HANDICAP INTERNATIONAL

ETC

IMPACT EVALUATION

IMPROVE THE LIVING CONDITIONS FOR THE MOST VULNERABLE POPULATIONS AFFECTED BY THE EARTHQUAKE

HAITI, WESTERN DEPARTMENT, PETIT GOAVE MUNICIPALITIES AND RURAL SECTIONS

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Contents

ABBREVIATIONS

CCPC	Comités Communaux de Protection Civile
DATIP	Direction Administrative et Technique de l'Intercommunalité des Palmes
DPC	Direction de la protection civile
GAA	German Agro Action / Welthungerhilfe
HI	Handicap International
PWD	People WITH DISABILITIES
UNOPS	United Nations Office for Project Services

I. Executive Summary

The Handicap International project entitled "Improve living conditions for the most vulnerable populations affected by the earthquake ", which was implemented from September 2010 to December 2011, helped efforts to provide safe and dignified housing solutions for people outside Port-au-Prince by improving access to sanitation and by proposing a prefabricated housing module that met accessibility standards and used traditional construction techniques. The HI project also aimed to support the inhabitants of the most remote areas by strengthening existing schools through the building of community structures (classrooms). HI constructed 1,050 transitional shelters, including 29 shelters used to provide 16 classrooms in 7 schools.

Five years after their construction, this evaluation has reviewed three main areas of the project: (A) current T-shelter and school use and conditions; (B) T-shelter modifications and durability; (C) the long-term impacts for beneficiaries and communities.

A. One of the main findings to emerge from our fieldwork is that 80% of the 206 T-shelters visited are still being lived in by their original occupants on their initial site, with this situation being more common among landowners and usufruct beneficiaries (90% and 89% respectively) than among tenants (84%). The location of the T-shelter also has an impact as 74% of beneficiaries in urban areas still live in their T-shelters compared to 88% of people in rural areas and 90% of beneficiaries in peri-urban areas.

   A second key finding is that 77% of the T-shelters show no signs of major damage. On the remaining 23%, there is either damage to the foundations (7%), wear and tear on the roof (6%), damage caused by flooding during Hurricane Matthew (5%), major deterioration of the timber frame (3%) or significant damage to the *clissage* panels (1%). This resistance is due to the shelter's good technical design (braced frame, bolts, plates and straps), as well as to the materials used and high quality of the shelters' construction (good quality concrete, imported and treated wood). Despite the T-shelter's high quality design, the timber frame nonetheless has two main areas of weakness, namely the posts at ground level and the timber bracing at slab level, both of which are susceptible to damp. Similarly, although the decision to use *Onduline* bituminous roofing sheets is in line with the aims of the project, these sheets are showing numerous signs of wear and tear (twisted out of shape and/or containing holes).

   The site visits and beneficiary interviews revealed that the T-shelters are continuing to provide protection to both people and their belongings and were particularly effective at withstanding Hurricane Matthew. The weakest points are the fittings installed for PwD (handrails, railings), as well as the light and fragile latrine superstructures, which have poorly withstood weather hazards.

   The classrooms constructed in the hilly area of the *mornes* have considerably improved local teaching conditions (specific space, security, teaching capacity). They are also used for other purposes (community meetings, refuge), although their vulnerability to the elements (wind and rain), makes them unsuitable for use during bad weather.

B. The terms of the contracts signed by HI, the beneficiaries and relevant landowners have been respected, thereby ensuring project sustainability. All shelter relocations took place only after the three-year contract ended, with more people in rural areas moving their T-shelters (6%) than beneficiaries in urban (3%) or peri-urban areas (1%). In towns, the T-shelters are more likely to have been sold, donated, loaned or rented out (around 18%) than in peri-urban (4%) or rural areas (1%).

   The visits revealed that people, particularly tenants, consider the fact that they are able to move their T-shelter to be a huge advantage. However, our visits to relocated shelters showed that, in each case, the reassembly process has resulted in some of the structural solidity being lost, mostly because the foundations are never laid in the same way as on the original site and/or the shelter is rarely reassembled correctly (weaknesses at the joints between the timber frame and posts).

Modifications to the T-shelter are common as only around 39% of the shelters visited are still as originally built. Four main types of improvement have been made: protection of the *clissage* panels (53% of the shelters visited); construction or walling in of a porch (24%); the installation of internal partition walls (7%); the construction of extensions (10%). However, none of these improvements has been carried out with the specific aim of strengthening the T-shelters as ensuring the shelters' longevity above all requires maintenance and repairs on the frames and roofs.

Beneficiaries' sense of ownership varies depending on the shelter location. In rural areas, the T-shelter has become a permanent home and needs to be adapted for long-term use. In peri-urban areas, the growing pressure on land question the relatively poorly planned installation of shelters (and latrines) on the available plots. Lastly, given urban areas' population density, urban planning and network constraints, etc., the standard T-shelter module is not particularly compatible with the urban environment.

C. The project has had significant long-term positive impacts on the beneficiaries as, five years after their construction, the vast majority of the T-shelters are still guaranteeing the physical security of people and their belongings and are continuing to provide security of tenure. Similarly, the common installation of latrines has helped improve overall sanitation conditions and provided greater protection against disease (cholera); however, due to the level of deterioration on these latrines, the effect of this impact is gradually being diminished.

   As the project targeted the most vulnerable groups, the T-shelter continues to be an important asset for the project beneficiaries, who would otherwise have been unable to afford to build a house of this type. This remains the case five years after the earthquake as living standards are still extremely low. However, overall, living conditions are not as good as they could be due to issues such as the permeability of the walls and the fragility of the roof.

   However, the construction of safe shelters has had less of an impact on overall construction quality. The techniques used have not been replicated, due both to a lack of resources and to the fact that the housing provided does not correspond to the younger generation's aspirations.

   As far as the project's economic impacts are concerned, the construction of T-shelters for victims of the earthquake helped reduce not only their immediate disaster-related costs (temporary accommodation, repairs, etc.) but also the longer-term costs of building or renting a new home. However, the impact of these lower housing-related costs is reduced as soon as the T-shelters start to need maintenance or repairs. For the communities, the project's greatest economic impacts were felt during the shelter construction phase, as it created jobs and helped boost cash flow in these extremely poor communities.

In conclusion, the report highlights four key points and provides recommendations for similar projects:

- The first point addresses options for improving the structural durability of the T-shelters, notably through technical modifications, improved analysis of local environmental risk and more realistic assumptions of the repairs and maintenance capacities of beneficiaries, particularly the poorest households.
- The second point involves adapting the architecture to the shelter's specific use. This applies to both the T-shelter housing modules, to provide more protection for the most vulnerable (PwD), and the schools, to enable their use as a shelter during extreme weather events.
- The third point shows that the standardized approach has helped overcome land-related constraints, but its impact on people's living conditions has varied for the different target groups.
- The fourth point reviews the relevance of the approach for the various project areas and recommends improving the incorporation of urban development issues in shelter programs.

II. Project Overview

A. Background and Objectives

At the beginning of 2010, when the earthquake struck Haiti, HI was in the process of finishing a project in the Gonaïves area. As HI already had teams working in the country, they were able to quickly assess the damage caused by the earthquake and launch an emergency response.

HI undertook to implement a T-shelter construction program in the Petit Goâve region. Although this area had been badly hit, most humanitarian organizations were focusing their relief and recovery efforts on Léogâne or Port-au-Prince and the needs of this region remained largely unmet. The initial target area was the hilly area of the *mornes*; however, the considerable logistical constraints[1] encountered meant HI had to review its strategy and focus more on the coastal plain instead. The project therefore prioritized constructing T-shelters for the vulnerable PwD living in the region[2] and then targeted a larger segment of vulnerable households within a smaller area[3] (to supplement the projects of other humanitarian agencies working in the region).

In this context, the Handicap International project entitled "Improve living conditions for the most vulnerable populations affected by the earthquake", which was implemented from September 2010 to December 2011, helped to provide safe and dignified housing solutions for people outside Port-au-Prince by improving access to sanitation and by proposing a prefabricated housing module that met accessibility standards and used traditional construction techniques. The HI project also aimed to support the inhabitants of the most remote areas by strengthening existing schools through the building of community structures (classrooms).

The project goal was to "support vulnerable earthquake-affected families living in inadequate shelter and using inadequate buildings with transitional shelter intended to bridge the gap between relief and reconstruction".

The project objective was defined as follows: "The most vulnerable affected families (including persons with disabilities), benefit from decent housing conditions or communitarian buildings respecting SPHERE technical standards (para seismic, anti-cyclonic and accessible) and Technical Working Group Shelter Cluster recommendations, and/or short term employment opportunities."

With an overall budget of US$7,629,057, HI constructed 1,050 transitional shelters, including 29 shelters used to provide 16 classrooms in 7 schools. Where feasible, HI also provided a latrine for each shelter. In total, by HI (399) and its partners (281) constructed 712 latrines. The schools were also provided with a total of 32 latrines.

This project was part of a global project (1000 T-Shelter) jointly funded by American Red Cross, ADH, SIDA, Hôpital Assistance Belgique Association, Région Rhône Alpes, Bette Midler Foundation and MAE Luxembourg.

[1] Along with the fact that the construction project risked employing the entire workforce and threatened food security.
[2] A strip from Vialletin the west to Grand Goâve in the east.
[3] Around Tapion.

B. Approach

1. Beneficiaries: PwD and Vulnerable Households

The project targeted two groups, PwD (and their families) and vulnerable households. The HI approach involved designing a shelter that met basic needs and which could be adapted to meet the specific accessibility needs of PwD, by installing steps, ramps, handrails and railings.

HI wanted to demonstrate ways of adapting housing modules to the needs of PwD and thus promote the inclusion of PwD in similar programs.

Unlike most housing projects, the beneficiaries' land tenure status was not one of the project selection criteria (landowners, tenants and usufructuaries were all eligible). This particularly benefited PwD as, being mostly extremely poor, they are often tenants or usufructuaries. The unique feature of the HI project was the fact that the shelter could be dismantled and reassembled elsewhere, thus beneficiaries did not need to own land to own a T-shelter.

2. T-Shelter Design

The T-shelter was designed in several stages. Following an initial unsuccessful attempt to design a temporary shelter using a timber frame and plastic sheeting, HI recruited an architect, David Sacca, to develop a transitional shelter. At the same time as fundraising efforts were being carried out, three initial models were successively tested and presented to the public in a 'show village' erected next to shelters designed by other organizations. To enable it to be adapted to the needs of different households, the designed shelter is modular and its total surface area can thus vary from 18 to 30m^2 [4].

The architectural design and construction of the T-shelter is based both on traditional rural houses (single room and local materials), and their 'modern' incarnation[5] (more complex architecture, processed materials). The technical design has therefore combined local construction practices (the frame's timber posts are embedded in the ground, *clissage* panels are used for the walls) and adapted them to meet earthquake and hurricane resistant building requirements (concrete foundations, braced timber frame, straps). The architectural design has adapted a simple building (single room, roof and simple doors and windows) by adding more modern features (concrete slabs and raised porch).

Whereas the traditional house is predominantly built from local materials (different types of wood, earth, stone, etc.), most of the materials used to construct the T-shelter were imported as this helped facilitate logistics, guarantee the quality of the materials and prevent local deforestation.

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[4] 18 m^2 for families with between 1 and 4 members, 24m^2 for 4 to 10 people and 30m^2 for more than 7 people. All shelters include a 6m^2 porch.

[5] "Over the course of the second half of the 20th century, poor farmers' rural houses changed with the arrival on the Haitian market of new materials: cement and roofing sheets." Garcia C and Trabaud V, *La reconstruction d'habitats en Haïti : Enjeux techniques, habitabilité et patrimoine*, Groupe URD, 2014 (author's own translation)

For the T-shelter roof, the HI project opted to replace the traditional metal roofing sheets with bituminous roofing felt (Onduline), as this is lighter (easier to transport), poses less risk in the event of disasters, provides good acoustic and thermal insulation and is less expensive[6] (see 2.b.ii).

The T-shelter was designed as a traditional structure and was thus intended to be upgradable, reusable, resalable and recyclable. T-shelter expected lifespan was 3 to 5 years and it was designed to be dismantled and modified to meet its occupants' needs. Thus, it was left to the beneficiaries to fill in and cover the *clissage* panels (see 2.b.iii). The fact that the shelter can be dismantled helps overcome land and property issues as the T-shelter belongs to its direct beneficiary.

3. Prefabrication and Construction

The T-shelter was designed to enable all its components to be prefabricated. These various sections and parts were pre-manufactured in a workshop before being assembled on-site. The timber frame was pre-assembled and the *clissage* panels included windows. This same prefabrication process was also used to construct the latrine superstructure.

Consequently, construction of the T-shelters on-site mainly involved laying the foundations and a slab, assembling the prefabricated parts (posts, frame, panels), fitting the doors and mosquito nets and laying the roof. The T-shelters were put up by local construction firms with the help of the beneficiary families, who were given a sum of money to hire laborers.

This prefabrication technique helped significantly speed up T-shelter construction (up to 36 a week). It also enabled the project to respond quickly to the beneficiaries' need for shelters of different sizes (the beneficiary selection and T-shelter construction phases were implemented at the same time).

The latrines were built at the same time as the T-shelters, either by HI or by one of their partners. Although latrine construction was common, some shelters remained without a latrine due to lack of space or because no agreement could be reached with the beneficiary. HI installed a variety of latrine types (watertight or not watertight, single or double pit) to adapt to the different target area environments encountered (coastal area, nearby spring or water table, etc.).

[6] At the time of project implementation, this type of roofing felt cost around US$9 per sheet, compared to around 20 for a metal sheet, resulting in a cost saving of between US$200 and 300 per T-shelter.

III. Evaluation Framework

A. Objectives

Five years after the project's implementation, the impact evaluation's main objective is to provide HI with an overall view of the medium to long-term impacts of the project on the target population.

The impact evaluation focuses on the project's long-term positive and negative impacts on the target groups (changes); specifically, on the sustainability of vulnerability reduction and on the technical quality, current use and beneficiary-initiated upgrades to the shelters.

The target audience of this evaluation is the HI Delegation and head office. The focus of this impact evaluation will be on learning objectives.

B. Context

This evaluation was conducted during a difficult time for Haiti as, two months prior to the evaluation fieldwork phase, Hurricane Matthew struck the south of the country. Although the hurricane had only a relatively minor impact on the project target area, it nonetheless caused significant damage, particularly in the *mornes* area.

Due to this post-disaster situation, some of the activities initially planned for the evaluation were canceled, most notably the participatory exercises, so as not to raise expectations of an HI project in the region. Other than this change, no other issues were encountered and the evaluation was able to take place in line with the initial plan.

Thus, the impact evaluation was conducted at a time when various humanitarian agencies and the authorities were once again planning assistance and reconstruction projects. The Haitian government has already announced that it does not want the construction of temporary shelters.

C. Methodology

1. Literature Review

The literature review covered two types of documentation, namely the project documents provided by HI and reports and studies from similar projects conducted in the region. The documents provided by HI notably included the technical specifications, technical drawings, the database and associated maps, the final project evaluation report and the project's *mornes* feasibility report. The external documents consulted are cited in the footnotes of the relevant page of this report and in the bibliography.

2. Shelter Visits and Beneficiary Interviews

A total of 206 T-shelters were visited and these were selected based on their geographical location to ensure the evaluation was representative of the different environments found within the region (remote rural areas, rural areas near the main road, urban areas, peri-urban areas, areas affected by Hurricane Matthew, etc.). In addition, attempts were made to ensure that the other main project features were also equally represented:

- The size of the shelters (18, 24 or 30m2);

- The type of tenure (usufructuary living on private land, landowner, leaseholder with a lease from the state, tenant, usufruct beneficiary, lease on purchase price);
- The type of current use (housing, business, etc.).

We visited the interior of around half of the shelters visited. We systematically took photos to document the current condition of the T-shelters, any modifications made and the most obvious signs of damage.

The number of shelters visited is sufficient to determine averages with an acceptable margin of error of 6.12%, for a confidence level of 95%.

To facilitate analysis of the data collected during the visits, the T-shelters visited were identified as belonging to one of three types of area, rural, peri-urban or urban. This distinction makes it possible to review and compare the evaluation findings for these different environments.

Basic data collected on visited T-shelters have been aggregated on an interactive map available online[7], it allows the reader to compare selected results (occupancy, walls rendering and interventions on porch) for the different environments and target groups.

During the visits, informal interviews were conducted with the occupants of the 206 T-shelters visited. A further twenty-three semi-structured interviews were also held, either face-to-face or, more rarely, during group discussions.

3. Visits to Other Types of Shelter

During the evaluation, we also visited shelter models developed by 12 other organizations following the earthquake: Adra, ASB, Conscience International, CHF, Cordaid, Eper, Haiti Vision, Help, NRC, IOM, Oxfam[8]. These visits enabled us to compare the various models and construction techniques used. We also held short discussions with their occupants to obtain their feedback on people's perception of the different models.

4. School Visits

Visits were paid to 4 of HI's 7 target schools. Interviews were conducted with the staff (headteacher and teachers) from three of these, Rosinette, Dufour and Pelagi; a brief meeting was also held with the headteacher of the fourth school, Poirier.

5. Focus Group with the Foremen

A Focus Group Discussion was held with 23 entrepreneurs (see the list of attendees in the Annex) in Petit Goâve. Attendees included foremen that worked on prefabricating and assembling the T-shelters, as well as other construction professionals who, at the time, were apprentices and members of the 'Association de la Jeunesse Progressive de Vialet'.

[7] https://lesimon.carto.com/viz/a6a14092-cce9-11e6-862e-0ecd1babdde5/public_map
[8] Plus another, unidentified, Dominican organization.

6. Interviews with HI Staff

A number of interviews were conducted with the HI staff in charge of the project's development and implementation, as well as with the current HI team in Haiti:

- Laurent Davy, Desk Manager
- Benoit Aurenche, Project Manager and RT Basic Needs
- David Sacca, architect
- Pascal Panosetti, architect
- Emmanuel Pajot, ATLAS Coordinator

A brief review meeting was held at the end of the fieldwork phase with Sylvia Sommela, HoM and Catherine Stubbe, Program Director.

7. Interviews with Local Authorities and Technical Agencies

Interviews were held with representatives from several local authorities:

- The Mayor of Petit Goâve, Jean Samson Limongy, plus his deputy, Delors Degrange, and his assistants;
- Frank Celestin, an engineer from MTPTC;
- Mr Louis Ronald from DPC,
- Mr Emmanuel Mareus, CMRP-DATIP Communications Officer and two project officers;
- Batichon and Petrice CASEC from the 1° and 12° commune sections.

8. Interviews with Other Organizations

Several interviews were conducted with experts or heads of organizations that had been involved in similar projects in the region:

- Olivier Moles (Craterre);
- Carolyn Garcia (Li'ncs);
- Alexandre Kocledja (ex-UN-Habitat);
- Hervé Manaud (Rustic Superior);
- Joseph Edner (GAA);
- Joan Mamique (Help).

D. Limitations

As so much time has elapsed since project implementation (5 years), it was difficult to determine the reason for some of the shelter relocations or to conclusively establish whether these relocations took place after the initial three-year contract had expired.

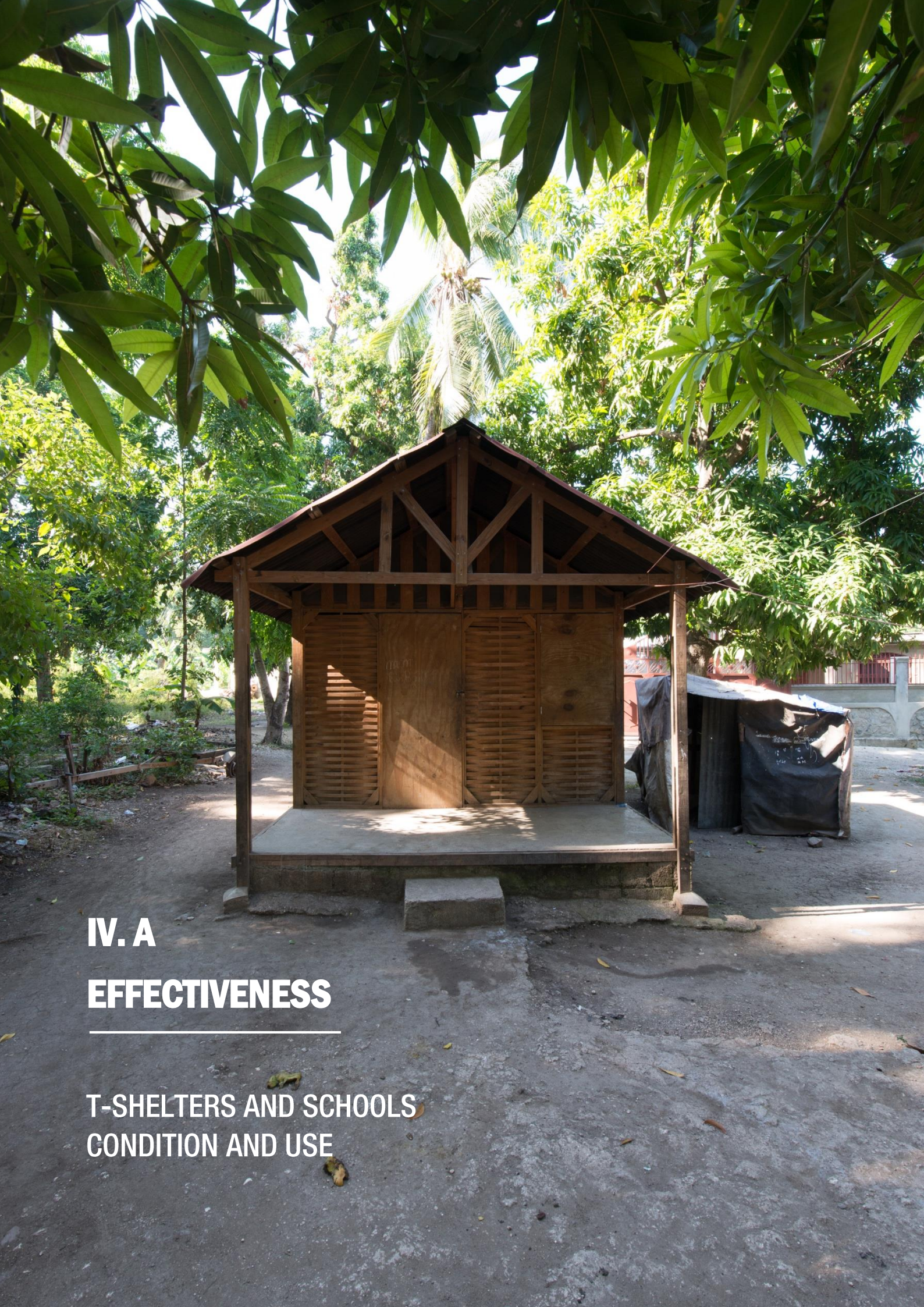
In addition, we were unable to locate and thus visit some of the T-shelters that had been moved, so it was impossible to determine whether these had been reassembled correctly, establish what condition they were in or confirm their current use.

The technical evaluation of the T-shelters focused only on the visible elements of the buildings; therefore, it was not possible to detect all deterioration, substandard work or damage that may have been present on the foundations or frame (rotting wood, for instance). This was also the case for the latrines, as we were unable to verify the condition or level of the pits.

As Hurricane Matthew had only recently affected the area, it was not always straightforward to determine whether the damage and deterioration seen was due to an extreme weather event (Hurricane Matthew) or to seasonal factors (rain). This was particularly true of the latrines (flooded pits and damaged superstructure) and shelter foundations (erosion, accumulation of debris and sediment).

Given the number of T-shelters constructed (1,050), the sample visited (206) was large enough to determine averages with an acceptable margin of error. However, if we want to compare information by sub-category (type of vulnerability or tenure), then this sample size is too small. Thus, only the figures for which we have a suitably high confidence level are cited in the report. Where the margin of error is too high, general trends have been indicated, but no actual figures have been supplied.

The economic impact of the project was difficult to assess for a number of reasons. There is no quantitative data available on the economic levels of households at the start of the project with which to conduct a comparative analysis (income, jobs, debts, proportion of spending on accommodation, etc.). In addition, the economy is mostly informal (sources of income, business dealings, debt), which complicates data collection and assessment. Finally, the impact evaluation is being conducted 5 years after project implementation and while the fragile economic environment of the post-earthquake period has evolved, it nonetheless remains difficult (numerous stresses); thus, it is difficult to determine the project's negative or positive impacts on household incomes. The evaluation findings are therefore based on the discussions held with households (jobs, sources of income and expenditure on the shelters) and the observations made during the visits that provided information on living standards (moveable assets, type and quality of any work carried out)."



IV. A
EFFECTIVENESS

T-SHELTERS AND SCHOOLS CONDITION AND USE

IV. Impact Evaluation Findings

A. Effectiveness - T-Shelter and School Condition and Use

1. T-Shelter Use

The vast majority of T-shelters visited (around 80%[9]) are still lived in by their original occupants on their initial site. Of the remainder, 7% of the T-shelters have been moved, either by their original occupants or after having being sold on to someone else. Some T-shelters (6%) are still on their original site but are now occupied by a different family to whom the shelter has been sold, lent, donated or rented. Only 1% of the T-shelters visited are being used for an economic activity. Lastly, 2% of the T-shelters have been destroyed by fire or falling trees or deliberately demolished to make way for a permanent home.

Landowners and usufructuaries are most likely to still occupy their T-shelters (90% and 89% compared to 84% for tenants). In contrast, there are fewer PwD still occupying their T-shelters on their original site (81% compared to 93% of vulnerable households). This is due to the fact that most households in this group are tenants rather than landowners[10].

The location of the T-shelters also has an impact on occupation with 74% of beneficiaries[11] in urban areas still occupying their T-shelters compared to 88% in rural and 90% in peri-urban areas. In towns, the T-shelters are more commonly bought and sold or rented out than in rural and peri-urban areas, due in part to the fact that there are fewer landowners in urban areas[12] (see section B.1.a).

Lastly, there are also a few rare cases of beneficiaries continuing to use their T-shelters to sleep in (as they make them feel safe) but who spend the day in concrete homes, which are perceived as more comfortable and socially valued.

2. T-Shelter Condition

As the T-shelters were well-designed and properly constructed, their condition is virtually the same as they were when the shelters were delivered. Five years after being built, they are generally in good overall condition[13]. The vast majority of the T-shelters visited (77%) show no major wear and tear; for the remaining 23%, issues include:

- Damage to the foundations, predominantly due to soil erosion caused by surface runoff (7%);
- Damage to roofs caused mainly by falling trees and branches (6%);
- Damage caused by flooding following Hurricane Matthew (5%);

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[9] Unless otherwise indicated, the figures given are those observed in the field.
[10] 18% compared to 8% of vulnerable households (source: project database).
[11] The generic term 'beneficiary' is used throughout the report to refer to all the people that received a T-shelter through the project due to their vulnerability. While this term is used for ease of reference, it also simplifies what is, in reality, a far more complex situation. These people are not currently the beneficiaries of any project and it would, in fact, be more accurate to refer to them as 'ex-beneficiaries' or, depending on their situation, as T-shelter owners or ex-owners.
[12] 38% compared to 61% in peri-urban areas and 83% in rural areas.
[13] Expected life span was 3 to 5 years.

- Major deterioration of the timber frame (3%);
- Severe damage to the *clissage* panels (thin slats of wood woven between the wall framing) (1%).

Otherwise, only minor signs of wear and tear can currently be seen on the frame (localized rotting of timber) and on the roof (leaks) of the majority of the T-shelters.

a. Safe buildings

The quality of the shelter design, and the many modifications made before starting mass production of the T-shelters, has resulted in hazard-resistant structures. This resistance has been ensured not only through the technical design (braced framework, bolts, plates and straps), but also through the materials used and the quality of their installation (high quality concrete, imported treated timber). The fast construction of the shelter did not prevent their good construction, and their overall condition is good.

All beneficiaries and institutions recognize and appreciate the high quality of the T-shelters (DPC, municipality, MTPTC, etc.). Five years after the end of the project, the T-shelters continue to prove to be hazard-resistant and are likely to remain so for many years if well-maintained. This resistance to hazards was notable demonstrated during Hurricane Matthew, as all the T-shelters and schools visited had successfully withstood the high winds and heavy rain (although some damage had been caused by flooding).

b. Weaknesses

i. Timber

Despite the high quality of the design, there are two main areas of weakness on the wooden frame: at the point where the wooden posts are embedded in the ground and on the timber bracing at slab level.

The wooden frame is secured by embedding the posts in concrete foundations (50 to 70cm deep depending on the slope of the land). This design is based on traditional local building techniques, where the truss posts are driven into the ground. The longevity of this type of structure is ensured by using highly resistant timber (such as logwood, colubrine or acacia). As the wood used to construct the HI T-shelters does not have the same rot-proof properties as certain local types of timber, the base of the post is prevented from coming into contact with the soil and surface runoff by an elevated concrete border.

This technique is generally effective but does not always prevent the base of the piers from rotting. In a significant portion of the T-shelters visited, the wooden posts showed signs of degradation at ground level. This deterioration is sometimes exacerbated by the build-up of soil deposited during heavy rain, which can locally raise the level of the ground.

The doubling up of posts and their breadth has helped minimize any damage as, despite sometimes advanced deterioration, none of the T-shelters have yet been deemed unstable or dangerous; however, this situation is more than likely to change over the course of the next few months.

This problem can also be found on the beams that brace the frame at slab level. These timbers that sit flush with the slab or encircle the base of the walls are highly exposed to the elements and can sometimes be partially buried under soil. Being thiner than the posts, these timbers are sometimes irretrievably damaged and have to be removed, thus weakening the frame of the shelter and reducing its resistance to winds and earthquakes.

Alternative techniques, such as using metal struts to attach the posts to the ground or laying a block base could be used to increase the lifespan of the shelters. These methods were considered as too complex or time-

consuming to implement within the constraints of the budget and the project schedule. However, these adaptations might have extended the lifespan of the shelters.

ii. Roofing

The use of *Onduline* corrugated bituminous roofing meets the project requirements in a number of respects. This type of roofing has several advantages over the traditional corrugated metal roofing as the sheets are lighter, easier to transport and install, less expensive, provide greater insulation and are not as sharp, being thus less of an accident risk during high winds. This final point was particularly highlighted by the authorities, especially the DPC, who underlined that cuts from steel roofing sheets are one of the most common causes of injury during storms.

However, this type of roofing has one major disadvantage in than its lifespan is much shorter than traditional roofing sheets. The material can warp during storms and be easily damaged by falling objects (branches, fruit, etc.). Most of the roofs on the T-shelters visited showed signs of damage due to these two weaknesses although, for the moment, this damage is limited to water entering into the shelters and to some of the roof edges having been torn off. These weaknesses are exacerbated by the fact that these roofing sheets are difficult to repair and replace. In addition, greater damage is likely to appear over time as the roofing sheets deteriorate further each time there is a serious weather event.

It would have been possible to prevent the roofing sheets from warping by placing the battens closer together and by reducing the overhang of the roof edge[14].

iii. Walls

The *clissage* wall infill is one of the key elements of the prefabricated T-shelters. Based on a traditional construction technique (independent structure), *clissage* provides an ingenious way of filling in the shelter walls using various modules, either solid panels or panels that include a door or window.

Traditionally, the *clissage* walls are nearly always covered with mud to provide extra protection (from the wind and rain). The project assumed that the beneficiaries would cover the *clissage* walls with render (lime + sand, sand + mud or cement + sand); however, this rendering work has been carried out on only 12% of the T-shelters visited (see section B.3). The main reason for this low figure is the cost, which at around US$100 is a large sum for poor households and disabled people to find. Other reasons were also sometimes put forward by the beneficiaries, such as the lack of compatibility between the traditional mud rendering and the wood used for the *clissage* panels. The wood traditionally used is highly fibrous palm that is roughly cut so that the mud sticks to it very easily. In contrast, the wood used for the HI T-shelters is much smoother. However, on all the shelters visited, cement rendering has been applied and appears to be holding up very well, although it remains to be seen how long this will last as this rendering is rigid whereas the wood is flexible and sometimes swells, and the cement may also damage the wood[15] (see section B.3).

Consequently, the T-shelter walls are frequently left bare (47%) or most often covered by plastic sheeting (35%) or other materials: wattle screens, plywood panels, roofing sheets (7%). The advantage of these materials is that they provide a low-cost way of insulating the shelter and protecting the *clissage* walls. As they have been constructed using good quality and treated wood, the bare *clissage* panels appear to have a long

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[14] For a slope of more than 30%, the manufacturer recommends leaving a maximum of 46.5cm between each batten and a maximum overhang of 7cm. This will provide a guaranteed lifespan of 10 years.

[15] Cement does not allow hygrometric exchanges.

lifespan as only a few show signs of slight deterioration (notably caused by children playing on and climbing them[16]). Similarly, the shelter doors and windows appear to be lasting well, the frames are proving resistant, despite some parts being unstable or even missing, and the plywood panels are of good quality and seem to be durable (unlike those used for the latrines, see A.4.b).

In addition, the wood used for the *clissage* panels (the slats and dividers) is bigger than the palm usually used which means the spaces between slats are wider than on traditional houses. These spaces make it easier for insects to get into the shelter, and also let in the wind and rain, as well as the cold, which is a common complaint of beneficiaries living on higher ground. Conversely, this larger space helps ensure the rendering properly adheres to the inside and outside of the panels (when both sides are rendered, see B.3.a).

The panels are supplemented by ventilation slots covered by mosquito nets, one at the top of both longitudinal walls and another at the base of one of them, to improve air flow and cool the shelter. This system is particularly important when the walls are covered and air can no longer pass through the panels. These panels appear highly durable; as those at the base of the walls are most often subject to damage, in some cases they have been replaced by a row of concrete blocks.

iv. Slabs and foundations

Several cases of damaged slabs and foundations were seen during the visits, mostly the raveling of foundations caused by surface runoff. This raveling is not yet serious enough to have destabilized any of the visited shelters, but could pose a short to medium-term risk. During the visits, we noted just one case where the slab on the terrace of a shelter had collapsed and, in another instance, a retaining wall supporting a ramp had fallen down.

In contrast, some T-shelters have been erected in sediment and debris deposit areas; this debris gradually causes the ground level to rise, ultimately leading to water getting into the shelters.

Strictly speaking, these issues are not due to a weakness in either the T-shelter design or construction, but do highlight the difficulties experienced by the teams when carrying out and supervising the foundation and slab construction work (the only parts of the shelter that are not prefabricated). The teams had to adapt the work to each specific situation (slope, soil type, etc.) and assess how to minimize risk (location, depth of the foundations, raised height, quality of the concrete, etc.).

c. Maintenance and repairs

Five years after being built the shelters are in good overall condition, and they could continue to be used many years if they are well used, maintained and repaired.

The guidelines for use listed in the technical specifications[17] have been generally followed and are helping reduce humidity and minimize the intrusion of rodents and insects. However, the recommended maintenance tasks have never been carried out. This maintenance could ensure the longevity of the shelters over the initial 3 to 5 year expected lifespan, not only to minimize the risks inherent in timber frames, but also to mitigate for the weaknesses listed above.

[16] As shown in the schools
[17] HI, T-Shelter Technical Specifications, Mars 2011

Five years after construction of the T-shelters, the most pressing type of maintenance is repairs. The technical specifications, despite they have been distributed to the foremen at the end of the project, do not mention repair methods. The most essential work commonly required includes:

- Repairing or replacing the damaged timbers;
- Plugging holes in the roof and replacing any damaged roofing sheets (ultimately using metal sheets);
- Repairing and rendering the *clissage* panels and regularly maintaining the rendering (especially when this is made of mud);
- Repairing the slabs and cement in the foundations to prevent water getting in between the timber and the foundations;
- Filling in the areas hollowed out by surface runoff or removing any built-up sediment and debris.

However, none of these repairs have ever been completed, mainly because of the cost and availability of the materials (timber, roofing sheets). Another reason is the complexity of the work involved. Replacing sections of the shelter frame is a complicated task that requires specific knowledge and skills. With regard to the roof, the corrugated sections of the *Onduline* sheets are different to those on metal roofing sheets, which means they cannot be interchanged and thus more comprehensive replacement work is required.

In order to protect (or treat) the wood from damage, a coat of wood treatment or protection should be regularly applied to the exposed timbers. However, these types of product remain unaffordable for the beneficiaries (or less effective products, such as motor oil, are used).

Thus, also the T-shelter is based on traditional construction techniques, its complex design (which makes it both structurally resistant and quick to erect) means it is more difficult for the beneficiaries to carry out those maintenance tasks that would help increase its lifespan.

d. Comparison with other types of shelter

Various temporary or transitional shelters have been developed and constructed by other humanitarian organizations in the Petit Goâve area. Their different construction methods mean it is possible to compare them with the T-shelters constructed by HI. The shelters designed and built by HI have certain advantages in terms of their solidity, but have disadvantages in other areas. During the field visits, we were able to ask the HI shelter beneficiaries and their neighbors about the various models built.

A number of organizations have built simplified temporary shelters (with thin sections of wood, fixed to the ground with no foundations). Compared to these lighter structures, the HI T-shelter is often lauded for its structural solidity as it includes a resistant timber frame and good quality foundations. The hazard-resistance and durability of other organizations' shelters are reduced by their lower quality construction (such as the foundations) or materials used (cheap plywood boards, overly thin roofing sheets, etc.).

Some of the people interviewed also highlighted that a further advantage of the HI shelters is the fact that the shelter walls can be rendered to provide a more durable house at a reasonable cost. In order to make other shelter models as robust and durable, all of the materials used for the walls (thin plywood or asbestos-cement panels) would need to be replaced, which would cost almost as much as building a small house[18].

[18] For this reason some of these shelters have been found abandoned.

Finally, one of the major benefits of the HI T-shelters is that they can be easily dismantled, moved and reassembled. This is a great advantage for the beneficiaries, as it enables them to move rather than sell the shelter; the benefits of the shelter (security) and the savings that can be made (rent, maintenance work) outweigh its sale price.

Nevertheless, some of the people met did highlight certain advantages of other shelter models over the HI T-shelters. For example, it is sometimes possible to sell on some of the construction materials when improving or dismantling other shelters (metal roofing sheets, plywood boards or planks, etc.), which helps people pay for improvement work, cover removal costs or the cost of rent. Some organizations kitted out their shelters with additional fittings, such as guttering or tanks, which are either used or sold on. Lastly, a few organizations have opted to construct more durable accommodation that consists of a wooden frame and blocks infill. This model is the preferred option of all the people interviewed, who consider this to be neither a shelter (which has negative connotations) nor a temporary dwelling (with a limited lifespan) but a proper, permanent house.

3. Risk reduction and accessibility

a. High risk areas

The shelter construction sites were selected by reviewing the cartography of the high risk areas and, in most cases, the DPC was consulted to confirm the suitability of the sites. Given the rapid pace of construction during the final phase of the project, the DPC was unable to confirm the suitability of all the sites identified; however, no shelters appear to have been constructed on sites that experience frequent flooding.

Nevertheless, given the high levels of erosion in the region and the flatness of the coastal area, previously safe areas can quickly become prone to flooding. Last October, Hurricane Matthew struck the Petit Goâve region only relatively lightly, but heavy rains caused La Digue River to burst its gabion banks, installed following the 2010 earthquake. This caused the bridge near Petit Goâve to collapse, several houses were washed away and many more were flooded. In the Provence neighborhood, several of the shelters constructed by HI were severely damaged. During our visits, it was noted that one shelter had been completely destroyed and a dozen others had been damaged by the floods. Mudslides had penetrated these shelters, which had had to be cleaned out. The flow of water, mud deposits and accompanying shifting of the ground must have weakened these structures, but the extent of any damage remains difficult to assess. All owners bar two are still living in their shelters; one severely damaged shelter has been abandoned (perhaps immediately) and the other has been moved to safer ground.

The zoning of high risk areas needs to be redefined to reflect this change in the river's profile (elevation of the river bed). This would most certainly place the Provence and La Digue districts within a major risk area, as they are now at, or even below, the level of the river bed (particularly La Digue, despite being only slightly affected by the hurricane).

b. Risk reduction

Apart from the localized impact of these major weather events, the shelters continue to ensure the security of people and their belongings, having proved suitably resistant to Hurricane Matthew. Other than the cases outlined above, only a few other instances of damage were recorded, mostly damage to roofs caused by falling branches. There were also four more serious cases that involved falling trees. In two of these instances, the frame of the shelter withstood the accident and could be repaired, a supporting truss broke on the third shelter and had to be replaced, whereas the fourth shelter was completed destroyed.

However, as the *clissage* panels let in rain, several beneficiaries went to seek shelter elsewhere during the hurricane and only returned to their T-shelter once the storm had passed. The solidity of the shelters meant

they were able to move back in straightaway (no repairs were required) and, in some cases, the beneficiaries also took in other families who had lost their homes. The situation was the same in the schools, which proved resistant to the hurricane, but was used as a refuge once it had passed rather than as a shelter during the storm itself.

There are two situations in which alterations to the quality of the shelter design and construction means people's security can no longer be guaranteed: when the shelters are moved or they undergo structural change. The dismantling and reassembling of the shelters are often not carried out correctly and a substantial amount of the structural quality is always lost: the foundations are not up to standard, the slopes are sometimes shaky, the connecting bolts are often replaced with nails, etc. Consequently, these shelters become less safe and less durable. The structural integrity of the T-shelters can also be reduced or jeopardized by 'improvements' or extensions. For instance, in order to extend or make the houses more permanent, some beneficiaries place rigid structural elements made of blocks (posts or walls) alongside the more ductile timber frame. This reduces the shelter's flexibility, and thus its wind and earthquake resistance.

Although the shelters are sufficiently hurricane resistant, it is important not to overlook the stress that such weather events place on these apparently solid structures, which can become weaker over time and thus less able to withstand future hazards.

Finally, the Matthew cyclonic winds (which were less strong in the Petit Goâve region than in Grande Anse or the south) did not cause any heavy damage to the shelter roofs, such as torn off roofing sheets, which commonly cause injury during high winds (the DPC reported that many of the 460 people hurt during the hurricane were injured in this way).

c. Accessibility for PwD

Overall, the fittings installed to provide access to the shelters for PwD have withstood the test of time less well than the T-shelters themselves. The ramps are generally in good condition (some of the slabs have been damaged and one has collapsed), but many of the other fittings (handrails and railings) are showing signs of wear and tear, particularly the metal poles and thin wooden handrails.

The shelters thus remain relatively accessible, although people with reduced mobility tend to find it difficult to get about due to the damaged fittings or to the state of the area immediately surrounding the houses. Even where the fittings facilitate getting in and around the shelter, PwD often encounter problems outside, such as steep slopes, ditches, uneven and narrow paths and corridors[19], all of which make getting about difficult and dangerous and leave them unable to go anywhere independently. Although work has been carried out to provide PwD with access to the main thoroughfares (via bridges, ramps, etc.), it is clear that the issue of accessibility goes beyond the immediate area surrounding the shelters.

[19] Many of the wheelchairs issued after the earthquake are no longer being used, either because they have been damaged or because the environment makes their use impossible.

4. Latrines

a. Use

In most cases, the latrines are still being used, even though their superstructure is less durable than that of the T-shelters. Where latrines are no longer in use, this is mainly because the latrine building collapsed during storms (see the following section) or because they are too near the entrances to other shelters (particularly in highly built-up peri-urban areas). Those beneficiaries that have stopped using the latrines built by HI or its project partners, now use their neighbors' latrines or, more rarely, dispose of their waste in the sea or the environment.

Most people are using the (single or double) pits correctly and only a very few cases of waste disposal have been reported. The majority of the pits are not yet full (only one full – shallow - pit recorded), although some of the beneficiaries expect their pits to become full very shortly. Once the pits are full, all beneficiaries are planning on moving the latrine superstructure and placing it over a new pit.

Finally, in some (15 recorded) cases, surface runoff or flood water has flooded the pits rendering the latrines unusable. These latrines were mostly located in the areas near La Digue River at Petit Goâve (see above).

b. Durability

While proper pit design and use have ensured that the pits remain functional, the same cannot be said for the superstructure of the latrines. The timber frame structures, plywood panels and bituminous roofing sheets are not wearing at all well. Either they are frequently damaged by storms or the construction materials used have deteriorated over time.

The greatest damage is caused by high winds, which can blow these light superstructures away; this is despite them being fixed to the ground, as the fixings sometimes rust and break. The damaged superstructures are sometime sold on or recycled, with the plywood panels and roofing sheets subsequently being used to cover shelter walls and roofs or to build an extension.

The plywood panels used for the latrine walls and doors appear to be of poorer quality than those used for the T-shelter doors and are often ravaged by insects or wood-boring larvae. The latrine frames also often suffer damage, no doubt due to their exposure to bad weather and frequent use. Lastly, the use of bituminous roofing sheets creates the same problems as on the T-shelters (premature deterioration).

The review of the shelters built by other organizations has shown that some have constructed more durable latrines, as they have notably used metal sheeting as cladding and on roofs.

The location of the latrines can also have a negative impact on their durability. For example, latrines built in areas frequently exposed to high winds (such as on the slopes of Tapion) or along the coast, where rain and erosion is common[20], are less durable than those in other areas. Finally, the spatial layout of densely populated peri-urban areas (such as Petite Guinée or Provence) precludes the long-term use of latrines. In many cases where latrines have been built along a path or between two houses, these are no longer in use due to the lack of privacy or inconvenience caused. In towns, plot or house boundaries are more clearly marked (with walls, etc.) and there is a more rationnal use of the space available (corridors, the rears of plots, *lakou*, etc.), thus it

[20] Some latrines built by other organizations have been carried away by the tide and the only thing left is the pit, which is now several meters nearer the sea.

is easier to find a place to build the latrine to ensure privacy or where several families from the same *lakou* can share a latrine (if there is not enough space for one each).

5. Schools

a. Use

We visited four[21] of the seven schools built, all in the commune of Dufour. Through these visits, we were able to confirm that all the schools are entirely used for teaching the area's children (see C.2.a).

However, these schools have been designed in the same way as the T-shelters (timber frame, *clissage* infill and bituminous roofing) and thus have the same weaknesses. Some of the roofs have been damaged by falling branches and winds (particularly Dufour and Poirier); however, it is the permeability of the clissage walls that pose the greatest problem as lessons cannot be held in the classrooms when it rains[22]. During the wet season, it is common for schools to have to close for several days at a time.

Like the T-shelters, the schools are solid structures that have proven to be hurricane-resistant (damages are however greater, maybe because of stronger winds), and which were used after the recent hurricane as a refuge for families whose homes were damaged[23]. However, also like the T-shelters, the schools were not used during the hurricane.

The schools are also regularly used for other activities, such as hosting the local farming organizations' meeting. In Pelagi, Poirier and Rosinette, the school is currently the only available meeting place[24]. In Dufour, the school is less frequently used for other activities as there are other community spaces available.

In Pelagi and Rosinette, there are two classrooms (each made from two adjoining shelters of 32m2) in which to teach 3 grade levels (levels 1 to 6), which is sufficient for the number of children enrolled in the schools (120 and 125 respectively) and enables supervision by fewer teachers. In Dufour, the school is larger (291 children) and so the 6 grade levels are split between the two classrooms, which are supplemented by two HI T-shelters (of 24m2 each, one of which is used as a classroom and the other as the staff room and headmaster's office[25]), as well as by a large tent. However, even with these additional facilities, there are still a high number of children in each of these two large classes. Under this set-up, the classrooms are too small for two grade levels, yet too large for just one. The Ministry of National Education and Vocational Training (MENFP: *Ministère de l'Education nationale et de la Formation professionnelle*) recommends a classroom of 50m2 per grade level for every 25 preschool children or 40 schoolchildren[26], whereas the classrooms constructed by HI are 64m2 for two to three grade levels (with between 40 and 100 children per grade level).

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[21] Rosinette, Poirier, Dufour and Pelagi

[22] In addition, it was not possible to install a concrete slab in the school in Pelagi, and the dirt floor turns to mud each time it rains.

[23] For instance, Rosinette school hosted 25 families. In Dufour, the affected families took refuge in the health center next to the school, which is made of blocs.

[24] The churches of Poirier and Rosinette were destroyed by the hurricane.

[25] The other schools have no space for a staff room or headmaster's office.

[26] MENFP, Petit guide pratique pour la conception et la réalisation d'écoles fondamentales en Haïti, basées sur les normes et selon les procédures préconisées par le MENFP, 2014; and MENFP, Normes de construction des bâtiments scolaires, 2013. Standards set in 2013, after HI had already built these schools.

The school latrines are still functional in Pelagi and Rosinette. They have been destructed by Matthew in Poirier. In Dufour the pits are full and the superstructure are damaged. As with the shelters, the latrine superstructures have suffered significant wear and tear, notably because the school latrines are used by large numbers of children, not all of whom have latrines at home. In Dufour, the 4 latrines built were insufficient given the high number of children in the school[27] and are no longer in use. In addition, the superstructure is in too great a state of disrepair to be moved to another pit.

b. Durability

The longevity of the classrooms is very similar to that of the T-shelters, as are their strengths and weaknesses; however, more damage can be seen on the classrooms' *clissage* panels as the rooms are used by more people and for the children's games. Unlike in the T-shelters, none of the school staff members have reported seeing any rotten wood. However, the permeability of the walls is a greater issue in schools than in the T-shelters as lessons are frequently disrupted when it rains.

As with the T-shelters, in order to improve the durability of the classrooms, maintenance and repair works are needed. Most notably, the *clissage* panels need to be rendered; however, this appears to be more challenging for schools. None of the classroom walls have been rendered or protected with plastic sheeting or other materials as is often the case for some of the T-shelters. The school managers maintain that this work is costly and difficult to carry out in such a hilly area. Nevertheless, this rendering is vital for ensuring the school can be kept open in all weathers and will also enable the buildings to be used as a refuge from extreme weather events.

School managers and community leaders also highlighted additional modifications, such as dividing the classrooms, installing furniture, constructing additional sanitation facilities and water points and putting in staff rooms and offices, as being factors of schools' durability.

[27] MENFP recommends one WC per classroom for preschool-age children and 2 per class for schoolchildren (boys and girls), thus around 2 gender-separate latrines to 40 children. The schools visited had around two WC to between 60 and 150 children.

IV. B
SUSTAINABILITY

T-SHELTER MODIFICATIONS AND CHANGES

B. Sustainability – T-Shelter Modifications and Changes

1. Tenure and Shelter Relocations

a. Contracts

The shelters have been provided to families with various land tenure statuses. The majority of families are landowners (72%), but there are also usufructuaries (12%), tenants (12%) or state leaseholders[28]. To supplement rental, usufructuary or lease agreements and provide greater housing security, HI established a contract between the various parties (HI, owners and occupants) confirming the agreements reached for a period of 3 years and these agreements were certified by the local authorities, municipalities or CCPC. At the end of the contract, the beneficiaries remain the owners of the shelters and are free to move them to another site.

There have been no evictions reported from any of the shelters visited. The vast majority of beneficiaries who were not landowners still occupy their T-shelters and all the relocations recorded took place after the three-year contract had expired (with the exception of one usufructuary dispute). Thus, 12% of the usufructuary beneficiaries and 16% of tenants no longer live in their shelter in its current location, compared to 10% of landowners.

When the families move out of their T-shelter, these shelters are either moved or left abandoned, sold, loaned or rented out. At the end of the contract, the T-shelters in rural areas are more frequently moved to another site (6%) than those in urban (3%) or peri-urban areas (1%). In towns, shelters are more likely to change hands (around 18% are sold, donated, lent or rented out) than in peri-urban (4%) or rural areas (1%); this is because there are more landlords and less land available, so more business transactions of this type take place

The status of T-shelter owner bestowed by the contract has been recognized by all parties and no misuse or abuse has been reported. However, when shelters are sold, this is because the tenants or usufructuaries need to move[29] and do not have the space or means to move the shelter. The T-shelter sale price is low (two reported cases: US$50 and US$100) and is only enough to enable households to pay one to two years rent. Furthermore, some beneficiaries are not always sure they are allowed to sell, move or even modify their shelter; during the visits, a few beneficiaries apologized for the transactions or modifications they had made and some new owners even denied the very obvious sale and relocation of the shelters (2 cases).

Thus, generalizing, it can be assumed that at the end of the contract:

- When moving, owners leave with their T-shelter or rent or loan it out (usually to a family member) so they are able to keep it; tenants and usufructuaries leave with their T-shelters when they can, as the shelters provide them with several years' low-cost accommodation; where circumstances dictate (lack of space on the new plot), they will sell the shelter instead;
- When they want to replace their T-shelter with a permanent house, owners, tenants and usufructuaries all sell their shelters.

[28] Non-representative sample.
[29] Only one case of a sale to construct a block house reported.

Lastly, as far as types of beneficiary vulnerability are concerned, occupancy rates for vulnerable households are higher than those for PwD (93% compared to 81%). In addition, a higher number of shelters have been abandoned, no doubt due to a higher number of deaths[30], particularly among elderly people. Following a death, the shelter is usually taken over by a family member or, as in other situations, it is sold on, relocated or rented out.

b. T-Shelter relocation or dismantling

One of the main features of the T-shelter is that it can be easily dismantled, moved and reassembled, which is a major advantage for households wanting to move or build a more permanent house. The inhabitants of rural areas have particularly taken advantage of this feature, predominantly to move to areas undergoing densification, such as peri-urban areas. The cost of moving a T-shelter remains affordable at around 1,000 HTG (20 USD)[31].

However, visits to the relocated T-shelters revealed that, during reassembly, some of the shelter's solidity is always lost and this for one or more of the following reasons:

- Certain parts can be broken during the dismantling process (pier bases) or omitted during reassembly (bracing);
- The new site of the shelter is not always selected with sufficient precision, the posts and trusses are not always vertical and the base is not always suitably flat;
- The foundations are never constructed in the same way as on the original site (the posts are not embedded in the foundations and there is rarely a concrete slab);
- Lastly, the shelter is seldom reassembled in the same way, particularly the joints between the timber frame and the pillars as the bolts are often replaced with nails.

Certain shelter owners have employed some of the foremen who worked on constructing the initial shelters to help them with their move; however, our visits were unable to confirm whether these shelters have been reassembled any better than the others.

Once the T-shelter has been moved, the remnants of the foundations and slab remain on the initial site. On two of the sites visited, these slabs had been reused to build makeshift shelters. In order to remove the shelter's timber frame, the foundations and slab have to be broken up and the foundations that remain are not solid enough to support a new structure.

Two other types of situation were found. One where the T-shelter has been dismantled and placed in storage for reassembly at a later date and another where the T-shelter has been recycled rather than reassembled because it was too badly damaged[32] (the materials can be used to construct a different type of structure or for extending another shelter).

[30] In 14% of the PwD shelters visited, beneficiaries were reported dead.
[31] 2 cases recorded
[32] By fallen trees

2. Shelter Modifications

a. Common modifications

The majority of T-shelters have been improved or modified to provide better living conditions (mainly by covering the walls) or more space (extensions). Only around 39% of the T-shelters visited remain unchanged. Four main types of improvement have been made:

- Protection of the *clissage* panels (around 50% of the shelters visited);
- Construction or walling in of a porch (24%);
- Installation of internal partition walls (around 10% recorded[33]);
- Construction of extensions (10%).

Covering panels is by far the most common improvement carried out by the beneficiaries and this for a number of reasons: it makes the walls impervious to wind and rain; it provides greater privacy and security; and it helps protect the *clissage* infill. The techniques used to cover the panels vary in accordance with each household's financial resources and the local availability of materials:

- Two-thirds of beneficiaries (66%) use plastic sheeting as it easy to put in place, has an immediate impact and is widely available and affordable.
- To make their T-shelters more durable, some occupants (22%) have used cement rendering; this rendering is usually applied to the exterior of the shelter walls, sometimes to both the exterior and interior and more rarely to the interior only. Rendering is sometimes applied in stages, as and when families can afford it, with the principle wall around the porch often being the first to be rendered. Despite some interviewees' reports to the contrary, none of the shelters visited have been rendered in mud. The *clissage* slats' lack of adhesion means that organic material (fiber, straw) needs to be added to the rendering; however, wattle and daub is not traditionally used in Haiti (see A.2.b.iv).
- A few beneficiaries (11%) have used recycled materials, usually roofing sheets[34], to (often only partially) cover the walls. These quick and cost-effective options are often less effective than the techniques described above.
- Finally, in one of the shelters visited, some of the *clissage* panels had been replaced by blocks after having been damaged by a falling tree.

The construction of a porch to completely or partially surround the T-shelter is the easiest shelter improvement to make. This can help improve the privacy of this semi-private area, increase the internal surface area or used to create an additional room. The materials used vary in accordance with the porch's required purpose and households' financial resources:

- The most common form of improvement (35%) involves installing a railing, which is often made of blocks and cement and usually painted; it provides more privacy and improves the appearance of the house (suggests a higher standing and looks more 'permanent');
- The wall around the porch is usually made with:
    - Flexible materials – plastic sheeting (23%) or curtains (14%)- for privacy;
    - Lightweight materials (16%) - wood, roofing sheets or mats;
    - Blocks (7%).

[33] We were unable to view the inside of all shelters visited; therefore, this figure reflects the minimum number of cases.
[34] Plywood panels and mats have also been used.

- Finally, some occupants (5%) have closed off their porch by moving the *clissage* panels to the edge of the porch and using other materials (wood or blocks) to fill any gaps.

During our visits, we noted only a small number of extensions, most of which had been carried out to create a new bedroom (55%), increase the size of the porch, extend the eaves (20%) or create a new living room, bathroom, kitchen or business space. The majority of the extensions are built with concrete blocks (62%), lightweight materials, such as wood and plastic sheeting (29%) or roofing sheets (5%), or *clissage* panels.

Lastly, inside the shelters, partitions have sometimes been put up to create separate bedrooms. These are usually made of wood (plywood) or consist of curtains or plastic sheeting; in some rarer cases, they are also made of blocks. In some of the T-shelters, partitions have been erected to divide the shelter into two independent dwellings, one accessible via the porch and the other via the back door.

b. T-shelter sustainability

The T-shelters made it possible to quickly re-house the earthquake victims and protect them from weather-related hazards, a function they continue to perform today. However, five years after their construction, there are a number of questions surrounding their sustainability: the lack of alternative housing for a large number of households; the wear and tear seen on certain shelters, which is having an adverse effect on their longevity; and, finally, the permeability of the walls, which limits proper usage of the shelters.

The majority of beneficiary households are extremely poor. The T-shelter and the land on which it stands are often the only major assets they possess and, without HI's assistance, their living conditions would not be the same. The beneficiaries' financial situations remain critical and it is vital that they keep the shelter in good condition to avoid having to pay out large sums on rent or construction work.

As highlighted above, maintenance and repairs to the frames and roofs are required to ensure the T-shelters' longevity. However, these are costly and complex tasks that not everyone is able to afford. Consequently, sustainability of the T-shelters is rarely assured.

Shelter sustainability and their proper long-term use are currently being hampered by two of the T-shelter's main weaknesses, namely the permeability of the walls and the fragility of the roof. The walls of each T-shelter need to be rendered to ensure decent housing conditions (the other solutions used can only ever be temporary).

For the most part, these two types of costly and complex task have not been carried out. Apart from the odd exception, the T-shelter occupants have preferred to carry out cost-effective but temporary modifications or works that improve their quality of life (protection from storms, additional space, greater privacy, etc.).

For many beneficiaries, another factor deterring them from wanting to continue living in their T-shelter is the shelter's negative connotations. In an attempt to improve their social image, certain occupants have focused on making the shelter look less temporary, adding embellishments and improving the porches (railings) to cost-effectively transform the shelter's frontage, as the front yard is used as a meeting place and helps establish social status.

Work to transform the T-shelter into a permanent house is often carried out in stages, as and when the household can afford it. Thus, the shelters are often rendered in phases and then by adding successive block-built extensions. Every shelters visited which included an extension have also been rendered and most of them had their porch modified (railing). In peri-urban areas, some beneficiaries have built a house in blocks next to their T-shelter and the family shares the two dwellings. In towns, the transition towards a permanent house

often involves destroying the shelter due to lack of space. In rural areas, the T-shelters most often become permanent housing.

c. *Modifications and structural integrity*

As we have seen above (section A), the structural integrity of the T-shelters is ensured in all but three instances: when the frame is damaged, when the shelters are moved and when certain structural modifications are made. The majority of the shelter improvements have no negative impact on the shelter's structural integrity, except in rare cases when these improvements are carried out using blocks connected to the shelter's timber frame (section A).

The lightweight materials most commonly used to cover the *clissage* panels do not usually pose a risk for either the frame or the panels, precisely because they are light. However, water and debris can collect in the plastic sheeting, particularly at the base of the walls and this can cause or exacerbate degradation of the wood.

The T-shelters were designed to be rendered. Thus, when carried out correctly, rendering has no apparent adverse effect[35] on the shelter's durability or ability to protect its occupants. The render makes the shelter more rigid but, as the panels are all separate, a certain amount of flexibility endures. In the event of an earthquake, the rendering will most likely crack as the shelter moves, but as it will break into small pieces, it should not pose any danger.

3. Factors Affecting T-Shelter Modifications

a. *Land tenure and socio-economic status*

The visits revealed that the shelter modifications made vary in accordance with the type of beneficiary (PwD or vulnerable households) and their land tenure status (owner, tenant, leaseholder or usufructuary).

As outlined above, the main obstacle to carrying out work or improvements on the shelters is financial resources. Thus, as the program targeted extremely poor vulnerable people, the number of repairs and modifications that have been carried out is very low. During the visits, we noted that PwD generally have the lowest standards of living (particularly as regards household equipment). Vulnerable households have thus carried out more work on their shelters than PwD, whether building extensions (4% compared to 12%) or rendering the walls (45% compared to 55%).

It is difficult to compare land tenure due to the large number of categories involved (meaning that the sample of 206 shelters visited is too small to be representative). However, there is a significant difference with regard to the rendering of walls, which is a more common practice among owners (53%) than among tenants (40%). This could be due to the fact that owners have greater security of tenure.

Lastly, the modifications made also vary in accordance with the size of the T-shelter (18, 24 or 32m2). Partitions are most commonly found in the largest shelters (2%, 10% and 24% respectively). The walls of the largest shelters are also most likely to be rendered (42%, 51% and 56%) and the porches of the largest shelters most likely to have been improved (20%, 29% and 33%).

[35] Doubts remain over whether the cement may damage the wood.

b. T-shelter location

The type of work carried out on the T-shelter is also strongly linked to whether it is in a rural, peri-urban or urban area. Work on the *clissage* panels is more common in rural areas than in towns (58%, 44% and 39% in rural, peri-urban and urban areas respectively); however, people in urban areas are most likely to use more durable materials (use of cement for rendering: 18%, 17% and 33%). Work to improve the T-shelters is also more commonly seen in towns, such as work on porches (20%, 23% and 36%) or extensions (8%, 8% and 16%). These differences are due to a number of factors:

- In rural areas, the T-shelter is an important asset for poor families and one they work hard to safeguard;
- Rural areas, particularly the hilly areas of the *mornes*, are more exposed to the elements (especially the cold), hence the need to cover the walls;
- Major building work (extensions, use of blocks, etc.) would make it harder to dismantle the shelter and move to peri-urban areas, for instance, which may explain why these types of improvement are less common in rural areas; plus rural households have fewer financial resources than urban households;
- Construction materials are not so readily available in rural areas, reducing the scope for improvements.

In towns, the temporary shelter has more negative connotations (a simple and lightweight building made with a timber frame and based on a traditional and rural design, etc.) and so the aim of most of the work carried out is to make the shelter look more permanent (cement is preferred to plastic sheeting, which is rarely used).

4. Local and Urban Development

The HI T-shelter program was implemented as part of post-earthquake reconstruction and longer-term development efforts being undertaken by mostly international organizations and the Haitian government. In the Petit-Goâve region, these efforts focused on two main targets: improving housing conditions (safer housing, sanitation, etc.) and, more locally, carrying out urban development projects (roads, public spaces, amenities).

a. Improving housing conditions

For both the Haitian government and the international community, improving housing conditions was the key theme of the post-earthquake reconstruction effort. The aim was not only to “Build Back Better” (by improving construction techniques) but also to improve sanitation and housing conditions (increasing the number of household sanitation facilities, reducing informal housing).

A brief analysis of the T-shelters constructed by HI is provided below to assess the extent to which the HI shelters have met the criteria for adequate housing set out by the International Covenant on Economic, Social and Cultural Rights (ICESCR)[36] and improved their occupants’ living conditions:

[36] UN Committee on Economic, Social and Cultural Rights (CESCR), General Comment No. 4: The Right to Adequate Housing (Art. 11 (1) of the Covenant), 13 December 1991, E/1992/23, available at: http://www.refworld.org/docid/47a7079a1.html [accessed 5 January 2017], also see UN Office of the High Commissioner for Human Rights (OHCHR), Fact Sheet No. 21, The Human Right

- **Legal security of tenure:** ownership of the T-shelters built is guaranteed through a 3-year contract between project stakeholders and by the fact that the shelter can be dismantled and moved.
- **Availability of services, materials, facilities and infrastructure:** wherever possible, all T-shelters include a latrine; however, accessibility and water supply remains major issues but ones that are beyond the scope of such a project to address.
- **Affordability:** the T-shelter beneficiaries all own their shelters and thus have no rent to pay; however, the costs of maintenance and repairs are high.
- **Habitability:** the T-shelter guarantees the physical security of occupants and generally provides inhabitants with adequate space (adapted to the size of the family); however, the shelter does not always guarantee protection from cold, damp, wind and rain or from mosquitoes.
- **Accessibility:** the T-shelters have been adapted to meet the accessibility needs of the occupants, particularly PwD.
- **Location:** the T-shelters have been built on plots chosen by the beneficiaries, often in the same place they were living when the earthquake struck. Not all of these locations provide the same level of access to employment options, health-care services, schools and other public and social facilities. However, none of the shelters are located in areas identified as high-risk zones at the time the project was implemented.
- **Cultural adequacy:** the T-shelters are based on a traditional rural Haitian housing design; thus, they fit in well in, and are appropriate for, rural areas. However, they do not particularly meet the aspirations of the urban population, who do not consider them a suitable option for permanent housing.

The HI program has contributed to the joint efforts to improve housing conditions for the people of Haiti and it has provided an alternative to concrete buildings by constructing hazard-resistant shelters. This aspect was praised by the institutions and organizations interviewed, who consider the HI project to be a model program in this respect. Similarly, the common installation of household latrines has improved living conditions and the environment and helped reduce disease.

The national technical agencies (MTPTC, DPC) and Petit Goâve municipality also appreciate the fact that the project has scaled up the use of safer construction practices (notably installing metal straps) and risk reduction measures, such as *Onduline* roofing sheets.

However, the local authorities (technical agencies, municipality and DATIP) all expressed disappointment with the fact that the T-shelters are only temporary and look relatively fragile (*clissage*). They were also concerned that the shelters will not guarantee adequate living conditions over the long-term (particularly given the fragility of the roof and permeability of the walls), especially considering that the beneficiaries do not have the resources to modify the shelters or move out. A further criticism relates to the fact that this type of housing is not aligned to the aspirations and lifestyles of city-dwellers and is thus not appropriate for urban areas. Following the devastation caused by the earthquake in 2010, timber buildings experienced something of a revival as they pose less danger should they collapse; however, the negative connotations of wooden shelters, reinforced by some of their weaknesses (fragile roofs, permeable walls), remain in place: people in urban areas continue to aspire to living in permanent, brick-built houses.

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to Adequate Housing, November 2009, Fact Sheet No. 21/Rev.1, available at: http://www.refworld.org/docid/479477400.html [accessed 5 January 2017].

b. Urban projects

The post-earthquake reconstruction projects have progressively evolved from distributing tents then shelters towards integrated urban rehabilitation projects, such as that being implemented by GAA and Help in Petit Goâve. The aim of this type of project is to simultaneously improve a neighborhood's infrastructure, amenities, networks and housing. These project approach is based on the principle that, in urban areas, risk, protection, economic development and access to services are intrinsically linked and all of these different urban components need to be implemented at the same time in order to achieve satisfactory results. The GAA was implemented in an area where a number of HI T-shelters had been constructed; however, these two successive projects proved to be compatible and none of the HI shelters had to be destroyed to make way for the GAA project.

Local authorities are currently focusing on improving living conditions in urban downtown areas and on curbing the development of informal housing and rural exodus[37] (Petit Goâve and Grand Goâve Development and Improvement Plan). One of the aims is to encourage the people living in rural areas to remain where they are (by providing them with schools up to *philo* school age, health and legal services, civil registrars and by building roads and markets) and, at the same time, to develop more durable, higher standard housing for the middle class living in urban areas. The HI project is helping to achieve this by guaranteeing safe housing to rural inhabitants over the medium to long-term.

The chaotic development of downtown areas, due mainly to poor governance, is complicating efforts to reconstruct or improve these areas' housing. During our visits, we saw firsthand the problems the HI teams had encountered when building the shelters on narrow and oddly shaped plots. There was sometimes not enough space left to build a latrine or the windows open onto a wall. In these types of area, it would have been advisable to design housing that could be built to measure and tailored to the specific constraints of each plot by introducing new types of housing unit, such as multi-story or semi-detached houses or apartment blocks.

Peri-urban areas are experiencing the same type of chaotic development seen in urban downtown areas a few years ago. There was enough land available in these areas on which to build the shelters, but no particular consideration was given to effectively utilizing the space (resulting in latrines that face onto other houses or busy thoroughfares). In order to ensure that development in peri-urban areas does not follow the same pattern and bring with it the same risks as in downtown areas, immediate action needs to be taken to rationally divide the land into plots, determine the layout of roads and thoroughfares and define the location of public spaces and amenities. The HI project implemented in the peri-urban areas of Petit-Goâve and Grand-Goâve could have benefited from an additional spatial planning component.

[37] People from the *mornes* and from Gonâve Island.

IV. C
LONG-TERM IMPACTS

SECURITY, LIVING CONDITIONS AND ECONOMIC DEVELOPMENT

C. Long-Term Impacts – Security, Living Conditions and Economic Development

The HI T-shelter project was developed as a post-emergency relocation project with short and medium-term objectives (3 years), while also assuming the project would have longer-term impacts due to the shelters' adaptability.

Thus, the long-term impacts were not considered to be specific project objectives; instead, it was hoped that these would be an extension of the short-term impacts (for instance, providing physical protection through the ability to move the shelter) or were seen as indirect benefits (having an economic impact on beneficiaries, using the schools as shelters). Despite the project short term objectives these long term impacts are real and significant for the shelters and schools beneficiaries, and might extend over several years.

Prior to reviewing the long-term impacts, it is important to highlight the fact that, because of the beneficiaries' low incomes, the majority of the T-shelters, which were initially designed to be temporary, have become permanent houses. As outlined above, the ongoing use of these T-shelters (over and beyond a period of 3 to 5 years) is contingent on routine maintenance and repairs, which the beneficiaries are not always able to carry out; thus, the positive impacts of the project are gradually diminished over time.

This situation is due more to the difficult context than to any shortcomings on the project. However, these weaknesses do reveal a number of missed opportunities; for instance, the project could have focused more on carrying out the improvements required to enable people to live in the shelters on a permanent basis.

1. Impact on Beneficiary Households

The T-shelters provided and continue to guarantee various types of security and protection for their occupants (security of tenure, protection of people and their belongings, etc.). The shelters have also helped strengthen beneficiaries' resilience to weather events and improved their living conditions.

The impact of these different factors has varied over time, notably in line with three key periods: following construction of the T-shelter and during the 3 years of the contract; after the end of the contract (now); and longer-term, assuming the shelters remain sustainable.

a. Security

The main aim of the project was to ensure the physical security of people and their belongings and the evaluation shows that, generally, this aim was and still is being met five years after the shelters were constructed. This protection is provided to all occupants irrespective of their status and also extends to the new occupants of T-shelters that have been sold or loaned out[38]. However, over the long-term, any deterioration or damage to the shelters will affect their structural resistance and, thus, the physical security they provide will gradually be reduced.

The project also guaranteed security of tenure. Aside from the landowning beneficiaries (72%), the 3-year contract agreed with the various parties helped strengthen existing agreements while enabling people to continue to live in the same place. These contracts were all respected as, following the end of the contract, many beneficiaries have continued to live in the shelters on the same site (usually with no changes to the terms of their agreements). This security of tenure is particularly important for PwD, who are more likely to

[38] Unless the shelter has been moved.

be tenants or usufructuaries (only 53% are landowners compared to 85% of vulnerable households) and who are also generally poor and thus at greater risk of eviction. At the end of the HI contract period, security of tenure declined somewhat (as people generally reverted to tacit agreements); however, it remains high as 93% of vulnerable households continue to occupy the same T-shelter, as do 81% of PwD. Nevertheless, occupancy rates are lower for PwD renting their property as only 69% of the people visited were still living in the same shelter[39]. Over the longer-term, it is clear that landowners will be better protected.

In addition to providing greater privacy, the common construction of latrines has also helped protect the shelter occupants from disease (especially cholera, which continues to pose a danger in the region). However, this protection is being gradually diminished by the fragility of the latrine superstructures, which can render them unusable, as well as by the rain that can flood the pits. At the majority of the shelters visited, the pits are not yet full; however, slowly but surely, these will become full over time and, consequently, the number of people with access to safe sanitation will be reduced[40].

Overall, these different factors have improved families' resilience to weather events. As a result of the protection provided by their T-shelters, they suffer fewer losses and are able to resume their everyday lives more quickly. The structural resistance of the T-shelters and their high durability also reduces the need for repairs, enabling cost savings. This resilience is thus dependent on the condition of the T-shelter, decreasing when the shelter is damaged or deteriorates and increasing when it is repaired and made more durable.

b. Living conditions

In addition to providing protection, the T-shelters guarantee their occupants adequate living conditions. This is mainly due to the good shelter design, which is adapted to the lifestyles of most of the people targeted by the project. The architecture respects the traditional layout of houses, including a transition from the semi-public area (street-facing terrace) to the private living space (the bedroom that looks out onto the yard). The construction methods used are also based on recognized local techniques, which have been improved to make the shelters more hazard-resistant. The benefits of the T-shelter have been felt even more keenly as none of the beneficiaries would otherwise have had the resources to build a house of this type. This remains the case five years after the earthquake as living standards are extremely low and, rather than being caused by major disasters, poverty and vulnerability are more fundamental factors (and are exacerbated by an accumulation of minor events).

Having improved living conditions is particularly important to PwD. Usually the poorest of all vulnerable groups, the shelter has provided them with safe and durable housing. The modifications made to each house to meet their occupants' accessibility needs have improved security around the shelter, from the road and to the latrine, thus providing PwD with greater independence.

However, overall, living conditions are not as good as they could be due to issues such as the permeability of the walls and the fragility of the roof, as well as due to the fact that there are no partitions inside the T-shelter to provide privacy.

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[39] PwD are also often usufructuaries of private land that usually belongs to a relative and which often provides good long-term security of tenure. In addition, and by way of comparison, all of the vulnerable tenant households visited continue to occupy their shelters (12 cases).

[40] Not all families are able to afford the cost of building a new latrine.

2. Impact on Local Communities

In addition to providing direct benefits to T-shelter beneficiaries and occupants, the program has also benefited local communities, most notably by constructing schools, but also by having an impact on communities' living environment.

a. Living environment

As the project's aim was to target vulnerable people, the HI program particularly focused on the poorly developed areas of the *mornes* hillsides between Petit Goâve and Grand Goâve. To ensure effective implementation of the project, discussions were held with representatives of these areas (the CASEC and ASEC), as well as with the municipality (the technical department and DPC). During our interviews, these local authority representatives commended the project for having selected areas with fewer public services and assistance programs. They also highlighted the overall improvements made to living conditions and sanitation for these communities. For the local representatives, the project also helped build a closer working relationship between community leaders and local authorities; a relationship that has since been maintained through work on other projects.

Due to their remoteness and lack of facilities, these areas have very low resilience to disasters. The project has thus helped improve this resilience by reducing the damage caused by the various weather hazards that have affected the region since the earthquake (including the most severe events, such as Hurricane Matthew) and by enabling people to continue living and working in the area. However, despite this, as these areas are extremely financially dependent and under-developed (access to services), their inhabitants remain highly vulnerable to weather-related and seismic hazards. They are far more vulnerable than people living in urban areas, hence the continuing large-scale rural exodus. The T-shelters are not enough on their own to extricate households from situations of vulnerability, exclusion or marginalization.

However, the construction of safe shelters has had less of an impact on overall construction quality. The techniques used have not been replicated, due both to a lack of resources and to the fact that the housing provided does not correspond to the younger generation's aspirations. Nevertheless, the project did promote the use of local construction techniques, which were adapted to meet para-seismic and disaster-resilience standards, and has thus informed the development of other construction projects in Haiti.

As far as the project's environmental impact is concerned, the timber used for shelter construction was imported, which meant that the project did not add to the already severe local deforestation. In addition, the common installation of latrines has helped reduce wastewater discharge into the sea and rivers, thus lowering both pollution of the water tables and the spread of disease. However, the construction of latrines along the coast (Petite Guinée) has not helped preservation of this area (which is a major environmental issue according to the municipality).

b. Schools

The construction of schools in the *mornes* area has had a number of major benefits. In particular, these schools have helped improve the working and learning environment for both teachers and children and they provide greater physical security during weather or seismic events. In addition, the project has importantly provided these communities with a building specifically for education as, previously, lessons were held in multi-purpose buildings, such as churches. This means that teaching staff and children always have a classroom available (no conflicts of use) in which lessons can take place undisturbed (fewer interruptions caused by other activities). In several of the schools, the project has thus helped increase school capacity and attendance (see A.5).

The classrooms can be used for other activities, such as hosting local organizations' regular meetings. Due to their hazard resistance, they also served as a refuge for people affected by Hurricane Matthew. However, the permeability of the walls, which let in both wind and rain, means the classrooms could not be used as shelters during the hurricane itself. Nevertheless, due to their hazard-resistant construction, lessons in the schools were able to resume only a few days after the hurricane.

3. Economic Impacts

a. Lower housing-related costs

The construction of T-shelters for victims of the earthquake helped reduce not only their immediate disaster-related costs (temporary accommodation, repairs, etc.) but also the longer-term costs of building or renting a new home. As the earthquake severely reduced families' resources (due to job losses, price increases, relocations, etc.), this financial benefit is not to be overlooked. However, the shelters enabled their occupants to merely reduce their spending rather than make any real savings, which could have been used to pay off debts for instance[41]. Our discussions with the beneficiaries revealed that in some cases, the lower housing-related costs have enabled them to make small savings, which they have used to pay school fees or invest in economic activities. However, it remains difficult to objectively assess and quantify the savings made due notably to the lack of comparative data and the difficult economic environment (informality and numerous stresses).

It is clear that the project has helped reduce housing-related costs (particularly as regards housing of this type). The visits showed that these impacts remain weak as they have neither led to the development of economic activities nor significantly helped improve living conditions (equipment, furniture, etc.); however, it may be worth conducting a specific study into some of the impacts the project has had on schooling or health[42].

Moreover, the impact of these lower housing-related costs is reduced as soon as the T-shelters start to need maintenance or repairs. Up to now, the good shelter design and construction quality has meant only a few such repairs have been required. However, five years after their construction, and as highlighted above, the T-shelters are increasingly starting to show signs of wear and tear that will necessitate repairs. This work is costly and something that most households cannot afford, thus it is likely that households will only find the money required to carry out the repairs - as cheaply as possible - once the situation becomes urgent.

b. Few economic activities

During our visits, we noted very few instances where the T-shelters were being used for economic activities rather than housing. Only two changes of use were recorded: one shelter is now being used as a coal store and another is a *borlette*, a booth selling lottery tickets. There were also a further two shelters that, in addition to providing housing for their owners, were also being used as small sewing workshops.

According to the local representatives, the project's greatest economic impacts were felt during the shelter construction phase. Each T-shelter beneficiary family was given a sum of 2,400 HTG (US$60 in 2011) to pay

[41] Given the extremely low incomes of the beneficiaries (particularly PwD), without HI's support, the families would certainly have adopted inexpensive housing strategies (basic construction with local or recycled materials or lodgings).

[42] There is no data available on school attendance or the level of access to health

whichever day laborers they decided to hire (laborers, workers to transport materials, etc.), which helped boost cash flow within the affected local economy. In addition, many of the foremen worked in the communities for a number of weeks and provided business to small eateries and shops. The construction of schools also triggered the same impacts, as HI employed a substantial number of day laborers over a period of several weeks. In both cases, the sums involved were relatively low; however, outside of urban areas, job opportunities are few and far between and even a few days' work can make a great difference to a household's income.

c. Limited impacts for the foremen

Several dozen laborers and foremen, divided into 12 to 18 construction teams (employees or subcontractors), worked full-time during the T-shelter construction phase, both in the prefabrication workshop and on the construction sites themselves. There was also a group of around thirty carpenters, including apprentices[43], who worked on prefabricating the shelter parts.

Our meetings with the foremen and carpenters (23) revealed that all are still working in construction, even if only part-time (supplementing this with other activities). Working with HI provided them with high quality training on timber construction techniques. However, today, most of their work involves carpentry and masonry and none of the foremen have since worked on other timber-framed construction projects as they state that their clients all prefer more 'permanent' buildings. Some of the foremen have worked on other projects (GAA-Help), through which they received training on reinforced masonry techniques (in conjunction with MTPTC).

The HI T-shelter and school construction sites remain a benchmark for all the foremen interviewed as their involvement in the project has led to other contracts and some have continued to regularly work together, both foremen and those who were still apprentices at the time of the project. Certain T-shelter owners have hired the foremen that worked on constructing their shelter to carry out improvements, build an extension or help dismantle, move and reassemble the shelter.

[43] AJPV (Association de la Jeunesse Progressiste de Vialet)

V. Conclusions and Recommendations

The evaluation conclusions and recommendations are intended for use by transitional housing construction projects being implemented in similar contexts.

A. Hazard-Resistant Shelters

The T-shelters (and schools) developed by HI provide their occupants with guaranteed **physical protection in the event of a disaster** through their design and construction, which ensure the shelters are resistant to weather-related and seismic hazards. However, this structural resistance risks being diminished over time as environmental factors (damp, the sun, etc.) and localized geomorphic phenomena (erosion, accumulation of debris, etc.) cause the T-shelter materials to deteriorate. The technical design of the T-shelter has guaranteed good para-disaster protection but appears to have under-estimated the environmental impacts.

R1. Ensure the long-term structural integrity of the T-shelters in order to guarantee people's physical protection, as well as their resilience to hazards. This should include properly anticipating the progressive deterioration caused by environmental factors and reducing maintenance requirements. Low extra financial investment on shelters might extend their lifespan for many years.

R2. Incorporate more of the technical or architectural building protection techniques used in 'modern' rural architecture[44]: stone or masonry footings, posts separated from the foundations by a bottom plate or metal struts, overhanging roof or extended slabs, etc. The introduction of some of these elements will not necessarily increase the complexity and time required to construct the shelters but their inclusion will significantly improve the shelters' durability and longevity.

R3. Extend the high risk area identification study (zoning) by analyzing local phenomena in order to modify the location or construction of the shelters accordingly (raised floor, size of the slabs and foundations). This analysis can be carried out by observing the topography, the condition of existing buildings and surrounding vegetation. These site analyses and building adaptations could be systematized to limit their impact on project budget and timeframe (construction away from steep slopes or areas of significant aggradation).

With traditional rural houses, the fragility of the frames and materials used means that regular maintenance work is required (floor, rendering, roof, etc.), which can be carried out relatively cheaply using local materials (local timber, earth, etc.). The T-shelters built by HI are based on this type of housing but the construction method has been adapted to meet the required para-disaster technical standards, enable the use of a single model and facilitate logistics and prefabrication. Thus, the T-shelter design has introduced new construction techniques and imported materials. The changes made to this traditional type of housing and the relative complexity of their construction has, in most cases, made repair and maintenance tasks too complicated and costly for poor families to carry out.

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[44] CRAterre, *Assessing local building cultures for resilience & development- A practical guide for community-based assessment*, 2015.

In addition, the development of a single construction and architectural model has proved to have a number of limitations. As the shelter was designed for construction in flat rural areas, it meant that HI was unable to implement the project in the *mornes* (too many logistical hurdles for transporting materials). The T-shelters were also rather unsuitable for urban areas (space for installing the shelters, relevance of the design).

R4. Design shelters that can be easily repaired using simple construction techniques and identify the various repair techniques that could be used (as these are often different to the techniques used during construction). Develop T-shelter repair and maintenance handbooks and training for professionals. These handbooks should take local construction practices into account by providing guidelines for carrying out repairs using local materials and well-known techniques.

R5. Draw on local practices to develop different models for different environments in order to encourage modifications, facilitate repairs or minimize building material transport costs. For instance, in some areas, shelters made of blocks, stones or earth may have been more appropriate than the timber-frame prefabricated shelters (or may have complete it) and the use of different building techniques would have made possible a more pertinent and extended intervention in the *mornes* or peri-urban areas.

The T-shelter design and construction method (prefabrication) means they can be **dismantled, moved and reassembled**. This is a major benefit in a region where safe housing is rare and the house is often a family's main asset. When moving house, a large number of beneficiaries have thus taken advantage of this option in order to either continue living in their shelter or sell it on. However, most of the T-shelters that have been moved have lost some of their structural resistance, as they have not been reassembled correctly.

R6. Encourage safe relocations by making it easier to dismantle and reassemble the shelters. Options include developing a handbook, numbering the various sections of the frame or developing different methods of fixing the shelter frame to the floor that are simple to implement and guarantee a minimum level of security.

B. Appropriate Architectural Design

The architectural layout of the T-shelters meets the needs of the majority of the beneficiaries as the shelter surface area is tailored to the size of the family and shelters have been adapted to facilitate access for PwD (ramps, handrails, etc.). Consequently, only a few modifications (extensions, walling in of porches) have been carried out by the beneficiaries themselves. The low number of modifications made can also be attributed to the fact that the beneficiaries generally have very low incomes, with the majority of improvements having been made by vulnerable households (comparatively less poor than PwD). The few 'architectural' changes made to the shelters visited have mainly centered on the porch, which is used as the main living space during the day and also serves as a meeting place and form of social status. Thus, the aim of the modifications made has been to improve both the porch's use (privacy) and its appearance (painted, surrounded with a decorative railing).

One of the weaknesses of the T-shelter is the permeability of the *clissage* wall panels. Many of the beneficiaries have thus made improvements to these; however, their choice of materials exposes their lack of financial resources. Rather than using rendering or durable materials, as the project had anticipated, beneficiaries have instead opted for less costly materials (plastic sheeting, recycled materials). This shows that the beneficiaries have been unable to raise the funds required to sustainably improve their shelters, not even to address a basic need.

R7. Anticipate the fact that beneficiaries may struggle to afford to improve their shelters and adapt to beneficiaries' financial resources. Thus, the T-shelters constructed for the poorest families should guarantee adequate living conditions upon delivery, without the need for further action on the beneficiaries' part. More

accurately assessing beneficiaries' capacity to carry out work on the shelters would make it possible to design specific models (or finishes) for different beneficiary income levels.

R8. Ensuring the shelter is properly sealed from the elements is vital for providing decent living conditions. However, on a modular housing project, in order to enable future improvements or extensions to be carried out, only one part of the shelter can be sealed.

R9. Support the households to carry out essential work on the shelters in order to ensure adequate housing for all. The assistance provided should be tailored to the beneficiaries' level of financial resources (training, provision of materials, etc.). The project should cover the cost of all work on the shelters of the poorest households.

The weakness of the *clissage* panels also prevented the shelters and schools from being used during Hurricane Matthew. The T-shelters and schools withstood the high winds (which were moderate in the region) but were unusable in the hurricane as they let in rain. However, their structural resistance meant that the shelter beneficiaries were able to move back in soon after the hurricane had passed and lessons in the schools were quickly resumed. Some of the schools were also used to temporarily house affected families.

R9. Ensure that the shelters built can be used for different purposes and, particularly, as a refuge during extreme weather events or earthquakes. This is particularly important for community buildings, such as schools, located in remote and under-served areas where there are often no other hazard-resistant buildings available.

A key advantage of the HI-designed T-shelter, and one that is recognized by both beneficiaries and the authorities, is its structural solidity, which is a feature lacking from many of the models developed by other NGOs. However, there are two factors preventing people from accepting the T-shelter as a permanent housing option or real alternative to a block-built home. The T-shelters are often considered to be temporary (damaged roofs, lightweight joinery) or 'unfinished' (*clissage* panels or plastic sheeting), which undermines their image and means they are perceived as being no different to other temporary shelters.

R10. Properly finishing (rendering) the T-shelter could help promote the more widespread use of safe and modular timber-frame buildings and improve their social acceptance, among both inhabitants and the authorities.

C. Improved Living Conditions

The T-shelters have helped substantially improve their beneficiaries' living conditions, predominantly by providing them with safe homes and access to sanitation. Although living conditions remain harsh, particularly with regard to access to services and job opportunities, the shelters have also helped to house the communities' poorest households. Thus, the T-shelters have improved the living conditions of all the beneficiaries; however, some disparities remain, no doubt due to the standardized approach used by the project. Overall, the situation remains particularly precarious for PwD and, while the T-shelters have helped increase their mobility and independence (at home), they are still highly vulnerable.

R11. Introduce specific approaches to meet the different needs and vulnerability levels of the target group. Vulnerable households form a heterogeneous group, whose needs may need to be further assessed in order to create sub-groups of beneficiaries in especially precarious situations (particularly PwD).

R12. Supplement housing programs with additional components or forge links with other initiatives to provide access to healthcare, services or jobs and thereby take parallel action to address some of the more underlying causes of vulnerability affecting the target groups (particularly PwD).

The project ensured that assistance was provided to the most vulnerable groups by opening up the project to all regardless of their tenure status (rather than restricting eligibility to landowners only as is often the case). By designing a movable shelter, the project ensured all beneficiaries were placed on an equal footing and was able to overcome the obstacle of informal land tenure, an issue that all post-earthquake reconstruction organizations recognize as being a major constraint. In addition, people's trust in the informal land rental and loan agreements (whether for financial gain or to provide mutual aid) proved to be well placed as no evictions were reported.

R13. Continue to recognize the various types of land tenure and ensure housing programs remain open to people with informal tenure status. However, an assessment will need to be conducted in each project area to ensure the project does not legitimize high-risk cases (house-building in ravines, flood-prone areas or on steep slopes) or illegal situations (infringement of urban planning laws, conflict, etc.).

The classrooms are proving to be a huge asset for communities in the *mornes*, an area that large-scale assistance programs (distribution, housing construction) often overlook. These classrooms have improved teaching conditions, can be used for other activities and are helping to improve the communities' resilience capacities. However, as with the T-shelters, had these classrooms been made less vulnerable to the elements (*clissage* panels) and been provided with more facilities (too few latrines), these benefits would have been even further enhanced.

R14. Design and develop durable community shelters that are able to withstand weather and earthquake hazards and which can be used as refuges. It is important to properly estimate the number of people likely to be using these facilities so that their size can be adapted accordingly and in line with national standards or international guidelines.

D. Target Areas

The project impacts vary significantly in line with the different environments in which the project was implemented, namely rural, peri-urban and urban areas. These disparate impacts are due to differences in people's ways of living and to contrasting dynamics. The palm region is home to both a stable rural population, for whom their house is a static asset and remaining in their family for generations, and more mobile households who move to seek work and improved access to services. Within this latter group, there are the renters who move relatively frequently (in urban areas) and also a large number of households who settle in one place and build their own home (mostly in peri-urban areas).

The project design successfully met the needs and expectations of the rural population as the type of shelter developed meets their usage requirements and is socially acceptable in rural areas, where it is often considered a permanent house.

The peri-urban areas of Petit Goâve and Grand Goâve are currently experiencing rapid urban growth as more and more families move into these areas in search of affordable housing near urban centers. The project provided this type of housing, but did not endeavor to bring any order to the sometimes chaotic layout of shelter plots, which could limit the future development of these areas. This is despite the fact that uncontrolled urban growth is a well-known phenomenon in Haiti as it has given rise to numerous informal urban settlements (notably in Port-au-Prince), which are now among the most vulnerable areas in the country.

R15. In urban and peri-urban areas, consider land use as a long-term development factor of the neighborhoods which need to be taken into account in order to ensure more rational spatial development and increase people's resilience to disasters. Even when implemented on a small-scale, housing projects need to factor in

land use, both by consolidating current use and by anticipating future needs (corridors and roads, waterways, amenities, networks, green space, etc.).

In urban areas, current dynamics are more complex and developing housing projects thus also involves taking a range of other related issues into account such as land use, density, networks, etc. Land tenure situations can also be complicated (no land use plans) and people are often occupying the land informally (no contract documents or title deeds). Thus, intervening in urban areas always require to collaborate with a multitude of bodies and complete numerous administrative procedures. Implementing projects in such environments without addressing land tenure can often result in a project legitimizing chaotic land use situations instead of improving them, and this applies to both temporary and permanent housing construction programs.

R16. When developing urban housing projects in Haiti, it is important to address the problems being encountered in Haitian towns and cities, particularly land use management, even if this is only on a small-scale. Reconstruction phases need to be used to initiate sustainable change (land consolidation).

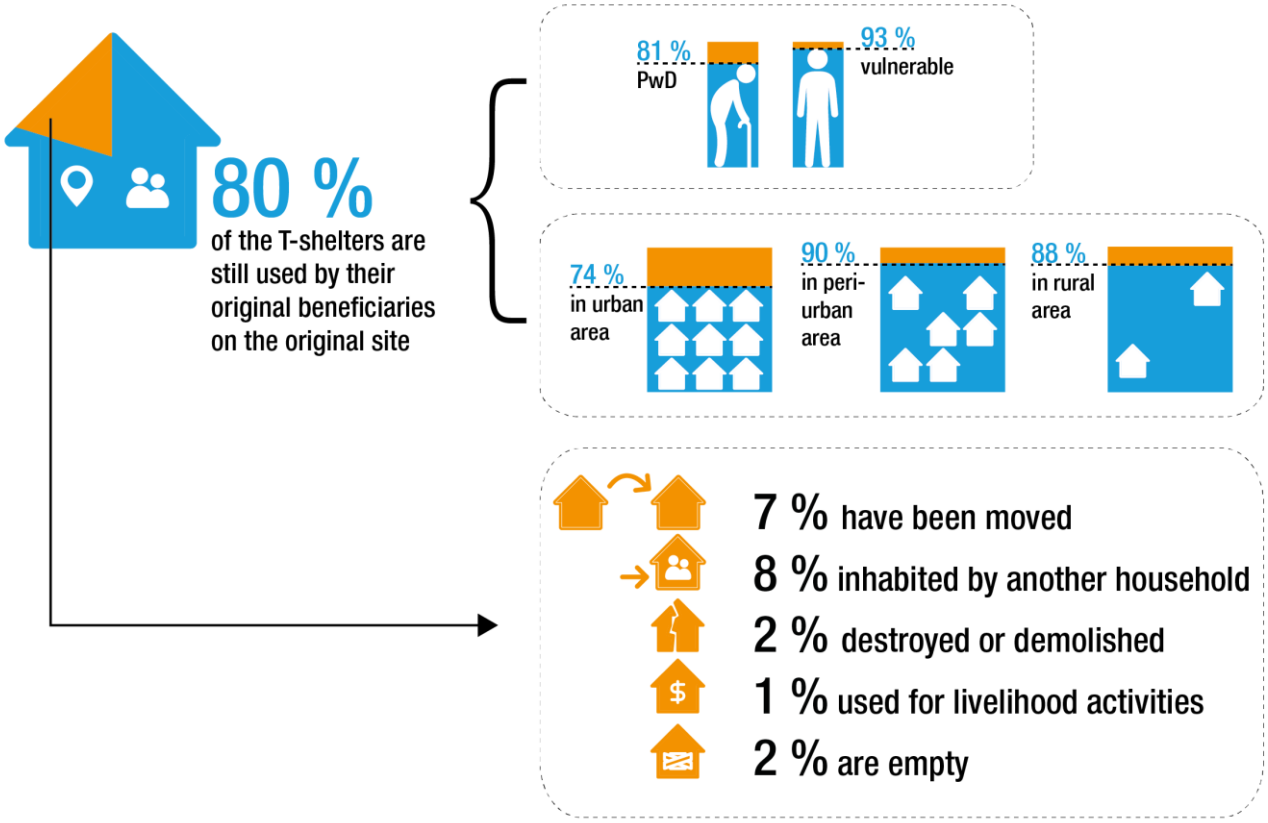
Urban households also have different aspirations to people in rural areas, meaning that the T-shelters have not been fully accepted and hence are poorly maintained (despite their beneficiaries' higher means) and remain little changed. The standardized T-shelter model was thus not particularly suited to urban areas, not only because of its architecture, but also because it was difficult to adapt the standard model to fit with space constraints and specific uses. The ability to move the T-shelter has also proved to be less relevant in urban areas and, in most cases, they have been sold on or rented out instead.

R17. When working in towns and cities, consider other approaches for improving housing conditions, such as renovating existing houses or improving security of tenure.

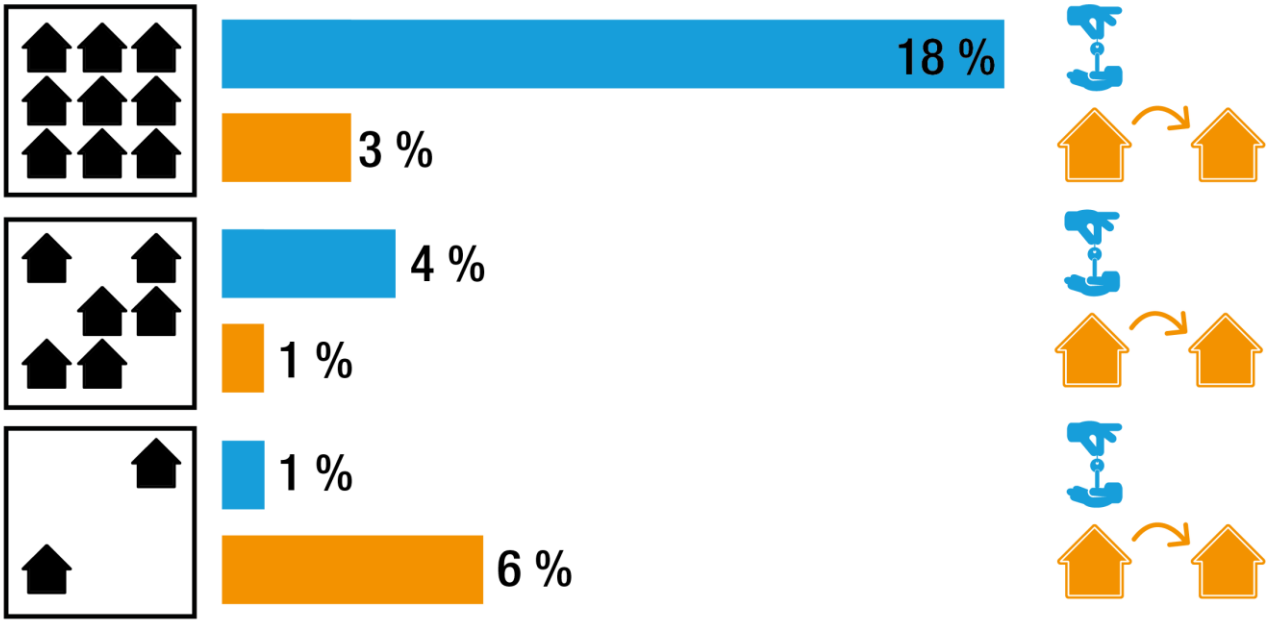
R18. In urban areas, develop alternative, tailored housing options that meet spatial requirements and social expectations, such as semi-detached or multi-story houses. The aim should be not only to adapt to specific situations, but also to foster changes to ways of living and to space management by proposing innovative alternatives. Such projects should also take into account the social connotations of the housing models proposed in order to ensure their acceptance.

VI. Graphic Overview of Results

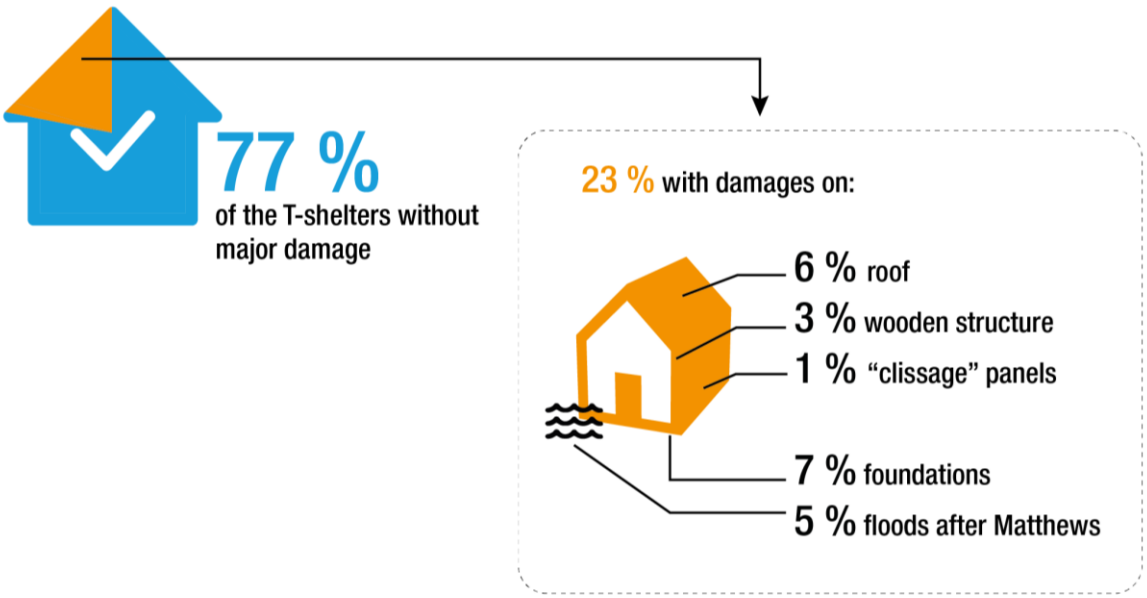
A. Evolution of T-shelters' occupancy after 5 years



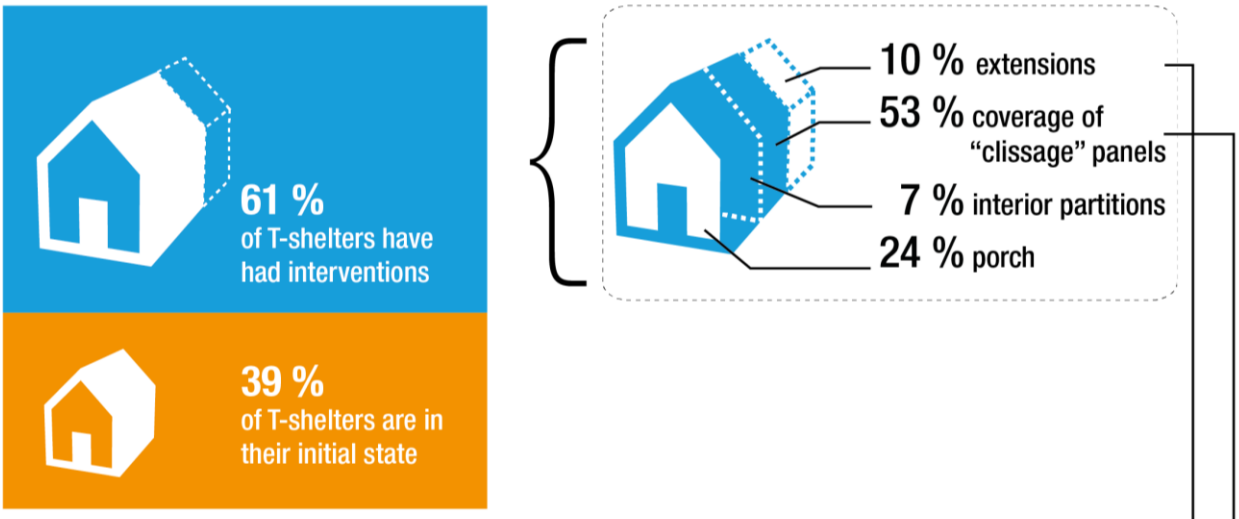
B. T-shelter transactions and displacements according to contexts



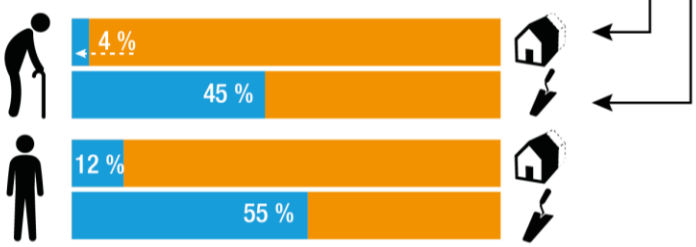
C. Overall condition of the T-shelters after 5 years



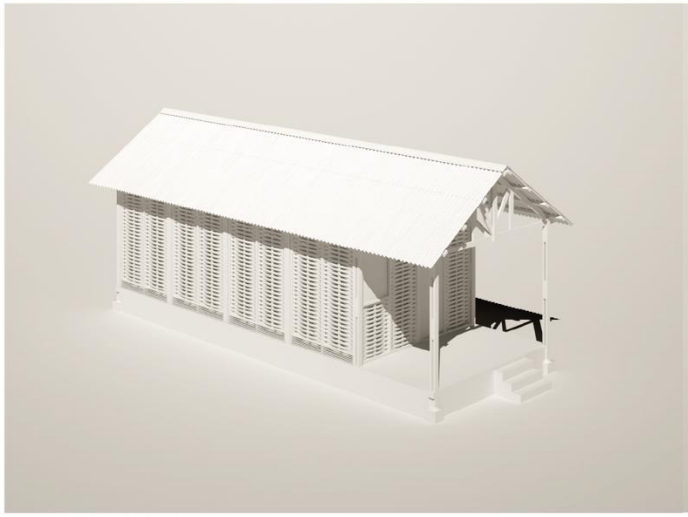
D. Improvement works and extensions



E. Undertaken works per target group



VII. Visualization of common modifications on shelters



a. standard shelter

b. plastic sheets to cover clissage walls

c. metal sheets to cover clissage walls

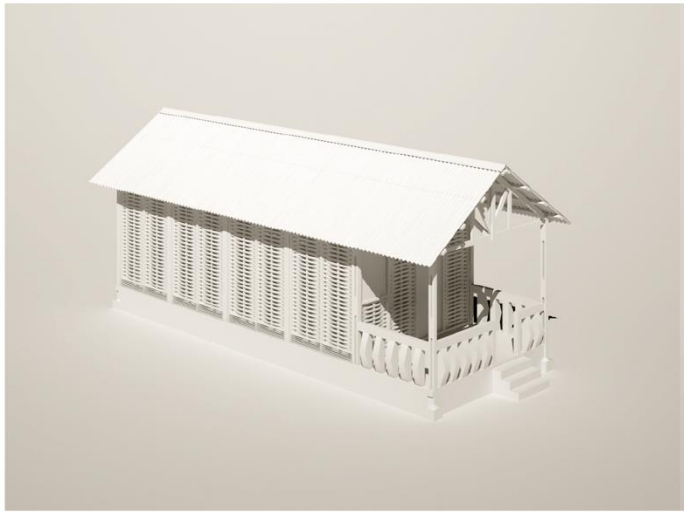
d. simple porch improvement

e. cement rendering

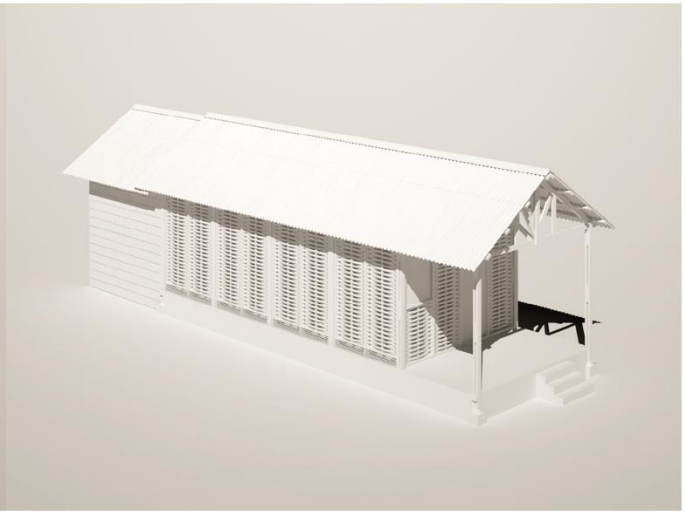
f. porch closure with plastic sheets

g. clissage pannels moved to close porch (1)

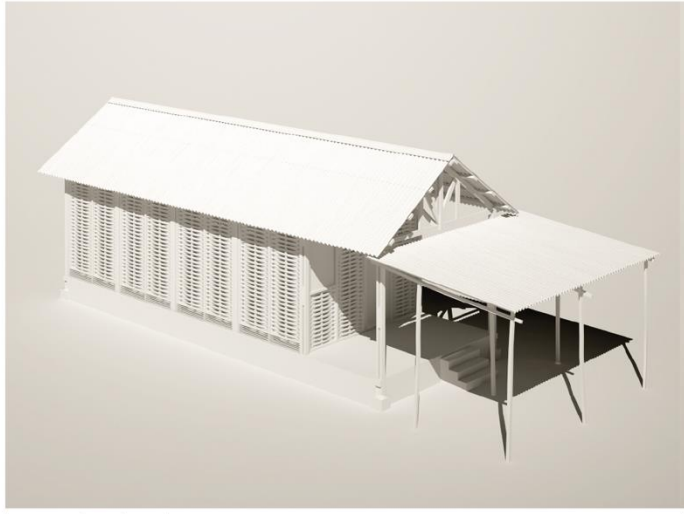
h. clissage pannels moved to close porch (2)



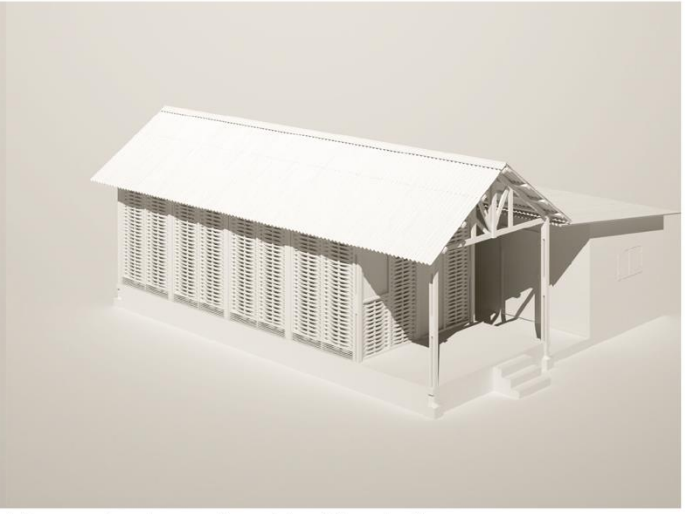
i. cement railing on the porch



j. extension at the back of the shelter



k. porch extension



l. large extension on the side of the shelter

VIII. Annexes

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2. List of Foremen and Carpenters

Foremen:

Jonas Saint Jous	37427365
Jean Ebert Sharles	37950067
Laguerre Wilner	37308051
Placide Wilner	
Wilson Laperre	36711917
Gabriel Eligeste	36222714
Neptune Mario	37529334

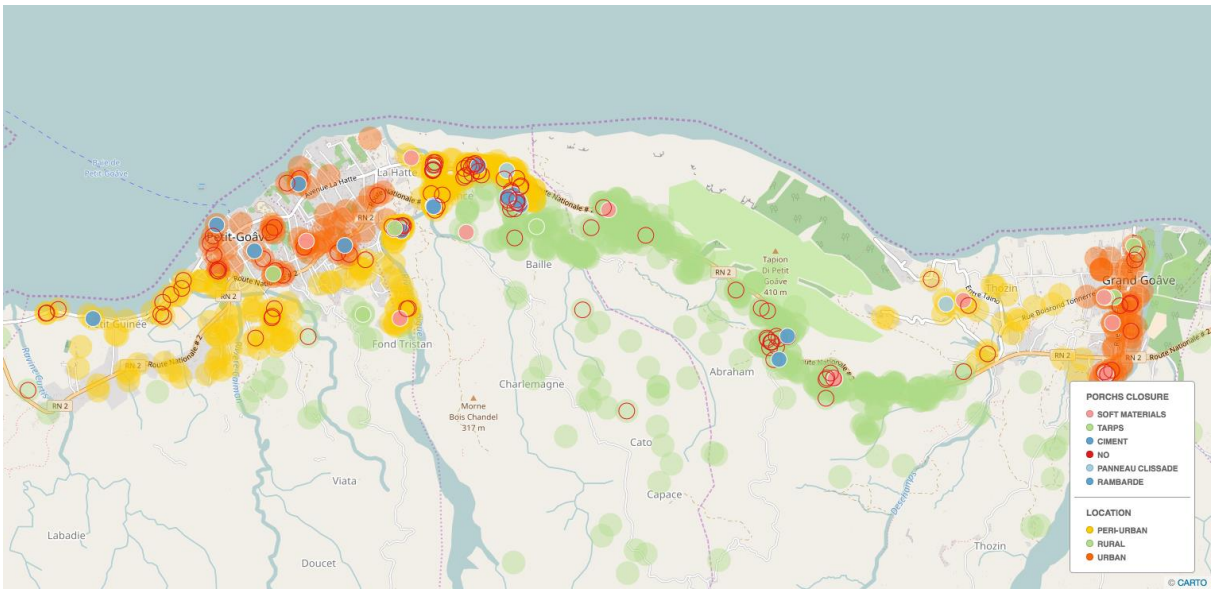
Carpenters:

Enord Joseph	37821529
Pierre Vilus Neczil	37105456
Exilus Maxo	37736328 / 31006445
Bazil Ronald	31008342
Rodner Louis	37947716
Carmelle Odette Cerisier	31413707 / 33204134
Edouard Benisoir	46969156
Zetrene Jean Obert	31540889
Leger Gerard	37301363
Derilis Jean Lilus	36939193
Idejene Calixte Michael	38190651
Guillaume Fatal	37301250
Edoazin Ive Rozenal	34297920
Paintdujour Serenor	47741912
David Noel	37157984
Desgranges Lusson	

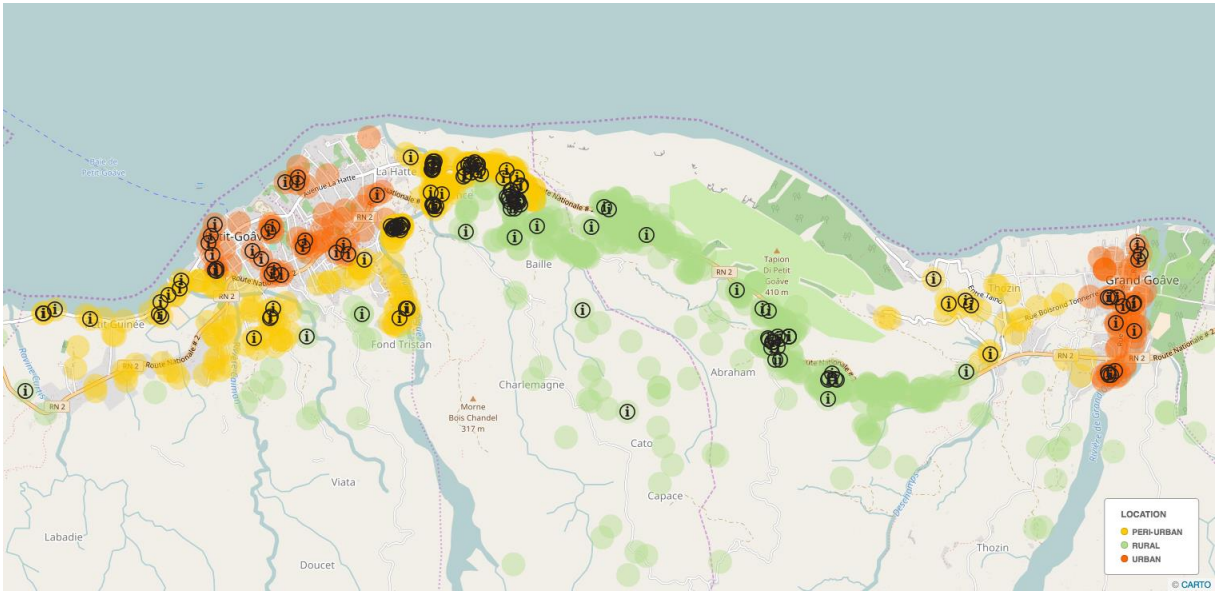
3. Interactive Map

Screenshots extracted from the online interactive map :

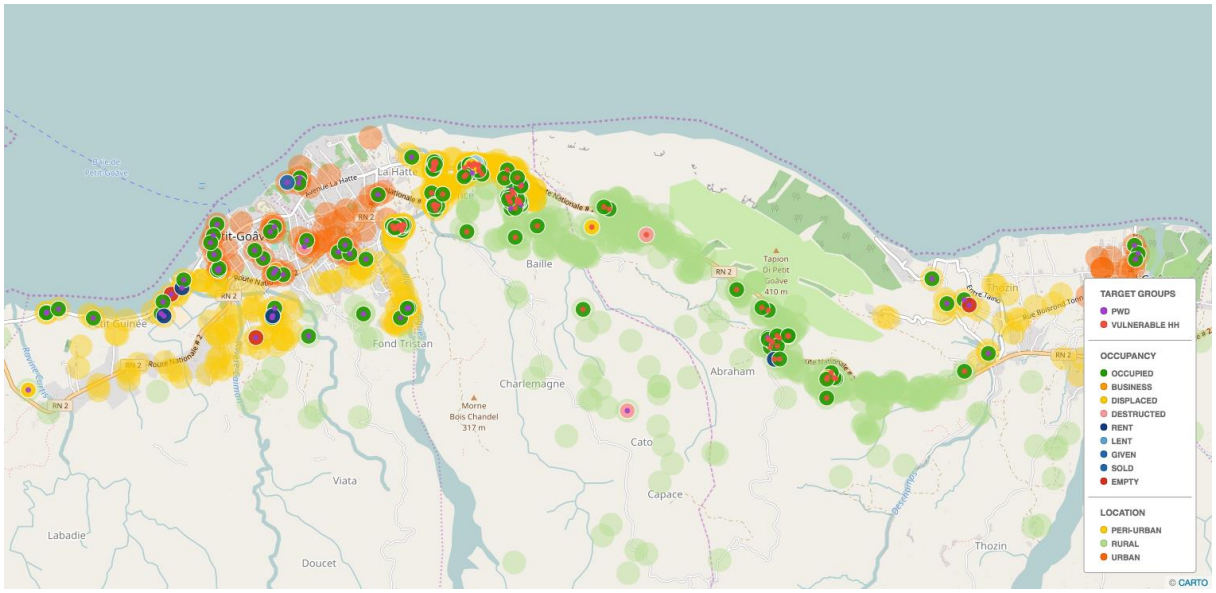
https://lesimon.carto.com/viz/a6a14092-cce9-11e6-862e-0ecd1babdde5/public_map



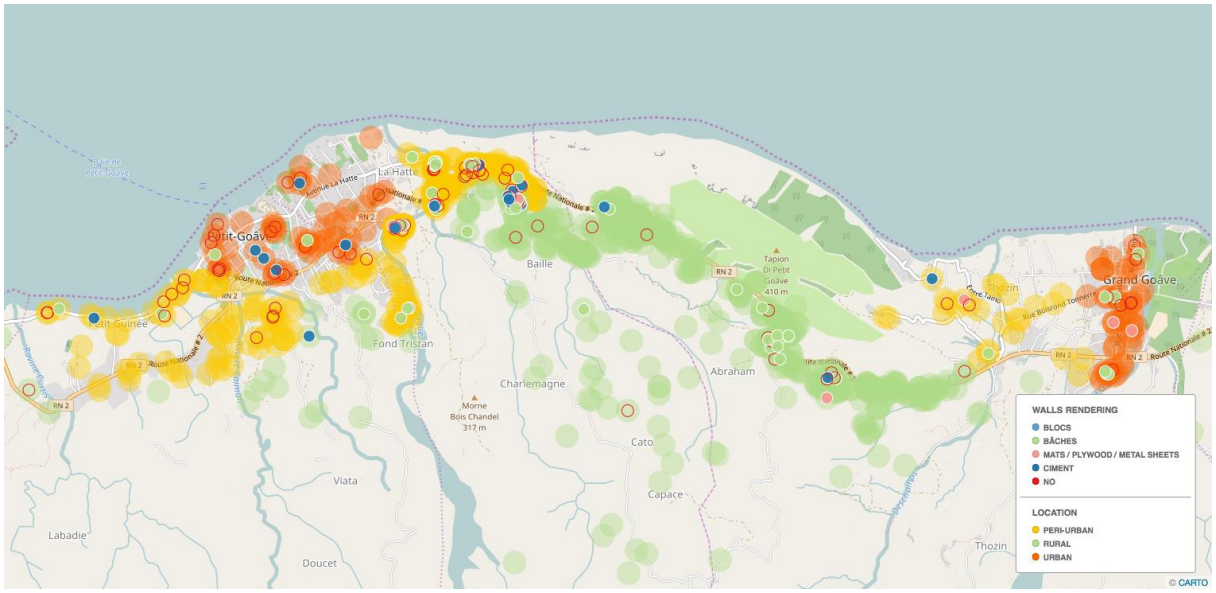
Porch closures per shelter location



Visited shelters



Occupancy per shelters location and target groups



Material used for walls rendering per shelter location

4. Impact Evaluation Matrix

Main evaluation questions	Sub-questions	Method of data collection
Impact		
Are there any positive or negative effects on beneficiary lives?	What are the long-term projects impacts on beneficiaries lives ?	Interviews with beneficiaries Observation during site visits
	To what extend the project support the settlement of people in their living area ?	Interviews with local authorities and community leaders
To what extent has the project supported self-sufficiency and development of livelihood opportunities?	Did the project support the development of economic activities (construction) ?	Interviews with beneficiaries FGD with contractors and bosses Interview with local MTPTC
	To what extend the provision of shelters support self-reliance and livelihood/economic activities? e.g. shelters used for economic activities (shops, workshops, …)	Interviews with beneficiaries Observation during site visits Photographic report
	To what extend did the project foster PwD recognizance and support them to be self-reliant and develop livelihood opportunities ?	Interviews with beneficiaries Observation during site visits Interviews with community leaders
	Were the young carpenters from Association de la Jeunesse Progressive de Vialet able to develop their professional activities?	FGD with contractors and bosses Interviews with community leaders
	To what extend the project supported the subcontractors to develop their professional activities?	FGD with contractors and bosses Interview with local MTPTC
Sustainability		
Are beneficiaries still using their shelter?	Have shelters been sold? rent? borrowed? For what purpose (residential, commercial,)? Where they displaced or are they still on the same plot? What are the average rent/sale price? What was the reason for this (need space, need money, not suitable for intended use, …)?	Interviews with beneficiaries Observation during site visits Photographic report
	To what extend does the rural/urban context influence the use, appropriation and evolution of the shelter ?	Interviews with beneficiaries Observation during site visits Photographic report Interviews with local authorities Interviews with DATIP representative
	To what extend does the occupancy status influence the use, appropriation and evolution of the shelter ?	Interviews with local authorities Interviews with community leaders Interviews with beneficiaries Observation during site visits Interviews with DATIP representative

	To what extend does the shelter location on the plot influence the use, appropriation and evolution of the shelter ?	Interviews with beneficiaries Observation during site visits Photographic report
To what extend contracts and occupancy status had an impact on project sustainability?	Have the agreements between the beneficiaries and the owners been extended after the 3-year initial period ?	Interviews with beneficiaries
	Were cases of eviction reported during the 3-year period ?	Interviews with beneficiaries Interviews with community leaders
	Were the T-shelter the subject of dispute at the term of the agreement period of other rent/occupancy contract?	Interviews with beneficiaries Interviews with community leaders
	To what extend beneficiaries consider the agreement has protected them (in comparison with other classic formal or informal contract)? To what extend the agreement provide beneficiaries a long-term protection?	Interviews with beneficiaries
What are the benefits of the individual shelter intervention at community level ?	What are the long-term impacts of the shelter projects for the local population (reduce inequalities in terms of housing, generalize access to individual sanitation solution, foster economic development, …)?	Interviews with beneficiaries Interviews with community leaders Interviews with local authorities Interviews with school representative (teacher)
	Did the project foster PwD self-reliance?	Interviews with beneficiaries Interviews with community leaders Interviews with local authorities
	Did the project foster the recognition of underserved areas (involvement and empowerment of local authorities and community leaders, …)?	Interviews with beneficiaries Interviews with community leaders Interviews with local authorities
	To what extend shelters support community resilience (less displacement, less school drop, interruptions of economic activities) ?	Interviews with beneficiaries Interviews with community leaders Interviews with local authorities Interviews with school representative (teacher)
	Is beneficiaries database can be used in the case of a new event (considering them as vulnerable population or resilient population) ?	Interviews with community leaders Interviews with local authorities Interview with local MTPTC
With a specific focus on the “morne intervention” are the classrooms still used	What is the current classrooms use? Did they had any upgrade, repair, … ?	Interviews with school representative (teacher) Observation during site visits Photographic report

and what are the benefits for the community?	What impacts did the project had on the schools functioning (more capacity, more attendance, more comfort, more security, …)? What wider impacts did the project had on local population ?	Interviews with school representative (teacher) Interviews with community leaders
	With a long-term perspective, what are the strengths and weaknesses of the classrooms design and construction?	Observation during site visits Photographic report Interviews with school representative (teacher) Interviews with community leaders
	To what extend did the classrooms host other activities (OCB, religious, economic activities, women, politic, …)?	Interviews with school representative (teacher) Interviews with community leaders
	Is the shelter used as a meeting point or collective shelter in the case of climatic events?	Interviews with school representative (teacher) Interviews with community leaders
To what extend beneficiaries upgraded their settlement? How adapted were the shelters to the specific needs of the beneficiaries (Age, gender and disability) and was it relevant and sustainable? Are there any durable evolution developed?	How did the shelters were adapted to address needs, including new needs (newborns, new disabilities, …) ? What were the main modifications (new door, kitchen, …)?	Interviews with beneficiaries Observation during site visits Photographic report
	Have the shelters been extended or modified (internal separation, structure modification, extension, ….)? What kind of modification have been necessary to ensure long-term use (residential)? Are main shelter characteristics still ensured after modification (earthquake and hurricane resistance, ventilation and airflow, …) ?	Interviews with beneficiaries Observation during site visits Photographic report
	Has the initial housing purpose of the shelter been modified (used for economic activities, …)?	Interviews with beneficiaries Observation during site visits Photographic report
	Do the beneficiaries still consider the Shelter as permanent? What kind of further modifications are planned?	Interviews with beneficiaries Observation during site visits Photographic report
	To what extend extensions are limited by the shelter and latrine location on the plot?	Interviews with beneficiaries Observation during site visits Photographic report
	To what extend the T-shelter construction supported or limited the construction of more permanent structure (localization on the plot)?	Interviews with beneficiaries Observation during site visits Photographic report
	To what extend does the concrete slab facilitate or limits further construction ?	Interviews with beneficiaries Observation during site visits Photographic report

	Does the construction typology allows easy extensions and upgrades (walls, roofs, …)? Does shelter dimensions fit standards equipment size (doors, windows, …)?	Interviews with beneficiaries Observation during site visits Photographic report FGD with contractors and bosses
	Is the shelter typology considered by people as a housing for poor people, elderlies or PwD (traditional vs modern construction) ? Were modifications done to make the shelter appear more or less « traditional » ?	Interviews with beneficiaries Interviews with community leaders Observation during site visits Photographic report
What is the impact of the shelters and latrines construction on the environment?	What long terms impacts do the shelters have on environment (wood use for repairs, …)?	Observation during site visits Interviews with community leaders Interviews with local authorities
	In the more densely inhabited areas, did the latrines concentration had any impact on the environment ?	Observation during site visits Interviews with community leaders Interviews with local authorities
What are the impacts of the program on urban / local development ?	Are the T-shelters still considered as transitional by the local authorities, project partners, … ?	Interviews with local authorities Interviews with local MTPTC and DATIP representatives
	How are the T-shelters considered by the urban development programs (land consolidation, roads, …)?	Interviews with local authorities Interviews with local MTPTC and DATIP representatives
Effectiveness		
Are shelters still existing, usable and in a good shape?	How are the shelters currently used ? What are their general conditions ?	Observation during site visits Photographic report Interviews with beneficiaries
	Have the shelters been recycled (materials used for others constructions) ?	Observation during site visits Interviews with beneficiaries
	Do the T-shelters continue to ensure accessibility to PwD? To what extend accessibility issues evolved since the construction of the shelters (deterioration, needs, …) ?	Observation during site visits Interviews with beneficiaries Interviews with community leaders
	Was the T-shelter construction typology replicated by beneficiaries or contractors? With the event of Matthew, were contractors solicited to undertake repairs?	FGD with contractors and bosses Observation during site visits Interviews with local MTPTC Interviews with beneficiaries
Are material used appropriate and resist to time and hazard?	What are the strengths and weaknesses of the construction (joineries, straps, frameworks, trusses, clissages, slabs, …)?	FGD with contractors and bosses Observation during site visits Photographic report

	Are beneficiaries able (themselves or a contractor) to repair or modify their shelter? Do they have the knowledge and financial means? Are materials et tools available to do such works? Are there any differences between rural and urban context ?	FGD with contractors and bosses Interviews with beneficiaries Interviews with community leaders Observation during site visits
What are the more frequent deteriorations and the weaknesses of the shelters' and latrines constructions? What are these deteriorations due to (time, hazard, etc.)?	What are the most frequent deteriorations? What are the most frequent repairs or upgrades (walls, roof, …)? are some deteriorations or weaknesses remain difficult to address ?	Observation during site visits Interviews with beneficiaries Photographic report
	To what events are the shelters most vulnerable (weather events)? How were initial issues on insulation and water leaks (winds) addressed by the beneficiaries?	Observation during site visits Interviews with beneficiaries Photographic report
	Are beneficiaries able to properly maintain or repair their T-shelters? Is maintenance required similar to the one needed in traditional houses (wooden structure and clissage)?	Observation during site visits Interviews with beneficiaries FGD with contractors and bosses
	Are all shelters located in rather safe locations (out of flooding areas, …)? Did the risks exposure locally changed since the shelters construction?	Observation during site visits Interviews with beneficiaries Interviews with community leaders Interviews with local authorities
	Did the use of traditional techniques allows a greater durability of the structure ?	FGD with contractors and bosses Observation during site visits Interviews with beneficiaries
Are the latrines built by HI used on an appropriated manner?	Do the beneficiaries continue to use the latrines on an appropriated manner (with a specific focus on the double pit latrines)?	Observation during site visits Interviews with beneficiaries
	What did beneficiaries do when latrines pits were filled?	Observation during site visits Interviews with beneficiaries
	Do latrines materials and instruction techniques (structure, pipes, walls, …) still ensure proper maintenance and hygiene ?	Observation during site visits Interviews with beneficiaries
At the time of the evaluation, compared to other NGOs' shelters, have the HI's shelters been more durables and solids? Have they been more adapted and upgraded than others?	How are the others T-shelters used, appropriated, modified?	Observation during site visits Photographic report
	Are HI T-shelters more durable than others ?	Observation during site visits Photographic report

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