Influence of Housing Designs on Resident-Initiated Housing Modifications in Resettlement Sites in Cagayan de Oro, Philippines

サンドラ・カラスコ[1], 落合知帆[2], 岡崎健二[2]

Sandra M. CARRASCO M.[1], Chiho OCHIAI[2], Kenji OKAZAKI[2]

[1] 京都大学大学院 地球環境学舎
Graduate School of Global Environmental Studies, Kyoto University
[2] 京都大学大学院 地球環境学堂
Graduate School of Global Environmental Studies, Kyoto University

The massive destruction caused by typhoon Washi triggered a large scale resettlement program in the city of Cagayan de Oro, which was based on a top-down approach for decision-making and implementation. As a result there was a limited understanding of the beneficiaries' needs and the local conditions. After beneficiaries' were allocated into the new houses, they expressed willingness to compensate the shortcomings of the provided houses starting with the construction of modifications. The aim of this study is to examine the influence of the designs of the original houses in the way residents built modifications, considering their initial motivations, actual use of modifications, location, and the type of materials used for their construction in four selected villages in Calaanan site.

Keywords: *Resident-initiated modifications, Post-disaster resettlement, Typhoon Washi, Philippines*

1. Background and Objectives

Resettlement implies a process where a community's housing, assets, and public infrastructure are rebuilt in a different location.[1)] Disaster-induced resettlement represents a measure to protect vulnerable communities, and may be appropriate when these vulnerabilities are the result of site-specific characteristics, which usually are the case of informal urban settlements.[1)2)] However, resettlement implies removing people from their familiar environments and detach them from their material and cultural sources which they depended on for living as individuals and as communities.[3)]

Involuntary resettlement in the city of Cagayan de Oro in the southern Philippines was the result of a sudden and massive destruction caused by typhoon Washi, which hit this region between December 16th and 17th, 2011. Although typhoons are common, the unexpected intensity of Washi caused the displacement of 228,576 persons which represents 40% of the city population.[4)] The most affected were the residents of informal settlements established in highly vulnerable areas along the river banks. These areas were later designated as "no-built" zones which triggered a major resettlement project. The priority of the government for the post-disaster housing reconstruction and recovery was to provide permanent houses and to avoid the construction of temporary or transitional housing projects. The initial objective was to build 8,599 permanent houses in resettlement sites.

In order to complete this ambitious project, the post-disaster housing recovery was based on a government-NGO partnership. The decision-making was mainly taken at the top level, which was led by the local government in coordination with agencies from the national government and NGOs. This approach limited the participation from affected communities during the planning and construction of the new housing settlements, considering them as mere recipients of help.

Various authors [1)3)5)] claimed the importance of community involvement in the housing reconstruction process because it is vital for the understanding of residents' needs and values, also because a participative approach stresses the importance of the dynamic role of communities in the planning and construction of the houses. In fact, researchers and practitioners [6)7)8)] stressed that apart from the challenges of low-income housing provision, one of the substantial differences between pre-disaster, normal, and post-disaster time is that the normal housing process and community "freedom to build" [9)] are often ignored in post-disaster reconstruction. In this context, government and NGOs prioritize the rapid completion of housing construction, simply presupposing the residents' needs and ignoring the understanding of the local conditions. As a result of the apathy to recognize the importance of socio-culturally appropriate settlement layouts and housing design, reconstruction and resettlement projects tend to fail.[1)5)10)11)12)]

On the contrary, researchers defined housing as a permanently changing element[13)14)], in which even owner-driven housing projects are likely to suffer changes in the time. Seek[15)] refers to the concept of "housing gap" arguing that only few households remain permanently satisfied with the same house. In fact, at one point of time, households' needs or expectations may change as a result of the process of inhabitation[16)17)18)] where have to take the decision between to move or to transform their current house.

This paper focuses on resident initiated modifications of the permanent houses provided in resettlement sites by the implementing agencies. It is crucial to understand this phenomenon as a natural process of residents' adaptation to a given housing setup. The aim of this research is to analyze the

influence of original houses' design on ways of resident built modifications, considering their initial motivations, actual use of modifications, location of modifications in reference to the housing unit, and the type of construction materials used in the four selected villages in Calaanan site. The outcomes from this research may provide a feedback that can be used for similar housing projects in the country.

2. Methodology

This study is based on a comparative analysis of four villages in Calaanan site in Cagayan de Oro, through identification of the main characteristics of housing modifications initiated by households, and how they differ from one village to another.

The primary data was obtained through 1) Interviews with 14 officials of governmental offices and NGOs involved in resettlement. 2) Household questionnaire survey conducted face-to-face with each household. 3) Housing observation survey and measurement; and 4) Graphic documentation of the settlements, the houses, and the households.

In order to determine the number of samples for 2), 3) and 4), normal approximation to the hypergeometric distribution was applied to calculate the sample size for small populations. The parameters for the sample size were at ±10% precision level for study feasibility and 90% reliability of confidence level. Thus, the total sample size needed was 212. The study was conducted between July and August 2014, and 254 samples were collected, 42 more samples were taken in order to have more accurate data. The distribution in the four villages is detailed in Table 1:

Table 1: Sample size and number of households surveyed

Village	No. of houses built	Sample Size	Actual number of households surveyed
Village 1:Mahogany	160	48	59
Village 2: Filipino.-Chinese F.	300	56	67
Village 3: GK Shell	271	55	64
Village 4: Oro Habitat	240	53	64
Total	971	212	254

The questions in the questionnaire included: a) Demographics which refer to the family structure and household profile, b) Pre-disaster housing conditions, c) Housing modifications built after allocation of beneficiaries, d) Residents' satisfaction with housing conditions and comparison about their pre and post-resettlement socio-economic situation.

3. Disaster-induced resettlement

Tropical storms regularly affect Cagayan de Oro; however, the frequency and intensity are lower than the regularly expected in the north and center of the country. Thus, when typhoon Washi hit Mindanao it caused an unpredicted impact, especially in urban areas. The target of the resettlement were the squatter residents settled along the river banks, which were the most vulnerable areas. In order to prevent the residents from returning to the squatter settlements, the government defined the No-Built Zone or buffer areas with specific prohibition to establish settlements in the land that was categorized as highly vulnerable.

(1) Calaanan site

Calaanan site is the largest resettlement site in Cagayan de Oro, in a total area of 26.7 ha. which accommodates about 2,299 houses were and 1,997 families (as of July 2014, according to reports from the Department of Social Welfare and Development). Calaanan is located in the peri-urban area of Cagayan de Oro, approximately 7.5 km southeast of the city center, and the major local public markets. This is one of the first settlements where implementing agencies (NGOs and other donors) and governmental agencies built permanent basic housing units for victims of Washi in Cagayan de Oro.

The land belongs to the local government of Cagayan de Oro, and before typhoon Washi occurred, it was partly used for social housing programs. Therefore, by the time the permanent housing for resettled communities were built, there were already some infrastructure built, such as access roads, transportation routes (local buses or jeepneys), community facilities such as Barangay center (which includes governmental offices, with administrative, and community spaces but also health facilities), schools and commercial areas.

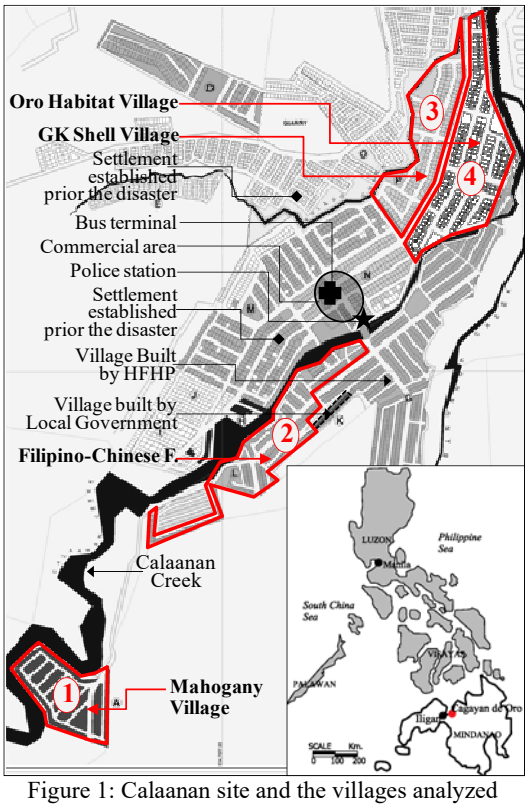


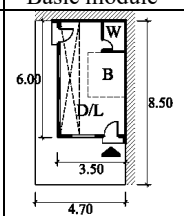
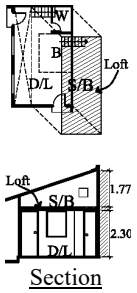
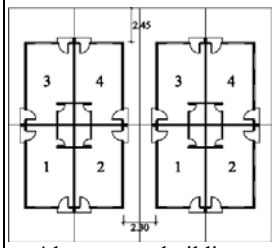
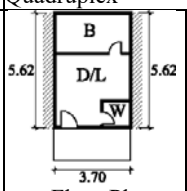
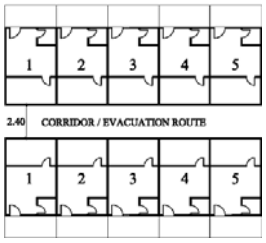
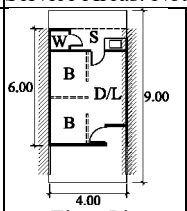
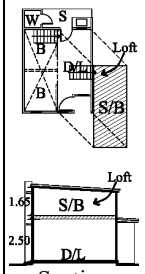
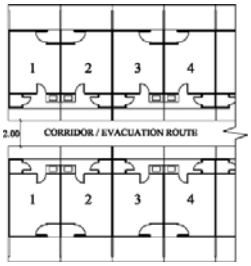
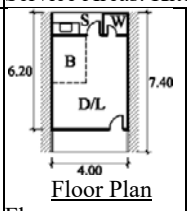
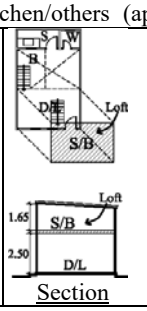
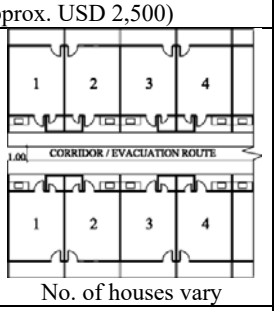
Figure 1: Calaanan site and the villages analyzed

From the 11 villages built in Calaanan, four were selected (Figure 1) based on the accessibility, and distance from community facilities, and the differences among housing designs.

(2) Designs of Agency-built permanent houses

The original houses constitute the initial environments where residents started their new lives after the disaster and later started to modify them. Table 2 presents the essential elements of the housing design for the understanding of the context for comparative purposes.

Table 2: Housing designs and characteristics

	Basic module	Planned ext.	Housing block layout
Village 1: Mahogany	 Floor Plan Floor area=21.00m^2 Lot area=39.95m^2	 Section	 4 houses per building
	Implementing Agency: Habitat for Humanity Philippines Housing typology: Quadruplex		Service Areas: Not provided Materials: Conventional* Planned extensions: Yes (loft) Cost per house: PhP 110,000 (approx. USD 2,500)
Village 2: Filipino-Chinese Friendship	 Floor Plan Floor area=21.16m^2 Lot area=27.00m^2		 Rows of 5 housing units
	Implementing Agency: Filipino-Chinese Chamber of Commerce Housing typology: Row house Service Areas: Not provided		Materials: Pre-fabricated** Planned extensions: None Cost per house: PhP 70,000 (approx. USD 1,550)
Village 3: GK Shell	 Floor Plan Floor area=24.00m^2 Lot area=36.00m^2	 Section	 No. of houses vary
	Implementing Agency: Gawad Kalinga Housing typology: Row house Service Areas: Kitchen/others		Materials: Conventional* Planned extensions: Yes(loft) Cost per house: PhP 110,000 (approx. USD 2,500)
Village 4: Oro Habitat	 Floor Plan Floor area=21.95m^2 Lot area=29.60m^2	 Section	 No. of houses vary
	Implementing Agency: Oro Habitat for Humanity Housing typology: row house Service Areas: Kitchen/others		Materials: Conventional* Planned extensions: Yes (loft) Cost per house: PhP 90,000 (approx. USD 2,000)

Legend: D/L=Dining/Living room B=Bedroom S=Service areas K=Kitchen W=Restroom

*Conventional: RC structures, concrete block masonry for walls, metal roof structure, and steel sheets.

**Prefabricated: Steel-frame structure, plastic wall panels, metallic roof truss and corrugated steel sheets.

4. Housing modifications

The phenomenon of *spontaneous transformation* or resident-initiated modifications[16)17)] refers to the alterations of the houses, carried out by their inhabitants with the objective to adapt their environment and meet their needs and behaviors. This is the result of what is called "housing stress", which emerges when the "level of tolerance" is exceeded, creating a mismatch between the actual and the preferred housing[15)]. In order to fill this mismatch, residents build alterations or additions to the original housing units due to diverse reasons originated from the current living conditions.

For the purpose of this research, internal partitions were not considered as housing modifications. The target for this study are the structures or elements that add useful floor area to the basic housing provided, which includes the internal or external extensions of the houses.

In the survey, an average 56% of the residents modified their houses, as shown in Table 3. Villages 1, 2 and 4 have the major percentages of modified houses. Although the housing designs are similar in Villages 3 and 4, unmodified houses in Village 3 represent 63%.

Table 3: Housing modifications

	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)	Mean
Modified	69%(41)	54%(36)	38%(24)	63%(40)	56%
Non-modified	31%(18)	46%(31)	63%(40)	38%(24)	44%
Total	100%(59)	100%(67)	100%(64)	100%(64)	

(1) Residents' motivations for modifications

Once the households who modified their houses were identified, they were asked about the motivations to transform their houses though a question of what were the initial reasons for the construction of the extensions. The results are presented in Table 4. The responses from residents revealed that some specific the needs or other driven factors were the reasons that influenced the construction of extensions:

Table 4: Motivations for housing modification

	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)	Mean
Limited Space	54% (22)	69% (25)	63% (15)	85% (34)	68%
Uncomfortably hot inside	41% (17)	36% (13)	0% (0)	18% (7)	24%
Need income source	20% (8)	6%(2)	8% (2)	8% (3)	11%
Security	0% (0)	0% (0)	29% (7)	0% (0)	7%

a) Limited Space

The limited space inside the provided house was the main motivation in the four villages to build extensions. An average of 68% of the residents requires larger areas to accommodate the family members and/or to develop their daily activities.

The initial premise is that the floor area of the house is limited considering the family size per household. Table 5 shows the number of family members in the total households surveyed in the four villages.

In average, 51% of the households have 4 to 6 members. This indicates that the average floor area per person in Village 1 is 4.2 m^2, in Village 2 is 4.23 m^2, in Village 3 is 4.8 m^2, and in Village 4 is 4.39 m^2.

Table 5: Number of family members and ages per household

No. of family members	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)	Mean
1 to 3	10% (6)	37% (25)	39% (25)	23% (15)	28% (71)
4 to 6	63% (37)	39% (26)	44% (28)	59% (38)	51% (129)
7 to 10	20% (12)	24% (16)	17% (11)	16% (10)	19% (49)
More than 10	7% (4)	0% (0)	0% (0)	2% (1)	2% (5)
Total	100% (59)	100% (67)	100% (64)	100% (64)	100% (254)

In the 2001 Report of the State of the World Cities[19], it was stated that the floor area per person is a key indicator of housing quality and measures the adequacy of living space in dwellings. Figure 2 shows the comparison of an average housing floor area per household in urban areas per region.

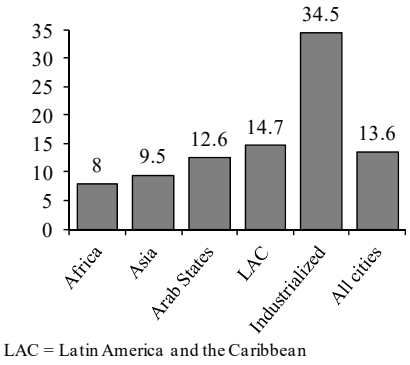


Figure 2: Floor area per person in cities (UN Habitat, 2001)

The average floor area per person in the houses of the four villages analyzed in Calaanan site was found to be half (4.2 to 4.8 m^2) if to be compared to the Asia's standard of 9.5 m^2 per person.

The need for spaces not considered in the original house design such as kitchens, service areas and others, is also a motivation for the construction of extensions. The specific motivation for these spaces is better explained when their current use was observed.

b) High temperatures in the interior of the houses

The second important factor for housing modification is the uncomfortably high temperatures inside the houses which were found to be decisive in Villages 1, 2, and 4.

The use of conventional materials and standardized housing designs from builder NGOs, governmental agencies like the National Housing Authority or the Department of Social Welfare and Development, promoted the construction of houses based on urban contexts and without considering the limitations of low-income people to have access to electrical systems to reduce the internal temperature of the houses, such as air conditioning or even electric fans.

As a consequence, the provided houses were not equipped with thermal insulation, low ceiling (like in Village 2), lack of ceiling where the galvanized steel sheets used for roofing produced the accumulation of heat inside the house (like in Villages 1, 3, and 4), and improper ventilation to allow air circulation due to the lack of upper windows especially in Village 1.

Residents in Village 3 reported that shaded spaces outside of the houses were not their priority. This is due to the prohibition posed by the builder NGO which discourages the construction of extensions in front of the houses, in fulfillment of the occupancy conditions that prohibit these kinds of constructions. However, the NGO allows modifications in the rear of the houses because they are "less obvious". This is a clear example of how an NGO can influence the residents' management.

c) Need for income source

In a new environment, livelihood opportunities are essential in order to generate income. Only 11% of the residents reported that the need for income source was their main motivation to build housing extensions. However, it is not clear from the point of view of housing design the reason why in Village 1 a higher percentage of the households considered this factor as a priority in comparison with other villages.

The possibility to have small scale loans (unregulated) from local moneylenders motivated residents to open small businesses, mainly small grocery shops or locally known "sari-sari" stores, motorbike repairing and vulcanizing, dressmaker and others. However, none of the surveyed households expressed motivation to build housing extensions in order to obtain extra incomes from renting out these spaces This is because to rent out part of the house means a serious misconduct and violation of occupancy terms. Hence, this was not found in the survey and neither reported by the local government staff working in the settlement.

The possible explanation for the high percentage of households in Village 1 motivated to modify their houses due to the income need may be related to its location in Calaanan site. Village 1 is physically isolated from the most densely populated areas on the site (see Figure 1) and is located far from the local facilities and commercial areas on the site. In addition, the distance to the main access roads and the limited accessibility to the city center where the major commercial areas are located and which were the main working sites of the residents before the disaster.

d) Security

The residents' need to protect their belongings through the construction of enclosures is a priority in Village 3. The housing block layout in this village has 2 meters for a corridor in the rear of the houses which each house has a secondary entrance. The layout is similar in Village 2 and 4. The basic differences are that in Village 2, the housing design does not consider a secondary entrance. Therefore, the house is apparently less vulnerable to thieves. In Village 4, the corridor for the secondary entrance is narrower, from 1 to 1.2 meters; also, there are many residents that built extensions in the rear partially and in some cases completely blocking the corridors.

(2) Current use of house modifications

In contrast with the residents' motivation to modify their houses, Table 6 presents the information related to the actual use of the housing extensions collected through direct observation in the site. The current uses of extensions are linked to the reasons described in a), b) and c).

Table 6: Actual use of extensions

Motivation		Use	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)	Mean
Limited space	Service areas	Kitchen	20% (25)	69% (25)	79% (19)	78% (31)	62%
		Laundry	5% (2)	3% (1)	0% (0)	0% (0)	2%
	Multi-purpose	Loft	17% (7)	0% (0)	54% (13)	23% (9)	24%
		Sub-house	15% (6)	19% (7)	4% (1)	5% (2)	11%
Uncomfortably hot inside		Rest area	54% (22)	39% (14)	4% (1)	33% (13)	33%
Need income source		Shop/ business	32% (13)	33% (12)	8% (2)	23% (9)	24%

a) Limited Space

The need to increase the limited space is expressed in the construction of spaces not provided in the original house, such as kitchen or laundry areas which are fundamental for daily activities in 64% of the houses. The need to increase the area of the house is also related to the construction of spaces to accommodate the family members, specifically sleeping spaces which represent 35% of the households who built lofts or sub-houses. In the field, it was observed that sleeping spaces are generally combined with other uses, such as storage (in the case of lofts) and are also part of structures independent from the provided house such as the sub houses built outside the provided lot, of course informally. Sub houses generally combine sleeping areas, rest spaces, kitchen, and other service spaces.

In Villages 2, 3, and 4 the use of most of the extensions are kitchens, in Villages 1 and 2, these spaces were not provided, therefore, residents needed to build an outdoor kitchen or attach the space to the provided house. The design of houses in Villages 3 and 4 considers spaces for kitchen and service, such as laundry, and the constructions in these areas imply to enclose them building a wall and roofing these spaces (Figure 3). Exclusive laundry spaces are few, 5% in Village 1 and 3% in Village 2, the reason is that these are secondary activities which are performed in rest areas.

Figure 3: Enclosed kitchens in Village 3 (left), rest space used also as rest space for socializing in Village 4 (right)

b) High temperatures in the interior of the houses

Rest areas were built responding to the need to have intermediate shaded spaces between the interior and exterior of the house for the 11% of the residents. The reason is the high temperatures inside the house. The uses of these spaces are commonly combined with laundry or storage, but these spaces also promote the interaction between the residents of the house and neighbors (Figure 3). The data shown in Table 4 is consistent with Table 5, the major percentage of rest areas was built in Villages 1, 2, and 4, and precisely residents of these villages expressed that it is due to the lack of proper ventilation.

As it was explained before, residents in Village 3 thought that they were limited to use only the remained lot area in the rear of the houses. Although they may feel the interior temperatures uncomfortable, their priorities are to build spaces that allow them to perform their daily activities such as cooking or to protect their belongings enclosing these spaces.

c) Need for income source

The need to have an immediate income source has promoted the construction of local small stores which spread rapidly in the four villages (24% in average), especially in Villages 1, 2, and 4. It does not mean that there are no small stores in Village 3. The difference is that residents did not build extensions for shops; instead, they accommodated the entrance of the house to create a space for stores (see Figure 4). However, this does not add living area to the house, for this reason, it is not considered in Table 5.

Figure 4: Shops build as extension in Village 4 (left), and shop accommodated in the entrance of the house (right)

5. Types and location of housing modifications

Lofts or mezzanines are the only extensions that are built inside the house, the designs of the houses in Villages 1, 3, and 4 allow the construction of these structures, because this issue was considered during the planning stage, with high ceiling, only in Village 2 because the ceiling is lower it is impossible to build these extensions.

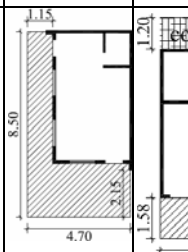
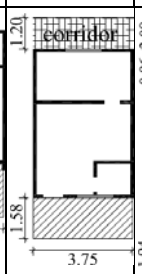
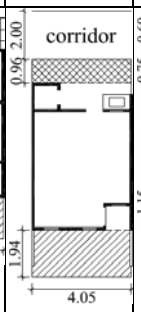
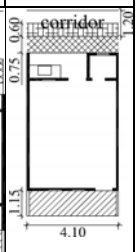
Besides lofts or mezzanines other extensions or housing modifications are unplanned, and since the local government forbids any construction outside the house, these unplanned modifications are also considered illegal. However, to satisfy the needs of the residents are their main priority, as it is presented in Table 7, the incidence of unplanned extensions built is clearly higher than the planned ones in the four villages.

Table 7: Type of modification

	Village 1 % (No)	Village 2 % (No)	Village 3 % (No)	Village 4 % (No)
Planned only	5%(2)	0%(0)	13%(3)	3%(1)
Unplanned only	83%(34)	100%(36)	46%(11)	78%(31)
Both (planned + unplanned)	12%(5)	0%(0)	42%(10)	20%(8)

To analyze the location of the extensions built by residents is a key factor for the understanding which housing design promoted certain extension. Table 8 presents the data related to the location of extensions.

Table 8: Location of extensions

	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)
Front/side	88% (36)	97% (35)	0% (0)	58% (23)
Rear	0% (0)	3% (1)	79% (19)	75% (30)
Inside the house	12% (5)	0% (0)	54% (13)	23% (9)
Outside the lot	12% (5)	8% (3)	0% (0)	3% (1)
Legend: Extension in front Extension in the rear Extension outside the property line	 -Floor Area =21.00 m^2 -Lot Area = 39.95 m^2 -Area of extensions (front/side) =18.42 m^2	 -Floor Area =21.16 m^2 -Lot Area = 27.00 m^2 -Area of extensions (front) =5.92m^2 -Area of extensions outside the property line (rear-corridor) =4.52m^2	 -Floor Area = 24.00 m^2 -Lot Area = 36.00 m^2 -Area of extensions (front) =7.62m^2 (rear) =3.90m^2	 -Floor Area =21.00 m^2 -Lot Area = 39.95 m^2 -Area of extensions (front) =4.48m^2 (rear) =3.08m^2 -Area of extensions outside the property line (rear-corridor) =4.48m^2

In Village 1, 88% of the extensions were built in front and/or side of the houses where the available area for extensions inside the lot is 18.42m^2. In Village 2, 97% built in the 5.92m^2 available in front. Village 4 also present a high percentage (54%) of extensions built in the 4.48m^2 available in the front of the house. In contrary, in Village 3, there were no extensions built in front, because of the influence of the builder NGO over the residents' decisions for housing modification.

Extensions built in the rear are more frequent in Villages 3 (79%) and 4 (75%), mainly kitchen enclosures. The design of the houses in Village 1 makes it impossible to build rear extensions. In Village 2, only 3% of the extensions are built in the rear, because there is no secondary access to connect any possible extension with the main building.

Figure 5: Sub houses in Village 1 (left) and Village 2 (right).

Constructions built outside of the lot are termed as sub-houses because in these constructions different activities are performed, but also are independent from the permanent housing building (Figure 5). This type of extension is more frequent in Village 1 (12%) and in Village 2 (8%). There were only 3% in Village 4, and none of the residents built sub houses in Village 3.

6. Technical characteristics of extensions

In this section, the technical characteristics of the extensions are presented in order to understand the quality of construction and the expected lifetime of these constructions.

Unplanned modifications cannot be considered permanent because legally they can be removed. Therefore, in this study housing extensions are classified as durable and precarious regarding the construction materials used. Additionally, there are residents who combined both types (Table 9). The major percentage of durable extensions built is presented in Village 3 (79%), which are mainly kitchen enclosures. In the rest of the villages the tendency is the construction of precarious extensions, this can be explained by the lack of control over the spread of extensions by an NGO or the local government. According to the local government officials, residents tend to build those extensions on weekends, when the local staff is not on the site. Later, these constructions were reported and residents received notifications to stop their construction or to remove them. However, so far these measures have not been effective.

Table 9: Materials of housing extensions

	Village 1 % (No.)	Village 2 % (No.)	Village 3 % (No.)	Village 4 % (No.)
Type of materials				
Durable	34%(14)	39%(14)	79%(19)	41%(16)
Precarious	76%(31)	64%(23)	42%(10)	78%(31)
Both	10%(4)	3%(1)	21%(5)	18%(7)
Foundations				
Concrete and steel bars	8% (3)	3% (1)	0% (0)	8% (3)
Concrete and stones	0% (0)	0% (0)	0% (0)	0% (0)
Unknown/ no foundation	92% (36)	97% (35)	100%(21)	92% (36)
Columns and beams				
Concrete and steel bars	13% (5)	3% (1)	0% (0)	13% (5)
Wood	72% (28)	53% (19)	48% (10)	67% (26)
Mixed wood/concrete	0% (0)	0% (0)	0% (0)	0% (0)
No structural elements	15% (6)	44% (16)	52% (11)	21% (8)
Outer walls				
Concrete block	26% (10)	28% (10)	43% (9)	23% (9)
Wood	8% (3)	3% (1)	5% (1)	13% (5)
Mixed wood/concrete	0% (0)	22% (8)	5% (1)	8% (3)
Traditional materials	54% (21)	36% (13)	38% (8)	28% (11)
Makeshift/improvised	5% (2)	6% (2)	10% (2)	21% (8)
No walls	8% (3)	6% (2)	0% (0)	8% (3)
Roofs				
Galvanized steel sheets/wood rafters	92% (36)	78% (28)	81% (17)	87% (34)
Galvanized steel sheets/concrete	0% (0)	3% (1)	0% (0)	3% (1)
Traditional materials	0% (0)	3% (1)	5% (1)	0% (0)
Makeshift/improvised	8% (3)	17% (6)	14% (3)	10% (4)

Table 9 presents information about the type of foundations of the extensions, it is clearly shown that in all the villages there is a low consideration for the stability of this part of the structures. In average, only 4.75% of the durable extensions in the four villages were reported concrete and steel bars as construction materials, which is important to provide more stability and safety to these constructions.

Structural elements like columns and beams are vital in order to keep the strength and stability of the constructions and protect walls from falling. In table 9, it is shown that most of the extensions' columns and beams are made from wood. Additionally, most of the extensions do not have structural elements.

The materials used for outer walls of extensions are diverse, from the conventional for durable constructions to locally available like coconut lumber, bamboo, and palm leaves for precarious extensions, where also makeshift or improvised and recycled materials were also used. In Village 3, 43% of the extensions were built with concrete blocks while in Village 1 most of the extensions were built with precarious materials (Figure 6).

Figure 6: Precarious extensions in Village 2, using nipa leaves, wood and bamboo (left), and combined bamboo for walls and corrugated galvanized steel sheets for roofing (right).

The materials of roofs are presented in Table 9. Residents in all villages preferred to use corrugated steel sheets on wood rafters for roofing in the four villages which are considered to have a longer lifespan. Local traditional materials were also found to be used for roofing but considering their shorter lifespan they were mostly used for precarious extensions.

7. Discussion

The construction of housing extensions has spread rapidly in the four villages, even in Village 3 despite the restrictions set by the builder NGO. The modification of the houses resulted to be an unavoidable phenomenon regardless the authorities' opposition to their construction. Conversely, for the residents, it means the possibility to improve their houses. Consequently, they feel identified with their homes and secured to be able to adapt and maximize the space.[20)]

In this study there are three main issues that are identified as crucial for the understanding of the influence of housing design in the construction of extensions:

(1) Housing mismatches

Expressed in the limited understanding of residents' needs, lifestyles and the local conditions by the planner and builder of the houses: For instance the variable family size (from 1 to more than 10 members) and the needed space to accommodate them. Additionally, the basic daily activities of the residents that were not considered like the lack of cooking and service spaces. The traditional way of cooking using firewood collected from surroundings. Also the challenges that residents have to face to restore their livelihoods or initiate income generating activities in their homes, which motivated the construction of spaces for local businesses. Issues related to the local conditions such as the limited consideration of thermal comfort inside the house as a result of the lack of proper ventilation or higher ceilings which are suitable for tropical locations. In addition to the preference for using conventional building materials instead of the traditionally used which allow fresher internal spaces. These issues promoted the need for intermediate shaded spaces where residents prefer to stay during the daytime, socialize and perform their daily activities.

(2) Location of extensions

Three physical issues such as housing design, the position of the house in the lot and the settlement layout have influenced where and how the extensions were built. As individual houses, the area inside the lot which is not occupied by the house is where residents start to enclose due to the need to protect their belongings, like in Villages 3 and 4. Subsequently, residents gradually build complementary spaces, like shaded areas, lofts, stores and even sub-houses. As a housing block, the layout also promotes different kinds of extensions, for instance, the residents of the houses located in the extreme ends of the rows or the blocks in the borders of the settlements built sub-houses informally occupying land outside of the given housing lot.

(3) Materials of extensions

These constructions were classified in durable and precarious according to the materials used and their considered lifespan. Although in the present most of the housing modifications can be classified as precarious where local traditional and makeshift materials are easily available in the surrounding areas or due to the cost are affordable for residents. However, housing needs and the way residents satisfy these needs are not static. The residents' living conditions change together with their socio-economic situation, the characteristics of housing extensions may also change. In the time as long as residents' perceive the stability in their environment and observe security in housing tenure, they may invest on long lasting constructions.

8. Conclusions

This study presents different types of housing extensions and their main characteristics. These extensions are based on specific residents' motivations resulted from residents' needs and local conditions that were not considered in the NGO-government built permanent housing. Thus, the construction of extensions provides the opportunity for residents' to control the changes in the design of their houses.

It is clear that in the resettlement program carried out in Cagayan de Oro, the priority was to complete the construction of a large number of houses in a limited period of time, rather than understanding the residents' needs, priorities and local conditions. Thus, it is necessary to consider a change in the approach for post-disaster housing reconstruction from top-down to community-inclusive management approach for future

events. However, evidences from different studies[14)15)16)17)18)] confirm that even with extensive community participation it is unlikely to cover the different and specific needs of the residents. Therefore, for already built houses it is important a flexible attitude of the local government over housing modifications, which in coordination with other stakeholders (such as NGOs and other government agencies) should prioritize the provision of technical assistance in order to avoid poor construction practices. It is possible to take advantage of the high level of influence of NGOs in local communities (as it was proved in Village 3), which can lead to a positive change for the compliance of construction standards.

The location of extensions is influenced by the housing design, its position in the provided lot and in the settlement. Therefore, in order to redesign the houses for future projects it is crucial that involved NGOs, donors, and government agencies recognize diverse issues. Thus it is important to consider a proper use of the spaces. This will provide flexibility for resident-initiated housing modifications inside or outside the house, and avoid the informal use of land beyond the provided lot.

This study was conducted after two and a half years since Typhoon Washi, and in average one and a half year after the residents' allocation in permanent housing. Regarding the permanently changing nature of housing and residents' living conditions, it is important to complement this research in the middle and long term in order to obtain a better understanding of housing modifications.

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References

1) Jha Abhas, K., Duyne, B. J., Phelps, P. M. and Sena S.: Safer Homes, Stronger Communities, A handbook for Reconstructing after Natural Disasters, The world Bank, Washington DC, 2010
2) Oliver-Smith A. and De Sherbinin A.: Resettlement in the twenty-first century, Forced Migration Review issue 45, Refugee Studies Centre, Oxford Department of International Development, University of Oxford. p. 23-25, 2014. Available at http://www.fmreview.org/en/crisis.pdf (accessed November 2014)
3) Oliver-Smith, A.: Successes and failures in post-disaster resettlement. Disasters 15 (1), 12-23, 1991
4) OCD, (2012), Post Disaster Needs Assessment, Tropical Storm Sendong, Office of Civil Defense Region 10, Cagayan de Oro.
5) Davidson, C. H., Johnson, C., Lizarralde, G., Dikmen, Nese., Sliwinski, A.: Truths and myths about community participation in post-disaster housing projects. Habitat International, No. 31 (1), pp 100-115, 2007
6) Cuny, F.: Disasters and the Small Dwelling: the State of Art. Habitat International. 5(5/6) pp. 741-751, 1981
7) Arroyo, I.: Building Resilience through Housing Reconstruction in Areas Affected by Typhoon Haiyan in the Philippines: Users Involvement and Incremental Growth for Medium-rise Buildings. In: A. M. Garland, ed. Urban Opportunities: Perspectives on Climate Change, Resilience, Inclusion, and the Informal Economy. A New Generation of Ideas. Washington D.C.: Wilson Center , pp. 67-92, 2015
8) Oxfam GB: Guidelines for Post Disaster Housing Reconstruction, Oxfam GB, UK, 2003. Available at http://www.ifrc.org/PageFiles/95751/B.d.03.%20Guidelines%20for%20Post%20Disaster%20Housing%20%20version%201_OXFAM%20GB.pdf. Accessed December 1, 2015.
9) Turner, J. F. C. and Fichter R.: Freedom to Build, dweller control of the housing process. Collier Macmillan, New York, 1972
10) Allen, K. M.: Community-based disaster preparedness and climate adaptation: local capacity-building in the Philippines. Disasters 30 (1), pp 81-101, 2006
11) Barenstein, J.D.: From Gujatat to Tamil Nadu: Owner-driven vs. contractor-driven housing reconstruction in India, paper presented at 4th International i-Rec Conference 2008 Building Resilience: achieving effective post-disaster reconstruction.
12) Ophiyandri, T.: Community-Based Post-Disaster Housing Reconstruction: Examples from Indonesia, Amaratunga, D. and Haigh, R., Post Disaster Reconstruction of the Built Environment: Rebuilding for Resilience, Blackwell Publishing, UK, pp 91-116, 2011
13) Turner, J. F. C.: Housing by People: Towards Autonomy in building Environments. New York, Macmillan, 1977
14) Carmon, N.: User-controlled Housing: Desirability and Feasibility, European Planning Studies, Vol. 10, No. 3, 2002.
15) Seek, N.: Adjusting Housing consumption: Improve or Move, Urban Studies, Vol. 20, pp 455-469, 1983
16) Khan, T.H.: Houses in Transformation: Search for the Implicit Reasons, Springer Science & Business Media - Political Science, 2013
17) Makachia, P. A.: Influence of House Form on Dweller-Initiated Transformations in Urban Housing, paper presented in XXXIII IAHS (International Association for Housing Science) - World Congress On housing, Transforming Housing Environments through Design, Pretoria, South Africa, September 27-30, 2005
18) Clark, W.A. and Onaka, J.: Life cycle and Housing Adjustment as Explanations of Residential Mobility, Urban Studies, Vol. 20, pp 47-57, 1983
19) UN Habitat; The State of World's Cities 2001, United Nations for Human Settlements, Nairobi, Kenya, 2001
20) Manalang, R. T.; Munemoto, J.; Yoshida, T.; Espina, C.: A study on residents' self-built improvements at MRB dwelling units in Metro Manila; Journal of Asian Architecture and Building Engineering 2002; 1(2); 177-184, 2002

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