

# Shelter Cluster Haiti

## Transitional Shelter technical guidance

### 19/02/10







This document is work in progress and has been drafted by the Shelter/NFI and CCCM Cluster Technical working group. Its contents are liable to change.

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## 1.0 Introduction - technical guidance in context

The emergency shelter cluster draft shelter strategy<sup>1</sup> and response plan focuses on shelter interventions on different groups, and focuses on different assistance programmes for each group. See below.

Summary of the response for displaced populations				Summary of the response for non-displaced populations	
Rural self-settlement	Urban self-settlement	Host families	Planned and self-settled sites	Owners	Tenants
					
<b>Phase 1 Shelter within 3 months, before the hurricane season</b>					
Tarpaulins with rope Tents Household items	Phase 1 transitional shelter – tarpaulins, rope when available\ Household items Tents for prioritised groups Public information			Priority given to displaced Unsafe structures demolished Public information	
<b>Phase 2 Full transitional shelter within 12 months</b>					
Phase 2 transitional shelter - roof of corrugated metal sheeting, frame of timber, bamboo or steel Support provided through public information campaigns and technical advice over seismic and hurricane resistance Cash, vouchers and materials distribution also considered Coordinated rubble clearance				Self-help Phased materials distribution Technical advice	Relocation assistance Rent assistance Extending credit
<b><i>Durable housing in less vulnerable locations, built back safer</i></b>					

<sup>1</sup> Available from <http://www.shelterhaiti.org>

## 2.0 Phase 1: shelter distribution

Emergency materials distributed are to provide people with cover from the elements and to provide privacy and dignity.

### Shelter NFIs

Differing shelter kits provide families with:

- Materials for covering structures (These shelter kits to supplement local items)
  - 2 x Plastic sheet 5m x 4m minimum (Annex A.6.3)
  - 30m Rope (Annex A.6.5) or wire
  - (Optional) Timber poles (imported) (Annex A.6.2), steel poles, or bamboo.
- Personal shelter
  - Blankets
- Household items
  - Kitchen kits (Annex A.6.8), Household kit

### Tents

- The policy on tents can be found in annex A.1. notes on their procurement can be found in Annex A.3.1.

### Cash / vouchers

- Cash or voucher programmes remain a option, especially for hosting families. Further information on cash is available in “Guidelines for cash transfer programming” (International Red Cross and Red Crescent Movement)<sup>2</sup>.
- Cash or vouchers should only be considered if markets are functioning and able to support activities.

### Shelter tool kits

- In rural locations or where city dwelling families lived in timber shelters, shelter kits consisting of tools and fixings may be appropriate. However they will be of limited use where families lived in masonry houses<sup>3</sup>.
- See annex A.6.7 for specifications

## 3.0 Phase 2: Transitional shelter construction

- Transitional shelters will consist of a durable roof (corrugated iron or equivalent) and a frame made of timber or steel.
- Transitional shelters programmes should include the support that vulnerable families will require to build them. They may need to be accompanied by tool kits, information and teams of carpenters.
- Shelter frames will be made of (imported) timber or steel.
- Rather than detailed drawings and design detailing, we copy below a performance specification. This is to allow for diversity in design between organisations, whilst maintaining consistency in quality.

### Hazards

By their location, design and construction, shelters should provide protection from the following hazards:

- Earthquakes and aftershocks
- Tidal surge in coastal areas (June-November)
- Heavy rains (March-May) and surface run-off
- Hurricanes and high winds (June-November)
- Landslides following rains and earthquakes
- infestation (termites etc)
- For lightweight transitional shelters, **flooding and high winds remain the major threat.**
- Shelters must additionally provide a degree of protection from the hot, humid climate of Haiti.
- Transitional shelter kits should incorporate and demonstrate key **disaster risk reduction** techniques in anticipation of imminent hazards (such as diagonal bracing or locating of doors away from corners of structures) and the need for more resilient permanent reconstruction.

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<sup>2</sup> <http://www.ifrc.org/docs/pubs/disasters/cash-guidelines-en.pdf>

<sup>3</sup> [http://procurement.ifrc.org/catalogue/upload/products\\_data/files/KRELSHEK02.xls](http://procurement.ifrc.org/catalogue/upload/products_data/files/KRELSHEK02.xls)

Performance standards and indicators for transitional shelters		
Indicators	Standard	Remarks
Key data		
Lifespan	Materials and shelter construction to allow for <b>more than 3 years use</b> . Materials should allow for easy maintenance and upgrade	
Cost	1000-1500USD <sup>1</sup> including transport and labour, excluding taxes. (For basic 1 storey transitional shelter, assuming additional input of material and labour from home owners)	Consider supplying only some of the materials where families have existing timbers / roofing materials to add to the structure.
Covered living space	Provide a target of <b>18m<sup>2</sup> in floor plan</b> <sup>11</sup> with 24m <sup>2</sup> as a maximum. <b>A minimum of 12m<sup>2</sup></b> may be considered for instances where no other space is available, and with a clear justification	Assuming average of 5 persons per family See annex A.2 for more on sphere standards.
Head height	A minimum of 1.8 m from the ground to the eaves	Slight variation may arise depending on material used.
Site and services		
Tenure	Legal aspects of the site or plot should be resolved. A minimum time frame for any transitional agreement is 18 months but it is preferred to have an agreement of 3 years or longer (linked to lifespan)	Take into account different forms of tenure security, including ownership, tenancy and other arrangements
Location	In principle, the location of the shelter should support the choice made by the beneficiaries themselves. Shelter should be constructed at, or near to the existing homestead, without inhibiting permanent housing reconstruction Shelters should be built in locations and with designs to minimise the exposure of the occupants to hazards and maintain access to livelihoods. Shelters should not be built next to dangerous buildings or structures. Shelters should not be built on land liable to flood. A shallow slope to allow for drainage is ideal. Shelters should not be built on land at risk of landslide.	Except when existing damaged house is deemed unsafe.
Plot preparation	Sites need to be cleared sites of any physical dangers	Rubble removal guidelines are to be found at the early recovery cluster
Water & Sanitation	Adequate water provision and sanitation should be provided. Construction must be coordinated with WASH cluster. Any water or sanitation gaps to be communicated to WASH cluster Adequate site drainage is provided to minimise the risk of flooding. Individual Shelters must be connected to site drainage solution.	This is agreed to be a longer term consideration that will require WASH and Health components
Design principles		
Access	Shelters should take into account access by disabled people, where applicable	See guidelines and check list from Handicap International.
Hazard resistant Learning	Design principles (e.g. openings such as doors should be away from the corners of the structure) should be easy visible and easily adaptable as a practical learning example of principles of good construction Information regarding safe building practices and techniques should be disseminated	To promote good earthquake, hurricane and flood resistance practice.
Ventilation and temperature	Design of the shelter to allow for adequate ventilation, and minimise internal temperatures. Where possible, promote openings on 3 sides of the shelter to allow for cross ventilation.	Openings shouldn't affect structural integrity of the shelter.

Privacy	The design should allow families to add at least one internal division for privacy The shelter should provide a flexible space.	Internal divisions should not go as high as the roof as this will inhibit ventilation.
Culturally appropriate	Materials and construction techniques to be used are familiar to the beneficiaries	
Flexibility/ resource efficiency	Where possible, materials are to be reusable.	Transitional shelters are often later used as kitchens, verandas, or shops.
<b>Design Details and hazard resistant construction</b>		
Rains and Floods	The roof should protect the interior and walling materials from rain Foundations have sufficient strength and height to withstand flooding of site.	At the same time, ensure that any roof overhang is not so large as to increase the hazard from strong winds
Hurricanes and tropical storms	Foundations must secure the shelter to the ground in strong winds. The roof must be fixed securely to be resistant to storms must be designed with adequate strength for proposed roofing material. A pitch of 30°- 45° for 2-pitched roofs and 12°-14° for 1-pitched roofs is optimum for resistance against strong winds. Ratio of length to width of the shelter approaches 1. Metal strapping is strongly advised to provide protection from hurricane and earthquake. Structures should be designed so that timbers and the joints take the loads rather than the fixings	CGI sheets are commonly used and well accepted by communities Wide roof spans are to be avoided as they weaken the structure. Correctly orientated hipped roofs are more hurricane resistant than gabled roofs. They also reflect local practice. Wind Speed Maps and Codes for the Caribbean suggest a design wind speed of 100mph for Port au Prince based on the probability of hurricane and non-hurricane winds <sup>iii-iv</sup>
Earthquake	Seismic resistance techniques must be incorporated into site selection, shelter form, the location of openings, foundations, bracing and ring beam connections	A detailed understanding of future earthquake risk by geological/topographical zone is not available <sup>v</sup> .
Other design details	Concrete foundations will not be a requirement, as land ownership issues may encourage displacement. Consideration must be given on some sites that multi-storey buildings will be built	
<b>Programme issues</b>		
Technical assistance	Ensure that transitional shelters are well constructed to maximise life span and protection	
Diversity of interventions	Organisations must ensure that families have the means and skills to build safe shelters. Other interventions next to shelter construction should be considered in a broad range of interventions	For example training in constructions skills, building of model shelters in communities, voucher systems, shelter and/or tool kits, labour provision etc.
Beneficiary selection	Organisations must work carefully to ensure that the most vulnerable families, including the landless are not excluded from transitional shelter support. Gender sensitive programming is required and women should be consulted about a range of issues.	The groups at risk in disasters are single headed households, children, older people, disabled people and people living with HIV/AIDS.

<sup>i</sup> Price maximum may be adjusted upwards due to any or all of the following conditions or provision of extra features such as:

- +/- 15% rise due to material, shipping and quantities to allow for market fluctuations
- Extra shipping costs for importation of goods outside of the USA and Latin America
- Use of multiple storey designs
- Use of demountable construction techniques
- Use of permanent shelter foundations

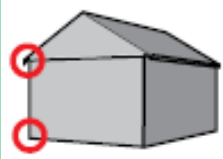
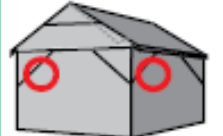

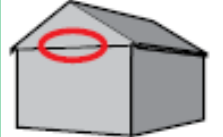


<sup>ii</sup> 18m<sup>2</sup> is based on 3.5m<sup>2</sup> covered living space per person for a family of 5

<sup>iii</sup> Myron W. Chin and Winston Suite, "Model Building Code for Wind Loads" (Association of Caribbean States, 2003), [www.pubs.asce.org/ASCE7.html?99913330](http://www.pubs.asce.org/ASCE7.html?99913330).

<sup>iv</sup> P. J. Vickery and D. Wadhwa, "Wind Speed Maps for the Caribbean for Application with the Wind Load Provisions of ASCE 7" (PAHO (funded by USAID), unknown), [http://www.disaster-info.net/safehospitals\\_refdocs/documents/english/windhazardmaps/WindSpeedMapsAndTablesReport.pdf](http://www.disaster-info.net/safehospitals_refdocs/documents/english/windhazardmaps/WindSpeedMapsAndTablesReport.pdf).

<sup>v</sup> Regional guidance for engineered structures can be found at <http://www.eird.org/cd/acs/English/WELCOME.pdf>

## 4.0 Construction checklist

Preventing common causes of timber building collapse	
	<p><b>Buildings should be tied down</b></p> <ul style="list-style-type: none"> <li>✓ The roofing material must be securely connected to the roof.</li> <li>✓ The battens should be securely connected to the rafters.</li> <li>✓ The rafters should be securely connected to the wall plate.</li> <li>✓ The wall plate should be securely connected to the wall.</li> <li>✓ The wall should be securely connected to the foundations...</li> </ul>
	<p><b>Buildings should be braced [D.2.3]</b></p> <ul style="list-style-type: none"> <li>✓ Walls should be braced diagonally.</li> <li>✓ Roofs should be internally braced.</li> </ul>
	<p><b>Timber should be sized appropriately [D.6]</b></p> <ul style="list-style-type: none"> <li>✓ Know which elements of a building take the highest forces, and size timbers appropriately.</li> <li>✓ Structurally critical building elements should be over designed if timber of uncertain quality is to be used.</li> </ul>
	<p><b>Avoid excessive spans [D.2.4]</b></p> <ul style="list-style-type: none"> <li>✓ Ensure that the distance between supports for timbers is at a minimum.</li> </ul>
	<p><b>Foundations must be solid [D.2.2]</b></p> <ul style="list-style-type: none"> <li>✓ Foundations must be on well prepared ground.</li> <li>✓ Foundations must be sufficiently deep.</li> <li>✓ Foundations must be protected from moisture and insect attack.</li> </ul>
	<p><b>Roof must be secure [D.2.4]</b></p> <ul style="list-style-type: none"> <li>✓ Roof must be properly connected to the walls to prevent it from lifting. (All roof components must be securely tied down to the walls.)</li> <li>✓ Timbers must be sized appropriately.</li> <li>✓ Structure and trusses must be carefully designed.</li> </ul>

Excerpt from "Timber as a construction material in humanitarian operations" downloadable from [www.humanitarian timber.org](http://www.humanitarian timber.org).

# ANNEXES

## A.1 Position on tents in Haiti

Document date 15<sup>th</sup> February 2010

### Position on tents

Tents will continue to be received at the airport and will continue to be distributed, but they are not a long term solution suitable for the hurricane season.

Purchase is not encouraged unless organisations have existing expertise in the procurement of humanitarian tents.

### Tents in context

- In the first days of the crisis, there was considerable focus upon the provision of tents. However as time has passed this situation has now changed.
- Across Haiti, affected families have started to build very basic shelters with the materials available to them. This is a process that should be supported through provision of suitable materials rather than ignored by the provision of tents.
- Given the various operational and logistic constraints with the distribution of materials, resources need to be focussed on getting water proof cover to affected people as quickly as possible.
- Tents provide a short term shelter solution, but have a limited lifetime in hot humid climates. As a result significant funds are used with limited long term advantage to the occupants.
- There is not enough room for tents in high density sites. Tents have a larger footprint than self built shelters.

### Tent quality

- Past experience has shown that when large quantities of tents are purchased at short notice, the quality remains unpredictable. Even the briefest visit to the earthquake affected areas of Haiti will show a huge diversity of tents distributed.
- Many of the tents will not remain waterproof for the heavy rains due later in the coming months. Many others are simply too small.
- Tents specialised for humanitarian relief have been developed over many years by major organisations. To purchase suitable tents requires establishing clear specifications and understandings with manufacturers.
- Rapid procurement invariably results in substandard quality of tents.
- Even good quality tents have a lifetime less than a year in hot and humid climates such as Haiti.

As an example, in a survey of the estimated 400,000 tents distributed after the Pakistan earthquake in 2005, over 80% were found to be unsuitable for the weather. Most of the distributed tents required remedial distributions of plastic sheeting. This caused significant delays.

More on tents can be found at "A guide to the use and logistics of family tents in humanitarian relief"

<http://ochaonline.un.org/OchaLinkClick.aspx?link=ocha&DocId=1002112>

More on plastic sheeting can be found at

<http://www.plastic-sheeting.org>

### The way forward

- Plastic sheeting is a well proven material in disaster response. Very clear and well established standards were developed in the mid 1990's. When combined with suitable fixings and salvaged materials, very strong and waterproof shelters can be built
- As Haitians have already started work on shelter construction. It is far more efficient to assist Haitians to improve and secure accommodations they have already started, rather than introducing a new, less preferable solution.

## A.2 Note on achieving Sphere Standards in Shelter for the Haiti Earthquake Response

Dated: 15/02/2010

Sphere 2004 - Shelter and settlement standard 3: covered living space: indicators:

**“Duration:** in the immediate aftermath of a disaster, particularly in extreme climatic conditions where shelter materials are not readily available, a covered area of less than 3.5m<sup>2</sup> per person may be appropriate to save life and to provide adequate short-term shelter to the greatest number of people in need. In such instances, the shelter response should be designed to reach 3.5m<sup>2</sup> per person as soon as possible, as longer durations may begin to affect the health and well-being of the people accommodated. If 3.5m<sup>2</sup> per person cannot be achieved, or is in excess of the typical space used by the affected or neighbouring population, consideration should be given to the impact on dignity, health and privacy of a reduced covered area. A decision to provide less than 3.5m<sup>2</sup> per person should be highlighted, along with measures to mitigate against any adverse affects on the affected population.”

### Proposal

For the earthquake response in Haiti, a core transitional shelter kit is proposed for use with small groupings of shelters in urban areas. This must be accompanied by support in construction and must allow for upgrade as soon as possible. Although providing less than 3.5m<sup>2</sup> covered living area per person may be lower than commonly accepted, the congestion on available sites may mean that such an approach is required.

### Criteria

The provision of shelters<sup>4</sup> smaller than 18m<sup>2</sup> should only be considered in when there is:

- A plan to mitigate against the impacts of crowded living conditions on inhabitants, including support with sanitation, drainage and hygiene promotion, access to communal spaces for livelihoods, health and childcare activities.
- A plan to increase the covered shelter area to 3.5m<sup>2</sup> per inhabitant in an agreed timeframe.

### Groups targeted

Specifically smaller shelters might be provided for:

- Groups of less than 10 shelters in congested urban environments

### Support required

- Negotiation of access to land for transitional shelter
- Identification of host families as an alternative option
- Provision of carpenters, builders training and potentially cash to support with construction of safe shelters.

### Justification

- Space in urban centres is extremely limited.
- Demanding that families have sites larger than 18m<sup>2</sup> may force them to relocate inappropriately - moving them away from livelihoods and losing their claim over their land.
- Variable sized plots of land must allow for flexibility in construction.

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<sup>4</sup> 18m<sup>2</sup> is Based upon 3.5m<sup>2</sup> for an average family of five.



## A.3 Transitional shelters - FAQ

Dated: 15/02/2010

### What do we mean by Transitional shelters in Haiti?

- Transitional shelters are structures that provide solid cover for families for up to 3 years, providing additional time to develop durable solutions.
- The materials from transitional shelter can be incorporated into final reconstruction or relocated if required. They can also be repaired and maintained by their owners to increase the shelter lifetime.

### What do transitional shelters look like?

- There will be many models, each developed by different organisations. All should conform to the technical design brief developed by the shelter cluster technical working group.
- Shelters built with the support of international organisations will have a timber or steel frame with a corrugated metal roof.
- Shelter construction will focus on a solid frame and roof. This should be well anchored to the ground, with movable foundations on sites where land tenure is not assured.

### Who will receive transitional shelters?

- Selection of beneficiaries for transitional shelters remains challenging. The majority should be built in small groups on family plots. Selection will be complicated by the high value of a shelter in comparison to low disposable income of the poorer Haitian families.
- Priority should be for families in rural areas who are identified as having an irreparable or destroyed home.
- Shelters in urban environments are liable to be smaller than shelters in rural environments. Beneficiary identification in urban environments will be more challenging.

### How big?

**18m<sup>2</sup> covered living space is the target.**

The provision of shelters, smaller than 18m<sup>2</sup> may be considered for confined sites when there is:

- A plan to mitigate against the impacts of crowded living conditions on inhabitants, including support with sanitation, drainage and hygiene promotion, access to communal spaces for livelihoods, health and childcare activities.
- A plan to increase the covered shelter area to 3.5m<sup>2</sup> per inhabitant as the situation allows.

### How much?

- Budget 1000-1500 USD for 18m<sup>2</sup> shelter including transport and labour

### Note on prefabricated shelters

- Prefabricated shelters using materials that cannot be repairable locally such as those expanded polystyrene fillers in walling are not advised.

## A.4 Dos and Don'ts Of Distribution

Dated: 14/02/2010

The Shelter Cluster coordination team presents these Dos and Don'ts to assist agencies with their distributions.

1. Make contact with local community leaders – Organisations should identify correct community leaders, including women, and discuss distribution needs and plans and to ask for initial information on affected families.
2. Verify needs – Organisations should then verify this information during field visits, discussion with other relevant stakeholders, community consultations, and other means. Organisations should ensure that the needs of the most vulnerable have been included in these plans.
3. Agree distribution plans – Where possible, organisations should agree distribution plans with local community leaders, ensuring that this plan is communicated as widely as possible with the whole community. Communities should understand how both needs and targeted beneficiaries have been identified.
4. Ensure targeted beneficiaries receive distributed items – Where possible, organisations should distribute directly to targeted beneficiaries in order to avoid misdirection of distributed items.
5. Communicate plans with Shelter Cluster – Organisations should always report planned and completed distributions to the Shelter Cluster coordination team<sup>5</sup>. When reporting, provide clear information on
  - location
  - numbers of households targeted
  - dates
  - type of assistance (including items to be distributed)

Wherever possible, use the reporting template from the cluster<sup>6</sup>.

6. Participate in the Shelter Cluster – organisations should participate in the Shelter Cluster, to improve coordination, to reduce gaps and overlaps in the response.
7. Coordinate on transitional shelter activities – Organisations should coordinate with other Shelter Cluster members on transitional shelter activities, and specifically with other agencies operating (or coordinating) in the same Commune.

Please forward you distribution advice to [shelterhaiti2010.tech1@gmail.com](mailto:shelterhaiti2010.tech1@gmail.com) for inclusion in future revisions of this document.

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<sup>5</sup> Email for reporting: [shelterhaiti2010.im@gmail.com](mailto:shelterhaiti2010.im@gmail.com)

<sup>6</sup> see "Reporting Forms for Shelter & NFI" at [www.shelterhaiti.org](http://www.shelterhaiti.org)

## A.5 - Technology based prefabricated shelters for family shelter

### Technical guidance note

Dated: 12/02/2010

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### Introduction

Operations in Haiti are currently based on very severe logistics constraints. Access to construction materials is limited, and there are significant unmet needs as a result.

Operations are focusing in the short term on the delivery of plastic sheeting, fixings, poles and household items to support self help. In the medium term, operations will focus on traditional materials that can be re-used by affected families in the longer term as they move to more durable housing solutions (transitional shelter).

For reconstruction, focus will be on durable housing solutions. More on the shelter strategy, anticipated shelter costs, and non food item prioritisation can be found at:

<http://groups.google.com/group/shelterhaiti2010>

In terms of emergency response, the general wisdom is against the use of prefabricated shelters using high technology materials for family shelter. Instead programmes should encourage the use of appropriate materials that can be re-used or easily maintained. Key documents such as Sphere ([www.sphereproject.org](http://www.sphereproject.org)), "UNHCR Handbook for Emergencies (2007)", "Shelter After Disaster" (UNDRO 1982), and "Transitional Settlement and Reconstruction after Natural Disaster" (UN-OCHA, 2009) (both available from [www.shelterlibrary.org](http://www.shelterlibrary.org)) all advise against technologically based prefabricated solutions for family use.

### What is a technology based prefabricated shelter

A technology based prefabricated shelter is a manufactured and industrially produced ready to assemble kit.

### Why the shelter cluster discourages ngo / agencies to use technology based prefabricated shelters as family shelter

Prefabricated shelters:

- are a more costly solution in terms of procurement, administrative procedures and transportation.
- are based on international expertise and engineering which disrupt the local construction market and tend not to support local employment and skills development.
- do not create the conditions to promote good practice in earthquake and hurricane prone areas
- are of higher quality and meet more housing standards than actual housing, causing tensions, jealousy and possibly conflict amongst the affected population
- materials and expertise come from other countries without consideration of local cultural practices.
- are not culturally adapted.
- are not easily adaptable to site and land constraints, especially in urban contexts.
- are not easily dismountable and/or transportable after their first installation, which is not appropriate for potential population movement.
- can not be used as a source of material for permanent housing construction after the temporary sheltering phase.

It is not currently anticipated that this is a practice that will be reversed for this response.

## A.6 Specifications

### A.6.1 Tent Specification:

- The procurement of tents requires solid knowledge of tent specification. A normal tent specification runs to several pages. Failure to have a detailed specification for large scale tent procurements will frequently lead to issues with quality.
- Tents should provide a **minimum of 16m<sup>2</sup>** usable covered area.
- Double fly is recommended as it provides:
  - A ventilated air gap for enhanced thermal performance
  - Improved water resistance
- **Fabric** should meet the specifications outlined in the IFRC Emergency items catalogue<sup>7</sup>.
- More on specification is available from “A guide to the use and logistics of family tents in humanitarian relief”<sup>8</sup>.

### A.6.2 Timber specification

Timber imported directly by international organisations should have all relevant accompanying documentation including phytosanitary certificates and certification of legality to avoid delays at customs. It must be certified legal in country of origin and preferably should be certified as coming from sustainable sources.

Specification	
Species	To be specified and checked for suitability.
Type of timber	Suitable for use in Haiti with durability of 3 plus years in normal construction use.
Treatments	Treatments are not mandatory, but will extend lifetime of timber. All treatments must be legal and safe <sup>9</sup>
Kind of defect	Acceptable limits
Sloping grain	1 in 8
Sound knots	1/3 dimension of face, to maximum, 10cm diameter. 1 per meter in length.
Unsound knots	¼ dimension of face, up to maximum of 7cm diameter. 1 per 3 meters in length.
Decay (Rot)	None (except in unsound knot)
Sound sapwood, including wane	1/3 sum of width and thickness
End splits	Longest split, 15cm at each end
Stain free from decay	Unlimited
Twist	1cm in 3 metres
Compression failures	None
Brittle heart	¼ of cross-section at ends
Open shakes, surface checks and end checks	½ of thickness
Seasoning/drying	Timber should be dried to 15% moisture content or less

Further information on specifications treatments, sustainability etc can be found in “Timber as a construction material in humanitarian operations”<sup>10</sup>.

<sup>7</sup> [http://procurement.ifrc.org/catalogue/upload/products\\_data/files/HSJETENT01.pdf](http://procurement.ifrc.org/catalogue/upload/products_data/files/HSJETENT01.pdf)

<sup>8</sup> [http://www.sheltercentre.org/sites/default/files/UNOCHA\\_tents.pdf](http://www.sheltercentre.org/sites/default/files/UNOCHA_tents.pdf)

<sup>9</sup> Note structures should be designed so that timbers are not in direct contact with the ground – build out termites and build out moisture.

<sup>10</sup> Timber as a construction material in humanitarian operations downloadable from [www.humanitarian-timber.org](http://www.humanitarian-timber.org)

### A.6.3 Plastic sheeting specification<sup>11</sup>

- Plastic sheeting is preferable over tents as it:
  - Permits flexible use of materials,
  - Is more waterproof,
  - Allows people to create improved living areas. Its relative light weight allows large volumes to be distributed rapidly.
- Plastic sheeting should be distributed with suitable fixings such as rope or wire.

#### Background

- Plastic sheeting is also known as plastic tarpaulin, tarp or polythene sheet. It is a sheet of strong, flexible, waterproof material.
- Although different qualities of plastic sheeting exist, those suitable for humanitarian relief are made from polyethylene to standards that were effectively agreed between major organisations in the 1990's. Some of the specifications such as UV resistance can only be found by detailed laboratory testing. As such, it may not be possible to verify all of the specifications when sheeting is procured locally.
- A standard sheet has a black woven core and is laminated on both sides. All plastic sheeting must reach minimum performance standards outlined below.
- Standard plastic sheeting is commonly available in 4 m wide rolls, or in sheets, measuring at least 4 m x 6 m.

#### Standard specification:

**Weight:** 200 g/m<sup>2</sup> ± 5% (ISO 3801). Add 10% for reinforcement. Lighter versions that meet the material performance specifications below might also be considered.

**Core material:** woven fabric High-Density Polyethylene (HDPE). Black colour, as this provides privacy, reduces heating under the sheeting due to the sun and is the cheapest way to reduce UV degradation.

**Lamination material:** Low-Density Polyethylene (LDPE).

**Reinforcement:** eyelets (sheets only) or reinforcement bands (rolls and sheets).

- Option 1: eyelets (on edges), one strong aluminium eyelet every 1.00 m ± 5% on edges. Sealed on all sides (or 2 sides heat sealed and two sides double stitched), with nylon or HDPE ropes in hem.
- Option 2: reinforcement bands, bands of 7.5 cm width made from black woven HDPE laminated on both sides.

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<sup>11</sup> see also [www.plasticsheeting.org](http://www.plasticsheeting.org).

#### A.6.4. Corrugated iron specification<sup>12</sup>

Corrugated galvanised iron is also known as corrugated iron, zinc sheet or abbreviated as CGI.

**There are alternative metal sheetings to galvanised iron that can also be used as long as they have a comparable performance to 28 SWG sheeting**

**Coating:** CGI often has a zinc carbonate coating which protects the iron from rusting. The zinc coating can usually be identified by the crystalline pattern. Alternative coatings include zinc rich paints.

Painting the zinc coated iron sheet will further increase its life-span. Painting also reduces heating in sunlight. It is necessary to wait some time before painting CGI to allow the greasy protective layer applied in the factory to wash off.

On a visual inspection there should be no gaps or bubbles in the coating. It should not easily scratch or rub off. 'Coating thickness gauges' can be bought to measure the thickness of galvanised layers.

**Corrugations:** Once coated with zinc, the flat sheet is rolled on a press to leave a corrugated pattern. Corrugations make the sheet more rigid. They can be described by the depth (the height from the top of a crest to the bottom of a trough) the pitch (the distance between two crests). Corrugation patterns may vary between manufacturers.

						Suggested Minimum			
SWG	18	20	22	24	26	28	30	32	34
Mm	1.219	0.914	0.711	0.559	0.457	0.376	0.315	0.274	0.234
inches	0.048	0.036	0.028	0.022	0.018	0.015	0.0124	0.0108	0.0009

Note: other wire gauges are used such as the American Wire Gauge (AWG). Quoted here is British Standard (Imperial) Wire Gauge (SWG). This was detailed in BS 3737: 1964, a standard that has now been withdrawn.

**Thickness:** minimum 28 SWG. Thinner gauge sheeting will not last as long and is more likely to fail in high winds. Note the lower the gauge number, the thicker the sheeting.

**Dimensions:** dimensions quoted with a tolerance of  $\pm 5$ mm. Dimensions should be appropriate to construction. With smaller sheets there is more wastage due to overlap between sheets. Larger sheets may be harder to transport.

**Corrugations:** Pitch and depth should be uniform. This allows the sheets to be stacked easily and to overlap neatly when making a join.

**Packing:** if they are being airlifted, bundles of sheets of CGI should be packaged in a sturdy wooden box. This is especially critical if the CGI is under slinging with a helicopter or being stored on or near an airfield.

#### Health and safety

Ensure that handling staff are equipped with gloves and sturdy boots to prevent injury, and that a first aid package is available at loading and off-loading locations.

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<sup>12</sup> text edited from "selecting NFIs for shelter", IASC shelter cluster  
[http://www.sheltercentre.org/sites/default/files/Selecting\\_NFIs\\_for\\_Shelter.pdf](http://www.sheltercentre.org/sites/default/files/Selecting_NFIs_for_Shelter.pdf)

## A.6.5 Rope specification<sup>13</sup>

Rope is one of the most common fixings for plastic sheeting. For fixing plastic sheeting, black 5mm to 14mm diameter rope is preferred. Black rope is preferred as it resists UV degradation, although other colours (such as blue polypropylene rope) may be cheaper or more available.

Ropes can be made from various types of material, properties of some of the most common materials are summarised below.

Properties of the most common types of rope (Based on the MSF catalogue)			
Natural fibre	Polypropylene	Nylon / polyester	
Strength	-	+	++
UV resistance	+++	-	+
Elasticity	+	++	++++
Wear resistance	+	+	++
Resistance to rot	-	++++	++++
Cost	Cheap	Average	Expensive

Specification - Rope: (natural fibre, nylon and polypropylene)	
Basic specification	
Weight	Large quantities are normally purchased by weight. Minimum lengths should be specified.
Dimensions	8-14mm diameter. (or 3-4mm if polyester hard braid)
Colour	Black for nylon and polypropylene, natural for natural fibres (subject to availability / cost)
Material	Polypropylene, Nylon, other polymers, or natural materials. Fibres should not be recycled (for quality).
Material specification	
Number of strands	3 or 4 strands for twisted rope. Twisted for polypropylene and natural fibres, braided for nylon.
Testing	ISO 9554
Printing and packing	
Printing	Bales of rope should be marked with type, material, manufacturer, length, tensile strength, inspection reference.

## A.6.6 Hurricane strapping

Hurricane strapping is metal strapping that can be nailed over timber joints to strengthen them in case of a hurricane. An example specification is as below:

**Material:** galvanised steel

**Thickness:** 0.9mm thick,

**Width:** 20mm

**Maximum hole diameter:** 6.5mm holes at regular intervals.

Note: holes decrease the cross sectional area, so the smaller the holes the better. Hurricane strapping with no holes is strongest

<sup>13</sup> see also [www.plasticsheeting.org](http://www.plasticsheeting.org).

## A.6.7 Shelter tool kit - for rural areas

Material	quantity
ROPE, POLYPROPYLENE, black, diam. 12mm, twisted	30m
HANSAW, for timber, 400mm blade	1
NAIL, FOR ROOF SHEETS, galvanised + watertight washer	0.5kg
SHOVEL, round point with Y handle, total length 1070mm +/-50mm	1
HOE, with long handle, large type	1
MACHETTE, length 495mm, wooden handle	1
SHEARS, straight, for metal sheet, semi-hard 0.8mm max., 255mm	1
NAIL, iron, for wood, 75mm	0.5Kg
NAIL, iron, for wood, 40mm	0.5kg
TIE WIRE, galvanised, diam. 1.5 mm	25m
CLAW HAMMER, carpenter type, 750g, wood handle	1
BAG, polypropylene 80g/m <sup>2</sup> , coated, 1300x400mm	1

For more on shelter tool kits see “The IFRC shelter kit” (under the technical guidance page at [www.shelterhaiti.org](http://www.shelterhaiti.org))

## A.6.8 Kitchen Kit

- There may be some variation in quality and content of kitchen sets. Aim for 70% convergence with the sample set below
- Below is a sample of a kitchen set

Item	Quantity
BOWL, for food, 1L, stainless steel	5
FORK, table, stainless steel	5
FRYING PAN, 2.5L, used as lid for the 7L cooking pot	1
KNIFE, kitchen, stainless steel blade 15cm, plastic handle	1
KNIFE, table knife, stainless steel	5
SPOON, wooden, stirring, 30cm	1
SPOON, soup, stainless steel, 15 ml	5
COOKING POT, 5L, s.steel, diam 20 cm, with handles and lid	1
COOKING POT, 7L, s.steel, diam 24 cm, with handles	1
CUP, stainless steel, with handle, 300ml	5
PLATE, deep, stainless steel, diam. 22 cm, cap. 0.75L	5
SCOURING PAD	1
Re-usable packing plastic box (optional)	1



## **A.7 Fire safety notes - notes for trainers**

These notes are to supplement a fire safety public information campaign

Open flames in or close to shelters are highly dangerous. Fires spread quickly and can destroy a shelter in less than 60 seconds. To keep control, there are simple but effective things you should bear in mind.

### **To prevent fires**

- NO open fires or naked flames inside shelters
- Candles MUST be placed within a glass jar or metal tin with sand in the bottom. Be careful with candles.
- NEVER leave a candle or a fire lit while sleeping or when leaving.
- If you light a fire outside your shelter, make sure to keep flammable materials, like dry grass, paper or kerosene away from the fire area.
- Ensure that children do not play near cooking areas. This is to prevent accidents with fires and with cooking pots.
- Ensure that stoves and pots are stable and shielded

### **To prepare for fires**

- Set up Community Fire Committees. These committees should train community members, especially women, making them aware of fire risks, and explaining what to do if fire starts and how to deal with burns. Action plans should be formed in the event of fire.
- Prioritise the involvement of women as they are responsible for the majority of domestic cooking.
- Fire committees should set up and maintain fire points with fire beating sticks and sand in plastic bags for fighting fires. (water can cause kerosene fires to spread).

### **If a fire starts**

- If a fire erupts and you are inside, do not spend time trying to gather valuables. Just get everyone out straight away and stay out.
- When the shelter is empty, knock the shelter over by cutting guy ropes or pulling out pegs. This will help to prevent the fire from spreading.
- Cover the flames with wet material, like a wet coat/ blanket or cover it with sand. This blocks the fire's supply of oxygen.
- Make sure everyone in your surrounding knows about the fire. Shout! Get everyone together.

### **If your clothes catch on fire**

STOP, DROP and ROLL

- STOP: Do not run around. You will only make the flames burn faster.
- DROP: Lie down. This makes it harder for the fire to spread. It also reduces the effect of flames on your face and head. Remember that flames burn upwards.
- ROLL AROUND: Rolling smothers the flames.

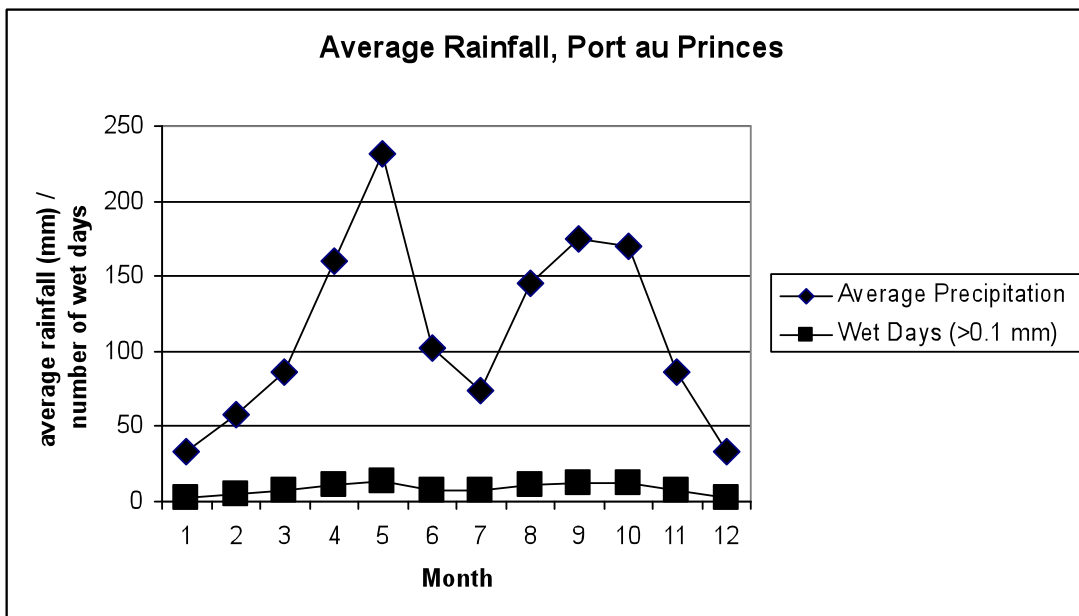
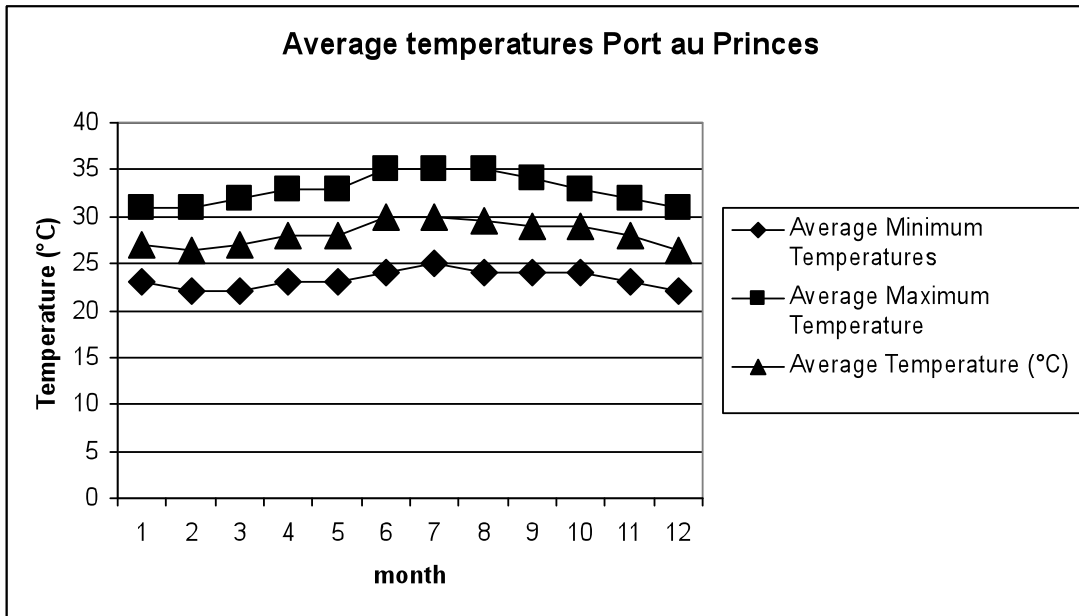
### **If you get burnt**

- Cool the affected area with cold water or a wet towel immediately.
- Protect the burn with a clean cloth.
- Seek medical help as soon as possible.
- keep burn victims warm.

### **And Finally**

- Ensure that Kerosene is stored safely so that children will not drink it.

## A.8 Haiti climate data



source: [www.climatetemp.info/haiti/](http://www.climatetemp.info/haiti/)