Qualitative Insights into the Costs and Benefits of Housing in Three Wards in Central Vietnam

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1. OVERVIEW

Da Nang is the most dynamically developed city in Central Vietnam where economic development and urbanization are both occurring rapidly. The city's gross domestic product (GDP) is the highest in the country, just over 11 percent in recent years (Cu, 2008). Surrounded by mountains, Da Nang is not only prone to the effects of typhoons but also at risk to floods. These, together with other natural hazards such as drought, high tides, coastal erosion, salinization, and landslides, are major concerns for city residents and local authorities, and are likely to be exacerbated under the context of climate change (ACCCRN, 2010).

Out of these natural hazards, the most dangerous climate hazard in Da Nang is typhoons (Da Nang CFSC, 2012). Typhoons have the greatest impact on housing compared to other sectors making housing one of the most vulnerable sectors to climate extremes. Housing damage is not caused by climate hazards, but also by inappropriate housing solutions and poor construction techniques. There are several barriers to safe housing construction in Da Nang: (a) additional costs of disaster resistant measures; (b) limited awareness for home owners; (c) social pressures on owners to build more rooms or more living space for larger families; (d) limited family financial capacity or insufficiency money to build; and (e) limited professional and technical assistance in typhoon and storm resistant housing (Anh et al., 2012).

While the adverse impacts of past typhoons are already seen in the current housing sector and in local livelihoods, they will only worsen as climate change makes the area more vulnerable. As a result, there is a need to investigate the costs and benefits of alternative housing designs that enhance resilience to typhoons and assist agencies and the private

sector in understanding the returns on investments and reducing future risks. Given the fact that there is little information available on the costs and benefits of housing improvements to reduce typhoon losses in Vietnam and Da Nang city in particular, there is a need to identify and evaluate alternative housing resilient measures. Qualitative approaches can provide insights into the costs and benefits associated with interventions that increase climate housing resilience.

The results of this paper show three options that local households in the study area undertook to reduce typhoon risks, which include Option 1: to rebuild their house; Option 2: to repair their house; and Option 3: to build a public shelter. Results from preference ranking options show that rebuilding their house (Option 1) is the most preferred option, while building a public shelter (Option 3) is the least preferred.

2. QUALITATIVE COSTS & BENEFITS ASSOCIATED WITH OPTIONS TO ENHANCE HOUSING RESILIENCE TO TYPHOONS USING SHARED LEARNING DIALOGUES

Three shared learning dialogues (SLDs) were organized in the selected wards including Hoa Quy, Man Thai, and Hoa Hiep Bac in September 2012 to investigate the qualitative costs and benefits related to the three resilience shelter options. The SLD participants consisted of local households, ward representatives, and staff of the Da Nang's Women Union (see Appendix 4 for a list of the SLD participants organized in Hoa Quy ward). Participants from local communities were invited to the SLD to represent households that were strongly affected by Xangsane and Ketsana typhoons in each of the selected wards.

IDENTIFYING KEY HOUSING INTERVENTION OPTIONS

Results from the SLDs indicate that there are three key options that local households consider as housing intervention strategies to increase typhoon resilience. These include: (i) building a new house (rebuild house), (ii) retrofitting a house (repair house), and (iii) building a common house (public shelter). Below, we discuss features of each option and identify the benefits and costs associated with each alternative option.

CHARACTERISTICS OF TYPHOON HOUSING RESILIENCE OPTIONS

Option 1: Building a new house (rebuild house):

It is noted that the focus of this study is to investigate housing options for medium and low income households in the study areas[1]. Typical characteristics for rebuilding a house that is both resistant to typhoons, at a level 12 on the Beaufort scale, and economically feasible for medium and low income households includes a floor area of 50 square meters (for 4–6 persons/household) with reinforced concrete columns and bond beam, mezzanine, and medium quality materials. Under the current housing condition in the study areas, the total cost to rebuild a house is estimated at about VND 125 million (average cost is VND 2.5 million per square meter [2]). The life span of this type of house is about 30 years but the lifetime for use is about 15–20 years, and in some cases it may be much shorter dependent on the economic status of households.

1 For higher income households, most of them already live in permanent houses. If someone plans to build a new house, it will be much larger and more expensive.

2 Figures from 22 households participated in the Woman Union's project in these areas show that the average size for rebuilding a house is 50 m2 (ranging from 24–100 m2) with an estimated cost per m2 is VND 2,452,660, varying from VND 1,571,429–4,000,000 per square meter (Da Nang's Woman Union, 2012).

Option 2: Retrofitting a house (repair house):

Repairing or retrofitting a house with typhoon resistant techniques is also a relevant option for local communities to respond to typhoon risks. This option is important for poor households with budget constraints. Typically, a less permanent house that is reinforced with 6 concrete columns and a metal roof that is secured to the wall can be considered a retrofitted house. For an area of 40 m2 with six reinforced concrete columns and bond beam, this housing option costs about 50% of total cost of rebuilding a house in Option 1. The life span is about 15–20 years but the lifetime use is only about 7–10 years of this type of house, and is rapidly becoming out of date compared to the option of rebuilding. Data from 12 households living in three study wards in the Woman Union's project show that the average size of a repaired house is 38 m2 (ranging from 20–75 m2) with an estimated cost per square meter is VND 1,107,143 (Da Nang's Woman Union, 2012). Similarly, the total cost of repairing the houses varies substantially among households and also depends on the quality of construction materials, size of the house, and household budget.

Option 3: Common houses (public shelters):

This is a popular solution to enhance local resilience to floods in rural areas in Central Vietnam. The first model of public shelter in Da Nang was built in Hoa Quy ward in 2006 with a total cost about VND 600 million (at current price, its cost is almost double). This is a concrete two-story house with an area of 300 m2. The public space not only serves as shelter for local people when flood and typhoons occur but also served as a place for living activities and meetings of local communities. There is a kitchen, toilet, power generator, beds, and other living necessities for sheltering about 300 people for about a week. This type of shelter is extremely effective to deal with floods in low-lying areas because public buildings in general do not exist.

However, in recent years under the city's reallocation program, many apartment buildings are built for reallocation of households located in low-lying areas. In addition to rapid economic growth, safer buildings such as schools, health care centers, public buildings, and private houses are built in these areas[3]. Therefore, many public shelters in Da Nang are abandoned especially during off-flooding seasons (DS&PL, 2010).

IDENTIFYING THE COSTS AND BENEFITS ASSOCIATED WITH EACH OPTION

During the SLDs, we identified types of benefits associated with typhoon housing resilience. Housing construction characteristics were categorized into sustainability (tính bền vững), socio-economic benefits (các lợi ích kinh tế-xã hội), utility/functionality (tính công năng), and society/community (tính xã hội/cộng đồng). Type of costs (dis-benefits) associated with typhoon housing resilience options were categorized by construction expenses and risks. The criteria are discussed in detail below.

Sustainability: The ability of a house to withstand strong typhoons (e.g. house that can be resistant to a level 12 typhoon) and the ability of a measure to increase the life span and life time of a house.

Socio-economic benefits: The ability to reduce damages and losses of household assets and lives. Owners feel more secure about their house and pay more attention to livelihood development. The owners have easier access to credit and loans, etc.

Utility/functionality: Spatial layouts and building typology are appropriate and familiar to cultural needs, living habits

3 Private houses with permanent structure are also mobilized and used for sheltering neighbors if flood and typhoon occurred.

or traditions of residents, achieve human comforts, and meet family demand, etc.

Society/community: The ability of local communities to also benefit in using the house. For example, neighbors are able to evacuate when a typhoon happens.

Costs: Costs of rebuilding or repairing a house and associated risks when selecting that option and other difficulties/ disadvantages of selecting the option.

The results of the SLDs organized in Hoa Quy, Man Thai, and Hoa Hiep Bac wards are identified in Table 1. The benefits associated with housing options included features such as sustainability, socio-economic benefits, society/community, and utility/functionality of house. The costs and risks of the options are also identified in Table 1.

TABLE 1: IDENTIFYING THE BENEFITS AND COSTS FOR OPTIONS IN THE SELECTED WARDS

Options	BENEFITS				COSTS	
	Sustainability	Socio-Economic Benefits	Utility/ Functionality	Society/ Community	Costs	Risks
Rebuild House	Longer life span and longer use time compared to retrofitting option (about 30 years and 15–20 years, respectively). Stronger resistance to typhoon wind (can be shelter to typhoon of level 12 magnitude)	Mitigate damages and losses of household's assets and lives. Safer shelter, stability in life, feel secure about the house, more chance to focus on livelihoods. Owners are proud of new house with neighbors, easier access to credit and loans.	More utility than old and retrofitting houses Owners have chance to make up for the houses, meet the demand for shelter of households Meet family's demand, more convenience for use	Neighbors are able to evacuate when typhoon happens Communities do not have to support when typhoon hits	This is more expensive than retrofitting option (about VND 2–4 million/ m2) Households that lack budget may borrow a loan with high interest rate	Because owners have to take a large loan, they may delay or even do not return it Leading to possible impact on life, health, education of children; being at risk of taking out of the list of the poverty households of the ward
Retrofitting House	Life span is about 15–20 years and use time is about 7–10 years Can be resistant to typhoon of level 9–10 wind magnitude	Feeling better a bit about house security Some other benefits are similar to the new house option such as safe shelter, reduce damage... but with lower degree	Lower level of utility compared to rebuild house Little chance to make up the house (space and appearance), partly meet household's demand	Neighbors are able to evacuate when typhoon returns	This option is cheaper than the rebuilding option (about VND1–2 million per square meter)	Same as above Could not avoid impact of floods as the house still uses old foundation
Common House	Permanent structure, can be resistant to typhoon level 12 and above Can provide shelter during both typhoons and floods	Reduce loss of lives in extreme typhoons and floods Communities are re-active in disaster response	Co-benefit: this can be used for other purposes in off-typhoon and flood seasons	Everyone in the community is able to use it	Large investment per shelter No chance to get the loan back	Limited use in off-typhoon and flood seasons in reality

OVERALL EVALUATION OF ALTERNATIVE OPTIONS

During the SLDs, a scenario was suggested to the communities to identify which option they would choose if their budget was limited. Most participants in the SLDs selected building a new house. It was explained that building a new house is even more expensive than the option of retrofitting a house and that the number of benefited households is limited. However, individual households still consider this the most effective and sustainable solution. The SLD participants also revealed that about 40 to 50% of the households in study wards would be willing to take a loan to build a new house if loans were available.

Results from the SLDs show that participants are reluctant to consider retrofitting a house (Option 2) as an effective response strategy to reduce typhoon risks not only because this option has less benefit than building a new house, but also because when you repair a house it is dependent on the structure of its walls and foundation. However, in most cases owners are not aware of this before hand, therefore, there is a risk of increasing the budget burden for the owners if they select this option.

Results of the SLDs show that the option of building a public shelter as a response strategy to typhoon is not very relevant in some study wards (such as Man Thai and Hoa Hiep Bac) because safe buildings already exist for sheltering local households if a typhoon occurred.

PREFERENCE RANKING OF OPTIONS

In this stage the SLD participants ranked each cost and benefit from one to three according to their perceived overall costs and benefits. The lowest costs are scored as 1, the highest costs as 3. The lowest benefits are scored as 1, and the highest benefits as 3. Table 2 presents the results by the SLD participants. Overall, the preference ranking shows the communities prefer rebuilding their house over the other options.

TABLE 2: RANKING THE BENEFITS AND COSTS FOR OPTIONS BY THE SLD'S PARTICIPANTS

Options	BENEFITS				COSTS	
	Sustainability	Socio-economic benefits	Utility/ functionality	Society/ Community	Costs	Risks
Rebuild house	2	3	3	2	3	3
Retrofitting house	1	2	2	1	1	1
Common house	3	1	1	3	2	2

3. CONCLUDING REMARKS

In summary, this paper shows the results of shared learning dialogues completed in three wards in Da Nang city where three options were investigated for building typhoon resilient shelter. This included the option to rebuild their house, repair their house, and build a public shelter. Among these options, results from overall evaluation show that rebuilding a house (Option 1) is most preferred, repairing their house (Option 2) comes second, and building a public shelter (Option 3) is not preferred.

For further information concerning the background of Da Nang city and study site background, please see Appendix 1.

REFERENCES

Cu, N. H. (2008). Da Nang's economic growth is stable or not. Journal of Science and Technology of Da Nang University, Vol. 5, 125-134.

Da Nang's Woman Union. (2012). Statistics of households particwipated in housing project, project funded by Rockefeller Foundation to People Committee of Da Nang city, and operated by Da Nang Women's Union. Da Nang: Da Nang Women's Union.

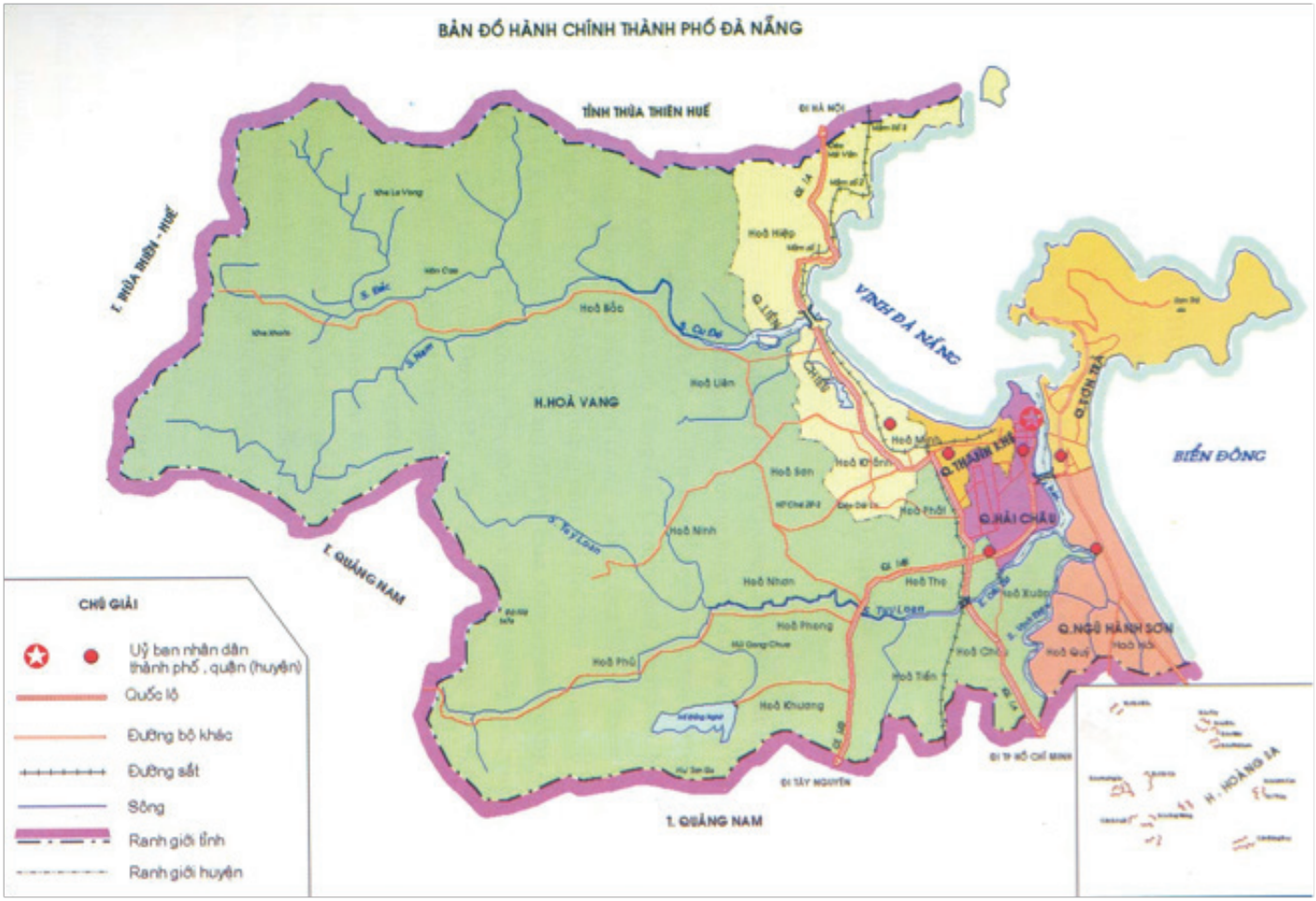
DS&PL. (2010). Many public shelters in Da Nang were abandoned (Nhiều nhà tránh bão ở Đà Nẵng đang bị bỏ hoang). Doi Song & Phap Luat (DS&PL). 2010. Retrieved from http://tamvoc.com/Nhieu-nha-tranh-bao-o-Da-Nang-dang-bi-bo-hoang/2016044 (20/2/2012).

Shared Learning Report. (2012). SLD Minute Report. Unpublished Manuscript.

Tuan Anh, T, T. Phong, T.H. Tuan and Kate Hawley. (2012). Review of Housing Vulnerability: Implications for climate resilience houses. Retrieved from http://www.i-s-e-t.org/images/pdfs/isetinternational_bookreviewofhousingvulnerability_tuananhtran_phongtran_tranhuutuan_katehawley_121031.pdf

APPENDIX 1: BACKGROUND INFORMATION OF DA NANG CITY

FIGURE 1: ADMINISTRATIVE UNITS MAP OF DA NANG CITY



Sources: Electronic portal of Da Nang City

Da Nang is characterized by aslope topography from west to east with many mountainous ranges, short rivers, deltas, and coastal areas, which created a diversified ecosystem and perhaps one of the most disaster prone regions in Vietnam. Flooding is a regular occurrence causing serious impact to local communities. Da Nang's main economic sectors (industry, services, and urbanization) have caused a reduction of agricultural production and laborers involved. The shift from agricultural production to an urban lifestyle caused residents to alter their traditional income generating activities (fishing and agriculture) to new ones such as construction and services. The process of urbanization and economic development of the city seems to have improved the living conditions for the people (ACCCRN, 2010).

With this, however, a number of challenges remain: First, the difficulty in shifting livelihoods from agriculture and fishing to non-farm sectors requires a higher level of adaptive capacity and education. Secondly, the rapid economic growth and urbanization rates over the last decade in the city have placed enormous pressure on the environment. Thirdly, as a coastal city, many types of climate hazards affect Da Nang including typhoons, floods, drought, coastline erosion, landslides, etc., and the risk of such hazards increases as a consequence of global climate change.

2. TYPHOON PROFILE AND ITS DAMAGES TO DA NANG CITY

Due to its geographical location, Da Nang is highly prone to climate disasters (typhoon, floods, droughts, erosion, saline intrusion, etc.) and extreme weather (heat waves, heavy rain, etc.). The greatest threat to Da Nang is typhoons (Da Nang CFSC, 2012), followed by flooding. On average 1–2 typhoons and 2–3 floods of Level 3 or higher hit the city directly per year. Detailed information on typhoons and damages caused in Da Nang during 1997–2011 is reported in Table 3, below.

TABLE 3: STATISTICS OF TYPHOONS AND THEIR DAMAGES, DA NANG (1997–2011)

Year	No. of Storms	No. of Deaths	No. of Houses Fully Collapsed	No. of Houses Damaged or Roof Blown Away	Total Damage (bil. VND)
1997	2	2	139	858	26.00
1998	1	-	-	-	-
1999	1	-	-	-	2000.00
2000	1	2	15	136	12.00
2001	2	-	11	131	5.00
2002	2	-	-	-	6.00
2003	1	2	-	-	1.50
2004	2	1	-	-	1.20
2005	1	2	246	2,230	41.00
2006	3	104	14,138	107,962	5,314.00
2007	4	-	-	-	-
2008	2	-	-		10.00
2009	3	-	283	6394	570.50
2010	-	8	-		
2011	-	1	-		
Total	**25**	**121**	**14,832**	**117,711**	**5,989.2**

(Sources: Da Nang CFSC, 2012)

FIGURE 1: TYPES OF HOUSES IN DA NANG

Row house

Detached house

Traditional house

Apartment building

(©Tuan, 2012)

During the period between 1976 and 2011 (36 years), there have been 59 typhoons and tropical low pressure storms that directly hit Da Nang, or about 1.6 typhoons and tropical low pressure storms occurring annually (Da Nang Hydro-met Station, 2012). Global climate change contributes to higher frequency and intensity of typhoons. It is assumed that typhoon trends will become more abnormal and unpredictable. Approximately 40% of households in Da Nang are affected when a typhoon occurs. Those most affected are people living in coastal areas, particularly the poor, women, and children. Other highly impacted groups are fishermen and farmers (ACCCRN, 2010; Da Nang People's Committee, 2011).

3. HOUSING CLASSIFICATION AND VULNERABILITY IN DA NANG

The classification of housing type can be divided into four groups: (i) row house (Nhà Đng), (ii) detached housed (Nhà phĐ), (iii) traditional house, and (iv) apartment building. To further elaborate, row houses were constructed primarily in the last decade, with about 80% of houses in Da Nang falling under this type. The row house is the largest and most vulnerable to typhoons (SLD report, 2012). The second largest proportion of housing type in Da Nang is the detached house. Traditional house is popular in peri-urban areas and can be considered the second most vulnerable to typhoon. Apartment buildings have become popular as a result of the rapid urbanization in recent years. This type of house is not vulnerable to typhoons below 12 Beaufort scale.

Before 2006 (Xangsane typhoon), most row houses were constructed without bond beams from the foundation, wall, and roof, thus were very vulnerable. The damage costs exhibited in the housing sector, due to Xangsane typhoon, provides clear evidence of the vulnerability towards typhoons. For example, in Man Thai ward, 45 houses were totally collapsed, 60 houses experienced their whole roof blown off, and 220 houses succumbed to just partial roof damage. In total, 1,875 houses were damaged out of 3,500. It is important to bear in mind that these damaged houses were row houses in this ward (Tinh, July 2012).

4. SELECTION OF STUDY SITE

Results from the SLDs with local authorities and experts organized in July 2012 indicated that the area along coastal lines in Son Tra district is the most vulnerable to typhoons. The second most vulnerable area are low-lying regions in Ngu Hanh Son district. These areas are not only affected by typhoons but also by floods. The third study site is located near Da Nang Bay, Lien Chieu district, and chosen because of its proximity to the sea where housing structures are weak, and thus, often damaged by typhoons (SLD, 2012).

Based on the above information, three wards were selected for organizing SLDs including Man Thai (Son Tra district), Hoa Quy (Ngu Hanh Son district), and Hoa Hiep Bac (Lien Chieu district). Hoa Hiep Bac and Man Thai wards are representative of wards located in coastal areas, which were directly impacted by typhoon winds. Hoa Quy is located in low-lying area of Da Nang city, which is often affected by typhoons and floods.

5. PROFILES OF STUDY WARDS

The main socio-economic characteristics of three study wards in 2011 are reported in Table 2. The figures show that although the population of each ward does not vary significantly, gross outputs and economic structures do.

Figures from Table 2 also reveal that the livelihoods of a large proportion of Hoa Quy inhabitants rely on agricultural production. The economic structure highlights the important role of the agricultural sector with a share of more than 50 percent of gross output, while the industrial sector is not as developed. Man Thai is a coastal ward where livelihood primarily depends on fishery. However, in recent years, the urbanization process has contributed to the change in economic structure with more dependence on the industrial sector and service rather than on agricultural and fishing practices. For example, agricultural production and fishing activities amounted to more than 75 percent in 2000 but now only accounts for about 33 percent of ward gross output. In Hoa Hiep Bac, located near to Da Nang Bay, over 98 percent of the wards gross output stems from industry and service sectors, while agriculture and fishery only account for a very small proportion of the gross output (see Table 4).

TABLE 4: SOCIO-ECONOMIC CHARACTERISTICS OF STUDY WARDS

Socio-economic characteristics	Hoa Quy	Man Thai	Hoa Hiep Bac
1. Total population*	16,000	13,000	16,000
2. Total number of houses**	3,000	3,500	3,564
3. Gross outputs (VND billion)	62.1	22.516	800.577
4. Percent of industry sector (%)	5.32	35,00	45.97
5. Percent of service sector (%)	38.16	31.21	52.75
6. Percent of agricultural and fishery sector (%)	56.52	33.79	1.28
7. Growth rate during 2010-2011	10.47	10.07	-

(Sources: Hoa Quy, Man Thai and Hoa Hiep Bac Wards' reports in socio-economics, 2012)
Note: (*,**) figures in 1 & 2 are gathered from SLDs and may not be accurate. These numbers will be double checked with statistics from each district.

6. DAMAGES BY XANGSANE AND KETSANA TYPHOONS IN STUDY WARDS

Xangsane was the strongest typhoon to hit Da Nang City in 40 years. On Saturday September 27, 2006, typhoon Xangsane hit the Central Coastal Provinces of Vietnam with heavy rainfall up to 250m and winds gusting over 140 kmh, the strongest winds ever recorded in this region. Da Nang was the most affected area. More than 15,000 people were evacuated to safe havens such as schools, hospitals, and government offices. In total, there were 14,138 totally collapsed houses and 107,962 unroofed and badly ruined houses (Da Nang CFSC, 2012). Ketsana typhoon hit Da Nang on the 2nd October 2009, with storm winds that reached a nine to ten magnitude. According to city statistics, there were 283 totally collapsed houses and 6,396 unroofed and ruined houses (Da Nang CFSC, 2012).

For the three selected wards, damages to houses caused by Xangsane and Ketsana typhoons are reported in Table 5.

FIGURE 3: HOUSING DAMAGES

(Binh, 2012).

TABLE 5: DAMAGES BY XANGSANE AND KETSANA TYPHOONS IN STUDY WARDS

Housing damages	Hoa Quy	Man Thai	HoaHiepBac
Damage by Xangsane typhoon in 2006			
1. No. of houses totally collapsed	50	184	720
2. No. of houses with proof totally blown	236	584	658
3. No. of houses partly collapsed	73	-(*)	50
4. No. of houses with proof partly blown	1,780	1,107	1,203
Damage by Ketsana typhoon in 2009			
5. No. of houses totally collapsed	6	1	6
6. No. of houses with proof totally blown	28	7	156
7. No. of houses partly collapsed	14	3	-(**)
8. No. of houses with proof partly blown	135	83	393

(Sources: Hoa Quy, Man Thai, and Hoa Hiep Bac Wards's reports on socio-economics, 2006 and 2009)
Note: (*) number of houses partly collapsed and number of houses with roof totally blown by Xangsane typhoon in Man Thai ward was not separated; (**) number of houses partly collapsed and number of houses vwith roof totally blown byKetsana typhoon in HoaHiepBac ward was not separated.

REFERENCES

ACCCRN. (2010). *Summary Da Nang city climate change resilience action plan (2011-2020): Within the framework of Asian Cities Climate Change Resilience Network.* Da Nang: Asian Cities Climate Change Resilience Network (ACCCRN).

Binh Nguyen Thanh (2012). Photos.

Da Nang Center of Floods and Storm Control (Da Nang CFSC). (2012). *Statistics on damages of natural disasters affected Da Nang over the 1998-2011 period* [Data file]. Retrieved from Da Nang Center of Floods and Storms Control.

Da Nang Hydro-met Station. (2012).*Typhoon and flood data for Da Nang during the 1976-2011 period* [Data file]. Retried from Da Nang Hydro-met Station.

Da Nang People's Committee. (2011). *Action plan for climate change adaptation and sea level rise: for the period of 2010-2015, vision to 2020* (Kehoachhanh dong ung pho voibiendoikhihauvanuocbien dang: giaidoan 2010-2015, dinhhuong den 2020). Da Nang: Da Nang People's Committee.

Hoa Quy, Man Thai and Hoa Hiep Bac Wards' reports on socio-economics. (2012). Annual reports on socio-economics of Hoa Quy, Man Thai and Hoa Hiep Bac wards in 2012.

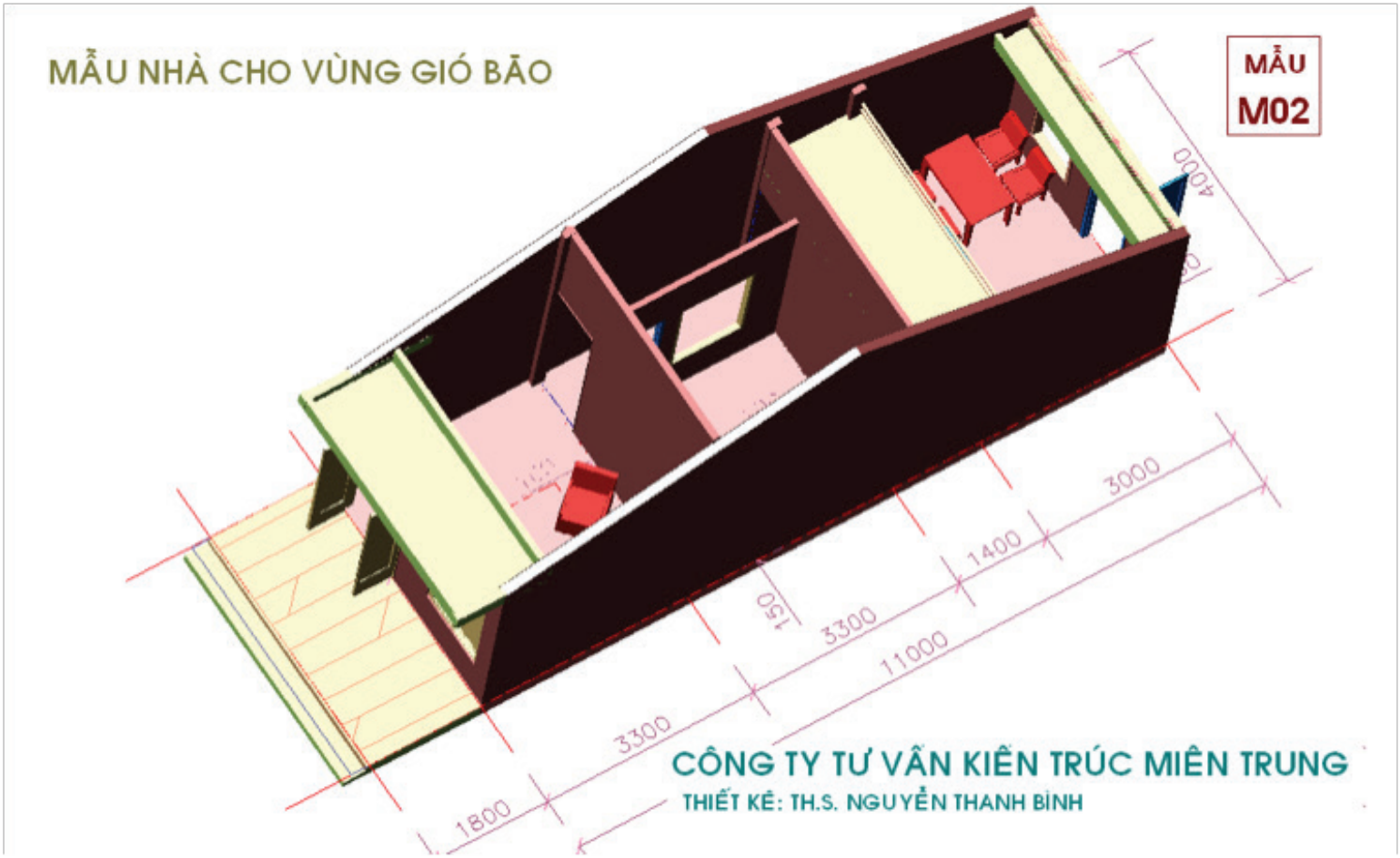
Hoa Quy, Man Thai and Hoa Hiep Bac Wards' reports on socio-economics. (2006 and 2009). Annual reports on socio-economics of Hoa Quy, Man Thai and Hoa Hiep Bac wards in 2006 and in 2009.

Shared Learning Report. (2012). *SLD Minute Report*. Unpublished Manuscript.

Tinh Bui Duc. (2012, July). Interview with Mr. Hai, Vice-Chairman of the Man Thai Ward's People Committee/Interviewer: July 2012. Copy in possession of ISET–International.

Tuan Tran Huu. (2012). Photos.

APPENDIX 2:
MODEL OF TYPHOON PROOF HOUSE



APPENDIX 3:
ESTIMATED COSTS OF TYPHOON PROOF HOUSE (M2 WITH FLOOR AREA OF 44 M2)

	Cost item	Unit	Quantity	Price	Price	Total	Total
	(Materials)			(in 2006)	(in 20012)	(in 2006)	(in 2012)
1	Cement PC30	kg	6,462.87	850	1,353	5,493,438	8,744,260
2	Sand for Concrete	m3	5.24	40,000	150,000	209,440	785,400
3	Sand for Mortar	m3	19.21	28,000	148,000	537,939	2,843,392
4	1x2-cm Macadam	m3	3.13	125,000	273,000	391,050	854,053
5	4x6-cm Macadam	m3	6.84	86,000	218,000	588,116	1,490,806
6	Stone for Foundation	m3	17.97	54,000	178,000	970,445	3,198,874
7	50*100*200 Brick	brick	1,122.30	500	1,060.	561,150	1,189,638
8	100*150*200 Brick	brick	5,433.03	450	1,837	2,444,864	9,980,476
9	Enamelled tile for Floor	m2	43.89	50,000	5,500	2,194,500	241,395
10	WC enamelled Tile	m2	10.82	50,000	170,000	540,750	1,838,550
11	Construction Steel	kg	437.98	8,600	17,010	3,766,594	7,449,972
12	U65 x 36 Steel	md	25.20	40,000	17,970	1,008,000	452,844
13	80 x120 cm Steel Purlin	m3	0.56	5,200,000	6,170,000	2,935,296	3,482,842
14	0,42mm Iron Sheet	m2	52.80	60,000	106,000	3,168,000	5,596,800
15	Other Doors	m2	14.52	400,000	690,000	5,808,000	10,018,800
	Main Material Cost	-	-	-	-	30,617,581	58,168,102
16	Other Materials	15%	-	-	-	4,592,637	8,725,215
17	Person days	d/m2	44.00	150,000.00	500,000.00	6,600,000	22,000,000
	Total cost					**41,810,218**	**88,893,317**

APPENDIX 4:
LIST OF THE SLD PARTICIPANTS ORGANIZED IN HOA QUY WARD

SN	Name of participants	Name of organizations
1	Mr. Huynh Kim	Vice president of People Committee, HoaQuy ward
2	Mr. Tra	Ward's staff, HoaQuy ward
3	Ms. Tran Kim Thao	Representative from Da Nang Women Union
4	Mr. Hung	Head of Farmer association
5	Ms. Di	Local people
6	Ms. Hoa	Local people
7	Mr. Nhu	Local people
8	Mr. Nghia	Local people
9	Mr. Cuong	Local people
10	Ms. Ly	Local people
11	Mr. Dai	Local people