'DOMES NOT DOUMS'

A CASE STUDY

THE INTRODUCTION OF EARTH BRICK DOMES AND VAULTS TO THE OUALLAM REGION OF NIGER

Development Workshop

June 1992

OUALLAM TRAINING PROGRAMME IN THE CONSTRUCTION OF UNSTABILIZED EARTH BRICK VAULT AND DOMES

November-December 1991

Objectives

The objectives of the programme were jointly drawn up by Peace Corps volunteers in Ouallam and Development Workshop and were as follows:

- to train masons in the basic skills necessary to build simple one or two-roomed houses with vaults and domes;

- to provide Ouallam with a range of simple public buildings ensuring that the buildings were constructed in the public eye and remained in public use;

- to provide technical support for the trained builders returning to build for their own communities.

Organization

Training was carried out by four masons with extensive experience both in building and training, three from Iférouane and one from Chikal.

Technical assistance was provided by Peter Tunley, Development Workshop, who designed the content of the programme, organized the trainers and supplied plans and material quantities for the "demonstration" buildings.

Logistical and administrative support was provided by Cindy Bullard, Peace Corps volunteer in AFSI programme, Ouallam.

Content

The Programme was essentially divided into two parts:

(i) a four week training programme, including:

a slide presentation to raise awareness of the woodless buildings existing in Niger and the masons competent to build them;

an explanation of the basic theories underlying the building techniques;

practical training in building vaults at ground level enabling them to be built, knocked down and rebuilt to perfect technique;

the construction of six public buildings (including domes - simpler to build than vaults) allowing all trainees to be involved in start-to-finish construction and decision making.

(ii) a two-week follow-on period, including:

voluntary construction of functional buildings in the masons' villages, supervised by the trainers.

Results

20 masons were trained in the techniques:

- 14 from Ouallam;
- 2 from Balayara;
- 4 from Youvarou, (Mali).

2 AFSI "extension" workers were also trained:

- 1 member of the AFSI Ouallam volunteer team;
- 1 member of AFSI Ouallam local staff.

6 "demonstration" buildings were structurally completed during the four-week training programme course, including:

4 buildings in Ouallam itself: a bus/taxi station in the central market area; a school library at the High School; an in-patient ward at the Medical Centre; and an AFSI office;

2 buildings on peripheral sites: a storage shed for a community tree nursery (2 km outside Ouallam) and a cooperative store at Garbey Malo Kwara.

4 further "voluntary" buildings were started during the two-week follow-on period and were well advanced by the end of that period. (Construction subsequently continued without the help of the trainers, but under the eye of the trained AFSI member now specializing in this work.)

Costs (Fcfa)

The budget was funded by AFSI (USAID funds) and IUCN (Mali) and was broken down as follows:

Trainees (travel, accomodation and allowance)	1,110,000
Local trainers (travel, accomodation and salaries)	660,000
Materials	650,000
Tools	1,100,000
Technical assistance (including international travel etc.)	1,800,000
TOTAL	5,320,000
AFSI contribution	4,200,000
IUCN contribution	1,120,000

The actual costs of the programme were within budget.

Case-study

The case-study which follows is intended:

to provide more detailed information about the Ouallam training programme - its background and the series of events which led up to it;

to highlight the key issues involved and draw some general conclusions on the overall approach to development used.

The Ouallam experience may in some respects serve as a model for the introduction of unstabilized earth vault and dome construction, including within the Peace Corps network, in Niger and elsewhere. If this does occur in areas with little or no experience of the techniques, it is strongly recommended that

as a first step a simple "demonstration" building should be put up, using experienced masons and minimal project funds to remove the element of financial risk for the newly-trained mason.

The objective here is to be able to observe, and allow the public to observe, the *technical performance* of the building (structure, design, renders etc.) through a complete year and at least one good rainy season. Aspects of *social acceptability* (appearance, form, prestige etc.) may have to be dealt with subsequently, i.e. once confidence in the building's structure has been established.

A formal training programme should only be considered when there is a reasonable certainty that the performance of future similar buildings on both these counts will be satisfactory, and when a genuine local demand exists.

Photos opposite:

Interior views of:

a "Nubian" domed roof, built in unstabilized sun-dried bricks and requiring no use of wood and no shuttering during construction;

a "traditional" flat roof, typical of many countries of the Sahel, which relies on the massive use of increasingly scarce and expensive wood: tree trunks or main branches for the beams, with smaller branches in between, all covered with earth.

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MOUNKAILA ALHASSANE

'The man who built his house without wood'

Mounkaila Alhassane is becoming famous. The first man in the Ouallam region to build his own house with a domed roof, "Everywhere I go," he says, "people know me as Mounkaila from Garbey who built his house without wood."

Mounkaila has long been an innovator, striving for an improved quality of life for himself, his family and his community. 10 years ago he was chosen to attend a rural development school for a year. Not all that was taught was appropriate, but significantly, of all those taught to plough with oxen, he was the first to practice his new skills and remains one of the few still doing so to this day. Now that the fields around his village are losing productivity Mounkaila camps 15 km outside town (where better land is available) in the growing season, a sacrifice few are prepared to make.

Mounkaila decided at the age of 20 to learn traditional masonry skills and spent two years working on building sites in Niamey. Once back in the village he became a popular local mason.

Fifteen years later, when the time came to select a mason to send tor training in building vaults and domes, Mounkaila's work ethic and constant striving for quality made him a natural choice.

Though, like everyone else, Mounkaila was sceptical when he first heard about woodless roofs, he soon became a convert. "With this house you don't put a single demand on the bush, no wood, no grass, nothing! What's more it's less work - no days spent searching for increasingly rare wood. And the result? A bigger and stronger house."

Background

The introduction of unstabilized earth brick domes and vaults to Niger started in 1980 in an attempt to solve the problem of the use of increasingly rare wood and organic materials (including the Doum palm) in the construction of traditional roofs. Time, and a carefully considered approach, proved the techniques to be suitable to a wide range of needs. Over twelve years much progress has been made in the provision of built examples and the training of masons. Indeed there are now many masons working totally independently to serve the needs of their families, friends and clients.

The strategies used and progress made between 1980 and 1990 in introducing and popularizing the techniques are described elsewhere.[2] In this case study, however, we examine the introduction of the techniques to a single limited area - the Ouallam district of Niger. We will attempt to show how a viable solution to an urgent problem was provided by a combination of the following elements:

- the presence of development workers at field level;
- the possibility of inspecting a range of tried and tested examples;
- the opportunity to meet and discuss with people who have used the techniques unaided to solve their own building needs
- flexible training facilities geared to masons' needs;
- the financial and moral support necessary to be able to make use of these training facilities;
- initial financial support to allow masons to construct an example of a "new" building system locally without financial risk.

It is important to comment further on the first of these elements, the presence of development workers. Their role should be neither over or under-stated. In this instance the development workers:

- were very aware of, and personally familiar with, local problems, and were searching for viable solutions;
- had only *limited funds*, but had the *time* and *motivation* to discuss ideas and attitudes with the local population.

For many organizations and government services the time to really discuss, exchange ideas and understand is often lacking. An approach to development which allows volunteers the luxury of time can place them in a unique position in the development process. Most volunteers arrive motivated to understand and enthusiastic to act. Given a structure to operate in they can become a very effective contact with local populations. Limited funds are paradoxically a bonus: they preclude rapid, large-scale action and

2 Development Workshop, "Vulgarisation de la construction de voûtes et coupoles au Sahel", July 1990, for IUCN - The World Conservation Union.

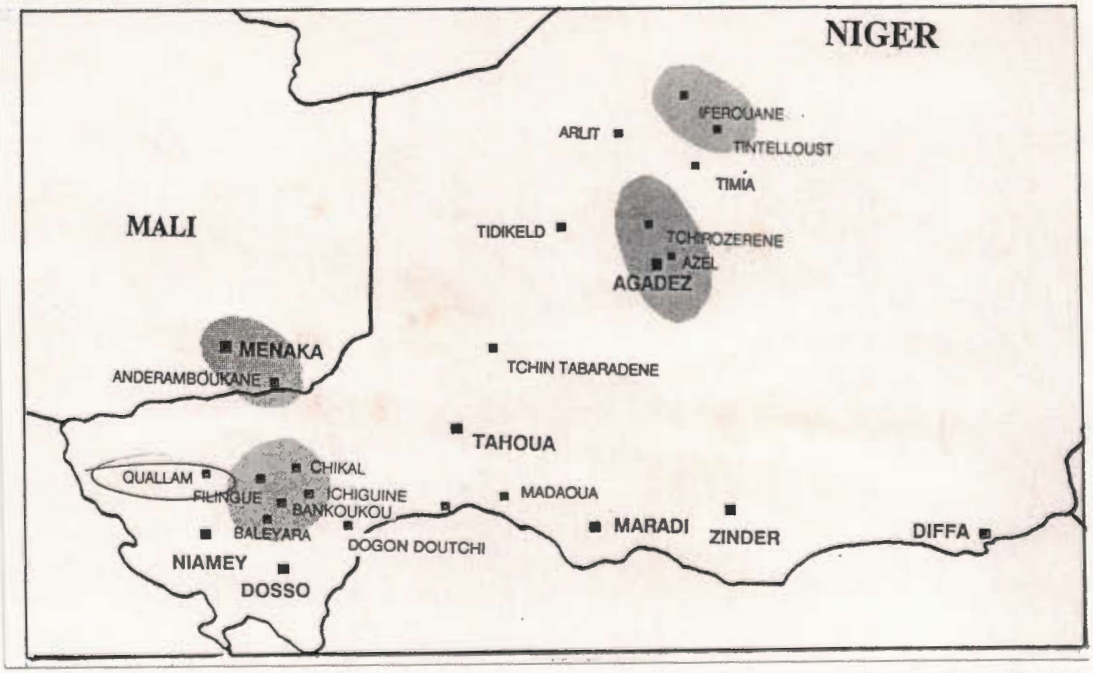
ensure that work evolves at a locally acceptable rather than a "force-fed" pace, a time-scale at which people have time to participate, assimilate and accept or reject for themselves.

The Ouallam experience: slowly but surely

Ten years after their introduction into Niger, examples of buildings based on ancient Nubian techniques using unstabilized earth brick for houses with vaults and domes are becoming widespread. In Ouallam, a recent surge in local enthusiasm has resulted in 10 community buildings using the techniques and the training of 20 village masons.

The joint efforts of development organizations, local officials, and motivated villagers in the area have followed a seemingly slow five-year path, culminating in a training workshop that has set the stage for a continuing growth in awareness and popularity of the concepts and their uses.

Ouallam is a district capital some 100 km north of Niamey, the capital of Niger, and is considered to be the heart of "Zarmaganda," reputedly founded by forefather Mali Bero when he fled conflicts in what is today Mali and resettled just 10 km south of present-day Ouallam. With a population of 5,000, Ouallam is the centre for numerous scattered Zarma villages. Rainfall is low, averaging less than 350 mm per year in the 1980's. Low rainfall and population growth have contributed to a rapid deterioration in the surrounding vegetation. One consequence of this is that the organic materials used for the flat roofs of traditional houses, i.e. wooden beams and branches, are becoming increasingly difficult to obtain, whether by gathering or purchasing.



Ouallam and the main areas (shaded) of vault and dome building in the region prior to the Ouallam training programme.

In 1987 Ouallam was one of two towns picked to be the centres for pilot project of the African Food Systems Initiative or AFSI.[3]

Woodless houses come to Ouallam

When AFSI began to operate in Ouallam, few had heard of building houses without wood and fewer still had witnessed this. Volunteers moved into traditional adobe houses with flat wood roofs and began working with villagers in their fields, gardens and homes. They made a consistent effort to demonstrate responsible and appropriate uses of resources in their behaviour and activities. Thus, when considering the construction of a new building (in the team's second year of operation), the volunteers discussed creating the Ouallam hostel as a demonstration of woodless masonry. Several of them had heard about the Nubian method of constructing domes and vaults and its success in areas between Niamey and Iférouane, further north. The nexus of the technique and its major proponent was a WWF/IUCN project in Iférouane itself.[4] With AFSI funding, the team sent four masons from the Ouallam area to be trained in Iférouane on a WWF/IUCN training programme run by Peter Tunley[5] and his locally trained masons.

The first house - a costly but crucial effort

The construction of Ouallam's first woodless house was subsequently funded by the AFSI programme as a vehicle for the newly trained Ouallam masons to use and demonstrate their skill, as well as to provide a hostel for the AFSI

3 AFSI is a programme elaborated by the United States Peace Corps and funded by USAID. With global objectives of improving quality of life by improving people's ability to produce food or improving their access to food produced by others. AFSI takes an holistic approach, operating through the use of teams of 5 to 9 volunteers working in the same district over a 10-year period. Volunteers normally serve for two years, but the villages they work in benefit from the intervention of several "generations" of volunteers. The team is coordinated by a volunteer living in a central town who organizes logistics between government services and the volunteers living in surrounding villages. Volunteers with particular skills are used as a resource by the team; volunteers also act as a liaison for the skills that must come from outside. Work in conservation and supplementing foods has evolved into demonstrating crop protection, soil protection, improved animal husbandry, dry season gardening and irrigation. In homes, issues dealt with include sanitation, basic health care, income generation, improved wood burning stoves and house building.

4 World Wide Fund for Nature/IUCN - World Conservation Union "Project for the Conservation and Management of Natural Resources in the Aïr and Ténéré". Initially, the Project headquarters in Iférouane were built using unstabilized earth vaults and domes. Subsequently, with technical assistance from Development Workshop, the Project included developing and disseminating the techniques (including running dedicated training programmes) as part of its resource management activities. These activities succeeded: a significant and growing number of local people now use local masons to build their homes and public buildings with vaults and domes.

5 Peter Tunley, Development Workshop Associate, was Technical Advisor to the WWF/IUCN Project from 1984 to 1989, designed and supervised the building of the Project headquarters using vaults and domes and subsequently ran numerous Project training programmes and building sites.

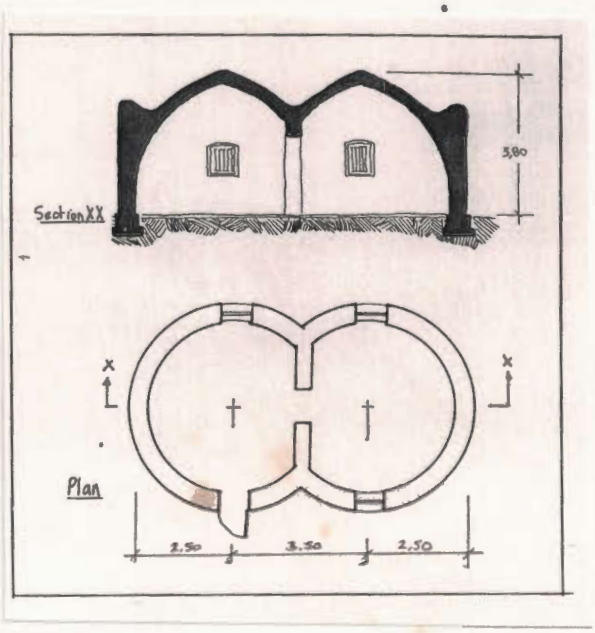
team. The process was not without its problems and the final cost of the origianl building was exorbitant, principally as a result of the volunteers' lack of experience of hiring labour and services from local people.

To take two examples:

- all four newly-trained masons were employed at masons' *daily* rates to do all levels of labour, including brick-making, an arduous job normally done by less skilled workers paid on piece work;

- transportation of earth to the site, which was monopolized by Ouallam's only tipping lorry owner, cost twice what was later found to be the going rate.

Despite the problems, the building was built soundly and has now withstood three Sahel monsoon seasons. It confirmed the *technical feasibility* of the techniques, but left doubts as to their *social acceptability*. In contemporary Niger, popular aspiration is towards "modernity", and modernity - as far as buildings are concerned - means rectangular. Although vaults and domes easily can and do cover rectangular spaces, the design chosen for Ouallam's first building was two domed rooms on interlocking circular bases.



This choice had been made because such a building, although simple to build, is extremely stable structurally.

On the training course attended by the Ouallam masons there had been insufficient time to teach the relatively complicated construction of a two roomed house on rectangular bases.

Experience in other regions has shown that round based buildings can become acceptable and indeed prestigious and certainly have a role to play. It was, however, a salutary lesson that the round forms did initially give domes a bad image in the Ouallam region.

Two years after the completion of this first building, no further progress had been made on the popularizing of woodless construction in Ouallam. The house had become the private residence of the volunteer coordinator and though people were aware of its existence, none had tried to replicate it. None that is, until two village masons were inspired to pick up the trail again in 1990.

Seeds of inspiration sown in Garbey Malo Kwara

Mounkaila and Souley, two of masons trained in Iférouane, are from the village of Garbey Malo Kwara, 12 km east of Ouallam. Although they had not built anything further using the techniques, they had continued to discuss woodless houses with villagers and the village volunteer. The second AFSI volunteer in Garbey suggested that a cooperative store be built using domes and proposed to fund it as another "demonstration" building. By the time a third AFSI volunteer, Cindy Bullard, arrived in Garbey in 1990, the villagers were asking for a cooperative store, but were wavering on the type of building they required. They seemed to think that a domed building could get project funding, but were dubious about its strength and durability. The masons themselves also seemed to be losing confidence in what they had learned and their ability to replicate it, two building seasons having elapsed since they constructed the first building in Ouallam.

In the event, it was perhaps fortunate that the cooperative store was never built, as instead a far more wide-reaching and catalytic series of events took place. Cindy Bullard, newly-arrived in the area, had never seen any examples of building using vaults and domes other than the Ouallam hostel. She was therefore poorly equipped to deal with local reluctance to use the techniques again, despite believing in their potential.

In July of 1990, however, Development Workshop personnel passed through the Ouallam region, conducting a survey of vault and dome building and reviewing progress in popularizing these building techniques throughout Niger. They visited Garbey to discuss with the masons what they thought of the technique and why they hadn't continued to build. Cindy Bullard and the masons were given copies of Development Workshop's newly available woodless roofs manual,[5] which was in part designed precisely with trained masons in mind, to help them to remember and apply their new skills.

WWF/IUCN Project headquarters and infrastructure, Iférouane.

In September of 1990, Cindy travelled to Agadez and Iférouane to see more for herself and to gauge the relevance of vaults and domes to her area. After visiting over 15 buildings and talking to keen and successful masons, she returned inspired to push the concept and encourage local masons to use the techniques.

5 Development Workshop, "Les toitures sans bois: Guide Pratique", 1990, financed by WWF/IUCN.

A turning point: visiting the Bankoukou mosque

Development Workshop followed up their visit to Ouallam by sending Peace Corps a copy of their survey report,[7] highlighting the work of successful masons in the Itchiguine, Chikal and Bonkoukou area, southwest of Filingué. Inspired by this, Cindy Bullard organized a tour, taking the Iférouane-trained masons on a three-day expedition to see the work of such proven masons as Mallam Abdou in Itchiguine and Karimou Guigiwa in Chikal.

Mosque, Bonkoukou, designed and built by Mallam Abdou.

In Bonkoukou, they visited the mosque which was designed and built in 1990 by Mallam Abdou. At the request of villagers and with village funds, this highly self-motivated individual, who had travelled on horseback to Iférouane to learn the "new" techniques he had only heard about, had used vaults to build a complex structure of outstanding quality and to create a mosque of great dignity and beauty. Intrigued and impressed, the Ouallam masons set about quizzing their host masons particularly on the details of building rectangular houses.

The house that Mounkaila built

Two days after returning home, Mounkaila and Souley began digging the foundation of a house for Mounkaila. He provided kola nuts and cigarettes to his friends for labour; the village women brought water; children carried extra loads of mud. Cindy Bullard, whose initiative had sparked off this renewed enthusiasm, carefully recorded the actual amount of time, labour, and resources necessary to build a sound domed house in a village using village methods and finished to village standards.[8]

7 See footnote 1.

8 This documentation of a village-level undertaking provided useful socio-economic information and helped establish guidelines for future building projects.

There were stark contrasts between the construction of the Ouallam hostel, with its obstacles and outlandish costs (although these were not unusually high for a project working on a prototype in a town) and the practical reality of a house built by local means and to local standards in a bush village.

Mounkaila's house is a two-room twin-dome on a rectangular base, which requires a slightly higher level of construction skill than domes on a circular base. But with a team of only 5 men, the house was finished in 14 work days (after brick-making) and the daily cost was only 225 Fcfa (4.5 FF or 80 US cents) for kola nuts and cigarettes. Even if the mason and all other labour were being paid for at local rates, the cost would still have been under 100,000 Fcfa (2000 French francs or US $ 375), less than the cost of transporting earth alone for the Ouallam hostel!

This two-roomed house with twin domes on rectangular bases is under contruction during the Ouallam training programme; the design, however, is the same as that used by Mounkaila for the first owner-built and owner-funded domed house in the area.

This comparison does not imply a criticism the first Ouallam building, which by all normal project criteria was a success. It produced a good, local example which was strong, comfortable and in resisting rain damage and infiltration had encouraged local confidence in the techniques. The lessons learned were also invaluable in helping volunteers with their subsequent hiring of manual labour.

Mounkaila's house, however, provided the opportunity for the field test needed to ascertain the *social* feasibility of dome structures. Word spread rapidly and within a month after the last brick dried, local people from the surrounding villages were stopping by to see the rumoured "house with no wood". During reforestation training, representatives from the government forestry service and village trainees were brought to Garbey to see how domes and vaults could help in the same battle.

Interest was mounting. Masons began approaching AFSI volunteers about learning the techniques. In response, AFSI in Ouallam began considering how to have more Ouallam masons trained. At about the same time, Development Workshop and IUCN were developing the idea of setting up a training and information centre for woodless construction in Agadez,[9] together with mobile training units, to meet precisely this kind of demand, which was by now growing in many areas of Niger and further afield in Mali. AFSI decided to look for funds to send six masons to the Agadez centre, once it was operational. A condition they imposed was that the masons trained should agree to contribute their labour for a pilot building in their own village on their return from training.

The Ouallam training programme: a collaborative effort

As things turned out slow progress in starting up the Agadez centre led Development Workshop to suggest that a training course be run in Ouallam itself: this would meet local demand and would provide a first experience for the mobile training unit of the proposed woodless construction training and information centre. The idea was eagerly taken up by AFSI and fourteen masons from Ouallam and two from neighbouring Baleyara were selected for training. IUCN also sent four of their Mali masons for training, which allowed overhead costs to be shared between the two organizations.

The process AFSI used for selecting trainees is significant. A survey was developed to interview interested masons and their village leaders and to assess their personal motivation and their commitment to using their new skills after the training programme. Each village involved was also asked to support the eventual construction of a community or private building in their village to serve both a useful function and as a demonstration of the masons' newly acquired skill.

As technical consultant to the programme, Development Workshop designed its content and organized experienced masons (three from Iférouane and one from Chikal) to carry out the training. Training focussed on two elements:

- theoretical training to ensure that the *principles* were well understood, with "build up and knock down" practice;

- the start-to-finish construction of six public buildings which would provide invaluable on-the-job training and at the same time be built in, and remain in, the public eye.

Development Workshop provided plans and material quantities for the six

9 "Unité de formation et de sensibilisation (UFS)". A site has been donated by Agadez authorities, who fully support the initiative and at the time of writing funding negotiations are well underway. Agadez was also the venue for a highly successful seminar on woodless construction for technicians, decision-makers and development agencies held by Development Workshop and IUCN in December 1991.

The course ran according to plan (in autumn 1991) and during the month of its duration all six buildings were put up successfully to a high standard. The involvement of Development Workshop personnel and Peace Corps/AFSI volunteers was minimal, and restricted to initial organization, all the actual training being carried out by the experienced masons.

Trainees on the Ouallam training programme build a dome on a rectangular base: a radial arm shows the position and angle of each brick.

The newly-trained masons and their villages carried out their promise to build using the techniques in their own village. For the first fortnight after the course, the trainers stayed on to help with this, and by the time they left four further buildings in four separate villages were well underway. Some of the masons were enthusiastically planning to build their own homes using the techniques and other private individuals were already making bricks in readiness for hiring the masons to build for them. This enthusiasm was, at the same time, only possible in part because there had been a good rainy season, and an excellent harvest - the men of the villages were able to stay in the region and work, rather than be forced to travel farther afield. At the time of writing (January 1992), Ouallam and its surrounding villages seem poised to rapidly absorb the "new" techniques into their own architectural vernacular with no further financial or technical support, although with the continuing encouragement of AFSI volunteers, particularly the "extension" worker who actually attended the course.

demonstration buildings, while AFSI liaised with the district government services to choose and plan the sites. Finally, the choice fell on four buildings to be built in Ouallam itself: a bus/taxi station in the central market area; a school library at the High School; an in-patient ward at the Medical Centre; and an AFSI office. The other two buildings were on peripheral sites: a storage shed for a community tree nursery (2 km outside Ouallam) and a cooperative store at Garbey Malo Kwara.

The trainees were split into five teams of four based on language comprehension in such a way that by use of the various available languages communication between trainees and trainers would be assured.

Practice work (at ground level) on vault-building during the Ouallam training programme.

What are the lessons to be learnt?

That technically viable responses to local needs, however urgent, must be introduced in such a way as to ensure that they are also socially and economically viable. .

That *limited* external funding can best be used to remove the financial risk involved in trying out anything new.

That the process of introducing a "new" technology can be greatly helped by dedicated training, but particularly where the demand for training and the commitment of the individuals concerned are proven.

That demonstrations have a key role to play and that to be acceptable form is as important as function.

That time, together with an underlying approach which verifies that there is a true local demand for a given solution - and a little luck - favour the creation of a genuinely local capacity to address local problems.