UIA Work Programme

Sustainable Development of the Built Environment
The Road from Rio

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SUSTAINABLE ARCHITECTURE FOR DEVELOPING COUNTRIES

What is sustainable design? The answer will be different in different contexts. The approach must be determined by local factors: climatic, economic, technological and not least cultural. Modernist approaches may be misplaced - or even irrelevant.

It is difficult to ensure good quality of construction in developing countries, let alone introducing quite new approaches - such as sustainable design. This brochure features two widely differing projects, designed by two Norwegian based architects who worked in Asia. Both have received acclaim from various sources.

The Media Centre in Colombo, Sri Lanka, contains an impressive range of ecological features. It has received praise both locally, and from top European Union and United Nations officials, as an example of climatic adaptation and innovative, sustainable design.

The Punakha hospital in Bhutan highlights the issue of cultural sustainability. Sensitivity to local cultural tradition is integrated into an efficient and extremely economical project. It has been adopted as a model for subsequent hospitals in Bhutan – a sure mark of appropriate design. It was described by international health experts as the most successful in the country; and it received a commendation in the international Ralph Erskine awards in 2000.

But how do we - back home in America or Europe - read such designs? We may judge according to our own values, however inappropriate. We may admire modernist buildings in developing countries because they satisfy us, even if they don't meet the needs they are built for. They may convey different messages to different cultures. Of one recent modernistic project in Nepal, local people commented that it must be a very poor project, since the architects had not even plastered the walls. In other words, our own liking for naked concrete may read simply as poverty, to a different aesthetic sensibility.

Similarly, bright colours used in the Colombo project, relate to the bright tropical light as well as the cultural affinities of Asian countries. The use of strong colour is almost a requirement, whereas in northern Europe, unrendered materials and puritan colouring is preferred.

In Bhutan one or two recent projects by foreign architects have omitted much of the traditional decoration - which has religious significance. The result looks more modern, but to local eyes it is just wrong - not a positive modernisation, but an undermining of local culture. To Bhutanese eyes such architecture is, quite simply, incomplete.

These are interesting issues; the theme of sustainability highlights the inappropriateness of imitating modern "international" design, which one sees almost all over the world. In many developing countries, not least in Asia, inspiring new regional trends are appearing, anchored in local traditions and climate. Sustainable design in our countries, too, often rediscovers old principles, and reinterprets them creatively with new technology.

Sustainability today is universally understood as having both ecological, economic, and social / cultural dimensions. Sustainable design is a synthesis of past and future. It is rooted in global awareness, local in its application. Our reading of the architecture needs to be rooted in a corresponding understanding of ecological and cultural context.

Media Centre, Colombo, Sri Lanka
Architect Harald N. Røstvik

The Punakha Hospital, Bhutan
Project Architect and Coordinator, Chris Butters

The overall concept is a lush garden courtyard design where all existing Mango, Jac and Coconut trees were kept, for pleasure and shading purposes. Colourful overhanging Bougainvillea flowers are planted and will cover and shade parts of the building in due time.

MEDIA CENTRE, COLOMBO

ECOLOGICAL, RESPONSIVE BUILDING DESIGN IN SRI LANKA

Harald N. Røstvik
Lead Architect, SunLab, Stavanger (Norway)

MEANING IN ARCHITECTURE

Buildings account for 50% of all global CO2 emissions. Instead of being polluters, can buildings and even whole cities become solar power stations? Leading ecological designers now suggest that they can.

In time, can a sun-blessed country like Sri Lanka be connected to the sun, and free of dependency on imported fossil fuels? With good architecture, yes.

BACKGROUND

In Battaramulla, on the outskirts of Colombo, WGM Ltd., a group of companies within the media (YATV) and internet sector and an organization (WIF) moved into their new 3000m2 headquarters in the autumn of 2001. The building has been designed by Harald N. Røstvik of SunLab Architects, in collaboration with a firm of local consultants, Kahawita de Silva Ltd, who ensured the necessary local links, a long with a visionary client rep. Arne Fjørftoft.

Max Fordham & Associates, London, provided valuable input to energy matters in the initial phases of the design. The main contractor was Link Ltd, Colombo. The Solar system contractor was Engcotec GmbH, Germany. Some funding for ecological measures was provided by the Norwegian Aid agency, NORAD.

INTELLIGENT DESIGN ”GREEN” GARDEN CONCEPT

The site concept creates a lush garden with no vehicle access, thus greatly reducing vehicle noise and air borne pollution in the working environment.

This garden setting creates a pleasant work situation, in a tropical and very colourful country. Vegetation ensures shading and cleaning of air locally on site before it enters the building to reach the natural cooling extract ducts.

Energy efficiency measures are the basis of the design strategy. To supplement this, solar photovoltaic energy is produced, in a grid connected system.

The ”intelligence” of this building is based on a blend of traditional techniques from the days prior to the current oil age (daylighting, natural ventilation etc.), combined with modern technology and new knowledge (energy efficient equipment, solar PV etc.).

The project is an attempt at responding to the growing need for new meaning in architecture. Buildings are not merely a question of style. Modern buildings are often ecological disasters. Some of the worst cases sometimes receive the most prestigious architecture prizes.

SPACE USE AND MATERIALS SELECTION
The initial planning requirement in 1997 was to design a building with a mainly floating occupancy; most people would not have their own desk, nor office. The mainly computer based activity in the building indicated that a system of plug-ins in open offices could be adequate, supplemented by a few closed spaces for meetings and confidential talks in quiet areas.

As planning progressed, it appeared that staff were not ready for this work style. Some of the new concepts have been introduced, however, and compromises reached.

The building is occupied by up to 450 people including visitors. The organizations and different companies were previously scattered throughout Colombo in 5-6 different buildings, resulting both in communication problems, and unnecessary traffic.

Each had their own canteens, stores and toilets etc. By co-locating these different units, a more rational use of space was made possible. This has resulted in a large space reduction of up to 30% - and hence reduction of material use as well as of energy needs.

Where realistically possible, local materials have been used. However, public regulations, structural and fire demands etc., limit the freedom of choosing completely ecological materials in a real-life building project today. Where building regulations allow, concrete is substituted by less harmful, locally manufactured brickwork. Use of steel/aluminium is limited.

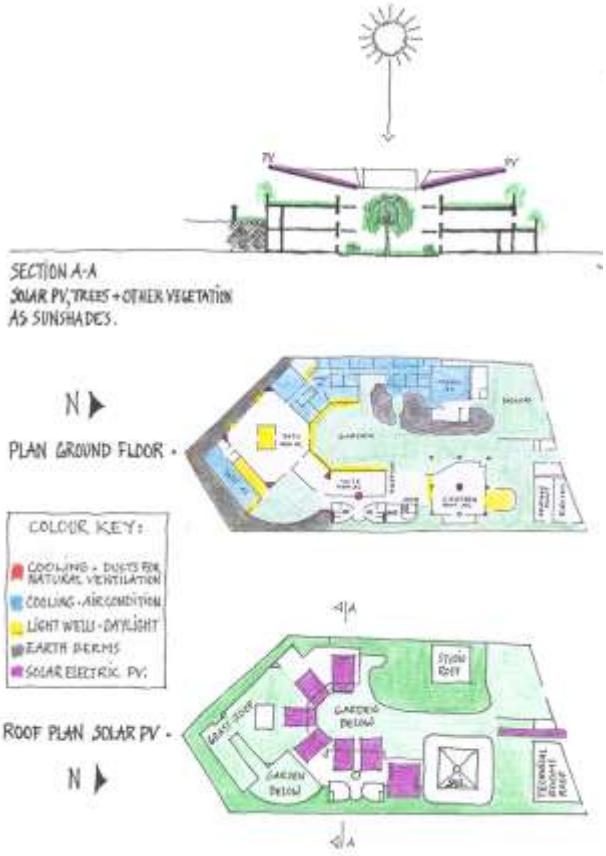
NON-TOXIC FINISHES AND PAINTS
Where possible, toxic and harmful materials (both as regards production process and life cycle) are avoided. Timber, a renewable material, is used for all doors and windows, from forests with ecologically balanced felling programs only.

In enclosed spaces with AC, lead free paints based on nature's own non-toxic raw materials are used.

FITTINGS AND FURNITURE
To create a meaningful interior from an environmental point of view, a program of furniture selection based on the following parameters was developed:
- Minimum of raw material used. Bulky, heavy, material consuming furniture and fittings were avoided,
- Health damaging glues and paints were avoided,
- Rational (short runs) cabling systems were selected,
- Non-energy demanding materials in the production process were selected.
- Timber was used preferably from eco-forestry.

During the furniture selection process, it was difficult to get all users to follow this strategy. Some compromises were made. As is often the case in such contexts, the environmental awareness has to be built up gradually.

Solar PV modules replace traditional roofs as shade and water catchers. Large overgangs stop the blazing sun from reaching the building walls. White tent like structures are used as shades, and more are being installed now. Large ducts, extending above the tents, extract air from the rooms to cool the building interior by a natural ventilation system which is assisted by solar PV driven fans. In addition to this vertical ventilation and cooling, horizontal cross ventilation is extensively used.



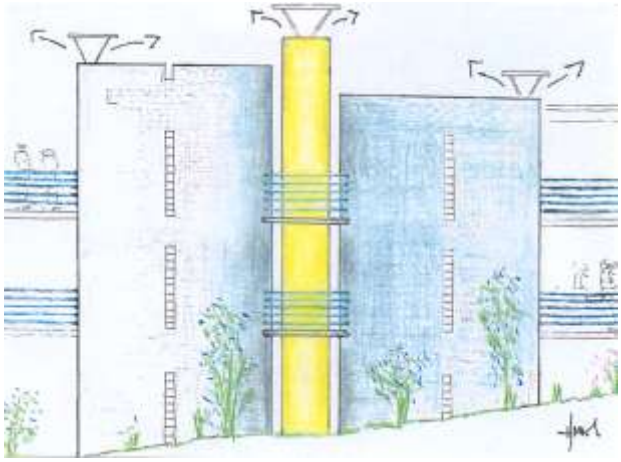
Section showing solar PV modules and vegetation as roofs and shade. Plans show location of solar PV modules. The coloured "Key Plan" shows natural ventilation ducts, locating which spaces use AC, which use natural ventilation, light shafts for daylight into deep offices, etc.

WASTES AND WATER CYCLES
No public sewage system exists near the site. All sewage from up to 450 people is therefore treated on site using biological methods, in an Extended Aeration underground type sewage disposal unit. Water supply is available and provided locally on the site.

The waste water treatment system on site recycles and "cleans" greywater for the main secondary uses, e.g. both to water the gardens and to flush toilets.

Water saving toilets have been introduced, reducing the water consumption by 60% (5 liters per flush as opposed to normally 13 liters in Sri Lanka). All basin taps are the automatic water saving, self-closing type push taps.

Sorting and recycling of paper, metals and other fractions of the solid wastes, seldom done in this country, are to be gradually introduced in the building.



Architecturally visible natural ventilation ducts drawing air from interior spaces - cooling them, "helped" by solar PV extract fans.

DAYLIGHTING AND SHADING
To reduce the electricity demand, the building is designed to allow maximum indirect daylight penetration into rooms via courtyards, light wells and patios, cutting vertically right through the building mass. Designing "deep", badly lit offices has been avoided. Shading by vegetation, sail cloth and solar PV modules (which thus have a double function) protects against direct sunlight and overheating.

The garden as seen from above, a year ago. Today the centre Temple-tree has grown to a larger size and really shades the courtyard effectively. This photo was taken before building was completely finished - some shades were still not in place above some windows.

NATURAL VENTILATION COOLING
Wherever possible, natural ventilation strategies have been discussed and recommended.

The client accepted that all areas with no heavy technical equipment requiring airconditioned cooling should be naturally ventilated. This considerably reduced the AC load. The natural ventilation is slightly "assisted" by solar powered fans, which are located on top of architecturally characteristic extract ducts.

ENERGY EFFICIENT EQUIPMENT
The main airconditioned areas are equipped with "cooled air recovery units" to reduce loads. This is a fairly new concept in the country, rarely if ever used previously. It is estimated that the extra investment cost will be paid back by energy cost savings in less than two years.

All lightbulbs are of energy efficient type, reducing energy needs for electric lighting to about one-fourth compared to traditional bulbs.

The main electric light source in the offices is composed of sets of uplights, creating indirect lighting as a comfortable overall lighting for computer based offices (no screen reflection) assisted by individual task lighting.

Most of the original site landscape was kept - here an earth berm with huge trees on top. It was cut through to access a part of the building. Note that yellow is used wherever a lightshaft occurs to let daylight into interior spaces to save on use of electric light.

SOLAR ELECTRICITY
For the first time in Sri Lanka`s history, the CEB (Ceylon Electricity Board) has accepted a solar PV grid intertie system of 25kWp in a building. The system is expandable up to 75kWp.

Huge new possibilities appear, not least for the economic feasibility of integrating renewable energy supply systems into architecture. Highly maintenance-demanding, costly

and bulky energy storage systems such as batteries are avoided. The grid itself becomes the "storage".

Negotiations are now going on for instalment of the next tranche of 50 kW of solar PV capacity, above the initially installed 25 kWp capacity which is already in use.

SOLAR HEATING
Solar water heating for showers has been projected, and the hope is to introduce this into the project at a later stage. Solar cookers for teas and coffees etc. will also be tried out. SunLab has extensively tested these and other solar technologies previously in Sri Lanka.

CLEAN BUILDING
Throughout the building process, the principle of "clean worksite", minimising all materials waste and construction pollution, has been followed. This implies an educational process, since the concept is quite new to the country.

The goal is to make working conditions for the labourers more pleasant, and healthy, by removing dust and debris at intervals. Another objective is to avoid accidents often caused by falling as a result of stepping over debris.

Waste products such as coconut shells and other items lead to breeding of mosquitoes, and were removed from the worksite systematically. Child labor was banned by contractual agreements, continuously checked up on, and hence avoided.

ACCESSIBILITY FOR THE HANDICAPPED
It is rare in most developing countries of Asia to provide easy access for the handicapped.

In a country like Sri Lanka having millions of casualties from the ethnic conflicts, this issue will become extremely important in the future. Most of the building is therefore accessible with wheelchairs via ramps, wide threshold-free doors, handicap-standard toilets and low level (one metre above finished floor level) electric switches.

FUTURE FLEXIBILITY
All electricity, telecom and communication cables are located in easy access, underfloor ducts embedded in the concrete floor. At intervals they enter connection boxes to which all sockets are connected. Worktables, computer stations etc. cluster around such boxes.

In case of changes in occupancy (type of company) or changed layout, complete flexibility for future cabling is possible by opening the floor trunking and/or changing connections in boxes. Structurally damaging and energy consuming changes to the building will hence be avoided in the future.

TRANSFER OF KNOW-HOW AND AWARENESS BUILDING
Sri Lanka, being a developing country, is in need of know how and modernisation in the energy technology sector. In such a sun blessed climate, solar energy could become a key to a very bright ecological future, not least a way of reducing the crippling burden of oil import bills.

The garden seen from an office on the first floor. At the far end, the access road and entrance to site.

Detail of column and flowers. Sri Lanka is tropical. The people and vegetation are tropical and colourful. This is reflected in the use of colours in the building.

Very valuable exchanges of information have taken place in the framework of this project, together with groups of local consultants (architects and engineers) and the local University, Moratuwa.

Our experience demonstrates that a practical design and building project is a very effective means of know-how transfer between so-called developed and developing nations, and vice versa.

The building sector is both a huge energy consumer, and polluter. Know-how can help reduce the energy needs in buildings. A very important point is that these issues must be raised at an early stage of the design process.

The users of the building have also been instructed how to operate the building most efficiently, ecologically and economically. PC equipment for example will be switched to "sleeping" mode when not in use, reducing the energy need per PC by up to 90%.

The technical maintenance engineer for the building was employed five months ahead of the building completion, to be familiarized with its technicalities and also to get to understand the pros and cons and pursue the goals of the planners.

To help create public awareness, at the entrance to the site an electronic board, which is continually updated, shows energy production from the solar system at any moment. It also shows the CO2-emission reductions since start-up, based on a Bavaria-mix energy supply being substituted.

A user manual will be developed for several target groups and in several local languages. Courses, lectures and site tours will be initiated for selected target groups. The press will be briefed regularly.

Lead Architect the day before the opening session in colourful setting. Note light boxes with energy efficient bulbs lighting all paths. No floodlighting, instead a dramatic low light philosophy is applied, highlighting certain features (paths, flowers, signs etc), always by indirect lighting - no visible bulbs.

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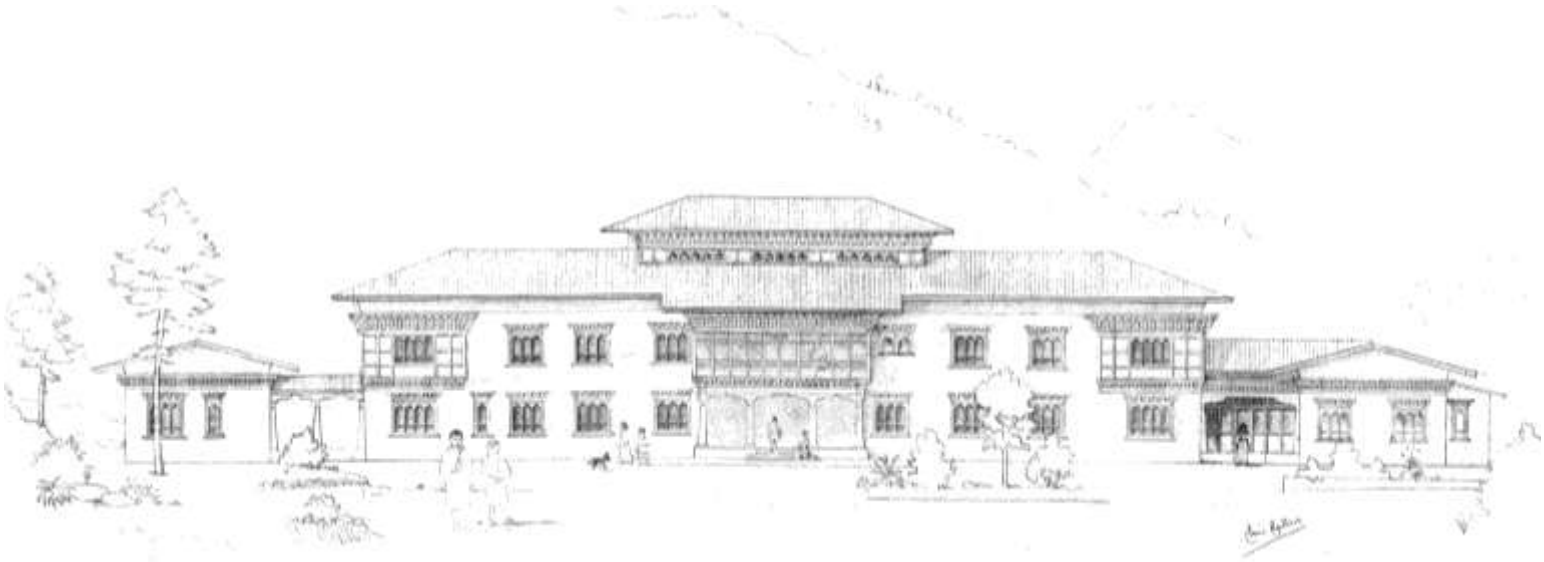
Credit : All photoes and drawings : Harald N. Røstvik / SunLab May 2001.

Overall picture from access road side of the site, showing the tent structure and flowers overhanging the roof. The huge column at centre and some of the side columns are hollow ducts for natural ventilation, bringing stale warm air out of the interior spaces, assisted by solar PV fans set in the top of the ducts.



THE PUNAKHA HOSPITAL, BHUTAN

Project Architect and Coordinator, Chris Butters

CULTURE AND COMPLEXITY

Architecture projects often highlight specific themes, such as formal aesthetic solutions, the social context, or the technical articulation. A degree of such ”specialisation” (or even, abstraction) helps to make projects easily readable; they contain one or two clear messages only.

But this is also their weakness - for, just as with scientific experiments, the highlighting of one or two parameters gives a clear focus only at the expense of the whole.

Ecology and sustainability are complex issues, requiring architecture to address and then integrate, a wide range of factors. The response is necessarily complex too. But complexity is not easy to describe, let alone depict visually. This is a generic difficulty in communicating or interpreting sustainable design.

Four principal challenges are: architectural, technical, economic, and cultural. Architects may tend to focus on the first; but in many situations, especially in developing countries, the others may be even more important.

It is intentional that environmental sustainability is not named as a separate aspect of this hospital project. For sustainability must be in ALL of these.

BHUTAN: THE CONTEXT

The Bhutanese have a proud history of independence, and a solid commitment to maintaining both their culture and their environment. Their official goal is one of careful and sustainable development, and their political leaders have stated: gross national happiness is more important than gross national product.

The Mahayana Buddhist philosophy underlies the tradit-ional architecture, as it does all daily life. Care for all sentient life, and for nature, is a central ideal. But it is very difficult to make architectural and construction choices today, faced with modern requirements and with the extremely rapid influence of foreign paradigms.

Traditional building, with all its religious ceremonies and craftsmanship, is still in practice, daily, all over Bhutan. Modern projects are starting to damage those processes and culture. This project aimed to sustain and strengthen the indigenous architecture. Not by imitation or pastiche – but genuine understanding of and careful improvements to the traditional architecture.

Bhutan is a small, isolated kingdom in the Himalayas with India in the south and Tibet to the north. Development in recent years has been quite rapid, providing basic needs - education, health, farm services and communications. Until the 1950’s, Bhutan had no schools or hospitals at all. The first road from the Indian border to the capital city, Thimphu, was only constructed in 1963. The population of about 750,000 lives in scattered farms and villages, and a largely cashless economy to this day.

Some villages in the Punakha hospital’s catchment area, for example, are more than three days’ walk away.

PROJECT DESCRIPTION

The new Punakha district hospital required an inpatient capacity of 25 to 30 beds and a full range of outpatient services: laboratory, pharmacy, X-ray, operations, clinic, sections for indigenous medicine and administration. Annexes include kitchen, stores, hostel and staff housing. The total is about 4,000 square metres of construction

The project included all the site development, medical equipment, and furniture. The donors, the German Bhutan Hospital Foundation. collected all the funds privately. A goal of the GBHF was to provide a low cost project, geared for the village people. Planning and organisation costs were to be kept to a minimum. The GBHF is also committed to follow up and assistance to the project over a number of years.

Today the hospital is functioning to full capacity and there are already plans to build a new wing behind the hospital, following the proposed future extensions provided in a master plan.

THE ARCHITECTURAL CHALLENGE

A hospital is a large and, by nature, high status building. In a country like Bhutan, it is a symbol of a new world. Being situated near the Punakha dzong, one of Bhutan's most sacred structures, it was an absolute requirement that this hospital should be of a high architectural quality. At the same time, the budget available was very low!

Symmetry is an ideal in Bhutanese architecture, an ideal rooted in Buddhist cosmology and the mandala. This can easily lead to a stiff monumentality. The main building is symmetrical, but the symmetry is deliberately broken in some details such as window placements, as well as in the site layout and placing of the wings and annexes. The hospital complex as a whole is arranged in an informal way where people can meet, sit, and move around in a relaxed atmosphere. For it is not only patients one must cater for; this kind of project becomes a focal community centre. When a villager is ill, half of the family may come too and stay at or near the hospital for days.

In the Buddhist Himalayas there are important hierarchies in space. This is reflected in the built environment, from the whole landscape, down to details of construction and decoration. Important buildings have a certain number of "layers", especially in their cornices, less important ones have fewer. Even painting works have a hierarchy: there are at least three main "grades" of painting. For wooden columns there are categories of shape, size and carving. For all of these, appropriate responses had to be found.

At the same time, the solutions had to be functional for a modern hospital's requirements, and appropriate to easy hygiene and maintenance, which can be a major problem in such buildings.

There are modern requirements which have no models in traditional typologies. A traditional society knows temples, farmhouses, granaries, bridges, stupas. How does one give shape to a petrol station, a laboratory or a hospital?

To adapt traditional architecture to new functions, one must build on its principles, so one needs to understand those principles. But the traditional architecture had hardly been documented. The Punakha project implied considerable cultural-historical research.

The site plan as a whole is zoned so that the major flows of patients and public are at one end of the site, whilst the X-ray and operations, demanding stricter hygiene and seclusion, are at the other end. The residential area is in a quiet area to the north. The plan includes extensive vegetation, not least for windbreaks, as well as fruit trees. Future expansion is included, both for new wings to be added and in the sense that some of the rooms in the main building can be converted to medical uses later.

The staff houses develop the idiom of local farmhouse architecture, but again with modern functional solutions. They are sited 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.

A major task involved finding out how Bhutanese actually use hospitals. Some projects function very badly because they were designed by foreigners as if the users were going to be foreigners. To follow a European functional layout could be a disaster.

THE TECHNICAL CHALLENGE

Punakha has a hot climate; it is also important to protect sites from dusty winter winds. The buildings are therefore oriented east, towards the river, minimising solar gain. Shade is increased by large roof overhangs, verandahs and trees. A small fountain in a round flower garden – only the third fountain ever built in Bhutan – provides coolness. It is also shaped like a little water mandala.

The main building has a three storey high stairwell to increase natural ventilation. All rooms and corridors have cross ventilation, and heavy building materials help to keep the building cool. The roof is an open, ventilated space, following traditional local solutions.

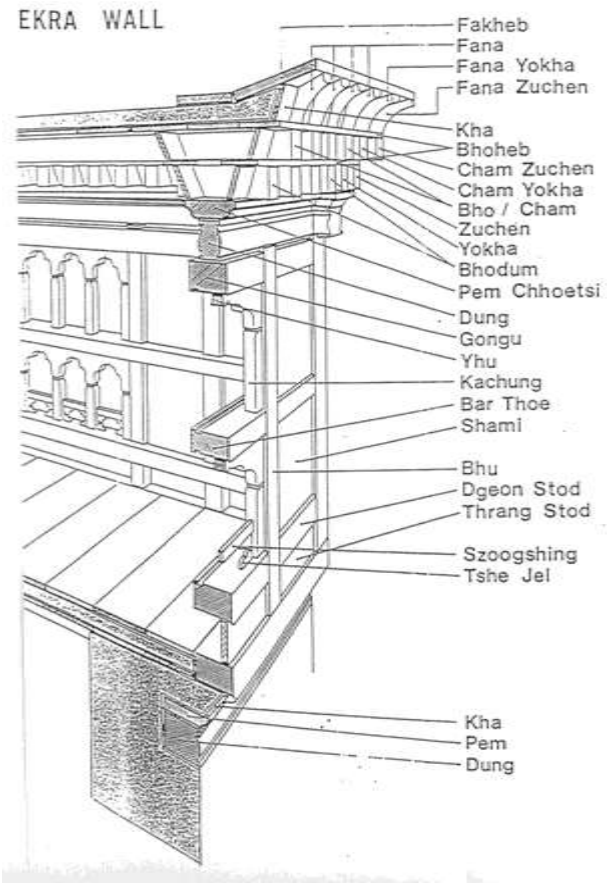
Most buildings in Bhutan are still built of rammed earth. As in many developing countries, earth building is, sadly, seen as ”old fashioned”, so in the end brick was chosen. Earth would have been far better. However, ecological awareness is a process over time; after years of talking with the Bhutanese, more people are building in earth again now. So although we did not achieve this particular goal for this hospital, the *process* has contributed to the revalorising of indigenous techniques. It hopefully opens the way for earth building in future projects.

Traditionally, Bhutanese roofs are of shakes or slate; but now, as all over the developing world, they are usually in galvanised iron sheet (CGI). Which is noisy, expensive, not very attractive - and has to be imported.

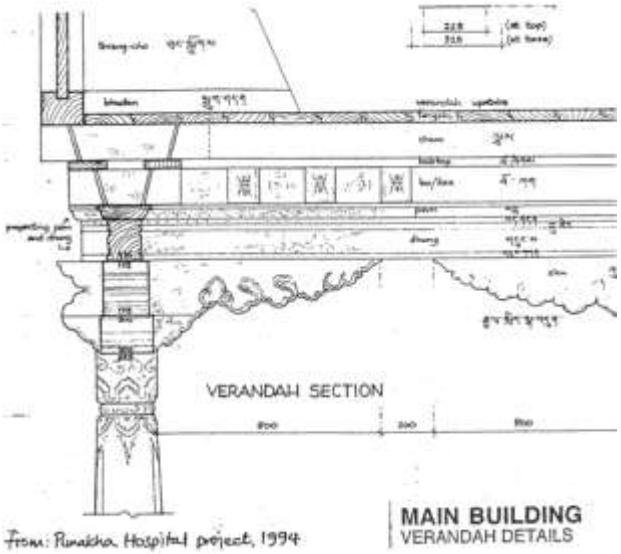
For this project, a workshop was set up on site to make microconcrete roof tiles (MCR) - a technique originally pioneered in Africa by E.F.Schumacher’s Intermediate Technology Development Group. Bhutanese were trained to make the tiles. The result is more attractive, far better climatically, and all the materials are local. In addition we managed to produce these tiles (over 50,000) at half the cost of the CGI; a saving of a quarter of a million rupees.

Special workmen were brought in from India to execute plaster-of-paris finishes, which are both environmentally better and healthier than cement-based rendering.

Doors, windows, verandahs and cornices are executed in timber in the traditional Bhutanese way. There is a simple



drawing by: K.Kaneko



modern truss, which saves over 50% of timber compared to the old Bhutanese ”flying roof” construction. For the main pillars, special trees have to be selected, and the carving had to be designed in collaboration with local craftsmen. The architect has to work *with* the craftsmen.

All paints used are traditional earth- and plant-based pigments, with their attractive soft colours, except in specially exposed areas where the indigenous paints are mixed with some enamel to increase durability.

It is hard to get anything built well, in many developing countries. Concrete can be a very major problem. For this project a testing machine from Norway was used and after two months of arguing, training and testing, the contractor was making excellent concrete.

All technical solutions were deliberately kept simple. The architect has to listen and learn all the time, adapt to local skills, and design what is *possible*.

THE ECONOMIC CHALLENGE

Whereas comparable projects at the time in Bhutan were costing around USD.240 per square metre, this hospital cost only USD.160, even though quality is generally higher. Very careful cost control, simple design solutions, and efficient management were the three keys to this.

Total costs of planning and supervision amount to only 15% of the total. This means that 85% of the donor funds actually reach the recipients. In many international Aid projects, on the contrary, the planning and foreign expertise can eat up over 50% of the total aid budget!

On-site training provided to both contractor and workers, was an important cost reducing factor, as well as an important sustainability aspect. Local materials are used nearly throughout, greatly reducing import costs – as well as transport pollution. All furniture was made locally too at a fraction of normal cost and to German high quality.

Costs (in US dollars):

Hospital buildings	350,000
Staff housing first phase	220,000
Infrastructures, site etc	110,000
Furniture	30,000
Medical equipment	70,000
Project costs, planning, TA	140,000

The economic success of the project, especially for a developing country with scarce resources, must be seen as one of the most important achievements.

THE CULTURAL CHALLENGE

The architecture of Bhutan constitutes an important and beautiful heritage. This is especially true of the religious structures such as the temples, which are a unique blend of monastery, fortress and administrative centre. This is a living heritage, these buildings are in daily use. How can such a cultural tradition evolve - without losing identity, but without falling into ”restoration nostalgia”?

The Bhutanese government requires all new buildings to be built ”in Bhutanese style”. But this often leads to a superficial copying of traditional decoration, in ways which are climatically unsuitable and where dimensions, colours and shapes of the parts are sometimes directly wrong in religious terms – for in traditional architecture, every part has its place, form and spiritual symbolism.

The ”easy way out” is to *copy* tradition. This may give superficially attractive results, but results which are non-functional as well as extremely expensive. And wasteful of resources, especially timber. Since they cost so much, they also have no use as models which the Bhutanese can use themselves. Such projects may look good – that is the superficial result – but fail seriously in other ways.

One must not be too romantic about traditions. There are weaknesses in traditional buildings. An appropriate response is therefore what is often designated ”improved traditional” methods. Damp proof coursing, day lighting and earthquake reinforcing are three such areas, where careful improvements must be introduced.

The introduction of new technology is ultimately, very much a cultural issue. Is it an evolution or an invasion? New, foreign solutions may undermine the self-reliance of local craftsmen and the capacity to stay in charge of their own future. Suddenly they will be living in structures they do not understand, do not relate to, and cannot maintain. This is about sustainability in the cultural sense.

Indigenous medicine is integrated into this hospital. In this way, the traditional, partly spiritual practices of health continue side by side with the modern.

Doors may have to face particular directions. The operations theatre could not be placed near the maternity ward, for example, due to a belief that mothers and babies are susceptible to harm through a kind of spiritual ”pollution”.

The mandala paintings on the hospital ceilings were a vital opportunity to work with Bhutanese craftsmen and painters. The Buddha depicted is Sangye Menlha – the Buddha of medicine. No Bhutanese building is complete without the Buddha; there can be no health, no architecture, without a spiritual dimension.

On the functional level, successful design in developing countries requires simplicity and flexibility. They are keys to sustainability, since maintenance may be minimal, and future uses may evolve rapidly. Design on the technical-ecological level must be bioclimatic and with maximum understanding of local traditional solutions

The Punakha Hospital project addresses sustainability in architecture both on the ecological, economic and above all cultural levels. It is more than a traditional building; it is a modern expression of an evolving culture. Culture is a process; this project aims to strengthen that process in the living architecture of Bhutan.

OTHER PARTICIPANTS:
Site Engineer and Supervisor: R.C.Sharma
Main contractor: Lhaki Construction Company
Minor contractor and Electrical: Etho Metho Company
Landscape and gardens: Dinesh Sarkar (Nepal)
Furniture: Andi Guggemos (German volunteer); DIWC.

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The Punakha dzong (built in the 16th century), directly across the river from the new hospital.

The International Union of Architects UIA Work Program - The Road from Rio

The Road from Rio – Sustainable Development of the Built Environment – was established by the UIA following the Rio conference of 1992, and the UIA's declaration on sustainability in Chicago, 1993.

The WP was entrusted to the Nordic Section of UIA, where it has been the responsibility of Denmark (1994-1997) and since then Norway (1998-2002). Within the National Association of Norwegian Architects, the WP has been organised by the NABU project, Norwegian Architects for Sustainable Development.

During these years the WP has arranged conferences and seminars, published newsletters, participated in international events including the UIA Congresses of 1996 (Barcelona), 1999 (Beijing) and 2002 (Berlin), as well as setting up active networks, with particular focus on Europe. North-south exchanges with and support to development projects have also been initiated.

The Road from Rio wishes to express thanks for the participation and contributions of WP members and in particular NoMiN, the Nordic environmental network.

Oslo, May 2002 WP Director, Chris Butters

Sustainable Building 2002

September 22-25, Oslo, Norway

Following on from Green Building Challenge in Vancouver (1998) and Sustainable Building in Maastricht (2000), this is the third in the series of major international conferences focusing on sustainability in the building sector. Urban issues and development issues are now also highlighted, providing a wider focus, and presenting the challenges - the knowledge – and the solutions as they are emerging today. Scientific papers have been received from over 50 countries. There is also a program of excursions to projects and other side events. Hosts: the Norwegian Ecobuild program and the municipality of Oslo.

See: www.sb02.com

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The Road from Rio

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