FLOOD ADAPTIVE HOUSING IN BANGLADESH

Peter Duby

Architectural designer Peter Duby was a volunteer for the Red Cross from August 1988 to December 1989 with the task of developing disaster relief housing for the handicapped and landless in Bangladesh, following the 1988 floods. Here he describes his experience in developing a model for houses with better flood resistance for the most vulnerable of the population.

Imagine, if you will, a billiard table. Flat. Bangladesh is so flat that the Gangetic dolphin not only swims up the rivers of the country, but swims out the other side too; leaving the country at a distance of 400 kilometres from the sea, but at an elevation of just 17 metres above sea-level. The country is watered (flooded would be more appropriate) by three great rivers, the Ganges, the Brahmaputra and the Meghna, which combine to form the largest delta in the world, with a freshwater outflow second only to the mighty Amazon.

Bangladesh lies at the apex of the Bay of Bengal, one of the most fecund of all bodies for giving rise to cyclonic storms. In August 1988 the rise in water in the Ganges, resulting from a late monsoon over northern India, coincided with the rise in water in the Brahmaputra, following an early snow melt in Tibet; and, combined with a spring tide and one of these onshore cyclonic storms, resulted in unprecedented floods. Over sixty per cent of the country was inundated.

With a population approaching 120,000,000 in an area of 143,998 square kilometres, and with a per capita average income amongst the lowest in the world, the country has to rely on intensive cereal agriculture; thus even fairly small upsets to the delicate balance of the routine rapidly deteriorate into major disasters.

The short history of this country is beset with calamity. Created by the stroke of a civil servant's pen in the early years of this century while dividing the unruly province of Bengal into West and East, and with its boundaries confirmed by the creation of the Islamic state of Pakistan at the partition of India in 1947, it took a bloody civil war to win independence in 1971. Almost immediately, the infant state was crippled by the devastating famine of 1974, and into this situation poured large amounts of foreign aid, establishing a pattern of dependency that exists to this day; foreign aid is responsible for over 75 per cent of the GNP.

Because the land is so flat, the flooding in Bangladesh is seldom very deep and the water does not rush with great speed. The image of the billiard table, but with a pail of water spilt on it, may suffice. This may mean that fewer lives are lost through drowning than might be expected, but it does not reduce the damage caused by the rising waters. It was estimated by the International Red Cross that beside the quarter million or so, families that had been added to the two million families already homeless in Bangladesh, another million homes had been severely damaged by the 1988 floods.

1. During the flooding the local people take to the rooftops, setting up complete communities on any available flat roof – in this case on the local mosque.
In November 1988, a cyclone struck the southeast of the country and resulted in an estimated 5,000 deaths, besides wreaking havoc in several districts. Finally, on 29 April, 1989 the area of Manikganj-Saturia was struck by what was quickly labelled a tornado, but actually appeared to be a hurricane or typhoon. Besides inflicting injury and death, the storm demolished or severely damaged thousands of houses. By the time of this third disaster, the Red Cross, working through the local body, the Bangladesh Red Crescent Society, had in hand a detailed operation for the building of 10,000 houses. This was by no means the only relief housing programme; other Non-Governmental Organizations such as Oxfam, Christian Aid and Enfant du Monde were considering rehabilitation programmes and the local Grameen Bank had its own project of housing loans for the rural poor but the Red Cross programme was designed specifically to reach the handicapped and landless among the poorest sector of the population.

The Red Cross houses were developed by the writer, and based on materials and techniques employed while constructing, in conjunction with a local 'bamboo builder', a temporary clinic on the roof of a flooded clinic that serves one of the most densely populated slums in Dhaka. As part of the background research, more than a dozen designs for disaster relief houses, by both local NGOs and international aid organizations, were assessed and costed to a common baseline.

The average house appeared to be a single room of about 6 x 3 metres, with walls of woven bamboo matting and a pitched roof of corrugated iron sheeting, which is locally rolled but from imported steel sheet. Details varied between the different designs, some having welded steel tube frames and others having precast concrete frames; but all shared a common feature in that the floor consisted of a platform which had to be provided by the beneficiary, built of the local clay about 300mm above the natural ground. This clay platform, of course, becomes waterlogged and during flooding is liable to return to the natural state: mud! It was felt, by the Red Crescent medical advisers, that sleeping on cold, and possibly damp, clay floors was responsible for various rheumatic ailments suffered by great numbers of the population. It was decided that the houses should have some form of raised flooring.

However, Bangladesh is now alarmingly deforested and timber is therefore an unaffordable luxury. The answer was to raise the whole house on stilts, to avoid minor flooding; and to make the floor of bamboo. This then was the starting point of the design. One of the early criticisms of this design was that the Bangladeshi women, many of whom wear bourka of Moslem purdah, would not climb the ladder to a house on stilts. The local people were asked to comment on this aspect of our first sample houses, and the comment was that as long as the floor platform was below the eye-level of the average man, no impropriety would be construed. A further consideration in the development of the house was that many of them would be built for landless people on the strength of a witnessed agreement of temporary occupation by the landowner. Landowners were known to rescind on these agreements and install their family members in houses built for
the scene, with our Red Crescent medical

The actual construction begins by sinking the ten main poles into the ground. For these pillars the base of the cane of a variety of bamboo known for its thickness and great strength, called 'borak', is used. First coated with old motor oil (obtained from the bus rank), these columns become both the stilt and the framing for the walls, so it is to these that the cross- and edge-beams for both floor and roof are attached. All joints are lashed, using coir or jute twine – a traditional fixing.

The woven bamboo matting for the walls, known as 'mouli bera' (from mouli, a variety of thin-walled bamboo that grows with a fairly constant diameter over most of its length, and bera, matting) is made up on site. First the mouli is split once along the length and opened out and flattened, forming long even strips about 100mm wide. These strips are then split in their thickness, creating two types of strip; the hard outer skin, known as 'pit', which contains the highest concentration of silica and is the most weather-resistant, and the softer, more pithy inner section known as 'book', and suitable only for internal use. Each wall is tailor-made of a single panel of bera framed with thin strips of borak, and lifted into place and fixed. To form the floor, a series of borak poles were split into four and lashed into place; this base was covered by a layer of mouli bera and finished with a soft grass or palm frond matting. Each beneficiary was advised that limewashing the stilts and underside of the floor would decrease the chance of attack by insects.

In the earliest versions of the house, a mono-pitch roof was used, but this did not allow for air circulation beneath the roof sheeting torn from the buildings and sweeping through the air like flying scythes. This led to a study of the aerodynamic qualities of the sheet and resulted in the recommendation that the sheet be curved on a gentle arc to ensure that in a high wind free sheets would fall to the ground. As the manufacturers were unable to curve their sheet, the matter was discussed with a local engineer and put to a remarkable man, Md. Hafizul Hassan, senior engineer at the Mirpur Agricultural Workshop and Training School, who designed a machine on no better information than a hazy memory of having seen such a machine in Africa. He had two ex-students build the machine, turning the shaped rollers by hand, from an old ship’s propeller shaft, and produced sample sheets. These curved sheets proved (as expected) to be inherently stable structurally; and were capable of spanning from wall to wall, eliminating the need for a roof structure, thereby effecting a saving of almost 20 per cent per house on our base costs. Unfortunately the modification was not adopted; had it been, 20 per cent more houses might have been built.

Further thought into the problem of flying roof sheeting led to consideration of the failure of the structure; when the roof sheeting was torn off by the wind to become a deadly object. The standard method of fixing the roof sheet was by means of the conventional roofing screw developed to hold corrugated sheeting to timber purlins. Because of the lack of available timber, the local people are forced to use bamboo strips in place of timber purlins. Bamboo shrinks laterally as it dries, and many roofing screws can be extracted with little more than finger pressure. An alternative fixing was designed, using a simple principle found elsewhere; a fixing which would have reduced still further the cost of each house, and ensured that, in the event of high wind, the roofsheet would remain attached to the house. But there was no local interest in this alternative fixing; the Bangladeshi industrialists were reluctant to venture capital on untried products whose cost benefit had not been proven.

By the end of 1989, as my agreement with the Red Cross came to an end, I began to see the long-term benefits of the housing. I was taken to see a house that had been built in a particularly poverty-stricken slum for a handicapped widow with three children, on a minute piece of land belonging to a man who supported his family with seasonal work as a goat-herder. This new establishment had meant that two of her children, six and eight years old, could now find regular employment – in part payment for which they were being taught to read.

PHOTOGRAPHS BY THE AUTHOR

PETER JON DUBY, A FRENCH CITIZEN, WAS BORN AND BROUGHT UP IN AFRICA, AND HAS SPENT MOST OF HIS WORKING LIFE IN THE DEVELOPING WORLD. HE IS CURRENTLY ASSISTING SKAT, THE SWISS CENTRE FOR APPROPRIATE TECHNOLOGY, IN A STUDY TO IDENTIFY PROMISING BUILDING MATERIALS AND TECHNOLOGIES IN BANGLADESH. WHEN IN LONDON, HE WORKS AS A CONSULTANT TO CHAPMAN TAYLOR PARTNERS.