A LOW INCOME HOUSE IN PUNAKHA, BHUTAN

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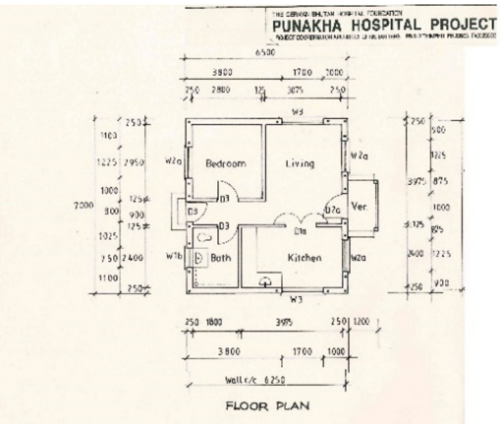
Staff housing was designed and built as part of a hospital construction project funded by an NGO, the GBHF, in the hot climate of Punakha, Bhutan. The net floor area is 36m2. Costs had to be kept to a minimum.

The housing was built in various models, from the minimum unit described here to a double storey version containing four units, shown below. Versions with several living units naturally save considerable amounts of material, as well as lowering costs. In later versions we built a covered veranda extending along the whole front of the house, since outdoor living in this hot climate is a key quality (winters are cool but very sunny).

From the point of view of energy and indoor comfort, the design applies passive climatisation features such as high thermal mass, solar protection with large roof overhangs, good cross ventilation, and a ventilated roof space. Extra cooling is provided by ceiling fans, which consume very little energy and can provide a perceived temperature difference of around 3 degrees.

As regards materials, options at that time were limited. Local materials were used where possible, including timber whereas newer buildings increasingly use cement products. However, in traditional construction in Bhutan, timber was used in large, inefficient sections; in the Punakha project a lightweight roof truss was introduced. In other (school) projects in Bhutan I used either stone in mud mortar or else rammed earth which has a long tradition, with carbon-intensive cement being used only for a few specific items such as bathrooms, damp proof course and roof level ring beam.



A particular success of the Punakha hospital project was the roofing. Instead of the universal trend of corrugated galvanised iron roofing (CGI), we trained workers to manufacture microconcrete roof tiles (MCR) on site. The MCR technology was originally developed by the Intermediate Technology Development Group (now Practical Action) in the UK, and has spread to quite a few developing countries. These are thermally much better than CGI, quieter during rain, and avoid import of roofing sheets. In addition, our small workshop managed to manufacture them for half the cost of CGI.

The house has proved successful. An updated and more sustainable version would, where possible, address operational energy by providing a small supply of photovoltaic solar panels for electricity and thermal solar panels for hot water. To reduce embodied energy/carbon, the option of using stone or improved earth construction techniques could almost entirely eliminate the need for Portland cements and reinforcing steel, which typically account for some 80% of the total embodied energy/carbon in such buildings. The result would be a house with extremely low embodied carbon.

See also: Sustainable Architecture for Developing Countries, Butters/UIA/NABU, Norway 2002:
https://www.researchgate.net/publication/267514821_UIA_Work_Programme_Sustainable_Development_of_the_Built_Environment_The_Road_from_Rio_SUSTAINABLE_ARCHITECTURE_FOR_DEVELOPING_COUNTRIES

The staff houses develop the idiom of the local two-storey domestic farmhouses, but with today's functional solutions. They are arranged in an informal, village-type cluster. There is space for the vegetable gardens, chickens and other bits and pieces which the staff and their families will want; room for the colour and chaos of normal village life.

Cluster of larger size staff units

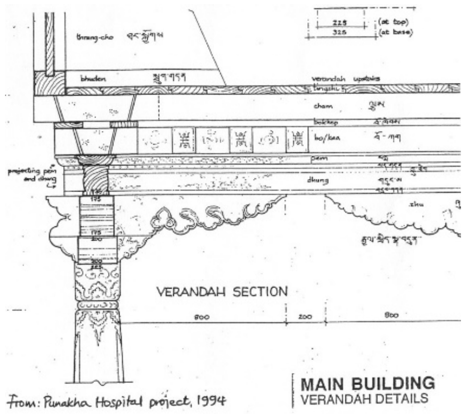
The MCR workshop

Cultural sustainability

The traditional architecture of Bhutan is an important and very beautiful heritage. How can such a cultural tradition evolve - without losing identity, but without falling into ”restoration nostalgia”? The ”easy way out” for donor projects is to *copy* tradition. This may lead to superficially attractive results, but ones which are nonfunctional and expensive. And very wasteful of natural resources. One must not be too romantic about traditions. There are weaknesses in Bhutan's traditional buildings, and an appropriate response is therefore what is usually designated ”improved traditional” methods. Damp proof coursing, daylighting and earthquake reinforcing are three areas which can be mentioned,

Ecology and sustainability are complex issues, and require that the architectural project must address - and then integrate - a wide range of challenges. The response is therefore complex. Challenges are architectural, technical, economic, and cultural. And of course the four are interrelated. It is intentional that environmental sustainability is not singled out as a separate aspect here, for sustainability must be in all of these; in the ecological solutions chosen in low costs – and perhaps above all, in enhancing cultural sustainability.

The Punakha Hospital, Bhutan



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