range of indigenous plant material such as orchids, bamboo and native vegetation, in addition to the agricultural fields which thrive in this growing zone.

C. Structure, Materials, Technology

Structural Systems

This project relies on four wooden trusses that provide the main structure for each home. The traditional *limasan* house is identified through the roofline. The jointing system uses bolts which are easy to work with and resist both in tension and compression. Concrete column bases separate the wooden frames from the ground.

Materials

Structural members - Knock down wood trusses made of high density coconut wood taken from the perimeter of the stem, commonly used for building construction.

Infill materials - Low brick walls, often using recycled bricks, were used for the lower one meter portion of each infill panel. Fibre cement board is used for the upper portion of each infill panel. Recycled doors and windows are inserted into the cement board walls.

Roof material - Corrugated fibre cement board panels were used for the roofing. This material is light weight, easy to cut and not as heavy as the clay tiles which were used for the existing houses pre-earthquake.

Construction Technology

Concrete column bases separate the wood trusses from the ground. Fibre cement board is light weight, waterproof, fire resistant, low maintenance and easy to cut and handle. No heavy equipment was used in the rebuilding of this village.

Building Services, Site Utilitie

All existing building services and site infrastructure were retained and reused.

D. Origin of Materials, Labour Force, Professionals

Materials

Coconut wood from local palm trees.
Bricks recycled from previous houses on site.
Fiber cement board exterior cladding purchased building product.
Windows and doors recycled from previous houses on site.

Labour Force

The village of Ngibikan is comprised of four neighbourhoods, and each neighbourhood is called a *Rukun Tetangga* (RT). Villagers from RT No. 5 consist of 55 families or approximately 250 individuals. The work force who volunteered their labour from RT No.5 to rebuild their own homes number 100. From this group of 100 from RT No.5, seven villagers had construction skills prior to the rebuilding and eleven villagers gained new construction skills during the rebuilding and have gained employment in this new field.

Maryono divided the villagers into smaller groups with different responsibilities. One group was responsible for foundations reusing existing concrete slabs where possible, and only adding supports for columns. Another group built knock down coconut wood frames and raised them in place. Another group was responsible for infill panels including low brick walls

and fibre cement board cladding, and another group was responsible for the roof construction and cladding.

Professionals

Architects:	Eko Prawoto, Eko Prawoto Architecture Workshop
Builder:	Maryono
Labour and Craftsmen:	Ngibikan Village Community

V. Construction Schedule and Costs

A. History of Project Design and Implementation

- May 27, 2006 at 5:53 am an earthquake registering 5.9-6.3 on the Richter scale hits the village of Ngibikan.
- May 28, 2006: Eko Prawoto calls Maryono asking him to fix his wall. Maryono tells Eko his village has been devastated by the earthquake. Eko and his wife visit the village bringing emergency food and supplies. After the earthquake, villagers are camping in the rice fields in temporary constructions made of plastic sheets and bamboo.
- May 29, 2006: Eko and Maryono discuss possible strategies for rebuilding the village.
- May 30, 2006 Maryono builds one prototypical wood truss.
- May 31, 2006 Ngibikan Village Community starts cleaning up debris.
- June 1, 2006 The Kompas newspaper called Eko Prawoto, a local architect known to them and asked him how they could help with post-earthquake rebuilding. Kompas is the most widely read newspaper in Indonesia with readership of over 2.25 million people maintaining a reputation for high quality writing and investigative journalist. The Kompas newspaper receives donations from its readers to help victims of the earthquake in their region.
- June 2, 2006. Eko and Maryono discuss the house design further.
- June 3, 2006. Maryono calls a community meeting for Rukun Tetangga (RT) No. 5. Maryono and the villagers agree to build a prototype of a single house with adjustments proposed by Eko Prawoto.
- June 4, 2006. The Kompas newspaper agrees to give financial support to the reconstruction of homes in RT No.5 in Ngibikan.
- June 12, 2006. The villagers organized a ceremony of thanks.
- September 2006. Over the next three months, the villagers worked together to rebuild the 55 homes located in their neighborhood RT No. 5. The community's goal was to have all homes rebuilt before the Islamic holy month of Ramadan, which was achieved.

B. Total Costs and Main Sources of Financing

Cost of land is not applicable.
Total cost of project is USD 54,698.00
Funder: Dana Kemanusiaan Kompas.

C. *Qualitative Analysis of Costs*

Cost per square metre: USD 19.00 for construction.

D. Maintenance Costs

The homes in the village have no mechanical heating or cooling.

E. Ongoing Costs and "Life Performance" of Building

The new homes will not require little or no long term maintenance.

VI. Technical Assessment

A. Functional Assessment

Four years after the devastating earthquake 2006, a visitor walking through the village of Ngibikan is unaware that a natural disaster had levelled the entire community. Each neighbourhood or *Rukun Tetangga* in the village of Ngibikan has been physically rebuilt and is thriving. Villagers have build additions to their homes and made modifications to suit their needs.

B. Climatic Performance

The traditional limasan homes respond directly to the equatorial climatic zone. The rebuilt homes reaffirm the vernacular building traditions.

C. *Choice of Materials, Level of Technology*

While the form of the traditional *limasan* home is retained, the innovations and adjustments made by the architect and builder have served the villagers well. Concrete columns separating the ground from the base of the wooden frames ensure no moisture penetrating the structural frame. Fiber cement board exterior cladding is a new building product that is lightweight and easy to use by unskilled labour.

D. ***Response to, and Planning for, Emergency Situations***

The new structural frame, made of four wooden trusses held together with metal bolts provides resistance in both tension and compression. This new structural system is a vast improvement over the existing homes. This previous construction method could not resist the 2006 earthquake and resulted in loss of life. Maryano's own house was the only house left standing in his neighbourhood. After the earthquake every other home was destroyed.

E. ***Ageing and Maintenance Problems***

No ageing or maintenance problems were visible.

F. ***Design Features: Massing and Volume, Articulation of Spaces, Integration into the Site***

The new village is built on the footprint of the existing village. The new village is fully integrated into the existing site.

G. ***Impact of the Project on the Site***

All of the existing site infrastructure - pathways, wells, irrigation ditches, roadways have been retained and reintegrated into the existing village.

H. ***Durability and Long-time Viability of the Project***

This project rebuilt by the villagers has provided many members of the community with new construction skills.

I. ***Ease and Appropriateness of Furnishings; Interior Design and Furnishing***

Each villager takes a great deal of pride in their own home and has furnished their interior according to their own tastes.

VII. Users

A. ***Description of those who use or Benefit from the Project***

The villagers of Ngibikan have benefitted directly from the rebuilding of their own village. The increased construction skill level acquired by some of the villagers has provided them with a broader range of employment possibilities either in the village or outside the village.

B. Response to Project by Clients, Users, Community, etc.

What do Architectural Professionals think about the Project?

Eko Prawoto is a significant architect in Indonesia. He is respected by colleagues in his university community in Yogyakarta as well as the broader local community. Eko Prawoto's approach to architecture is connected to his deep understanding of the local context. He explores formal possibilities and innovations to local methods of construction systems based on input from local builders and craftsman.

Professors teaching at universities in Jakarta and students of architecture in Indonesia view Prawoto as a local hero, providing a form of resistance to the simplistic pictorial depiction of the country's architectural heritage. Eko Prawoto's ambition is to create modern buildings which also consider their context and their architectural tradition.

There is a clear link between Eko Prawoto and his mentor, Yusuf Bilyarta Mangunwijaya - a famed Javanese activist who was also a writer, a Catholic priest, and the founding figure of modern Indonesian architecture. Mangunwijaya stressed the importance of spending money on training first and materials second - a teaching adhered to by his disciples. Mangunwijaya wanted to empower the people by giving them a skill that would last beyond any one project. Mangunwijaya was the architect for an inspiring Aga Khan Award winning project for the informal settlement of Kampung Kali Cho-De in the heart of urban Yogyakarta. Eko Prawato is currently involved in the restoration of portions of this existing settlement initiated by Mangunwijaya in 1985. Prawoto's attitude to construction is informed by his respect for local builders and carpenters who he collaborates with on all his projects.

What is the Popular Reaction to the Project?

The villagers of Ngibikan have been empowered by providing the labour to rebuild their new homes. They are appreciative of the financial assistance for building materials provided by the readers of the Kompas newspaper. Typically, the Javanese accept hardships and misfortunes of fate willingly. The villagers have acted by building, and then reacted very positively to the Ngibikan reconstruction.

What do Neighbours and those in the Immediate Vicinity think about the Project?

The villagers in RT No. 5 rebuilt 55 homes in their own neighbourhood, and then helped adjacent neighbourhoods to rebuild 10 addition homes. The neighbours in the immediate vicinity are grateful to Maryono and his neighbourhood in RT No. 5 for their support.

VIII. Persons Involved

Architect: Eko Prawoto, Principal of Eko Prawoto Architectural Workshop (EPAW)
Builder and Project Coordinator: Maryono, Community Leader RT No.5
Labourers and Craftsmen: Ngibikan Village Community
Funding: Dana Kemanusiaan Kompas

IX. Bibliography

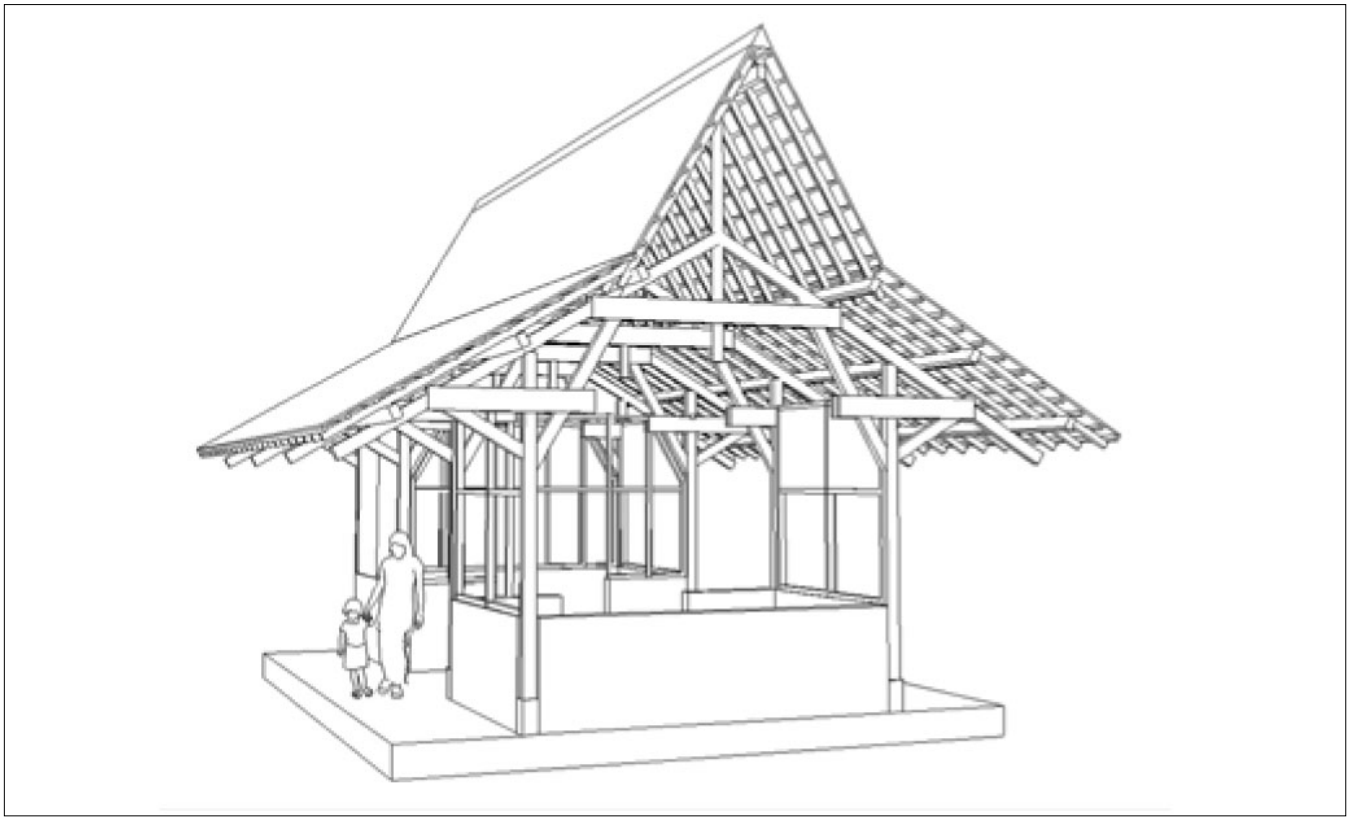
Translation from Indonesian to English underway.

Brigitte Shim
May 2010

* This report is the orginal, unedited version sent by the author on the 13th May 2010.

Site plan of the village before the earthquake, 2006.

Site plan of the village after reconstruction, 2009.



Architect’s sketch.

Traditional construction of the village, a ‘limasan’.

New structure based on the design of the traditional ‘limasan’ houses.

Street view of two houses.

Rear view of a house made of brickwalls combinated with fiber cement panels.

A owner in front of his dwelling.

Front view of a house.

Deatil of the wooden roof.

Terrace under the canopy roof, made of wooden beams and panels.

Living-room, and view on the wooden roof.

Interior view, with the panels on the wooden beams.