RESEARCH OF ENVIRONMENTAL ADAPTATION OF TRADITIONAL BUILDING CONSTRUCTIONS AND TECHNIQUES IN NIAS

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ABSTRACT: On December 26th 2004 a major earthquake caused a Tsunami in the region of the Indian Ocean. The epicentre of the quake lay offshore the Indonesian Island of Sumatra close to its neighbouring island Nias. 3 months later Nias was again hit by a series of earthquakes causing death of thousands of people. Besides the human tragedy the earthquake the natural disasters showed that outstanding resilience of the vernacular buildings: whereas 80 percent of the modern style houses collapsed few old buildings where damaged, causing less harm to the inhabitants. The traditional architecture of the Island of Nias is an outstanding example of the adaptation to specific environmental conditions. The location of the settlements, used materials, building construction and techniques result from development over centuries. The houses provide excellent shelter from the hot and humid tropical climate. In particular they seem to be constructed specifically to withstand the common unstable ground conditions and earthquakes in the area. During the earthquakes in the last months the exceptional stability of the traditional constructions has been proved. Even though, the knowledge and application of these techniques is endangered due to different reasons. Scientist of the Viennese Institute for Comparative Research in Architecture undertook an interdisciplinary excursion to Nias in summer 2003. A 45 minutes documentary film summarized the results of the field trip. The building surveys gained in 2003 and results of ongoing interdisciplinary and international cooperation with Indonesian scientists and local organisations provided a basis for the research project, which will finally lead to the sustainable development of earth quake resistant architecture in Nias for the 21st century considering indigenous principles, knowledge and techniques.

INTRODUCTION

Nias, is a small island 120 kilometres west offshore the Indonesian archipelago of Sumatra. Until recently it has been renowned as a perfect surf spot only to a small group of people. In the aftermath of the Tsunami, on the 28th of March 2005 Nias was struck by a severe earthquake, which destroyed numerous buildings. Thousands of people lost their lives in the collapsing houses. Only these recent natural disasters made the island known to the general public.

Nias is part of a very active tectonic area. Lying on the fracture zone of the so called Eurasian and Indo-Australian tectonic plates it is shaken by earthquakes regularly causing the inhabitants to call Nias "the dancing island". Significantly most of the destroyed buildings have been built out of concrete within the recent decades following western influence, but not meeting western standards concerning foundation and safety. In contrast comparatively few vernacular houses collapsed or were damaged by the quake. In the indigenous architecture of Nias over many generations special constructions have been developed to make buildings resistant to earthquakes. Particularly interesting are the foundations and the elevation with unique and complex arrangement of vertical and diagonal columns. If the buildings are well maintained they can last over generations and withstand even strong seismic shocks. Even if damage occurs the threat to life is not as dangerous due to the relative lightness of the wooden constructions.

Although the vernacular architectural of Nias has undoubted advantages the people prefer to build bungalow style buildings made of concrete following modern influences. The recent catastrophe may start a process of reconsideration of the traditional ways of building. Research of the indigenous building types has to be carried out in order to apply the findings to the design of new forms, constructions and typologies.

The Vienna based Institute for Comparative Research in Architecture (ICRA) started to work on a documentation of the traditional building methods of Indonesia in 2003. A first outcome of the research has been published as a documentary film, which was finished by the time the Tsunami hit the region. Our first reaction was to use the presentation of the preview to collect donations for the victims. Furthermore the building surveys will provide a basis for comprehensive analysis of the traditional buildings in Nias. In interdisciplinary cooperation with Indonesian scientists and in consideration of the indigenous construction principles, knowledge and techniques, a proposal for future earth quake resistant architectural developments will be worked out.

1. INDIGENOUS ARCHITECTURE OF NIAS

"Tano Niha" land of mankind is what the people of Nias are calling their homeland. In ancient days head hunting, ancestor worship, feasts of merit and a stratified society composed on noble men, commoners and slaves shaped the living of the small island. In former days Nias was a wild place, overgrown with jungle, with only few settlements situated inside the island far from the coast. Today there are many settlements along the shoreline, and you can find large plantations on the island. Only few is left from the original forest and good building timber is becoming scarce. Nowadays visitors of the populated country can hardly imagine that old travel stories describe Nias as an uninhabited island.

1500 years ago settlers from Southeast Asia started to populate the island from its centre. Due to the rough topography most of the settlements were erected inland, in the most southern and
most northern parts of the island. The territories were isolated and developed independently. Differences in social organisation and village formation divide Nias into three distinct regions: north, central and south. Between the regions you will find linguistic, social and cultural differences, as well as diversities in architecture.

1.1 Architecture of North Nias

Traditional villages in the northern part consist either of groups of 6 to 12 oval houses, which are being oriented longitudinal-side towards the street or single cottages far away from each other, also in oval shape. In former times the settlements were fortified with fences of bamboo or with an earth wall overgrown with trees.

The interior of the North Nias house is surprisingly light. Besides the skylights in the roof, large openings with louvers provide the main source of daylight illumination and ventilation. The louvers and the vast roof space enforce the air circulation in the house, providing a comfortable climate within the building. The living floor is divided into a meeting room, “Talu salo” and a variable number of bedrooms. The kitchen and sanitary rooms are situated in an annex on the backside of the house.

The house is hardly furnished, the inhabitants’ belongings stored in chests. The most important piece of furniture is a long plank below the louvers, which the tenants use as a bench. From there they overlook the village square and get easily into contact with the people on the street and in other houses. Considering an average of 250 days of rain per year, these views options, together with the big meeting room, enable essential social contact.

1.2 Architecture of Central Nias

Although the settlement history of Nias has its roots in Central Nias nowadays the architecture of this region appears as a hybrid of northern and southern styles. Like in the villages of North Nias the settlements are a collective of single buildings. But different from the north the houses are situated with its eaves facing the village square. This orientation and the rectangular floor plan are also found in the South Nias villages.
1.3 Architecture of South Nias

Villages in South Nias are situated on hills and are named after their location. In the past, when warfare and headhunting raids were endemic, an outer palisade of sharpened bamboo stakes fortified the village with a deep ditch behind.

Between two coupled houses covered entrance terraces are shared by pairs of adjacent households. Neighbouring houses are also connected with doors to provide escape routes, which were needed in the past.

A central fireplace divides the interior space into a public room in front and sleeping rooms in the back. The front room is lighted by an opening, which is stretching over the whole street facade and is secured by a wooden grid. Like in the north the form the beginnings of the streets. The basic linear street pattern can be enlarged to T- or L shaped configuration.

In the covered area in front of the houses along the street semi-public space is used for working, socialising and for transition. A drainage gutter defines the border. The following area towards the street is reserved for the megaliths as representation space. This zone is called “wall of stones” (dili batu) and indicates the rank of the householders. The megaliths are a kind of petrified model of the social hierarchy and feasts of merit. The stones are classified by gender, and come in a variety of forms, which include menhirs, benches and circular seats.
2.2 Aim

The task of this project is the analysis of traditional buildings on the island of Nias. Constructions, types and techniques will be investigated regarding their development, use, function and stability. Detailed descriptions of traditional building techniques will form a valuable collection for further development. The record of solutions found would help to outline their use in future building projects, which should be comparably earthquake-resistant.

Furthermore the scientific publication of the results will be translated into a film-documentation. This allows public access to the scientific results, to communicate the people of Nias a different view on their traditional architecture. Thus the project creates a sensibility about the maintenance of traditional houses or the application of traditional building techniques on new architectural solutions.

In cooperation with Pater Johannes Hämerle specific projects of preservation and/or design can be granted financial support.

2.3 Workflow

In co-operation with Pater Johannes Hämerle and Laretna T. Adishakti (ICOMOS Indonesia) villages and houses will be selected, which can be used as research examples. Buildings, which have been documented by IVA during a field trip in 2003, will be included into the research. Due to its specific appearance traditional architecture in Nias has been the focus of different research groups in the past. After the recent earthquakes record of damage has been done by national and international organisations. In co-operation with Pater Johannes and Laretna T. Adishakti partners will be defined and contacted. Available records will be examined and integrated into the research.

A first post-earthquake excursion from Austrian side will do a brief building survey, looking for damaged and non-damaged traditional buildings. With this survey and pre-earthquake records a first phase of research can be carried out. Experts in engineering will cooperate to elaborate 3d computer models of the structures being used to test flexibility and deformation under extreme conditions.

A final excursion with architects, building engineers, surveyors and film technicians will focus on the completion of the records. Additional vibration tests and documentation of special features, are defined in the expert review. Simultaneously, local craftsmen will be looked for who are familiar with traditional techniques and invited to participate in the project.

The material of the excursions will be used to outline the value of the traditional building techniques in Nias by means of identification of the crucial factors, which make the structures safe during earthquakes.

3. DOCUMENTATION

3.1 Conventional approach

Conventionally, architectural documentation includes plans, sections, elevations, sketches and photographs. Video documentation is still seldom used, although moving images allow the understanding of space in a much easier and immediate way.

The documents are usually produced by visiting experts of any kind, not the inhabitants, who would in some respect be much better informed about the "abilities" of their houses.

3.2 Integrative approach

In addition to the conventional means of recording in architecture also other methods are used.

Craftsmen in Nias built very accurate wooden models, which explain clearly the structure of the constructions. This is essential, as the roof area is very dark and difficult to measure. Using the principles of the real models, the 1:1 measurements, and virtual 3d modelling tools, the roof construction and spatial relations of the interior can be analysed.
Fig. 11: Wooden model of a house at North Nias

Fig. 12: Roof space in a Central Nias house.

Interviews with the tenants provide information about the history of the buildings and the functions of the rooms. The knowledge of the people can help scientific researchers in many ways. Craftsmen know about the material and the construction in detail and the tenants can give essential information about the building and its and significance. Information gained from local people will be essential to avoid misinterpretation and to define changes in architecture, typology and use through the recent earthquakes.

With the help of a film documentary the interrelation between people and built and natural environment can be outlined emphatically. In that way this tool of documentation enhances the building survey and supports the work of scientific research.

4. OUTLOOK AND CONCLUSION

The outcome of the described project will be published in a book and in a film documentary. It will be shown to public audiences in Nias to show the people the advantages and lacks of the traditional building techniques. People will be supported when they decide to renovate their old building or use traditional techniques for the construction of a new house. Financial support will be done by funds, which have been collected after the Tsunami in December 2004 and the Earthquakes Easter 2005. Pater Johannes Hämmerle at mission of the fraternity of the Kapuziner at Gunung Sitoli initiated a kind of adoption for houses. He is raising funds for defined objects and their godparents will be kept informed about the progress.

In winter term 2005 a design program will be carried out at the University of Technology in Vienna at the department of HB2 to apply the findings of the investigation on future architectural projects.

The influence of ecology and society on spatial relations and building will be most important concerning the continuation of these traditional building forms and techniques. All research material serves as a basis for future research- or applied projects and can be used for the support of the Nias people after these severe catastrophes.

Filming can do the combination of different means of recording. Photographs and measures can provide two- and respectively three-dimensional information about the documented object. A video shows movement, adding the fourth dimension of time to the record. Functions and use are clearly visible as well as the daily life of the inhabitants. Furthermore the impact of rain or smoke diffusing through the roof can be shown directly.
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