

Likelihood of Innovative Construction Techniques to Build Disaster Resilience for Vernacular Housing in the Highland of Central Vietnam

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Abstract: Disaster mitigation for marginal communities has become one of the most significant development goals of the 21st century. Vietnam has been reported one of the five most vulnerable nations in the world to climate change and so serves as a useful case study in developing appropriate housing solutions after disasters. In addition, some local communities in remote mountainous areas of Vietnam still keep strong vernacular traditions in their housing, especially the typical timber house-on-stilt, which need intense consideration before employing any new techniques of disaster mitigation on them. Perceptions on how to develop a sustainable housing solution for such communities, therefore, is still controversial with very few useful options developed to date. The paper investigates the existing unsafe conditions of traditional houses of a local community in the central highland of Vietnam, exposed to natural disasters, together with an identification of several traditional features of this housing that would be needed to preserve in future construction. Some important gaps of these traditional houses in terms of disaster risk reduction are then displayed to show opportunities where new construction techniques have a high possibility to perform against extreme climate events.

Key words: Disaster, vernacular housing, housing design, housing reconstruction.

1. Introduction

Housing and natural disasters have a close linkage in developing countries where housing is considered as one of the most valuable assets of residents [1]. Natural disasters intensified by climate change with their unfavourable impacts on housings have put high pressure of meeting shelter demands for disaster-affected regions [2]. Housing reconstruction after disasters therefore becomes one of the key interventions of disaster recovery, ranging from provision of short-term or temporary shelter to long-term or permanent housing. Funds for disaster management all over the world have not increased while the proportion spent on post-disaster housing reconstruction has risen significantly [3]. In Asian

developing countries, despite national governments and humanitarian agencies carry out plenty of recovery responses, most affected households still receive little or even no assistance [4]. In Vietnam, the government considers housing as one of the four most vulnerable sectors to climate hazards [5].

Housing reconstruction often reproduces vulnerability to future disasters [6]. The complex relationship between human actions and climate events require aid agencies to re-consider their methods or approaches to disaster mitigation in the future [4]. Inappropriate design solutions and badly constructed houses have been known as one of the root causes of increased disaster risks [7]. It is said that addressing local patterns and responsive characteristics in housing reconstruction is importantly necessary to provide a so-called “normal house” for a given community [7]. Housing solutions, both technical and non-technical, are seen as

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“responsive” or “appropriate” once they not only meet shelter needs but also bring about non-housing outcomes for inhabitants (such as family stability, better homework and educational performances, healthy living practices etc.) [8].

However, one of the most common failures in some recent post-disaster housing programs in Vietnam is the exclusive concentration on physical and visual aspects of buildings with little or no attention to people’s normal activities (farming, crafting, fishing, etc.) and community’s meanings, symbols, or traditions [9]. These mistakes may create conflicts or rejections from inhabitants towards proposed mitigation measures [9] and subsequently lead to the ineffectiveness of housing assistant projects. In most implemented projects on housing reconstruction in central Vietnam, their excessive focuses on technical issues to provide robust buildings has led to inadequate responses to local contexts and potentially created discontent or resistance of people (see Fig. 1). One of main causes originates from the improper evaluation of successfulness of those projects relying on physical outcomes (visible buildings or facilities), whereas the key evaluation criteria absolutely come from people’s acceptance and community’s adoption towards proposed measures [10] because they are the ones who continuously use these measures for future disasters. In addition, the common approach to post-disaster reconstruction by applying one-size-fits-all solutions for geographically and culturally different locations may create greater severity of post-disaster built environment [11].

Sustainable housing reconstruction comes into existence as a consequence with the central focus on

achieving the best long-term results of post-disaster reconstruction [2]. It will not only ensures technical stability of buildings, better construction quality, but also offer a plenty of social, economic, and environmental benefits for disaster-affected communities in the future [9]. Climate change and unexpected occurrences of climate events in recent years have highly supported the development of sustainable housing for vulnerable local communities all over the world [4].

The paper presents the result of a successful reconstruction project in 2010 to assist housing for a local community after the typhoon Ketsana (2009) in the highland of central Vietnam. The author worked as an architect based in the DWF (Development Workshop France) organisation to propose design options of disaster resilient housing for this community. The interesting point here is the very strong living tradition of this community, particularly in their housing architecture, that really attracted me on my first visit and challenged me in developing appropriate disaster resilient housing. The key aspect of the design is the engagement of local people in all design phases which helps me to better understand local context and local needs before initiating my design proposals.

2. Housing in the highland of Central Vietnam

Vietnam has been known as one of the five most vulnerable countries to climate change with different types of climate hazards. Flood and typhoon expose the most frequent and awful occurrences, affecting approximately 80–90% of Vietnam’s population [12]

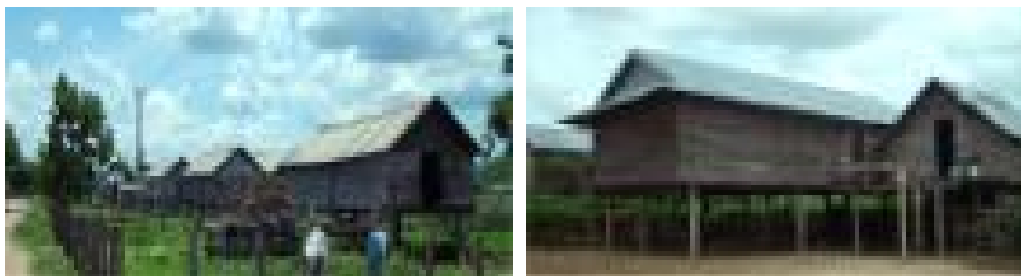


Fig. 1 Existing vernacular timber houses on stilts in Iabroai commune, Gia Lai highland province of central Vietnam.

and causing great losses of human life, housing, livelihood, and other property [13]. In central Vietnam, the most disaster prone region of the country [14], the provision of disaster resilient housing is more important and significant, especially when most past and current shelter programs face similar problems regarding cultural appropriateness and local-context responsiveness. The factors influencing community adoption need to be investigated through community consultation and addressed in housing design and reconstruction. Once this task is satisfied, safety-related measures proposed in new houses will be continuously used and expanded by locals (house owners and local builders) to cope with future disasters. It helps to maintain the effectiveness of housing strategies in the long run and, consequently, contribute to sustainable development of local communities.

Housing of an ethnic minority group in Ia Broai commune, Gia Lai mountainous province of central Vietnam, currently contain strong vernacular characteristics in building form, structure, and materials used. These are the timber structures sitting on stilts to accommodate various functional spaces under and above the floor (see Fig. 2). Living activities such as sleeping, cooking, and eating occur on the floor and other functions such as storage or livestock are positioned under the floor. According to the discussions between the author and beneficiaries in 2010, people said that they have a long tradition of living on stilts to avoid dangerous animals and unhealthy air from the ground and still want this way of living. However, strong occurrences of climate

events in recent years have damaged their houses partially or totally and make their lives vulnerable to natural disasters. Housing assistance for such communities is highlighted not only to improve their living conditions but also to preserve the outstandingly in-progress traditional ways of living of this community.

3. Unsafe Conditions of Housing

This village locates in mountainous region suffers from tornados or whirl-winds and floods. Residential houses were seriously damaged by whirl-winds every year, focused on unsecured roofs and walls. The annual average flood-level was reported one metre high from the ground that makes timber supporting stilts underneath rotten and weakened. In short, there are four typical unsafe performances found in surveyed vernacular houses (see Figs. 3).

Surprisingly, these unsafe conditions are unimportantly considered or even unknown in community. People who were asked the questions related to disaster and disaster preparedness know very little about it. Therefore, they just left their home unstably facing natural disasters in a hope that it would be intact after disasters. This is in fact the social cause of vulnerability which closely links to the development of physical causes or unsafe conditions mentioned above. Therefore, housing assistance for such local community not only focuses on physically housing improvement but also includes raising public awareness on disaster preparedness and reduction.



Fig. 2 Inappropriate masonry houses built recently in this village are unattractive to local people.

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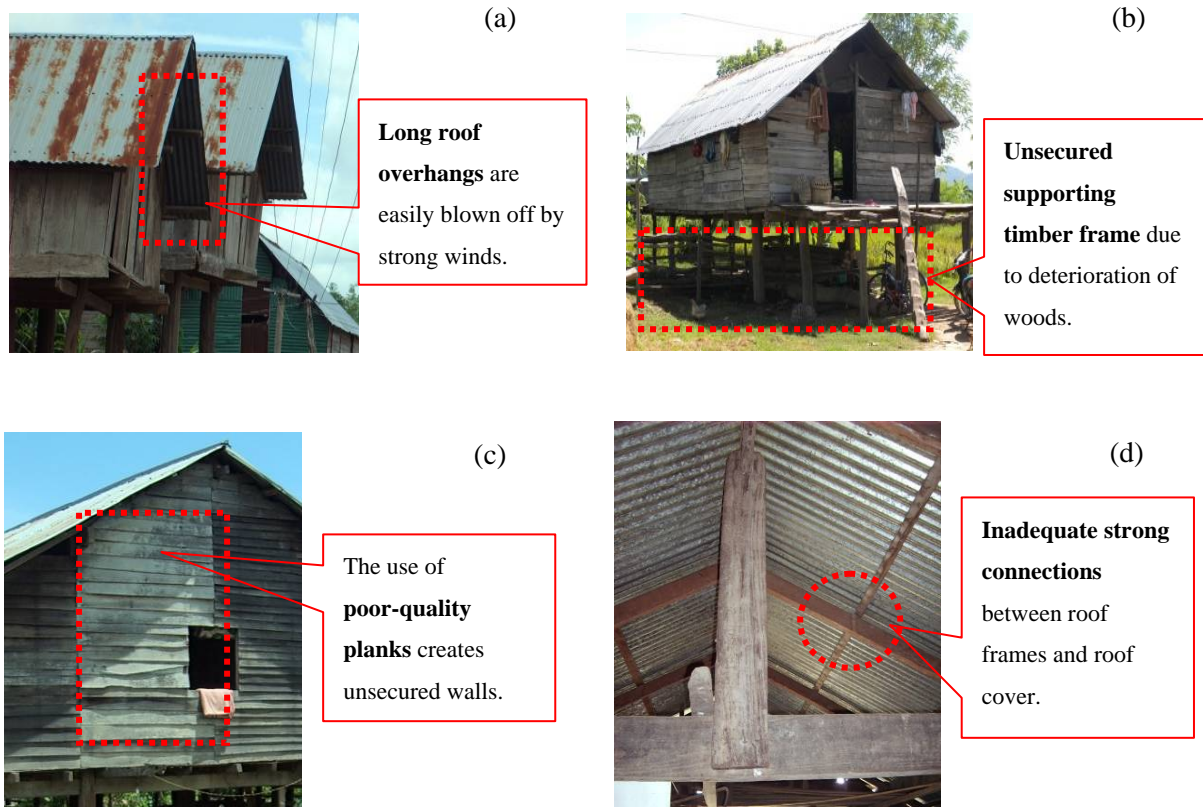


Fig. 3 Typical vulnerable conditions of existing houses-on-stilt.

4. Methodological Approach

Sustainability in post-disaster housing reconstruction is the key aspect of this project. It is a long-term strategy dealing with many different but interrelated issues. It will not only include technical aspects of housing but also address unseen important factors in terms of social, economic and institutional benefits. The consultation with target groups in community at certain stages is critically important in line with an adequate understanding of local contexts for applying appropriate new construction methods or techniques on disaster mitigation.

The design process was started by a field survey to assess housing situation, living conditions, housing damage, and local capacity for construction such as material suppliers, transportation method, and local labour or available builders. The participation of beneficiaries in all phases is the key success of this project. They worked closely with the team (architect,

technical supervisor, and local workers) to define their new homes according to their needs and capacities (see Fig. 4). They were also equipped with basic knowledge of safe construction which, subsequently, enables them to follow and monitor each step of construction work. Another benefit from participatory design is offering beneficiaries the sense of ownership towards their new homes.

5. Results

The combination of new construction by RC (reinforced concrete) skeleton with the traditional method of installing wooden walls in the typology of house-on-stilts has got a certain achievement in practice. The use of RC skeleton (see Fig. 5) to replace the previous timber ones not only helps to secure the building but also to prevent material damage by flood water (see Fig. 6). It also partly contributes to the reduction of deforestation for the need of construction materials in the region as before.



Fig. 4 Working with people in their traditional houses.



Fig. 5 Executing RC skeleton (left) and installing wooden walls (right) on the site.



Fig. 6 The harmony of RC skeleton to existing traditional housing architecture of the village.



Fig. 7 The finished houses are happily agreed and adopted by local people.

The design also makes full use of available wooden planks of families for installing surrounding walls of their houses and, as a reward, builders increased the housing floor-area according to their spatial needs. It also created plenty of employment opportunities for locals in wall-installation jobs since it is their familiar traditional technique of construction.

The new rebuilt houses have been highly appreciated by locals because their architecture not only ensure technical stability and safety in disasters but also respect their traditional ways of living (see Fig. 7). Architecturally, this housing design helps to harmonise with existing housing patterns of the village where most residential houses are currently sitting on stilts (see Fig. 7).

6. Conclusions

The re-utilisation of traditional form of house-on-stilts did familiarise local people with their new houses. The replacement of timber structures by RC (reinforced concrete) skeletons provides safer houses for people in future disasters. The engagement of local craftsmen in installing building walls onto the RC structure help them better understand the importance of applying new construction technology to promote valuable local characteristics in disaster risk reduction. This integrated approach significantly improves current construction practice and perception on safe housing construction in the region.

These outcomes may be used as a useful case study to develop housing solutions for other vulnerable minority groups who are still living in similar houses on stilts in other regions of the highland of central Vietnam or in other countries. However, participatory-design approach in line with community consultation with local groups (home owners, local builders, local representatives, etc.) before initiating design options is compulsorily required to develop appropriate and sustainable housing for such communities.

Acknowledgments

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References

- [1] I. Ahmed, An overview of post-disaster permanent housing reconstruction in developing countries, *International Journal of Disaster Resilience in the Built Environment* 2 (2011) 148–164.
- [2] U. N. E. P. Unep and S. R. C. A. C. F. D. Skat, *After the Tsunami: Sustainable building guidelines for South East Asia*[Online], UNEP and SKAT, 2007, available online at: <http://www.skat.ch/>.
- [3] R. Gilbert, *Doing More for Those Made Homeless by Natural Disasters*, The World Bank, Washington DC, 2001.
- [4] P. Suarez, G. Suanders, S. Mendler, I. Lemaire, J. Karol and L. Curtis, Climate-related disasters: Humanitarian challenges and reconstruction opportunities, *Climate Change and Place* 20 (2008) 62–67.
- [5] M. O. N. R. A. E. Monre, *National Target Program for Climate Change Response*, Vietnamese Government, Hanoi, 2008.
- [6] B. Wisner, P. Blaikie, T. Cannon and I. Davis, *At Risk: Natural Hazards, People's Vulnerability and Disasters*, Routledge, London and New York, 2004.
- [7] I. Davis, *Shelter after Disaster*, Oxford Polytechnic Press, Oxford, 1978.
- [8] J. Fien, E. Charlesworth, G. Lee, D. Morris, D. Baker and T. Grice, *Towards a Design Framework for Remote Indigenous Housing*, Australian Housing and Urban Research Institute, 2008.
- [9] J. F. Audefroy, Post-disaster emergency and reconstruction experiences in Asia and Latin America: An assessment, *Development in Practice* 20 (2010) 664–677.
- [10] K. M. Gharaati, *Knowledge transfer in post-disaster reconstruction: The problem of post-post-disaster reconstruction*, Ph.D. Thesis, McGill University, 2009.
- [11] E. Charlesworth, *Home, Sustainable Home, Making*

Cities Work, Paul Noonan, Australia, 2011.

[12] V. Vietnamese Government, National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020, Vietnamese Government, Ha Noi, 2007.

[13] O. L. Nhu, N. T. T. Thuy, I. Wilderspin and M. Coulier, A Preliminary Analysis of Flood and Storm Disaster Data

in Vietnam, Ha Noi, 2011.

[14] B. D. Tinh, T. H. Tuan, T. Phong, B. D. The and B. T. Tam, Local Vulnerability and Adaptation to Extreme Climate Events along the Central Coast of Vietnam, Climate Change Adaptation and Disaster Risk Reduction: An Asian Perspective Emerald, 2010.