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# MOBILE AND MODULAR SHELTERS

Innovation for protecting the lives and rights  
of the most vulnerable people during emergencies

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**TITLE: CAPITALISATION**

**MOBILE AND MODULAR SHELTERS**

**Innovation for protecting the lives and rights of the most vulnerable people during emergencies**

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**PLAN International**

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## Abbreviations and Acronyms

<b>CM-PMR</b>	Municipal Prevention, Mitigation and Response Committee
<b>COE</b>	Emergency Operations Centre
<b>DC</b>	Civil Defence
<b>DIPECHO</b>	ECHO Disaster Preparedness Programme
<b>ECHO</b>	European Commission Humanitarian Aid and Civil Protection Department
<b>EIRD / UNISDR</b>	United Nations International Strategy for Disaster Reduction
<b>FUNDASEP</b>	San Juan, Azua and Elías Piña Development Foundation
<b>DRM</b>	Disaster Risk Management
<b>INVI</b>	National Housing Institute
<b>MINERD</b>	Dominican Republic Ministry of Education
<b>DRR</b>	Disaster Risk Reduction
<b>SN-GRD</b>	National System for Disaster Risk Management







# Introduction

## About this capitalisation<sup>1</sup>

When engaging in capitalisation, the aim is to interpret an experience and extract learning that may be reproduced in other comparable contexts. This document therefore seeks to record an experience with innovative features, specifically the work carried out by the Plan-Oxfam-Habitat consortium in the framework of the “Warning, informing and including: Strengthening emergency information management, school safety and inclusive Disaster Risk Reduction” project, as part of the DIPECHO Action Plan 2013-2014 funded by the European Commission’s Humanitarian Aid and Civil Protection Department (ECHO).

This project has been implemented in the province of Azua (south west of the Dominican Republic), where nine communities have benefited from a large number of DRR activities, and one of them stood out for its capitalisation potential: the Mobile and Modular Shelters initiative. This document describes the entire process, from its design, which was based on a process of reflection and exchange of experiences between the consortium members, right through its implementation, with a focus on the testimonies of the beneficiaries and institutions that took part.

With this initiative, the Plan-Oxfam-Habitat consortium has added a new element that contributes practical community infrastructure solutions that guarantee shelter for displaced populations during emergencies under protection standards.

## About the methodology<sup>2</sup>

In order to fulfil the objective of a capitalisation it is essential to design and apply a methodology that allows us to obtain the key information. Due to the characteristics of the experience that we wanted to capitalize we opted for a qualitative-type methodology based on the definition and application of two tools: interviews and direct observation.

- **Interviews:** Once a script with open questions was designed, a total of nine interviews were held with key informants. The interviewees included the people responsible for the design, development and implementation of the Mobile and Modular Shelters, as well as the project coordinators, field promoters, and beneficiaries who were involved in this process.
- **Direct observation:** Achieved through a series of field visits, where we were able to get to know and verify the way the experience worked.

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<sup>1</sup> In this document “capitalisation” refers to the process of logically ordering and reconstructing a positive experience of a project by identifying the factors that have come in to play and how they have related to each other in order to generate new knowledge. This process is set out in simple and consecutive critical stages in order to promote its divulgation and replication in projects and programmes in diverse or similar contexts.

<sup>2</sup> For the methodological aspects a fundamental reference was made to the “Methodological Guide for the Systematization of Risk Management Tools”, (Mackliff F., EIRD/ECHO, 2011).

It should be stressed that the design and application of the information gathering tools, field visits and meetings with key actors took place with the help and support of Plan International, Oxfam Intermón, Habitat for Humanity and their local partners, which provided all of the information and logistical support for this purpose.

## About the intervention context

In order to understand the importance of creating capital from this experience, it must be defined within the context of the Dominican Republic.

The Dominican Republic, located in the northern Caribbean region, is categorized as being highly exposed to a range of natural hazards, mainly tropical storms, hurricanes and floods as well as earthquakes and tsunamis.

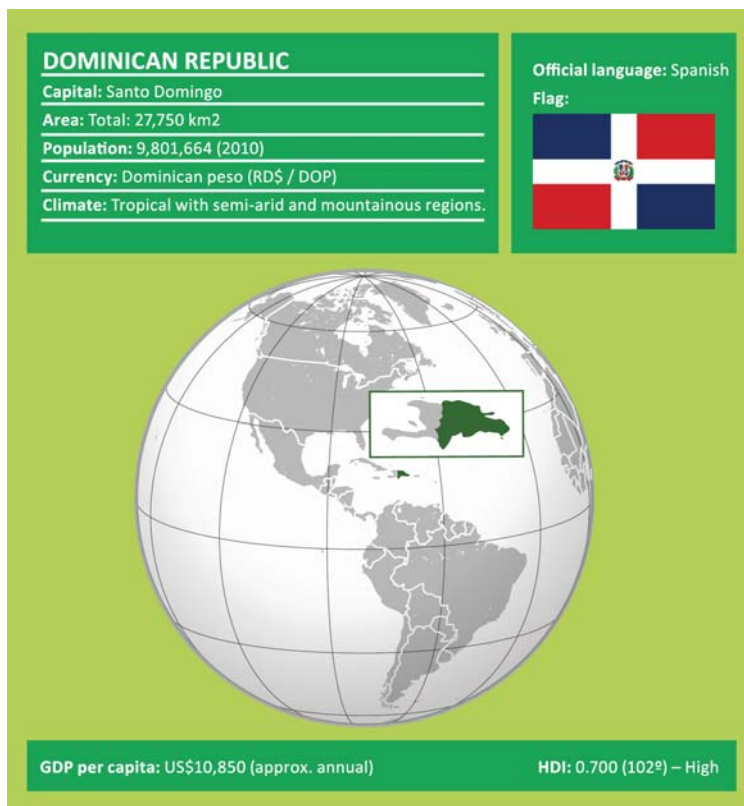
Hurricanes, for example, are recurrent phenomena. In the past 150 years more than 100 events of this type have directly affected the country. The Dominican territory is also especially prone to **flooding**, one of the most common phenomena, typically occurring throughout the year and not necessarily as a direct result of tropical storms<sup>3</sup>.

This is combined with the fact that the Dominican Republic's geography has a high level of seismic activity, due to the strong pressures and deformations of several fault systems and micro-plates that cut across the island of Hispaniola.

These natural hazards to which the country is exposed are also linked to the context of local vulnerabilities and capacities.

The poor socio-economic conditions experienced by a large part of the population and the weakness of the political-administrative system are determining factors in the country's capacities and vulnerabilities, which are combined with the hazards to which it is exposed. This is reflected in most of the country's regions and provinces, with the greatest consequences in the most deprived and isolated areas.

In this specific case, the experience that is being capitalized took place in the **province of Azua**, located in the country's south-western region. Like much of the Dominican Republic's territory, Azua has a high level of exposure to natural hazards combined with physical, socio-economic and environmental vulnerability factors, as well as being one of the country's least developed provinces. At provincial level, political-administrative



<sup>3</sup> 52% of floods in the country are recorded during the rainy season, and only 8.4% are caused by tropical cyclones (1966-2000).

decentralisation is still in process, which means that the relationship with the national authorities and local DRR skills transfer is still ongoing. These provincial characteristics are even more evident at community level, where the vulnerabilities are more accentuated and there are fewer capacities, which increases the risk and impact of disasters.

*“Our community is completely vulnerable to any type of disaster, because every time it rains we experience floods. We are also very near the shoreline and 80-90% of this area floods during storms.”*

Antonio Segura  
Municipal District Mayor,  
Puerto Viejo (Los Negros)-  
Azua

The project was implemented in nine communities in the province of Azua, with very similar features. However the communities of Palmar de Ocoa and Puerto Viejo (Los Negros) presented an additional distinctive feature: any natural event of a certain degree of intensity isolates them and cuts them off.

This was reflected by the impact of tropical storm Sandy (October 2012) on these areas, as well as the recent hurricane Cristóbal (August 2014) with torrential rains and 120 km/h winds, which led to several rural communities being cut off, forced the evacuation of 3,600 people, and resulted in three confirmed deaths.

All this reaffirms that both communities of intervention by the project were a priority setting for implementing the Mobile and Modular Shelters programme.

## MULTI-HAZARD MAP OF PUERTO VIEJO - LOS NEGROS (Floods, tsunamis, technological hazards)



Population of Azua province: 214,311  
 Illiteracy rate: 21.8%  
 Households without water at home: 72.8%  
 Households without sanitation: 15.9%  
 Overcrowded households: 26.0%  
 Households in extreme poverty: 21.6%









## Capitalising on the Experience

### In brief...

If the characteristics listed above are taken as a starting point it is understandable how these very exposed and vulnerable communities do not have the infrastructure for sheltering and protecting the population during an emergency. The only existing structures are the schools and rural health clinics, which means that they have to be taken over and used as shelters.

This is why, after considering a range of technically viable solutions that could be developed in order to provide a response to the lack of shelters with minimum protection standards, the Plan-Oxfam-Habitat consortium and ECHO came up with a cost-effective shelter system with maximum flexibility: the Mobile and Modular Shelters.

The mobile and modular Shelter is an infrastructure that can be assembled and dismantled, made up of prefabricated modules installed over a previously constructed concrete floor-base, with a capacity to withstand hurricane-force winds and designed according to earthquake resistant building codes.

This system contains innovative and replicable elements, making it a viable option for investment in protection infrastructures, which could become a nationwide initiative.

### Yesterday's situation

The province of Azua has been affected by a wide range of emergency situations over the years, which have caused large-scale physical and material damage, cutting of entire communities, displacing people and leading to the need for the authorities to develop local PMR mechanisms, as well as protection for the most vulnerable groups.

#### FACT SHEET – MOBILE AND MODULAR SHELTERS

**Name:** Mobile and Modular Shelters

**Actors involved:** Habitat for Humanity, OXFAM, Plan International and FUNDASEP, which led the design and implementation of the work; the Civil Defence and the Centre of Excellence, which accompanied the experience appreciating its usefulness and functionality within the National System for Disaster Risk Management; DG-ECHO which has provided sustained support throughout this initiative.

**Objective:** To guarantee safety and protection for the most vulnerable populations affected by emergencies or disasters, while supporting the fulfillment of State responsibilities and international humanitarian standards.

**Implementation period:** from 1st April 2013 to 30th September 2014.

**Direct beneficiaries:** 1,862 people in the community of Pueblo Viejo (Los Negros).

**Indirect beneficiaries:** Provincial authorities and the inhabitants of the province of Azua (214,311 people).

**Location:** Municipal District of Puerto Viejo (Los Negros) Province of Azua, Dominican Republic.

**Duration:** 1 month in the identification phase, 2 months in the development phase, 3 months in the implementation phase at community level, 2 months of follow-up.

**Cost:** EUR 29,000.00 per 266m<sup>2</sup> shelter (including water, sanitation, electricity and kitchen installations).

When the community of Puerto Viejo (Los Negros), was hit by tropical storms Sandy (2012), Olga and Noel (2007) or hurricanes David (1979) and Georges (1998), the waste water drains that go through the community overflowed and blocked road access, cutting off the population for several weeks. Unfortunately, this situation does not just happen during tropical storms: even heavy rainfall or light flooding (which occurs at least once a year) creates emergency situations and cuts off the community, leaving large areas under water and leading to the evacuation of many families.

Most existing community infrastructure and installations are inadequate for protecting the population during emergencies, as they only have a rural clinic and a school. At a nationwide level the schools, UNAPS or rural clinics are usually the only infrastructures built to national construction standards, and are therefore considered safe for use as shelters by the population during an emergency.

However, in the case of schools, extended occupation during emergency situations (e.g. due to hurricanes, severe flooding, earthquakes, etc.) affects **children's right to education during emergency situations**. One of the objectives of this project has been to promote the need to guarantee education during these periods, which involves promoting actions for preventing schools from being used as shelters, as well as raising awareness and sensitisation about the negative implications of using them for this purpose. In this case, the Mobile and Modular Shelters offer a viable alternative to using schools as shelters, also because school buildings cannot always respond in terms of adequate **water and sanitation services** for a displaced population due to their limited capacity, and the space is not organised in such a way that guarantees the safety of the most vulnerable population groups they are not accessible for **people with disabilities**.

In this context, **ensuring the safety and wellbeing of the most vulnerable groups** has probably been the main motivation for seeking alternative solutions to using these premises as shelters. Thus the Mobile and Modular Shelters are being developed using an approach that is both inclusive and aimed at protecting the most vulnerable groups.

Violence in the shelters is a reality. Women, children and other vulnerable groups can be victims of it. Due to this, these Mobile and Modular Shelters take into account the organization of the spaces, as well as the availability of access to toilet facilities as a way of violence prevention and risk reduction.

In the case of disabled people, the Mobile and Modular Shelters are built and designed with an inclusive approach, which respects basic access and habitability standards for these populations, thus guaranteeing their protection in situations of emergency and displacement.

Another vulnerable group is made up of Haitian migrants or descendants, giving rise to the importance of having solid but temporary structures, which are able to guarantee protection demands and healthy conditions

*"In the province of Azua, the communities of Palmar de Ocoa and Puerto Viejo have high levels of exposure and vulnerability and they get cut off during emergencies; they have specific socio-economic, political and administrative features that mean they are among the most vulnerable communities in province".*

Diana Díaz,  
DIPECHO  
Consortium Coordinator

*"In the recent storms, the only safe space in Los Negros was the clinic, which is at the highest point. If there is an earthquake, I think only the school and the clinic would withstand it. The neediest people are sheltered there, and they are given support, but when the emergency is over, people do not always return to their homes at once."*

Miembro de la  
Red Comunitaria de PMR  
Puerto Viejo (Los Negros)-  
Azua

during emergencies, but without replacing the municipal development policies that are necessary for resolving social exclusion on a permanent basis.

## The project

The “Warning, informing and including: Strengthening emergency information management, school safety and inclusive Disaster Risk Reduction” project, implemented by the Plan-Oxfam-Habitat consortium with funding from the European Union’s Humanitarian Aid and Civil Protection Department (ECHO) is aimed at strengthening community and institutional disaster preparedness in Azua, while guaranteeing the inclusion of groups with specific vulnerabilities, especially women, children, people of Haitian descent and people with disabilities.

In order to achieve the objective, four results were proposed. Result 4 consisted of ensuring at least two safe structures as shelters in the communities of intervention and the Mobile and Modular Shelters initiative was carried out in this framework.

The initial plan was to repair two structures for use as shelters, and information was gathered on the existing buildings in the communities for this purpose. A total of 22 infrastructures were identified, but none of them met the requirements of a safe shelter. The only ones that did meet these criteria were schools, which were being repaired by the Ministry of Education (MINERD).

In the light of this situation the consortium team explored ways of achieving this project indicator without involving schools as well as providing a solution to two communities like Puerto Viejo (Los Negros) and Palmar de Ocoa, which did not have shelter facilities. They embarked on a process of reflection and exchange of experiences between members. During this process Habitat proposed drawing from their experience of modular houses that was implemented with FUNDASEP in the country, in order to convert it into what became the Mobile and Modular Shelters.

These shelters, like modular houses, are earthquake and hurricane-resistant and are designed to SPHERE standards, thus representing a viable technical solution that is appropriate and cost-effective, as well as guaranteeing education in emergencies and the inclusive approach that the project sought to achieve.

## PROJECT RESULTS

### RESULT 1:

The key DRR actors at a national level and at Azua province level strengthen their capacities, improved their tools for effective information management, develop emergency plans and make a commitment to community resilience with a special emphasis on groups with specific vulnerabilities.

### RESULT 2:

The target schools are safer and more committed to the “Safe Schools” campaign and to educational continuity during emergencies.

### RESULT 3:

Greater awareness of disaster risk and vulnerabilities in the target communities.

### RESULT 4:

The key communities increase their capacities for predicting and preparing for disasters and responding to them, while focusing attention on the people with specific vulnerabilities.



## REHABILITATION OF SCHOOL BUILDINGS FOR USE AS TEMPORARY SHELTERS, YES OR NO?



Habitat for Humanity's initial proposal involved evaluating the rehabilitation of infrastructures that the community normally used as shelters during emergency or disaster situations, by reflecting on the features of "safe" and "unsafe" infrastructures. Based on this work, the structures that best matched their perceptions were identified.

This community exercise revealed a situation in which the only structures that guaranteed a certain degree of protection were the schools and health centres, thus creating a dilemma with the priority of ensuring the rights to protection, education and health of the most vulnerable groups.

Nonetheless, Habitat embarked on a technical assessment of all of the community structures, which included formal criteria for the resistance levels of the buildings, materials, availability of spaces and services, and compiled all the information in an evaluation report that was submitted to the competent authorities (especially the Ministry of Education and Civil Defence).

This community diagnostic exercise with elements of technical opportunity ultimately resulted in the MINERD deciding to invest directly in the rehabilitation and improvement of its school buildings, and specifically in the case of the Célida Pérez School for Children with Special Needs (Azua).







## The Mobile and Modular Shelters

### What are the Mobile and Modular Shelters?

When an emergency situation occurs, the first response always arrives from within the community itself; even more so when it involves communities that get cut off and isolated and can therefore only depend on their own capacities and resources. In these situations it becomes essential to have at least one shelter-type building in the community that can protect the population, especially the most vulnerable groups.

A **temporary shelter** (or Collective Centre) is a safe space used by a population affected (or threatened) by an emergency or disaster, which has found itself in a situation where they have to leave their homes due to unsafe conditions. The population is accommodated in the shelter on a temporary basis and must be helped with their basic and health needs.

On the other hand, a **Mobile and Modular Shelter** is a collective centre that has all the same features; the difference being that it can be assembled and dismantled, extended or reduced if necessary. The planned spatial capacity ranges between 250 and 500 m<sup>2</sup>, although it can be extended.

SECTOR	MINIMUM STANDARDS FOR HUMANITARIAN RESPONSE IN TEMPORARY SHELTERS <sup>4</sup>
 <b>STRUCTURE</b>	<ul style="list-style-type: none"><li>• Accommodation solution and materials meet technical standards and are culturally acceptable</li><li>• The structure fulfills warm weather requirements (adequate ventilation, higher roofs, shady spaces, etc.)</li></ul>
 <b>SPACES</b> Individual and Shared	<ul style="list-style-type: none"><li>• A minimum covered area of 3.5 m<sup>2</sup> per person</li><li>• Good planning of access routes through the covered areas and provision of materials for separating personal and family space in order to ensure people's privacy and safety.</li><li>• Ensure recreational and social spaces, especially for children and adolescents.</li></ul>
 <b>Water, Sanitation and Hygiene FACILITIES</b>	<ul style="list-style-type: none"><li>• 15 liters of water per person per day (7.5 l flow per minute)</li><li>• 20 people per toilet facility (50 in an acute emergency) located no more than 50 m from the accommodation (and if they are latrines no more than 30 m from water sources)</li><li>• Hand washing point must be provided outside the toilet facility (toilet or latrine)</li></ul>
 <b>PROTECTION AND SAFETY</b>	<ul style="list-style-type: none"><li>• Access to individual protection, family reunification mechanisms</li><li>• Guarantee the right to receiving humanitarian assistance (shelter, food, health, etc.)</li><li>• Services (water, sanitation, etc.) with a degree of privacy in accordance with the users' cultural norms (especially for women, girls and adolescent girls)</li><li>• Supervision of the spaces for children organized by adults (or family members)</li></ul>
 <b>ACCESSIBILITY</b>	<ul style="list-style-type: none"><li>• Access to water, sanitation and hygiene services provided for the youngest children.</li></ul>

It is designed to meet the technical standards and minimum regulations for humanitarian response to disasters: space, drinking water, toilet facilities, safety, protection for vulnerable groups, etc. It is also

composed of reinforced concrete modules and steel frames, which make them earthquake resistant, and able to withstand winds of up to 200 km/h (category 3 hurricanes on the Saffir-Simpson scale).

### Modular technology

The proposal for modular shelters by the DIPECHO Plan-Oxfam-Habitat project in Puerto Viejo (Los Negros) is the result of more than a decade of experience of low-cost and high-resistance housing solutions capitalized in Latin America.

## THE TECHNOLOGY: FROM MOBILE AND MODULAR HOMES TO SHELTERS



*“After hurricane Georges (1998), FUNDASEP, through the PROTECHO programme, carried out low-cost and high-resistance housing solution for the most vulnerable families who had lost their homes during the disaster. Starting in 2013, after a pilot project using the same building technology, HABITAT formalised and agreement with FUNDASEP in order to add it to its catalogue of homes, with the aim of reaching the poorest families while guaranteeing quality standards in the homes.”*

*Architect Nadia Tejeda*  
Habitat for Humanity  
Int. Programme Manager



The floor-base is the reinforced concrete foundation on top of which the modular shelter is assembled.

This can be pre-existing (e.g. a sports court) or built on a foundation over a leveled piece of land, with dimensions based on the available area and architectural design.

The walls are made of simple concrete prefabricated modules, reinforced with electrically soldered mesh and combined with metal frames without linings.

The modules are composed of solid concrete panels with a maximum size of 1x1 m (although also with smaller measurements), with an approximate weight of 70 kg that can be easily carried and handled by two people.

The modules (commonly known as panels) are made using a simple framework, sheets and angles. The concrete that is used has a minimum resistance of 210 kg/cm<sup>2</sup>



<sup>4</sup> “Humanitarian charter and minimum standards for humanitarian response” (Sphere Project, 2011)



## THE TECHNOLOGY: FROM MOBILE AND MODULAR HOMES TO SHELTERS

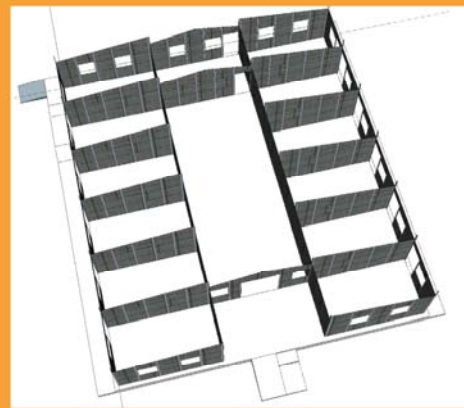


The roof is made of alu-zinc sheet modules (more resistant than the common zinc sheets), which are supported by a structure of collapsible brackets, beams and columns that hold up the roof. The system is reinforced by a metallic structure that is anchored to the walls, to resist hurricane-force winds of up to 200km/h. Habitat for Humanity has produced a small factsheet that explains the resistance of all of the components of the community shelter.

**Space organisation:** the interior of the shelter is divided into independent areas measuring 3 x 5 m, designed for use by about four people. Each of these areas has an independent access door from the outside, and ramps for people with limited mobility.

Organisation in “family modules” was designed to increase safety and protection, especially for children and women, but it can also be modified according to priorities, for example, separate areas for single mothers with babies, for underage children, breastfeeding women, or people with disabilities, etc.

The central area (approximately 59 m<sup>2</sup>) is designed as a multi-use space that could be used as a social area or to accommodate more people if necessary. This area is accessed through a main door that does not lead to the separate areas, as well as a ramp for people with limited mobility. There is also a kitchen area.



**Drinking water:** This consists of a storage (water tanks) and distribution (taps) system. The water tanks rest on a base (metal or masonry) that ensures maximum stability even in strong winds.

According to the storage capacity, 310 gallons (1,700 litres) per day is considered necessary, stored in two 560-gallon tanks (total of 4,233 liters) for human consumption, and one of 250 gallons (1,000 litres) for hand-washing.

Although it can vary greatly depending on context, if a safe water source is not identified, the water tanks must be refilled using tanker trucks on a weekly basis.

**Sanitation:** This is organised by modules, one per 20 people, and separated according to sex (men/women). The modules include three basic elements: toilet, hand-washing basin and shower/changing room. For the toilets, systems that use a small amount or no water at all have been prioritised (e.g. dry pit latrines or siphon toilets).

Of the total number of modules, it is considered that two out of three toilets should be for females, and the rest of the toilets should be for males.

**Electrical system:** It is worth pointing out that in an emergency that involves situations where a population is cut off, electricity in the shelter is dependent on the local power supply, or an alternative source that may be available in the community itself.

In Los Negros, it was agreed that the community would commit to finding a source of electricity when the need arose during an emergency.

With this purpose in mind, the solution was a lighting installation with a connection lead to an electricity generator from a central control panel.



The most innovative aspect of the experience of the modular shelters consists of having succeeded in **maximising the cost-efficiency and flexibility** of a structure that is traditionally “immobile,” thanks to a relatively simple construction technology based on industrial-scale **prefabricated modules**, but using conventional equipment.

The fact that the shelter is modular and can be dismantled, simply ensuring an installation base (or floor base), allows for its use to be maximised in emergency situations as it can be transported to wherever there is a displaced population.

With an earthquake-resistant design, it combines this high resistance to natural events with low production and assembly costs, which cannot be found in any other emergency infrastructure in the country.

The technology utilised is locally manufactured, made with durable materials that are available everywhere in the country, which guarantees a sense of **ownership** on the part of the population, by reducing external dependency in terms of availability and accessibility to construction equipment or materials. The manufacturing is also simple and does not require specialists in the field, which makes it even more accessible to the local populations. Nonetheless, community participation is essential as it strengthens the sense of ownership and reduces assembly times and resources, as well as creating local capacities<sup>5</sup>.

*“The project was presented to us before assembling it. They involved us, and some of us received training as master builders. At that point we asked all our questions about the shelter’s resistance and we were satisfied with the answers.”*

Member of the Community PMR Network, Puerto Viejo (Los Negros)-Azua

## The construction and installation process

The process of installing the modular shelter in Puerto Viejo (Los Negros) was based on the development of 5 key steps: **a. Evaluation of the alternatives; b. Identification of the space and design; c. Construction of the floor-base; d. Assembling the shelter and installations; e. Dismantling the shelter and storing it.**



**Community participation** is an essential element throughout the process of construction and installation of the mobile and modular shelter, because it links the investment of time and resources of the future beneficiaries of the structure in case of emergency.

In order to achieve adequate levels of attention and participation from the community, when the shelter proposal was made the project organised a **technical training process for master builders**. This training has allowed people already working in construction who did not have official certification to have their skills

<sup>5</sup> After the hurricane Georges response, FUNDASEP contacted SERVIVIENDA in Colombia, a social company that seeks affordable housing solutions for poor families using appropriate technology ([www.servivienda.org.co](http://www.servivienda.org.co)).

recognised. This training also included basic risk reduction guidelines in the area of construction (especially earthquake resistance and reduction of vulnerability to strong winds and flooding).

A reflection of construction union solidarity has been the interest and participation demonstrated by master builders from other communities, like La Bombita, who have travelled to Puerto Viejo in cooperation with their colleagues in order to learn how to assemble the structure with a view to cooperating in the future if necessary.

### a. Evaluation of the alternatives

Evaluating the alternatives is an essential step towards identifying the cost-effectiveness of any investment. The first step in the evaluation is to identify structures used as shelters in the communities of intervention.

The partner responsible for this identification was Habitat, due to its experience, and it was carried out with participation of the communities themselves. **Work groups**<sup>6</sup> with representatives from the existing community associations were organised for this purpose, ensuring gender equality criteria, as well as participation by young people, elderly people and adults, and with the requisite of having lived in the community for at least 10 years.

#### INFRASTRUCTURE EVALUATION

Composition of the technical team:

- 1 engineer
- 1 risk management specialist
- 1 community leader (in most cases the person responsible for the infrastructure)

Once the structures used as shelters were identified, a technical team made **visual inspection visits** and went on to evaluate the characteristics of these buildings using a fact sheet that was designed taking the required standards into account. During the visits, area measurements were carried out in order to determine the covered area. In some cases volume measurements were also carried out in order to assess the capacity of the water supply source. The people in charge of the buildings also obtained other data.

### b. Identification of the space

The process of identifying the optimum space for assembling the shelter started with a **community meeting**, in which the population was informed about the idea of a shelter that could be assembled and dismantled in the event of an emergency.

The community **identification criteria** include the basic elements for minimising exposure to any type of hazard. For this reason, the area surrounding the shelter should remain at least 300 metres away from any flood-prone area, from unstable electrical cables, trees or other hazards like rubbish dumps, dangerous waste matter and other pollutants. The area should also be free of risk of landslides or other soil instability processes.

*“Identifying an area in Los Negros that doesn’t flood is very difficult. Thanks to the work with the mayor and the community, a provisional site was obtained. Later, it will be moved to a permanent site that belongs to INVI, which is currently building houses for relocating 80 families to a safer area. This area will ultimately be passed on to municipal council ownership.”*

Engineer Yanelba Abreu  
Habitat for Humanity

<sup>6</sup> These groups received methodological guidance in a session designed for the “Safe and Unsafe Accommodation” activity, using the PASSA methodology (*Participatory Assessment for Safe Shelter Awareness*), whose objective is to identify the conditions that make an accommodation safe or unsafe in the face of the hazards that the community prioritises in its surrounding area.



The meeting is the key space for **clearing up all types of uncertainties** about the shelter, its use, the structure's resistance (especially the walls and the roof), the question of who will be responsible for assembling/dismantling, and for storage and maintenance. The presence of a high-level technical team (engineers, architects, etc.) as well as local authority representatives, allows for making the links of responsibilities that will be fundamental aspects for the sustainability of the whole process.

### c. Building the floor-base

Before getting down to work, the community members who are involved should receive training in safety measures, the elements, materials and tools that must be used during the whole process of construction, assembly and dismantling of the mobile and modular shelter.

After that, once they have defined the shelter dimensions, they start demarcating the area, cleaning it, marking the levels and other points marking where the installations will be made. Work continues with the excavation and levelling for the area for the floor base, in the constant presence of approximately seven people and a master builder, and the preparation of the concrete until it is poured and polished.

**1 master builder** (mid-range technician)  
**7 workers** (basic technician)

Cement, sand, gravel, rebar, lime, blocks, wood, nails, wire

Mixer /drum, steamroller, pick, spade, spirit level, crowbar, hammer, chisel, bolt cutters for bending iron bars, saw. Medium sized truck.

**5-7 days:** 1 day preparing the ground, + 1 leveling-compacting + 1 molding- mesh placement + 1 pouring and polishing + 3 drying

The next step is the excavation and levelling of the area for the foundation/floor-base (in cases where there is no existing floor-base) and the preparation of the concrete, in this case, for the large volume we use factory cement with minimum resistance of 210 kg/cm<sup>2</sup> poured without a pump (pump use is recommended for the pouring). In this case this was achieved with the constant presence of seven people and a master builder.

### d. Assembling the shelter and installing the services

Once the floor-base has been identified or constructed, the next step is to assemble the shelter, which consists of i) raising the walls and demarking the access points, ii) ensuring the roofing and installations, and iii) installing the sanitary modules.

As the components are being installed, the door and window frames are put in place and **the walls are raised**.

The ease of handling provided by the panels and their low weight (approximately 70kg) means they are easy to unload from the trucks and install, without any need for heavy equipment (there is a technique for lifting them without breaking them and the use of protective gloves is recommended). Then the slabs that hold all the modules together on their upper part are installed, working in the same way as a crossbeam.

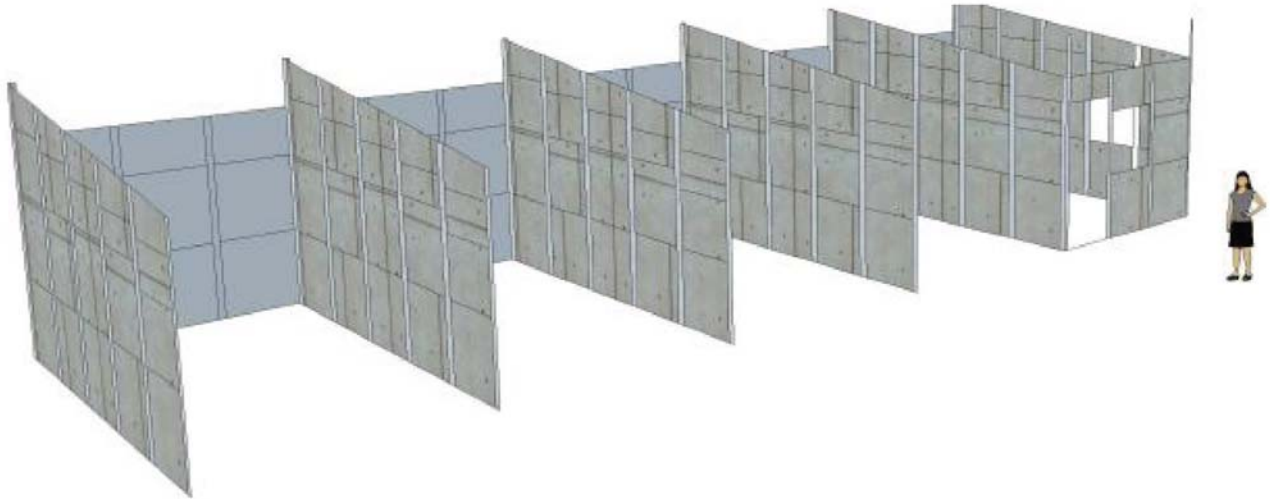
**1 Master builder** (mid-level technician)  
**10 labourers** (basic technician)

Panels/ modules, slabs, doors, windows, steel frames, alu-zinc sheets, screws, bolts, nuts, brackets, steel columns, cables, wiring, electric boxes.

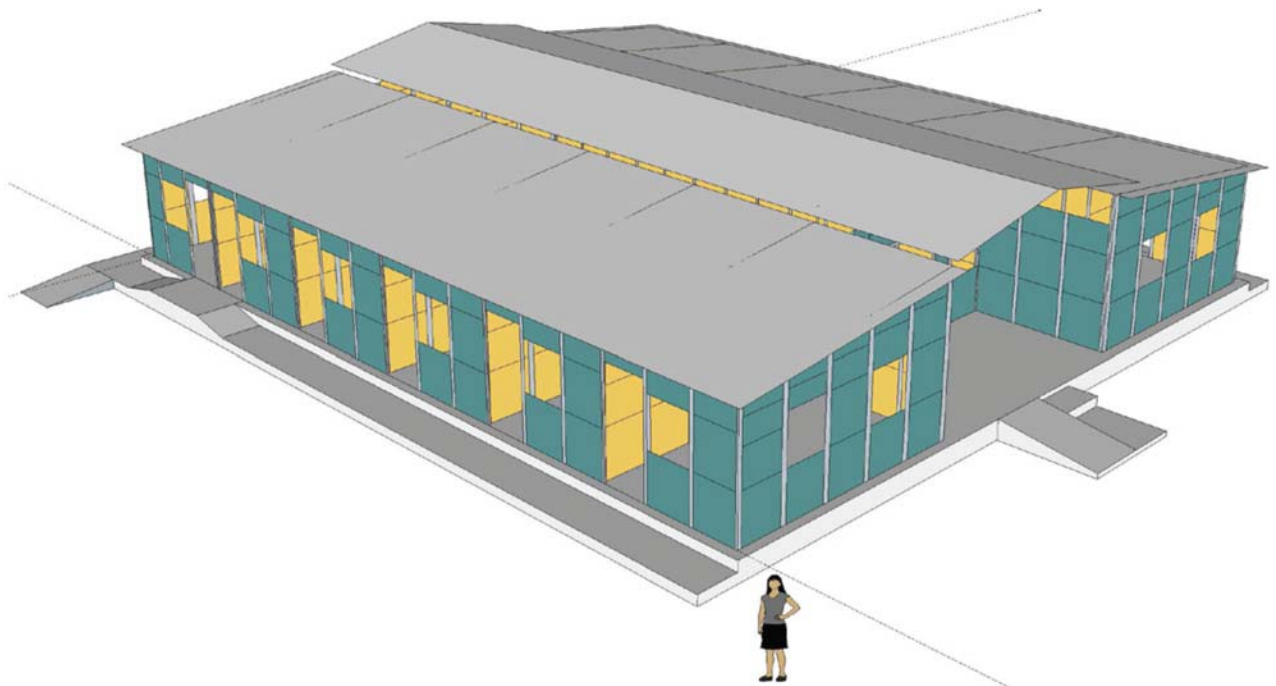
Spirit level, hammer, spatula, scaffolding, ladder, power drill, screwdrivers, bolt cutters, spanner set, helmets, protective gloves. Heavy haul truck.

**5-6 days:** 1 transport + 2 assembling wall + 3 roof (the services are installed at the same time)

It must be stressed that no element or mix is used for fixing the frames and panels. They stabilise each other thanks to the shelter's own modular structure, which saves time and additional materials in this process.



When the shelter's supporting structure is complete, next comes the **roof installation**. Columns are placed in the central part and attached to the floor and the frames using screws. The next step is the roof installation, first in the central part, by placing the alu-zinc sheets and screwing them in on the under side, and then along the sides, thus preventing warping and holes in the sheets by the workers in charge of assembly.



Once the structure has been assembled correctly, we move on to fitting the **electrical installations** by placing the necessary tubing according to the electrical design. The cables will be finally visible and external to the walls (as well as the plug boxes and switches) making it easier to dismantle and store without damaging the panels or materials.

Like the shelter, the **toilet system** is designed in modules, and it consists of a row of latrines and a set of showers/changing rooms that provide maximum privacy for their users.

In this phase it is very important to **minimise the risk of polluting** the environment and the available water sources. The following guidance is listed for correct location:

- The land should be dry to allow for excavation, and sited in an area free of flooding; if there is a slope, it should be located on a site below the population and water sources (rivers, wells, lakes, etc.);
- The minimum distance between the latrine and any home should be between 3 and 6 metres, but no more than 50 metres, which would be too far.
- The minimum distance between the latrines and any water source should be 15 metres
- The bottom of the pit excavated for the latrine should be 3 metres over the water table level
- The hand-washing point should be as close as possible, preferably on the outside of the latrine.



**1 master builder** (mid-level technician)  
**2 labourers** (basic technicians)

Sand, cement, doors, fibro-cement and corrugated zinc sheets, concrete slabs, toilet bowl, tubes.

Spirit level, hammer, spatula, bolt cutters, spanners set, helmets, protective gloves. Medium sized truck

**2 days:** 1 pit and anchor points + 1 module assembly

### e. Dismantling and storing the shelter

The dismantling process must take into account that the components must be kept in the best possible condition, so they can be used on future occasions, by preventing damage and using the correct tools. The process is practically to follow the assembly steps, but in reverse order.

The first thing that has to be uninstalled is the electrical system, and the tubes, boxes, wires and the accessories must be stored in boxes or bags with labelling for easy identification.

This is followed by dismantling the roof, by taking out all of the screws. The alu-zinc sheets will be stored in three sets according to size: the 20-foot sheets (underneath all of the others) followed by the 12 and then the 10-foot sheets.

Once the alu-zinc has been dismantled, the frames (panels) and brackets have to be taken down, taking into account that handling their weight badly could cause injuries. As with the roofing sheets, the panels are also classified according to size, but these should be stored vertically (using the handling techniques that were explained) and slightly inclined: under no circumstances should they be supported or laid down horizontally against the floor, due to the risk of breakage.



**1 master builder** (mid-level technician)  
**10 labourers** (basic technician)

Protective tarp (optional), heavy-duty plastic sacks.

Screwdrivers, power drill, bolt cutters, spanner set, spatula, scaffolding, ladder, helmets, protective gloves. Light truck

**2-3 days:** 1 dismantling and removing installation + 1 storage + 1 transport (optional.)

For storage, the metal materials should not be left out in the open air, to prevent rusting. The doors and the windows especially are the elements most vulnerable to loss or theft.

### The process of dissemination and institutionalisation

Every innovative initiative that is based on providing national solutions to local problems should always have the involvement and participation of all of the key institutional as well as community actors. The proposal for a modular shelter that can be assembled and dismantled according to the emergency preparedness and



response needs has been developed as a community process, but placed in an institutional framework at provincial as well as national level.

As well as the systematised community involvement in the phases described above (evaluation of alternatives, identifying the space, building the floor-base, assembly and dismantling), the local authorities - in this case the Municipal Council of Puerto Viejo (Los Negros) - have also been involved from the start. The mayor's office, the residents' association and the community groups agreed that the mayor would take charge of the administrative part and the procedures for obtaining a provisional site, and the community members would be responsible for assembly, installation, dismantling and all of the operational management aspects.

The most outstanding achievement in this process of institutional linking with the Mayor's office was the fact that a commitment to include an annual sum in the municipal budget for specific costs related to assembling and dismantling the shelter has been secured. This sum will be used to cover all the costs of repairs, as well as anything else that might affect the shelter.

At the level of the provincial and national authorities responsible for the shelters and their management, the levels of interest and appreciation shown towards this initiative have been varied.

At a **provincial level**, the contacts made and meetings held with the Azua Civil Defence have been notable for a certain amount of reactivity (especially in the technical verification process for the appropriateness of the installation site), although without having a stable presence in the community accompaniment process. At a provincial level we have the express manifest written support of the Azua provincial PMR committee and the Governor's office. Despite all this, we still need to work on these relationships - especially at the provincial and municipal levels - in order to achieve total ownership of the experience.

At a **national level**, the pre-existing advocacy work with all of the National System for Prevention, Mitigation and Response actors has eased the process of disseminating and promoting this solution, especially through the national Civil Defence (DC), the Emergency Operations Centre (COE) and the Ministry of the Presidency<sup>7</sup>. All of these institutions now recognise that the Mobile and Modular Shelters respond to the needs for protection in emergency by providing a viable and effective alternative, as well as having the potential to extend their reach if combined with a centralized management (at provincial level) with an adequate stock of modules that could be used according to the needs of each event.

## The situation today

The most direct and spontaneous way of describing a changed situation is through the eyes and voices of the people who have directly experienced and are experiencing this change. Here is a list of the most significant comments that represent a new reality in Puerto Viejo (Los Negros) and more generally in preparedness and protection from emergencies and disasters in the province of Azua.

*"What I like best about the mobile and modular shelter is how practical and safe it is. The fact that you can assemble and dismantle it in a few hours, and that it is safe and well built, is absolutely phenomenal!" - Antonio Segura - Mayor of Puerto Viejo (Los Negros)*

*"Up until now the only place we could protect ourselves in the case of an emergency was the clinic, or if not, to sit tight at home and wait until it was over. But often there were sick people in the clinic, so it was dangerous. We also used the schools, which are well built, but they also flood sometimes, and the space and the equipment ends up getting ruined. Also, for some poor families the emergency often lasts for several weeks, because their houses are in very dangerous places. Today, if there is a hurricane warning we will rush to the shelter if our*

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<sup>7</sup> The Ministry of the Presidency recently created a Center of Excellence as a platform for cooperation between civilian and military humanitarian groups for rescue operations in the event of disasters in the Caribbean region.

house is at risk, because we feel safe there. And we can stay there for as long as we need to, without disturbing anyone". - **Community member**

"Having the shelter has been a great boost for us, and it allows more people to stay there for longer, and it frees up the clinic for the people who are sick and the school for the students." - **Antonio Segura - Mayor of Puerto Viejo (Los Negros)**

"The area inside the shelter is divided into rooms, and although perhaps fewer people can be accommodated, it is safer for children, women, elderly people and people with disabilities. There is less disorder, it is more organised, and there is a lower risk of violence and theft. There is also a common area like a living room for everyone, and all the additional services that need to be provided to the community". - **Community member**

"As Civil Defence and people from Azua, we feel very fortunate and proud to have this pioneering initiative in the country" **Socrates Urraca - Provincial Director Civil Defence of Azua**

"There are no fixed dates for hurricanes, but it would be a great help to assemble the shelter at the beginning of the hurricane season and dismantle it at the end, so that the community teams are well prepared for this work." - **Community member**

"Thanks to the work being done in Azua, we can now promote the experience so that it is included in the national policy for protecting the population in emergency situations. Today an opportunity has been created, through the Centres of Excellence, to set up reception centres, and an interest has been shown in improving coverage of this service due to the low cost of the Mobile and Modular Shelters. We think it will be a perfect choice for these new circumstances, and it would contribute to sustainability if the State decides to invest in this option." - **Nadia Tejada - Habitat for Humanity**

"At a public policy level, the Mobile and Modular Shelters are a very good investment, because despite the low cost, they meet all of the minimum standards and humanitarian response rules for temporary shelters at times of emergencies." - **Diana Díaz - Plan International**

"The modular/mobile shelters fulfil a double purpose. On the one hand they are safe and very versatile structures where people can be sheltered and which frees up other community structures; schools or health centres. On the other hand, the assembly and dismantling process has turned out to be an important communication element for preparedness work at community and municipal level, or even an early recovery mechanism in cases of serious losses for the population; for example through cash-for-work activities for reactivating the local economy." - **Raúl Del Río - Oxfam Intermón.**





## Conclusions

Capitalizing on the experience of the Mobile and Modular Shelters contributes to the **advocacy work** that has been done with the SNPMR over the past few years, with the aim of promoting the addition of the Mobile and Modular Shelters solution to the national risk reduction and emergencies guidelines, by replicating this model at a provincial and national level.

This document is presented as a **practical reference** for other organizations in the country and overseas to receive guidance for their work in the sector in the design, implementation, promotion and dissemination of structures for protecting the population in the event of an emergency, which are able to guarantee safety standards as well as services, especially for the most vulnerable groups.

However, the DIPECHO consortium member organizations acknowledge that the experience still has a great deal of room for improvement that justifies a **dynamic process** of creation, training and follow-up, which is still far from being considered complete. Here are the main lessons learned and challenges viewed from a point of view of continuously improving the work of all of the actors involved in Disaster Risk Management in the Dominican Republic.

### Main lessons learned

As has already been mentioned, the proposal contained in the project initially sought to rehabilitate existing structures to certify them as “model shelters” in the National System, for their capacity to fulfil all the minimum standards of humanitarian response for the population affected by a disaster. Unfortunately, the communities’ highly vulnerable situation demonstrated that, apart from the schools and health centres, no other infrastructures were suitable for this purpose.

If on the one hand, thanks to the mobilisation of MINERD at a national level, there was no longer a need to invest in rehabilitating school buildings and thus promote (albeit indirectly) the use of schools as temporary shelters, on the other hand, there was still an unmet need for a solution for protecting populations in emergencies that would contain the appropriate conditions for protecting and serving the most vulnerable groups.

The combined experience of the Plan-Oxfam-Habitat consortium yielded the innovative idea of combining technical knowledge of building highly resistant structures, with minimum standards for a quality response in an emergency, and the specific sensitivity of protecting the most vulnerable groups in a population. This idea was analysed and compared with the other available options based on a series of criteria that analysed the **positive aspects** of one option against another:

- The structure’s **physical resistance** to a range of hazards (earthquakes, hurricanes or floods);
- The **comfort of the spaces** and adequate **ventilation** (depending on the weather conditions in the area);
- The **water, sanitation and hygiene facilities** available for the sheltered population (toilets, latrines, drinking water, washbasins, waste collection system, etc.);
- The structure’s capacity to ensure **protection for the most vulnerable groups** (including children, women, elderly people);
- **Accessibility** for people with limited mobility or disabilities (ramps, passageways and wide doorways);

- The capacity for ensuring positive **participation dynamics for the sheltered population** (food preparation, involvement in construction, structure maintenance);
- Potential for **reusing** the structure at the end of the emergency, either because it goes back to its original function or because it can be dismantled and stored for reuse in case of need.

The **negative aspects** of each technical solution were also identified and discussed:

- The possibility of **inappropriate infrastructures** being used; whether it is used for other essential services that will be disrupted and/or curtailed (as in the case of using schools or health centres), or because unsafe structures are used, or buildings whose vulnerability has not been assessed (before or after an earthquake).
- The overall cost of the option, which includes the structure and installations needed for its operation (water, sanitation, hygiene, electricity, safety, kitchen, etc.).

A comparative summary table follows, which justifies the prioritisation of the Mobile and Modular Shelters over the other options that are more commonly used in this context.

OPTIONS FOR TECHNICAL SOLUTIONS				
FEATURES	Temporary camp (tents)	EXISTING concrete structure	NEW concrete structure	Modular/mobile shelter
STRUCTURE'S RESISTANCE TO HAZARDS				
SPACES AND COMFORT				
FACILITIES				
PROTECTION AND SAFETY				
ACCESSIBILITY				
COMMUNITY PARTICIPATION				
REUSE				
INAPPROPRIATE INFRA-STRUCTURES				
OVERALL COST*				
GENERAL EVALUATION				

## Strengths

- A structure that is specifically equipped for emergencies (although provisional), guarantees that other infrastructures that are used for **other essential services** are freed up. A special mention is in order for community health centres and schools, because if they are not used during an emergency, this guarantees the right to **education and health during emergencies**.
- A mobile and modular Shelter has a **high replication potential**, because as well as its capacity to physically protect and serve a given population during an emergency or disaster situation, it is characterised by two features that stand out in comparison to other options: it is **extremely cost-efficient and flexible**.
- The **infrastructure is very resistant** to a range of major intensity natural phenomena, especially hurricanes (resistant to winds of up to 200km/h) and earthquakes.
- Depending on the type of emergency, it has the capacity to **adapt to the needs** of specific populations at determined moments (whether 30 or 3,000 families); as well as to the **skills and resources** available in a first response (local and/or community resources), with the potential for being extended (in consecutive phases) as contact is established and new resources are added from the higher levels (provincial or national).
- The investment **does not tie up resources**, meaning that as well as being logistically *moveable*; it is also *reusable* time and time again and with very limited losses in the process of assembly/dismantling (estimated at less than 10-20% of the investment).
- The **cost of the prefabricated modules** (panels) is very low. The technology used in their production is based on very accessible materials in the construction sector, and a mid-level technician (a master builder) has the skills for replicating the adequate design, selection and mix of the materials. This allows for a “decentralized” construction process at community level, whether with a temporary or permanent local operation.
- In addition, the **assembly and dismantling process** does not require high-level technical staff (like an architect or engineer), thus allowing for further reduction of costs and dependence on resources that are not always present at community level.

## Weaknesses

- The **production capacity** of the prefabricated modules by FUNDASEP and/or Plan-Oxfam-Habitat consortium is currently limited to a provincial level, due to the lack of a productive structure or planning with nationwide-scale reach.
- The **assembly time** (between 4 and 8 days in an incipient phase of the community experience) implies a reduced possibility for promoting initial phase activities according to the warning levels issued by the COE, although the assembly/dismantling is a task that could be carried out at the beginning and end of the hurricane season.
- The assumption that the national **SN-PMR authorities will take on and lead the management process** of the Mobile and Modular Shelters (production, prioritisation, location, storage, decision making for the assembly/dismantling, community involvement in managing the centres during an emergency), is a medium-term objective (within 5 years) as at the moment it is still in the early stages.
- At a community level, especially in locations that do not have alternatives with the same degree of structural resistance, the Mobile and Modular Shelters could create **expectations that they will remain permanent** after they are installed. This aspect is also linked to the logistical difficulty of reaching a consensus on where to store the shelter once it is dismantled, in order to protect it from deterioration or losses, taking into account that the further it is from the floor-base, there will be more logistical difficulties for transporting it. In this case the elements have been distributed among a community space that was



identified by the network and a warehouse for metal structure panels to be assembled over the floor-base itself.

## Lessons Learned

The **mobile and modular Shelter** combines two main objectives that are fulfilled at different times in an emergency and/or disaster:

- During the **initial phase**, the assembly (and subsequent dismantling) process fulfils the substantial aim of **communication to the population**. Although it is impossible for the assembly work to form part of a sudden-onset emergency response (there is hardly ever more than two days' notice before a possible event), linking it to the start of the hurricane season guarantees a municipal/provincial activation mechanism as part of a wider plan for raising awareness among the authorities and the local population. In this context, the process of identification, location, prioritisation and assembly of a Mobile and Modular Shelter in an area considered to be high-risk (and especially in those communities which, like Puerto Viejo (Los Negros) tend to get cut off even in the most minor event) contributes to activating the authorities and the population's attention to the risks to which they are exposed, and thus boosts the necessary preparedness and mitigation mechanisms.
- During the **response phase**, the mobile and modular shelter guarantees much more practical added value, and it is **adaptable to the needs, skills and resources** that characterise a given emergency and/or disaster situation. In this area, by achieving management from the provincial level, effective and efficient help can be provided which also has the capacity, thanks to its modular nature, to be expanded or reduced as needed. Also, if a post-event phase is considered, the assembly process and/or the shelter maintenance work could be linked to **early recovery activities**, especially in the types of disasters that seriously affect the economic dynamics of an area.

As well as these fundamental objectives, there are also other lessons learned that are worth highlighting throughout this process, as follows:

- **Community involvement** is crucial, and must be ensured from the earliest stages. Identification and clearing the site for the shelter, assembly and installation of all of the systems and services, care and management, are all ways of generating shared responsibility at a community level, and especially the PMR Networks, without which it would be impossible to guarantee adequate protection work.
- The **local authorities** (municipal and provincial), and especially the Civil Defence and the Municipal Council, must also accompany and share responsibility for managing the structure, agreeing on clear and complementary roles and responsibilities. In this context, it is worth establishing the need for a percentage (or sum) of these institutions' annual budget from the start, in order to allocate it to the correct storage and maintenance of the structure.
- The local people's motivation can be maximised by linking the **preparedness and response training** to the mobile and modular shelter, so that the assembly and dismantling process is also seen as one of the PMR activities in the community or the province.
- **Training the master builders** in the community, and their direct linkage with the shelter production, assembly and dismantling process, has a highly positive effect on the process, with synergies that encourage multiplication of knowledge and skills.
- **The structure and materials must be culturally acceptable** and valued by the user population. The perception of resistance and safety can be a critically decisive element for their use in a real emergency situation.

- The community rates very highly all of the solutions that provide access and protection to vulnerable people or people with restricted mobility (ramps, passageways and wide doorways, etc.). It also recognises that only after using it will they be able to fully appreciate the **combination of comfort and safety** (for example in the increased use of windows; in a tropical area this needs to be balanced with the need for protection from hurricane-force winds that is aimed at limiting the vulnerable elements in the structure). In this respect, any change that takes place during the process must be systematised at that time (especially in the case of pilot projects).
- An unexpected benefit of a mobile and modular shelter lies in the fact that it can be installed anywhere (as long as is not dangerous) without land ownership. Solutions like land loan or rental are perfectly viable options precisely due to the possibility, at any point in time, of dismantling and removing the installation, at a very limited cost, as only the floor-base will need to be rebuilt.

### What's left for tomorrow?

The process of promotion and institutionalisation of the Mobile and Modular Shelters is well under way now, and it will be essential to work on their consolidation according to the following strategic guidelines:

- For the beneficial potential of a tool of this type to be maximized, it should be viewed as an alternative to traditional concrete structures. For this level of investment to be possible, the State has to decide to take it on and/or promote it as part of its **national emergency protection policy**.
- The Civil Defence (or other competent state authority) should be able to manage it, depending on need, from a provincial level. The **provinces can be prioritised** according to **level of risk**. This small analysis in several provinces (greatest recurrence and vulnerability) allows for the identification of the areas that need this type of infrastructure in order to ensure that they are given quick access in the event of an emergency. Once they have been located (in a provincial warehouse), the modular structures can be moved to the affected populations in an adequate time for a first response in the case of an emergency and/or disaster.
- The mobile and modular shelter **administration process** also has to be in the hands of the State body that manages the shelters during emergencies (DC), so as to make the most of the investments in capacities already under way in the country.

In conclusion, the main challenge for ensuring sustainability in this initial experience is to strengthen the relationship with the public institutions, with the purpose of establishing transparent management with clearly defined responsibilities. If the stage of negotiating with the State is reached it will be possible to extend the scope of this technology and thus strategically increase national coverage of safe structures for emergency and/or disaster situations.







## Annexes

**Annex I – Technical Assessment Report – Buildings used as Shelters in Communities in Azua**

**Annex II – Model Catalogue for Homes with a Modular Prefabricated System**

**Annex III – Mobile Shelter Assembly Guide**





