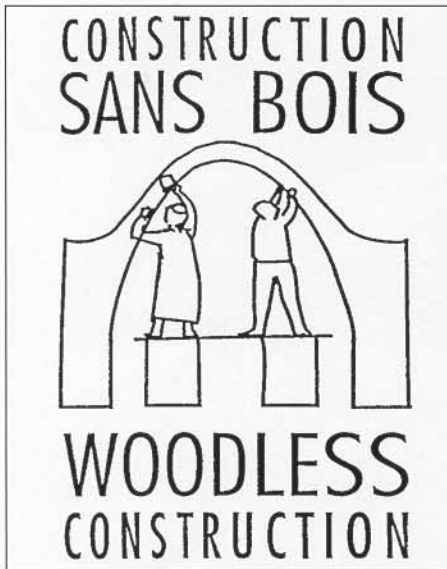
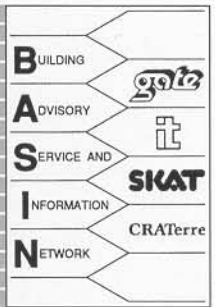




Wall Building

Case Study



Woodless Construction – 1

An overview

smoothed by hand and dried in the open – a method very widely used in the region. Both the vaults and the domes are built using techniques which have their origin in Iran and Egypt. The most important characteristic of these roofs is that they are built without any supporting shuttering. Thus the entire structure – walls, lintels, and roofs – is built with locally available earth, earth buildings already having a rich tradition in the region.

battens to provide the support for grass-woven mats and for compacted earth on the roof. Thatched roof structures also use poles, branches and roots to support grass, straw or reed thatch. Surveys in the region show that for almost all such structures the availability and quality of wood or branches has deteriorated markedly in the past twenty years.¹ A common complaint is that finding good wood (species such as the doum

¹ On-going surveys and previous work undertaken in Niger and Mali including Uhde, M-L., *Relations entre Habitat Humain et Ressources Naturelles*, CEEA thesis, Grenoble School of Architecture, 1995, 70 pp., illus.; Development Workshop, *Evaluation des bâtiments et des techniques de construction dans le Cercle de Youvarou*, a DW/IUCN report, 1991, 45 pp., illus.; Hammer, D., Tunley P. and Development Workshop, *Iférouane - Habitat en évolution*, a DW/IUCN/WWF report, 1991, 30 pp., illus.

Why Woodless Construction?

“Woodless Construction” is the name that has been given in the Sahel countries of West Africa to the construction of vault or dome roofed buildings using ordinary mud bricks. The bricks for the walls and roofs are formed in simple rectangular moulds,

The majority of dwellings in the Sahel depend on the use of organic materials for the structure of the roof, and often for the walls as well. Flat-roofed buildings typically use large beams and intermediary



Figure 1 Bricks made using simple wooden moulds and dried in the sun

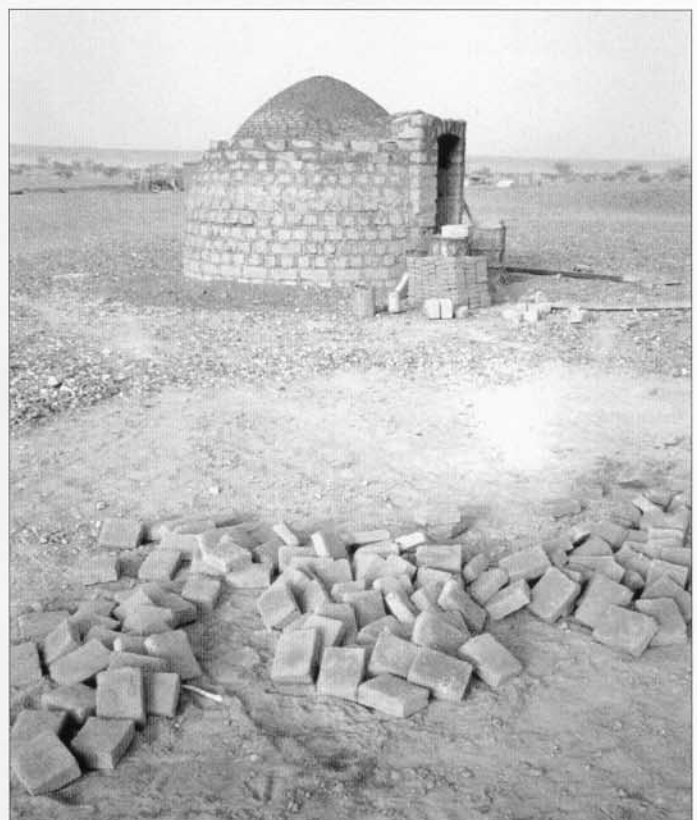


Figure 2 Round dome structure – a cheap, easily built shelter

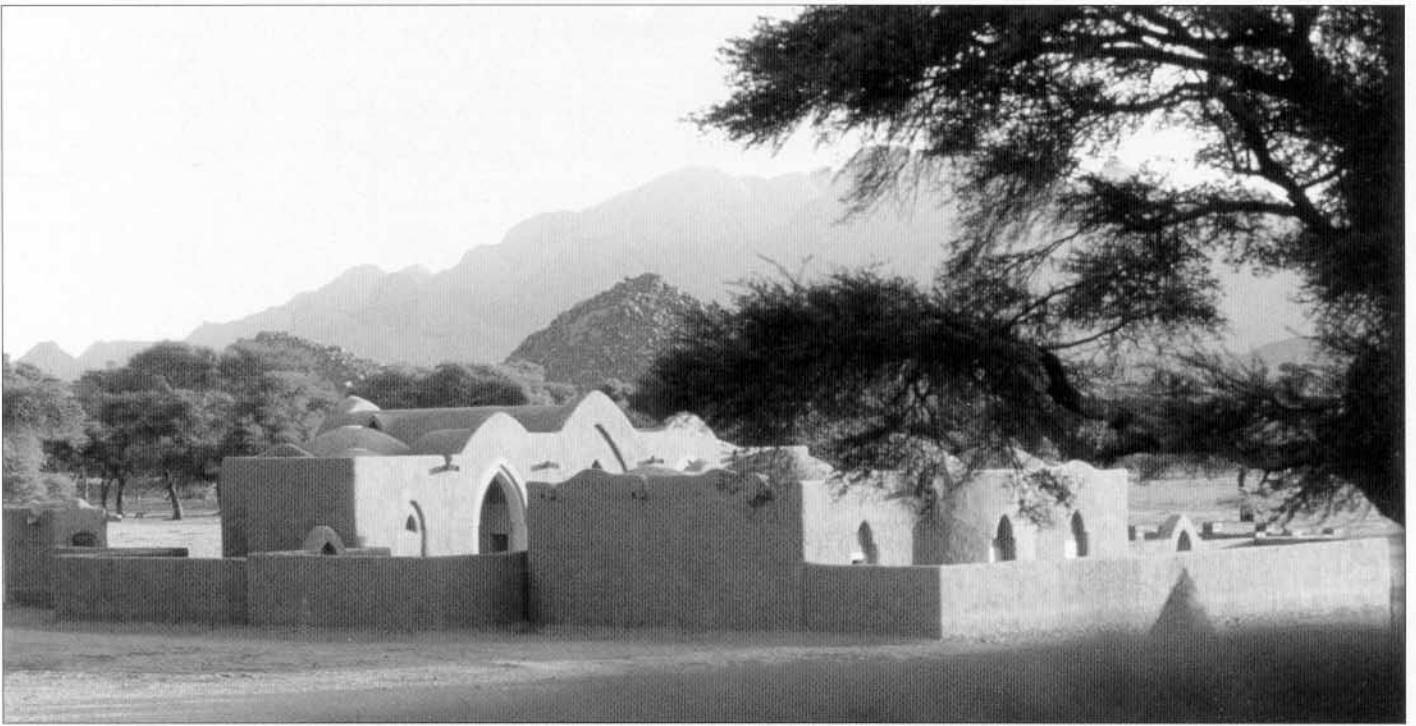


Figure 3 Combinations of vaults and domes for attractive and comfortable facilities

palm or the borassus palm, highly favoured for their ability to resist termite attack and to provide good structural strength and long durability) has become much more difficult. The Sahel has been blighted by years of drought, and there is no doubt that this has in many ways contributed to the disappearance of trees, but the biggest single source of degradation is over-consumption by man. Fuel-wood is one major cause for concern, but wood for building is undoubtedly another.

Woodless Construction was developed to provide a viable, affordable and accessible alternative to this dual problem – how to alleviate pressure on the threatened natural resources of the Sahel and at the same time to make building by the population easier.

Time to listen, observe, adapt

Current Woodless Construction activities in Niger, Mali, Mauritania and Burkina Faso have evolved from an initial, “one-off” training course run by Development Workshop in 1980 which introduced the techniques to Niger.² There was early rec-

ognition that whilst the basic idea of vault and dome building suited the conditions of the Sahel, both the techniques and the way they were introduced and put into use needed to be adapted to suit the habits, experience and preferences of the population, as well as to suit the specifics of local climate and soil conditions. There was also recognition that this would be a long process. In each new locality time has been needed: to demonstrate the Woodless Construction techniques and to allow the population to see that woodless buildings would withstand several seasons of rain; to listen to the population and to react to their ideas; to observe how the buildings behave in the climate of the Sahel; and only then to adapt techniques and forms to suit. One example: the brief but often violent rainstorms which are common in the Sahel during the rainy season require particular care in shaping roofs to ensure quick but controlled rain-water run-off. But because of the high winds that frequently drive the rain almost horizontally, it is very often the *walls* that need protection more than the roofs. Given what are often very localised specific conditions, problems such as the choice of surface finishes or the form of the building is invariably strongly influenced by local practice.

“Tuning-in”

Both training methods and working practices on building sites are the object of constant evaluation and refinement in order to facilitate the way in which the masons learn the techniques. (See *Woodless Construction – 3: Change and adaptation*

to local needs in this series of BASIN case studies). This process reflects above all an approach of *adapting to that which exists* rather than trying to impose changes to local practices. Thus Woodless Construction aims to use whatever size local bricks are available for wall building (good quality provided!) rather than insist on special, unfamiliar dimensions for bricks and moulds. In parallel, the unit which determines the dimensions of the building is now the (local) brick, rather than the metre/centimetre, which enormously simplifies laying out and bonding.

Gaining the people’s confidence

Confidence in Woodless Construction has come with the passage of time, thanks to the construction of a wide range of buildings, some of them with considerable prestige. Large buildings and complexes and prestigious private houses in Niger, Mali, and more recently Mauritania have helped develop a reputation for high quality which has certainly encouraged emulation by the population. But the greatest emphasis has been to demonstrate small and easily built one, two and three roomed buildings, suited to housing and to small public facilities, all of which are easy to imitate and affordable. These buildings range from cheap, single-domed, round rooms with 20 cm walls through to numerous different combinations of round and rectangular rooms which can be adapted to suit individual tastes and specific functions. Increasingly, the demand for even larger buildings is being met by combinations of two and three roomed structures which can be built quickly by

² After ten years of experience using these technologies in Iran and Egypt where they have existed for centuries, Development Workshop introduced woodless vaults and domes to Niger in 1980, at the request of a small Canadian NGO, ISAID, in the context of a rural development programme. Over the next 8 years, support from this and other projects, and notably the WWF/IUCN’s project for the Conservation and Management of Natural Resources in the Aïr-Ténéré in northern Niger, laid the groundwork for the development of what has now become a major regional activity.

builders after basic training, and can be developed in stages according to the resources of the owner.

The training approach

Early opportunities to learn

During the early 1980's, builders learnt Woodless Construction techniques through 'on the job' experience. The first formally organised training course for builders only took place as late as 1987, at Iférouane (Niger).³ A survey carried out in Niger and Mali in 1990⁴ showed that of over 300 Woodless Construction buildings, some 50% had been paid for by private clients, of which half were local villagers. The survey also showed that the shortage of trained masons was acting as a break on building activity and on the spontaneous spread of the techniques. For Woodless Construction to achieve a significant impact on local building practices, emphasis needed to be put on providing sustained and regular training opportunities, complemented by actions to identify where interest and demand was greatest.

Present activities

A major boost to Woodless Construction came in 1993 when a Development Workshop/IUCN (World Conservation Union) partnership obtained funding from the Danish Government (Danida) for a five year, Woodless Construction Programme of training and awareness-raising in Niger and eastern Mali. In Niger, the United States Peace Corps is also making a major contribution to Woodless Construction through the involvement of their volunteers, as is Lutheran World Relief. In Burkina Faso and Mali, Development Workshop is able to promote Woodless Construction techniques thanks to the Danish Red Cross "Hope in the Desert" environmental programme. In Mauritania, Development Workshop has recently erected some of the first Woodless Construction buildings on behalf of an IUCN sponsored National Park. Through such partnerships and collaborations, of which there are many more, Development Workshop is able to organise, amongst other Woodless Construction activities, several main cycles of training each year in different parts of the Sahel.

Basic training for novice builders lasts about two months, divided into (1) a period of

3 Funded by WWF/IUCN – see footnote 2.

4 Development Workshop, *Vulgarisation de la construction de voûtes et coupôles au Sahel*, a DW/IUCN report, 1990, 59 pp., illus.

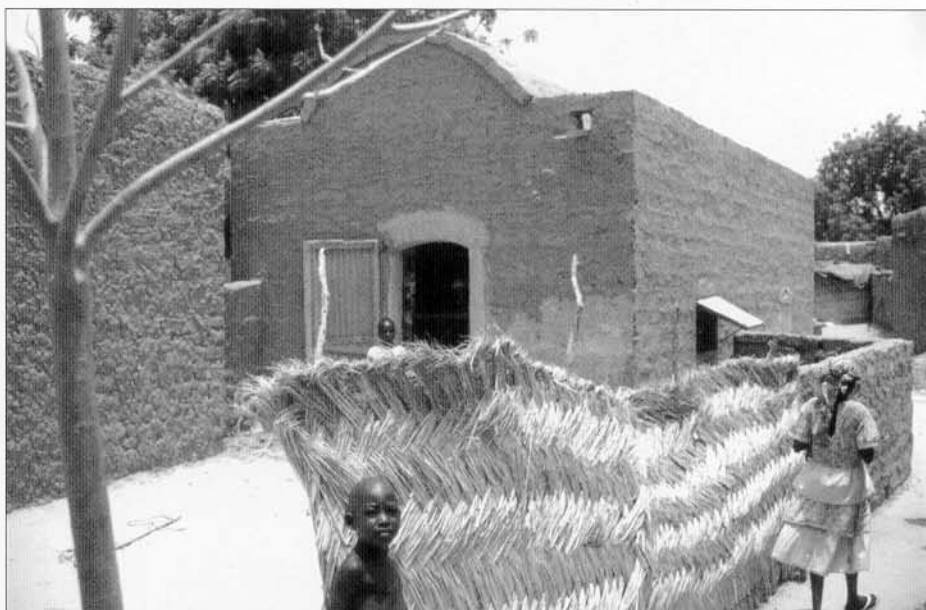


Figure 4 "Spontaneous" construction – a vaulted house built by a trained mason with no external help

theoretical explanation and practice, followed by (2) work on complete building projects. (For more detailed information on the organisation and content of the training cycles, including training for experienced Woodless Construction masons, see *Woodless Construction–2: The training of trainers and builders* in this series of BASIN case studies).

Local client partnerships

During the second part of these training cycles (work on complete building projects), site work is carried out on a partnership basis with local clients. The local client contributes unskilled labour, building materials, normal site tools, and everything concerned with the finishing of the building, including doors, windows, paint and internal plasters. In return he does not have

to pay for a tailor-made plan of his building nor for the cost of Woodless Construction trainees and their experienced supervisors. This partnership relationship represents a major local commitment – some 75% of real costs of putting up the building. It also clearly defines who owns and is responsible for looking after the building. And not least, the client-partnership relationship is an important factor in establishing local market values for Woodless Construction.

Impact and accessibility

In many villages, Woodless Construction is now the predominant roofing method being used for new buildings. Demand is high: after a training cycle, almost all local newly-trained builders go straight on to work on private building contracts.

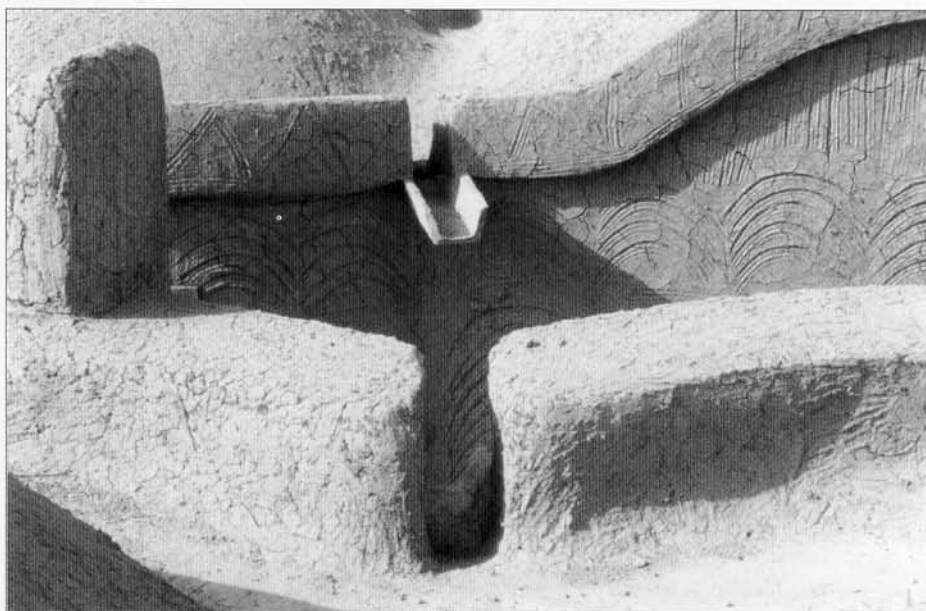
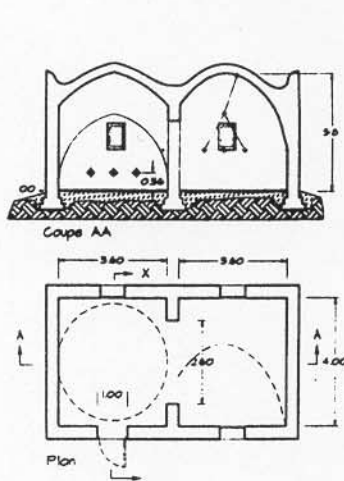


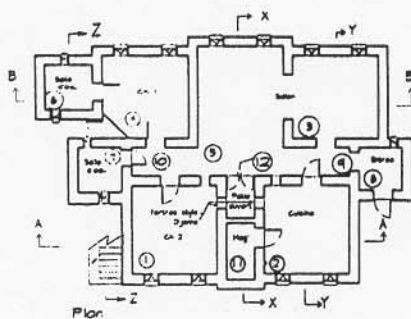
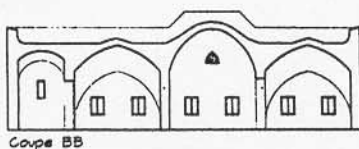
Figure 5 Particular care in shaping roofs to ensure quick but controlled rainwater run-off

COSTS

(Buildings commissioned by client-partners in Spring 1994,
ie after the Fcfa devaluation)



Simple, two-room house,
30m² habitable area,
7,200 Fcfa (\$ 12) / m²,
excluding finishings.



More complex house,
90m² habitable area,
15,200 Fcfa (\$ 25) / m²,
excluding finishings.

A two or three room house costs about 9,000 FCfa/m² (or 15\$/m²) to build, not including finishings (see box). This average cost is similar to those incurred in the construction of the flat, timber-roofed buildings they are replacing. But a family making its own bricks and providing its own labour will obtain a house for a fraction of this. Clients are attracted to the system because it avoids the difficulty and expense of having to obtain often poor quality wood, needing replacement sometimes within a year, and because the buildings are much cheaper than those built with non-local materials. There are increasing signs, too, that it is considered prestigious to have a Woodless Construction house. And every 30m² dwelling built without wood represents a saving of about 15 wooden beams and some 8 cartloads of smaller wood for battens.

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Spreading the word

A variety of activities are undertaken to ensure that the public is aware of the potential of Woodless Construction.

But it is the local builders who play the most important role in spreading the techniques. On-going technical support is provided after training, and initiatives by local builders to form themselves into organised groups with the aim of promoting the techniques are being encouraged. Future focuses include the training of local architects and technicians and a broader range of dissemination tools addressing the various audiences of Woodless Construction, including the local builder.

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What is BASIN?

Building materials and construction technologies that are appropriate for developing countries, particularly in the low-income sector, are being developed, applied and documented in many parts of the world. This is an important prerequisite for providing safe, decent and affordable buildings for an ever-growing population.

But such new developments can do little to improve the building situation, as long as the information does not reach potential builders. The types and sources of information on standard and innovative building technologies are numerous and very diverse, making access to them difficult.

Thus, in order to remedy this drawback, GATE, ITDG, SKAT and CRATerre are co-operating in the Building Advisory Service and Information Network, which covers four principal subject areas and co-ordinates the documentation, evaluation and dissemination of information.

All four groups have a co-ordinated database from which information is available on Documents, Technologies, Equipment, Institutions, Consultants as well as on Projects and Programmes. In addition, printed material or individual advice on certain special subjects is provided on request. Research projects, training programmes and other field work can be implemented in co-operation with local organizations, if a distinct need can be identified and the circumstances permit.

BASIN is a service available to all institutions and individuals concerned with housing, building and planning in developing countries, but can only function efficiently if there is a regular feedback. Therefore, any publications, information, personal experiences, etc. that can be made available to BASIN are always welcome and will help BASIN to help others.



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