

BANGLADESH

Piloting Construction Techniques to Improve Design: Mid-Term Shelters



PROJECT DESCRIPTION

Country: Bangladesh

Location: Camp 4 Extension, Kutapalong, Cox's Bazaar

Conflict: Displaced Rohingya fleeing violence in Myanmar

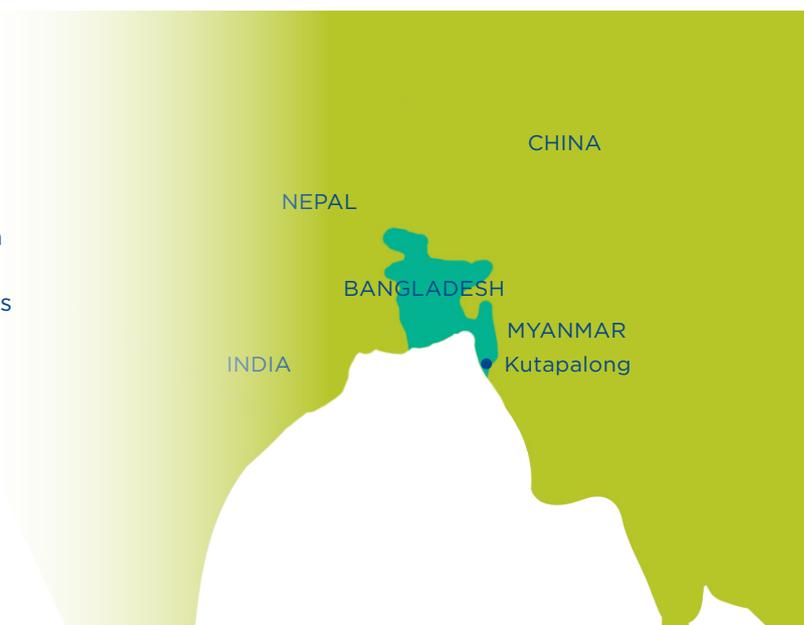
Project Duration: 4 weeks for the construction of pilot shelters

Target Population: 650,000 Rohingya refugees living in the Cox's bazaar refugee camps

Cost per household (USD): \$850-\$1000 per shelter depending on design type

Donors: Caritas Bangladesh internal funds

Partners: CRS, Caritas Bangladesh, UNHCR, Government of Bangladesh



What did CRS and Partners do?

In Cox's Bazaar, Bangladesh, which had become one of the world's most congested and largest refugee settlements after the 2017 Rohingya refugee crisis, CRS supported Caritas Bangladesh in piloting a range of Mid-Term Shelter designs to improve people's safe, dignified living conditions in the precarious surroundings.

The designs sought to improve the durability and ease of construction, while maintaining a temporary construction model for large-scale implementation. The design model was approved by the Refugee Relief and Repatriation Commissioner (RRRC) and endorsed by the Shelter/NFI sector technical working group.

Background

When the Rohingya refugee crisis escalated in late 2017 - with a massive influx of 700,000 refugees into Bangladesh (bringing the total Rohingya refugee population in Bangladesh to nearly 1 million) - the country saw itself at the epicenter of one of the world's most pressing, and quickly-evolving, humanitarian crises. About 600,000 settled in the Kutapalong-Balukhali expansion site, the world's largest and most densely populated refugee camp. The refugee population initially settled on a hilly landscape that was quickly deforested, and ripe for risk in the cyclone-prone area.

Since the onset of the crisis, the Government, with assistance from UNHCR and IOM, have sought to improve the camp infrastructure and facilities, as well as allocate and prepare new land to be developed for new settlements. Refugees receive shelter and tool kits (with materials such as bamboo, tarpaulin and rope) upon arrival, as well as those who have already settled, so that they can construct or upgrade their home.

Problem Statement, including core questions

Although the Bangladesh government discouraged the provision of any form of permanent houses or WASH infrastructure outside the designated areas, a return to Myanmar seems increasingly unlikely in the short term. Therefore, the need exists to prepare for a protracted displacement, and to develop a shelter design that is more durable than the existing bamboo and tarpaulin emergency shelters that are constructed and upgraded by the refugees.



Participants attach the lightweight bamboo lattice to the roof of one of the Mid-Term shelters to prevent the tarpaulin from flying away.
Photo credit: Silla Chow / CRS

Project Process

Design

Caritas Bangladesh has extensive experience in low cost shelters in cyclone prone areas, and has been leading the technical working group on a more durable shelter design, referred to by the government as 'Mid-Term Shelter' (MTS). The key design considerations for the MTS are that the designs should:

- Benefit both the local economy and host communities
- Ensure household and community participation
- Aspire to meet relevant standards e.g. Government/ SPHERE
- Be cost effective
- Be flexible
- Be appropriate to climate and weather
- Minimize environmental impact
- Make use of existing capacity

Working closely with RRRRC and the technical working group, Caritas Bangladesh developed a set of drawings with five MTS design options that provided different layouts and dimensions for the plot size, allowing families to choose their preferred option. SPHERE standards specify that all affected individuals have an initial minimum covered floor area of 3.5m² per person.

The designs use a combination of bamboo and pre-cast reinforced concrete (RCC) posts as the main construction materials. The refugee community has excellent bamboo construction skills, so the structural frame (posts, beams and roof structure) is mostly in bamboo. However treated bamboo is not locally

available, and bamboo used in construction in the camps can have life spans as short as 1 to 2 years. This and the need for further upgrading in future stages necessitate the inclusion of RCC posts.

Caritas Bangladesh has experience constructing shelters of similar design in previous responses in the coastal region, and these shelters have withstood heavy winds and storms. Critical design elements included: foundations, concrete post, bracing, strong connections, hipped roof, tie-down ropes. These are the dimensions of design options approved by RRRRC:

Option	Length	Width	Height	Area (ft ² /p)	Area (m ² /p)	Family size
1	18'	10'6"	7'	189	3.52	5
2	16'	12'	7'	192	3.56	5
3	14'	14'	7'	196	3.64	5
4	18'	10'6"	7'	189	3.52	5
5	15'	10'	7'	150	3.48	4

Construction

Caritas Bangladesh constructed a total of 10 pilot MTS, and took the opportunity to trial many different construction materials and methods to maximize the potential of the piloting and learning phase. These included trials of upgrade techniques such as replacing low-level walls with mud, brick or CGI, and trialing several alternative roof cover designs using different material combinations, as shown in the table below.

Element	Materials in the original design	Materials trialed on site
Columns	RCC and bamboo	<ul style="list-style-type: none"> • RCC and bamboo • Bamboo only (combined with footings)
Footings	Embedment of RCC posts only, no separate footing	<ul style="list-style-type: none"> • Embedment of RCC posts • concrete pad footings • concrete strip footings
Horizontal Structural frame members	Bamboo	Bamboo
Roof frame including purlins	Bamboo	Bamboo
Wall cover	Middle 4' in bamboo fence, top 1' in bamboo ventilation lattice, bottom 2' in: <ul style="list-style-type: none"> • CGI sheet placed vertically • bamboo fence 	Middle 4' in bamboo fence, top 1' in bamboo ventilation lattice, bottom 2' in: <ul style="list-style-type: none"> • CGI sheet placed vertically • CGI sheet placed horizontally • Plain iron sheet • bamboo fence • tarpaulin • bamboo fence with tarpaulin under layer • brick • mud wall
Roof cover	Tarpaulin, with bamboo lattice and bamboo holding down frame	<ul style="list-style-type: none"> • Tarpaulin with rope • Tarpaulin, with bamboo lattice and bamboo holding down frame in various configurations
Doors and windows	Timber frame and batten with plain steel sheet	<ul style="list-style-type: none"> • Timber frame and batten with plain steel sheet • Bamboo
Room height	7'	7', 6'6" and 6'
Roof overhang	2'	2', 1'9" and 1'6"

Core elements of the Mid-term Shelters and the materials used.
Credit: CRS

Learnings & Recommendations

The pilot construction of 10 MTS gave invaluable information for the future roll out of MTS. Based on this information, informed decisions can be made regarding the type of design and materials to be used, the budget, construction time frame and manpower required. Core findings of the pilot construction concerning the designs of the houses included:

Option	Key Characteristics
1	<ul style="list-style-type: none"> • Most expensive option due to 2 extra RCC posts • Least strong wall frame due to weak bracing • Least strong roof frame as the end roof trusses sit on wall plate instead of posts
2	<ul style="list-style-type: none"> • Most economic option • Strongest wall and roof frame • This is the recommended option if the shelter dimensions can fit within the size and layout of the plot
3	<ul style="list-style-type: none"> • “Deepest” building, therefore the longest roof span and partition wall • Require the largest roof height to achieve the roof angle of 27° • Option 3 is not recommended unless no other design can fit inside the plot
4	<ul style="list-style-type: none"> • Same as Option 1
5	<ul style="list-style-type: none"> • “Deepest” building, therefore the longest roof span and partition wall • Require the largest roof height to achieve the roof angle of 27° • Option 3 is not recommended unless no other design can fit inside the plot

These designs are significantly more expensive than the emergency / upgraded shelter designs in use across the camp even more than one year into the emergency response, and may not provide the value for money that some donors require. But, the designs offer more durable solutions that would provide cost savings over time.

Construction of trial houses prior to rolling out of large-scale responses is an effective way to test or demonstrate several factors that can affect effectiveness and efficiency, such as:

- Exploring the existing capacities of participant populations in the construction skills required.
- Demonstrating both good and bad practical application of techniques, providing persuasive evidence for all stakeholders.
- Testing materials in the environment in which they will be used.
- Providing a non-technical learning resource, not just for Caritas Bangladesh, but also for all shelter stakeholders.

Recommendations for roll out of MTS by Caritas Bangladesh:

- Use Option 2 where possible, as it is the most economic and structurally rigid design.
- Use double house where possible to maximize use of the scarce land available, and save costs.
- Use only bamboo fence and tarpaulin (for the bottom 2') as wall materials, including doors and windows.



Participants cut the bamboo with simple familiar tools for the pilot shelter.
Photo credit: Silla Chow / CRS

This means construction materials required for the whole shelter are limited to RCC posts, bamboo, tarpaulin, rope and G.I. wire.

- Maximize the skills of the refugee community, which has experience working with the above materials.
- Establish bamboo treatment centers to provide more durable construction materials, and to lessen the need for replacement of materials within 24 months of construction.
- Seek alternatives to bamboo as structural materials given the pressure on bamboo supplies.

By November 2018, Caritas Bangladesh had rolled out 620 MTS in Camp C20 Extension, and the designs have been adopted by other agencies across the camp.

The pilot project provided learning that was shared with all sector partners, and used to advocate and gain approval from government for the use of pre-caste concrete posts, which are an essential component to provide strength and durability. Beyond the immediate needs of the emergency response, this leadership process in the core area of shelter helped to raise the profile and reputation of Caritas Bangladesh, which led to having greater influence in the sector and new partnerships.

Where can I find out more?

Silla Chow (2018) Caritas Bangladesh – Rohingya Response Program Mid-Term Shelters Pilot Construction Report on Findings and Lessons Learnt

Shelter/NFI Sector Technical Working Group (2018) MID-TERM SHELTER FOR DISPLACED CITIZENS OF MYANMAR

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