

Overview

64 Red Cross volunteers, local and international NGOs attended the two one day training workshops to build bamboo reciprocal frame roof relief shelters based on the ReciproBoo Shelter Kit (RSK).

Conditions and materials were very different to the 2015 workshop held at the same venue. Extensive flooding of the site the day before the workshop interrupted the building of the planned 4 unit communal shelter for the participants. Further heavy rain on the second day ensured a sea of mud prevailed and, unlike last year, bamboo quality was poor.

These difficult conditions provided participants with experience of some of the difficulties that families face in a disaster situation.

All the teams rose to the challenge. None of the participants had built this type of shelter before, and yet all completed the course empowered with the skills and “know how” to build all the 5 types of emergency and transitional ReciproBoo shelters.

The 4 unit classroom / reception was built for the first time ever, as was the low profile storm shelter. New ideas were explored and built upon, and as a consequence, some will be included in the next guideline handbook.

Participants remained enthusiastic throughout and feedback (see last page) was most positive. It was a privilege to work with and learn from both groups.

The following report is a summary of the training and workshops. Further workshop photos can be seen [here on our website](#). For detailed specifications of the shelters please see [Myanmar 2015](#). For instructions on how to build the shelters see the [Nepal workshop](#).

Special thanks to Myanmar Red Cross for allowing the use of this venue and their facilities over 2 days, to Aung Thaug Shwe of the Red Cross and London architect Harriet Pillman ,assistant course instructor.

Shaun Halbert



Day 1 : Red Cross volunteers



Day 2 : Myanmar and International shelter representatives

Materials

Bamboo:

Dry bamboo poles sourced locally (retail). For the frame the bamboo ideal is 30mm to 45mm diameter. Bamboo used was 20mm to 40mm, poorly stored on the ground and starting to rot. Bamboo posts were good quality and up to 90mm.

Ropes.

6mm polypropylene rope, sourced locally (retail).

Lashings:

Coconut fibre twine and bamboo strips for tarpaulin attachment, sourced locally (retail).

Tarpaulins.

Standard triple laminated 6m x 4m relief tarpaulins, weight 4.5Kg.

Tools

IFRC shelter kit .

Saw and machete.



Frame poles. Under specification but adequate.



Support poles. Good specification and condition.



Standard IFRC shelter kit (tools and tarps)



Coconut fibre lashings.
Bamboo strip tarpaulin ties.

Shelter 1 : Emergency ReciproBoo Shelter Kit (RSK)

Key points:

- ✓ Requires only 7 bamboo poles
- ✓ Rapid assembly in 30 minutes
- ✓ Supports heavy insulation so cooler than a tent
- ✓ Uses 33% less bamboo than any other type of frame
- ✓ Lightweight and easily carried
- ✓ It can easily be lowered to a storm profile if required
- ✓ Easily upgraded to the elevated or double shelter

Frame dimensions: Myanmar works in feet and inches:

- 4 x 9ft frame poles
- 2 x 7ft support poles
- 1 x 12ft ridge pole

Central frame overlap was set to 2ft 6in. All the shelter frames were built to this size as it results in a shelter unit that fits the standard relief tarpaulins supplied.

Workshop observations :

1. Overall build quality was good considering this was the first time participants had built a shelter and that they were allowed to improvise their own lashings.
2. Common errors included forgetting to position the support poles inside the frame and ridge pole instead of outside, not leaving enough space at the top of support poles for guy rope attachment and not angling bamboo stakes at 45 degrees for rope attachment.
- 3 Two of the 4 teams were not provided with tape measures but instructed to estimate lengths using the guidebook. These shelters tended to result in larger frames but the resultant shelters were still fit for purpose.

Estimating the 2ft 6ins central frame overlap points

It would have been better to estimate this overlap as a proportion: i.e. At a point a little less than one third of the length of a central frame pole.



This estimated frame is too large but still suitable for shelter. Ends can simply be trimmed to fit the tarpaulin.

This measured frame shows the correct proportion for the overlap points



Shelter 1 : Emergency ReciproBoo Shelter Kit (RSK)

Workshop observations (continued)

4. We increased the strength of the frame by replacing the two side ropes with bamboo ridge poles. This results in a 24% reduction in stress and hence improved overall strength:
(Galway University Engineering Dept: [Research 2012](#))
5. With this weaker bamboo it was also agreed that the strength of the frame and tarpaulin support could have been further improved by not cutting the ends off the 4 central frame poles but allowing them to reach the 3 distant ridge poles and the ground for attachment. See page 10.

Future considerations Myanmar:

1. Bamboo is less expensive than rope per unit length so consideration could be given to making the shelter Kit using 9 poles instead of 7.

Rope attachment as frame nears completion



Attaching tarpaulin to frame with bamboo strips

Side ropes being replaced by bamboo poles



Shelter 2 : Single elevated ReciproBoo Shelter Kit (RSK)

Key points:

- ✓ Requires only 12 bamboo poles
- ✓ The roof frame can be elevated onto a low wall in an urban disaster
- ✓ Supports heavy insulation so cooler than a tent
- ✓ Uses 33% less bamboo than any other type of frame
- ✓ It can easily be lowered to a storm profile within 5 minutes

Workshop observations :

1. Teams were allowed to elevate the roof of their emergency shelter to their own requirements. Even a small elevation of 1 to 2 feet made a considerable difference to living space.



Low single elevated shelter. Good use of dowel to attach roof frame to support posts



Even a 2 foot elevation makes a considerable difference to living space.

Shelter 2 : Single elevated ReciproBoo Shelter Kit (RSK)

Workshop observations (continued) :

2. This shelter can be considered as a standard basic unit for temporary living space. A second frame of 6 bamboo poles is easily added to this shelter to make the double elevated shelter that we built at the Myanmar 2015 workshop.



The double elevated shelter.

Future considerations Myanmar:

1. The roof of this shelter can be thatched on the ground and then lifted onto support poles to provide emergency shelter, if tarpaulins are delayed (see page 12)



The builders of this elevated shelter placed the support poles vertically and then partly buried the bases in the ground.

This single unit of the 4 unit temporary classroom demonstrates the living space of the fully elevated single emergency shelter. In a severe storm the left side of this shelter would be simply lifted off its two support poles and lowered to the ground to provide a low profile storm shelter (see page 11).



School children take the shade.

Shelter 2 : Single elevated ReciproBoo Shelter Kit (RSK)



Shelter, the night before rains. Note the single tarpaulin tie (arrowed)

Tarpaulin attachment failure.

We visited the site early on Friday before participants arrived and found that, after heavy overnight rain this shelter had collapsed. We wanted to use this as an example of the importance of securely attaching the tarpaulins to the frame.

The reasons for collapse were clear:

1. Only a single bamboo strip tie had been used to secure the tarp to the side ridge pole. Once the wind had torn through this the roof tarp sagged and started to fill with rainwater.
2. The partially rotted thin 20mm frame pole collapsed under the weight of water.

The lesson learnt.

Ensuring there is secure tarpaulin attachment to the frame is very important.



The single tarpaulin tie has broken.



20mm bamboo breaks under the massive weight of water



The support post starts to fail under massive weight of water.

Shelter 3 : Double ReciproBoo Shelter Kit (RSK)

Key points:

- ✓ Requires 11 bamboo poles if side ropes used or 15 poles if side bamboo poles are used
- ✓ Provides an additional 6 square metres of floor space and an extra 20cm of headroom.
- ✓ Supports heavy insulation so cooler than a tent
- ✓ Uses 33% less bamboo than any other type of frame
- ✓ It can easily be lowered to a storm profile within 5 minutes.

Workshop observations :

1. This shelter is set up using two vertical support poles. These poles can be buried in the ground as needed.
2. Two heavy lateral guy ropes are used to anchor the shelter to the ground. The support poles can also be inclined laterally to provide additional support for the end wall tarpaulin and increase the floor space to over 20 square metres.
3. The 6m x 4m standard tarps were at least a metre too short for this shelter. A 7 or 8 metre tarp would have been better for anchoring to the ground.

Future considerations Myanmar:

1. This shelter could be used as the standard emergency shelter kit if the additional 6 bamboo poles are available.



Double shelter frame



Single tarpaulin attachment.
End walls would usually be completed with a second tarpaulin



Shelter 4 : 4 unit classroom / communal shelter (RSK)

Key points:

- ✓ Requires 42 poles cut to 4 standard lengths.
- ✓ Provides over 40 square metres covered floor space.
- ✓ Team of 6 persons can assemble in less than 2 hours.
- ✓ Supports heavy insulation so cooler than a tent
- ✓ Uses 33% less bamboo than any other type of frame
- ✓ It can easily be lowered to a storm profile if required.

Workshop observations :

1. This was the first time ever that this shelter had been built. Our objective was to erect it the day before the training as a shelter for participants. Unfortunately due to late delivery of bamboo and bad weather only half the shelter was initially built. However, on the first day, a small team rapidly completed the shelter frame and partially completed the tarpaulin cover.
2. The speed of assembly of the frame was remarkable. If the holes for the support posts are marked out and dug in advance, we estimate the shelter can be completed by a team of 6 in about 2 hours.
3. Time was spent trying to see if a single post arrangement would work at the centre of the shelter. It was agreed that the double support pole arrangement we used worked better.

Half the shelter frame nears completion. Two frames await support posts.



Attaching tarpaulin to frame. Note the second (parallel) ridge pole above the first ridge pole; this provided better tarpaulin support.

Dowel to secure roof to support posts.



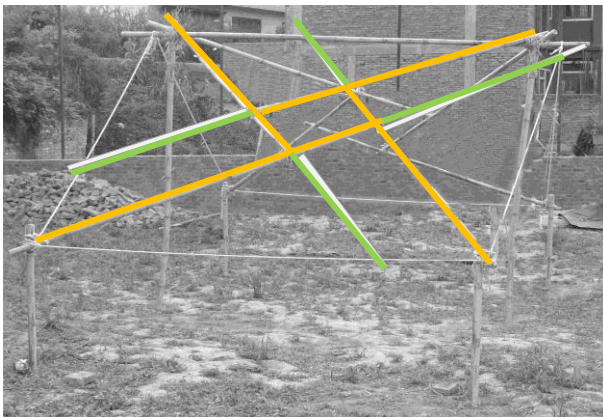
4 unit classroom / communal shelter (RSK)

Workshop observations continued.

- By constructing 4 independent reciprocal roof frames on the ground and then lifting them onto support posts the full potential of this modular shelter is seen. Not only is assembly rapid but also minimal skills are required as shown by this workshop.

Future considerations Myanmar:

- Thatching frames individually with palm leaves can be considered if tarpaulins are not available. If thatching is used, the angle of incline for the roof must be increased to approximately 45 degrees to achieve the required water run off.
- If flexible bamboo is being used it is suggested that additional tarpaulin support, and overall strength, can be provided by not cutting the ends off the 4 reciprocal frame poles but allowing them to extend to the ridge poles. These flexible ends are then lashed to the ridge poles and trimmed when in place.



Frame poles (yellow) are not cut but extended (green) to meet the ridge poles.



Single elevated shelter is one quarter size of the communal shelter.



Tarpaulins partly attached.

Inspecting the tarp as it bulges under the weight of overnight rain. The reason this happened is due to not securing the tarp to the frame.

This time, unlike the single shelter, the frame did not collapse under the weight, and the water was simply pushed out from each sector to drain away.



Storm shelter option : a proposal to lower the shelter profile for severe storms.

Workshop observations

Participants demonstrated how, in the event of an imminent severe storm, the shelters can be lowered to a low wind profile within 5 minutes.

Although the tubular steel frame storm shelter has been high speed [wind tunnel tests](#), it should be pointed out that the bamboo shelter has not been tested under storm conditions.

There is however every indication that bamboo is better for this purpose than the 22mm tubular steel frame that was tested under laboratory conditions.

A mistake was made in lifting the frame off its lower support posts and then cutting the main support poles in half to 1.2m. It would of course have been better to leave the frame on its lower support posts and simply lower the frame to the ground on the side of the main support poles.

Future considerations Myanmar:

If completely enclosed by tarpaulins that are anchored to the ground this storm profile shelter offers an exceptionally strong shelter, of reasonable comfort for several hours.

Importantly it does not require removal of possessions as floor space is not compromised.



The shelter before lowering



The lowered storm shelter profile.



Inside space is surprisingly comfortable. Holding on to the overhead frame is reassuring.

Additional information for workshop participants.

Thatching of shelter roofs.

3 days after the Yangon workshop we were able to demonstrate thatching of the RSK roof frame in a village in the Delta.

By simply lashing two split bamboo lengths vertically on top of the frame, sufficient support was provided for the palm leaf panels.

If individual palm leaves are to be used it is suggested that twine tied horizontally in rows across the frame, or thin bamboo strips could be used for support.

Future considerations Myanmar:

The option to temporarily thatch the RSK roof may be a serious consideration in the more remote regions of Myanmar to provide shelter whilst waiting for tarpaulins to be delivered.



First layer palm leaves



Nearing completion



Note good frame support



2 split bamboo supports lashed to frame



Holding thatched roof up while support posts positioned



Guy ropes would not be needed if posts are dug into ground

Additional information for workshop participants.

Single elevated RSK with Red Cross tarpaulin attachment

This was the first time this arrangement for tarpaulin attachment had been used with the single elevated RSK.

Two half tarpaulins were used for the side walls and back wall. This left a natural door entrance that could be closed at night by the final roof tarp or lifted as an awning during the day as seen here.

Future considerations Myanmar:

This 12 pole shelter may provide basic family shelter. The roof can support a layer of foliage that would make it cooler than a tent.



Half tarp side wall



Both side walls completed



Final roof tarp in place



Shelter open with awning

Additional information for workshop participants.

Completed classroom / communal shelter

Building the shelter for the second time was considerably easier as we had learnt a great deal from the first build

The large 40 square metre covered area was well received for discussions during the heat of the afternoon.

Future considerations Myanmar:

There is every indication that with small modifications to its dimensions this shelter can have a role in Myanmar where communities are displaced.



Communal space. Modular units.



Discussing modifications.



Covered communal shelter

Conclusions

Build quality.

Taking into consideration that this was the first time participants had built ReciproBoo shelters, the standard was very good. All the shelters built were fit for purpose ie emergency shelters with upgrades to temporary / transitional shelter.

To demonstrate the shelters could be built with the minimal skills participants were allowed to use their own method for lashing frames together.

Future applications in Myanmar:

All the workshop participants have basic training in how to build and upgrade ReciproBoo shelters . It is now important that these skills are built upon to benefit communities in Myanmar. Based on my discussions with local and international NGOs after this training, there are clear applications where this method of shelter construction can be used in Myanmar.

1. Disaster Preparedness Programs (DPPs).

After this training we set up the first DPP in a village affected by recurring floods (Pyin Ma Chaung village near Hinthada). The community response to using this method of construction in emergencies was most positive and a separate report will shortly be put on the website .

2. Disaster Response .

From IDPs of conflict or regional disasters to national Cyclone response, the bamboo RSKs offer not only a simple, strong, cooler, more dignified shelter but also a 33% saving in bamboo and transport costs.

Follow up.

We are looking to put in place teams that can not only effectively disseminate the shelter method where needed in Myanmar, but also to maintain the high standard we have set, together with the monitoring, evaluation and follow up required.

Please contact me if your organisation would like to participate in these future programs.

Shaun Halbert
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Single elevated ReciproBoo Shelter Kit (RSK)

- 9 bamboo poles
- + 2 tarpaulins
- + coconut twine lashing
- + guy ropes



Comments from participants

Day 1. Red Cross Volunteers.

“ Good training , get good idea for our activities”

“ Very limited time”

“Most enjoyable. Get many idea, like this activities”

“Good”

“Better to put on the roof”

“Good”

“Good”

“ This shelter will be strong. Is necessary to do orderly and precise manner”

“Excellent. To prevent something dangerous. Easy to get construction raw materials”

“Fine good”

“Fine good”

For this campaign very keen to do for social welfare work”

“ Useful. But we need to change technique how to build shelter”

“Good training for volunteers, useful for emergency time and disaster”

“Good”

“Safety is better than cheap”

“Good”

“Very good”

“Very Good”

“Good”

“ Even this temporary shelter is strong using bamboo and rope”

“Success by cooperation”

“Good”

”Very Good”

“Good”

“ We want this training again”

“Good “

“Good”

“Very good for me”

Day 2 . Myanmar and International shelter representatives:

World Vision, IFRC, Habitat For Humanity International, Plan International, Care International, Norwegian Refugee Council, Lutheran World Federation,KT Care Foundation and members of the Community Development Association (CDA) Myanmar.

“Realistic and effective, we can apply it in disaster regions”

“ Some points are useful and some are not suitable for mountain area also depending living culture of some tribes”

“Useful. Some points special in emergency response”

“Can get knowledge about many kinds of shelters”

“Very limited time”

“Effective for limited materials”

“Good lesson learned”

“Fun and enjoyable. Suitable for Myanmar context”

“Fine good”

“Got the vital information on how to make better shelter”

“Reflective exercise with participants”

“Very good for me”

“ Can get how to construct emergency bamboo and tarpaulin shelters”

“Good”

“Very good for me”

“ Seems really useful and practical. I understand the need/ want for a one day workshop. I am curious if a two day would be more useful”