PRACTICAL ACTION
Technology challenging poverty

FLOOD RESISTANT HOUSING

LOW-COST DISASTER-RESISTANT HOUSING IN BANGLADESH

technical brief

Floods are an annual part of life in much of Bangladesh following the monsoon rains and river bank overflow for up to 3 months a year. So much of the country is low-lying, that many fields and homes are flooded. Especially vulnerable are people living on the charlands – the sand banks lying in the rivers. These floods wash away lands, houses and their vital assets. As part of a broader approach to improving resilience to floods Practical Action has designed a low cost flood resistant house. 24 flood-resistant houses were piloted in the four villages.

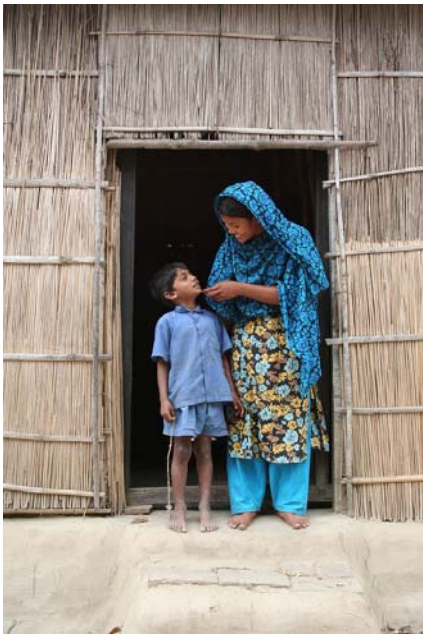

Figure 1: Hosne Ara (14 yrs) and Faruq Hussein (10 yrs) live with their parents in Wazuddin Fakirer Dangi, The house is built on a raised plinth made from sand, clay and cement. Photo: Practical Action Bangladesh.

Wealthier people use materials which are not damaged by flooding, such as corrugated iron sheets, cement pillars and walls, but people who are less well off have to manage with thatch and bamboo. When this monsoon season is over families will often painstakingly rebuild their house, doing the best they can, knowing that their hard work will be swept away once again by the next unforgiving monsoons.

Families attempt to counter annual flooding by:

- Storing food, household items and crops on a platform in the main living room.
- Planting of water resistant plants/trees (to protect the houses from erosion) such as bamboo, banana and hogla grass next to homesteads is a common practice.
- Building houses on raised earthen platforms (of around 300-400mm in height) to prevent water reaching the plinth during normal floods.

Practical Action aimed to improve on the approaches taken by people while keeping the cost of the houses low. The worked focused on individual houses and on cluster villages.
These houses incorporated a number of flood resistant features.

Figure 2: Finishing off the plinth. Photo: Practical Action Bangladesh.

Constructed on raised land so water cannot reach the plinth in normal floods.

The house is built on a raised plinth made from sand, clay and cement (meaning it is less likely to be washed away in floods), and made using concrete pillars and treated bamboo poles. Strong and high enough to last through repeated floods, unlike the traditional earthen floors that simply wash away.

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The design included an improved attic that could be used as living and storage space during times of floods.

Jute panels make resilient walls that cost very little yet are quick and easy to replace. Treated bamboo poles on concrete bases are strengthened with metal tie rods to hold the wall firm and safe. Treated jute stick woven mat partitions increase durability.

The structure, with woven bamboo walls, can be dismantled in the case of a forecast severe flood, and moved for re-erection on a new site or restoration after floodwaters subside.

Figure 3: Julekha Begum is the owner of this house in Yasin Mirdhar Dangi, Faridpur. Photo: Practical Action Bangladesh.

Bracings and fastenings bind the walls firmly to the house 'skeleton' through a network of holes and notches – locally called a 'clam system' – and the whole building can stay standing through the strongest of winds and rain. Nuts and bolts, screws, ties and nails are required.

Bamboo poles are treated to make them more resilient to flooding so that they last longer.

Figure 4: Curing bamboo trees for building flood resistant houses Faridpur, Bangladesh. Photo: Practical Action Bangladesh.

Reinforced concrete posts with footings were introduced to strengthen the structure. Short reinforced concrete stumps for the treated bamboo posts make the structure more resilient to the water.

Corrugated Galvanised Iron Sheets as roofing material help to reduce maintenance costs and are more resistant to rain.

Introduction of windows for ventilation has improved the general housing conditions and speeds the process of drying out after flooding.

As well as the changes in the structure of the house other interventions to help make households resilient to

Water-thirsty plants are set around the house, such as bamboo, banana, hogla that 'drink up' flood water and hold onto the soil, helping the whole homestead stay intact. Most plants can be found locally growing wild, but a little people power is needed to get them in place. Planting of water resistant plants/trees like Bamboo, Banana, hogla, dhal kolmi and others next to the home helps prevent the house suffering from erosion.

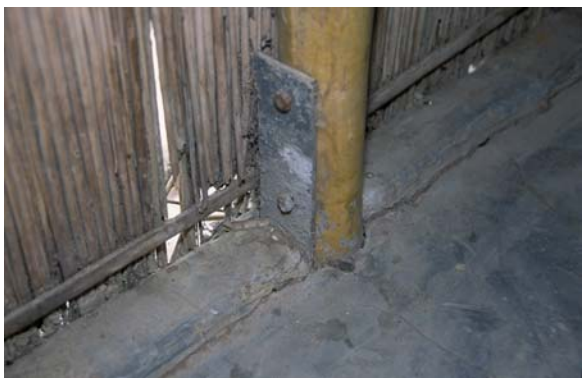

Figure 5: detail of the footing. Photo: Practical Action Bangladesh.

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Animals are considered in the plans too. Crucial to the family's welfare, poultry and livestock have a separate area in the improved houses, to improve hygiene – and the henhouse can be picked up and carried to safety, out of the way of the floodwater. Portable hen houses mean a family's valuable assets can be safely removed from the waters.

Cluster villages

Another integrated approach taken up by Practical Action was the resettlement of dam dwellers through the development of cluster villages where the whole village was built on raised land. 500 decimal (1 decimal is equal to 1/100 of an acre or approximately 40.46 m²) of land was acquired that was large enough to contain a small village, of up to about 100 houses and the height of earth embankment was determined by considering the flooding records for the previous 40 years i.e. ground level of cluster village should be 3 feet or 900 mm above the highest flood level.

Figure 6 : A completed cluster village with pond for community fish culture. Photo: Practical Action Bangladesh.

The target beneficiaries are the vulnerable poorest people living besides the dam in the area, such as the landless, displaced, widows, the old and beggars. They were selected by the community through a wellbeing ranking methodology. The Disappearing Lands Project (River Erosion Project) worked with 5 local NGOs; AKOTA, GUK, SKS, PBKS and S-SUS but resettlement work was implemented with 3 partners; AKOTA, GUK and S-SUS.

Practical Action, Bangladesh has developed 4 cluster villages in four locations including facilities such as water supply and sanitation, community clinic, non formal primary school, cattle sheds, community hall, shops, solar panels and biogas plant with provision to extend in the future. 342 (In a population of 1710) displaced vulnerable dam dwellers have been re-homed in 4 cluster villages with livelihood support (agriculture, livestock, fisheries, light engineering, small enterprise and agro processing) and capacity building training.

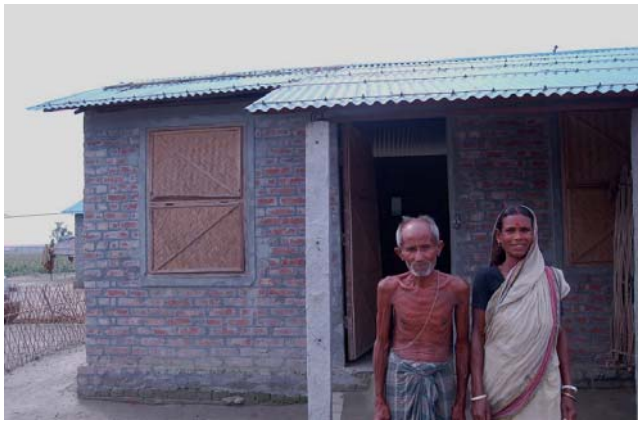

Figure 7: Husband and wife standing in front of their new house. Photo: Practical Action Bangladesh.

This has proven to be at least 3 feet higher than floods that have since occurred, and people and animals have remained safe. Houses were designed in conjunction with the end users, community people, and an architect consultant and on the basis of Practical Action's previous experience. Facilities were placed around several small courtyards in the cluster called a sub-cluster. To consider the privacy of women, separate bathing and sanitary facilities for men and women were also introduced.

The standards used for construction in Gaibandha river erosion project were quite high: houses were 23 m² in area with concrete floors, brick and mortar walls, steel roof trusses covered by corrugated coloured iron sheets, and door and window frames. At the time of construction, the cost per house was about £1,000, including all services. That is probably too high to be replicable at scale, and if the houses are not going to be flooded, they can probably be made from somewhat less permanent

materials, as long as they stand up against strong winds. In a subsequent project, therefore, houses have been designed to a reduced their cost by at least half.

This housing model has been developed and implemented based on the previous experience of Practical Action and other development partners and Government of Bangladesh. Here Practical Action has followed some steps to make it different and innovative which as follows:

- Cluster housing site is free from the risk of erosion.
- Land developed by dumping earth considering highest flood level of previous 40 years and future factor of safety.
- 5 decimal lands consider for each family for their housing, vegetable cultivation, cow, sheep rearing, fish culture, future extension, plantation and other purposes.
- Locally available materials and resources involving local community and other stakeholders.
- Floor, wall, roofing, joint of the roofing, roof frame of the house has been considered flood and tornado proof.
- Living space of the dwellers designed considering their family size and future population and it was doing after learning and doing method.
- There are considering sub-cluster under the cluster village to create more interaction among the settlers.
- Proper ventilation (door and window), kitchen, veranda and courtyard have been provided.
- Beneficiaries selected using wealth ranking methodology
- Community based organization has been formed in the cluster community for its future operation and maintenance.
- This project has been implemented with the help of local NGOs.
- After full settlement of the dwellers in the cluster village, their legal registration for ownership has been handed over.

The cluster village is made in a collaborative way; people excavate soil and sand from one area to build an earth platform. This is done in the dry season December to April. The hole where the soil/sand is excavated from creates a reservoir which is used by the community for various livelihood initiatives such as fish farming, duck rearing, floating gardens etc.

The banks are stabilised by planting fruit trees and Napier grass (which can also be used as goat/sheep fodder).

Overview

The project was one of collaboration between community and experts brought in by Practical Action, Bangladesh. Several workshops were held before the design was finalized. The community contributed much in the way of ideas on how to improve on the present housing model.

The housing technology was shared with the whole community, carpenters and local masons were trained in flood proof house construction. In addition members of the community were also given skills development on construction and maintenance of the house.

Figure 8: The whole community work together to make a large raised platform for the cluster village.
Photo: Practical Action Bangladesh.

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Each one draws on local know-how and the materials used are readily available and highly cost effective. Together they are designed to ensure that, though the floods come and go, the house will stay standing.

Conclusion

Floods are not a new phenomenon, they have happened for centuries, and the people of Bangladesh have found some ways of their own to cope and keep themselves safe, but these are not always entirely successful, and the asset losses are hard to overcome, particularly for the poorest and most vulnerable people.

Figure 9: The newly finished earth raising is planted with young trees to stabilise the sandy soil. Photo: Practical Action Bangladesh.

References and further reading

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Building Safer Houses in Rural Bangladesh Salek M. Seraj & K. Iftekhar Ahmed, Bangladesh University of Engineering and Technology, 2004, ISBN 984-32-1280-5

The Housing & Hazards Group
http://www.housingandhazards.org/
The Housing & Hazards Group develops practical methodologies and links professionals, academics and practitioners based in and around the University of Exeter to make safer, hazard-resistant housing available and affordable to vulnerable rural communities around the world.

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