



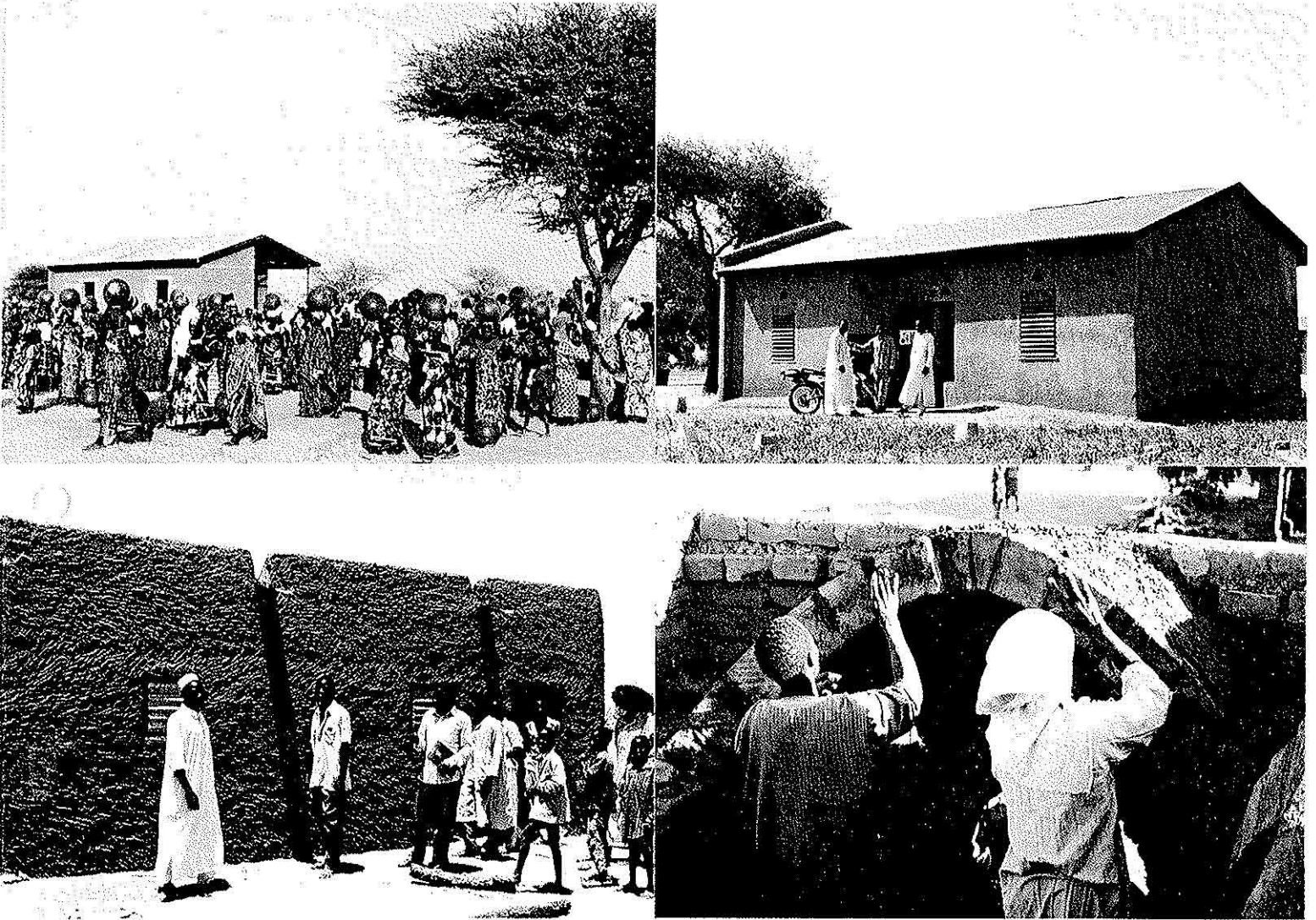
**F.A.O.**

FOOD AND AGRICULTURE ORGANISATION

A.G.O. III      A.G.S.E.

PROJECT : NER/90/013

Niger Government, UNDP, FENU, FAO



**BUILDING COMPONENT  
RURAL DEVELOPMENT PROGRAMME**

**MAYAHI  
NIGER REPUBLIC**

1997





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**RURAL DEVELOPMENT PROGRAMME**  
**MAYAHY, NIGER REPUBLIC**  
**BUILDING COMPONENT**

Prepared by :

CRATerre-EAG

Thierry Joffroy and Olivier Moles

1998

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This document presents the work done from July 1994 to December 1996  
within the frame of the construction section of the Rural development project set up in Mayahi  
FAO, FENU, PNUD, Niger Government

by:

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with the assistance of the  
"service GR de Mayahi" directed by  
**M. Zabeirou Issaka**

and the active participation of the  
artisans in Mayahi district  
and  
the inhabitants of the following villages :  
Janrwa, Dan Toudou, Goumza, Kanem bakatché, Guidan Cima,  
Ganaw, Zodi, Agalali, Kaka, Jali, Alasan, Gaya, Gakudi, Guje, Cake, et Amumun

We want to thank all those who have, directly or indirectly facilitated this work and more particularly :

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# 1. OBJECTIVES OF THE CONSTRUCTION SECTION OF THE PROJECT

## 1.1. The project objectives

This FAO supported programme is covering the region around the small town of Mayahi, situated approximately 100 km North of Maradi, the next bigger town in Central Niger. The region is characterised by sahelian climate and a strong ecological imbalance (frequent drought, strong degradation of soils and natural resources).

The rural development project in Mayahi is supposed to improve the conditions of life of the population in this region by:

- The restoration of a lasting agro-ecological balance.
- An increase of the animal and crop production.
- The diversification of economic activities and as a consequence, the creation of permanent employment in the rural zone.

## 1.2. The development objectives of the construction section of the project

The construction section has as its specific development objectives to propose technical solutions:

- That can be managed by the people in a way that they can contribute to the project realisations and at the same time allow the people to improve their own habitat.
- Allowing a maximum use of local materials while trying to reduce the removal of vegetative materials in an aim of preserving the environment.

## 1.3. Planned realisations

This part of the programme should be put into practice during the whole project period, which is four years, going from July 1994 to 1998, and includes:

- The construction of 30 community cereal stores.
- The construction of 4 dispensaries.
- The construction of 10 shelters for the installation of motorised grinding mills.
- The construction of 10 classrooms.
- The construction of social centres.
- Renovation of the rural habitat through the assistance in the construction in 100 individual houses.
- The construction of the project office and of three annexed lodgings.



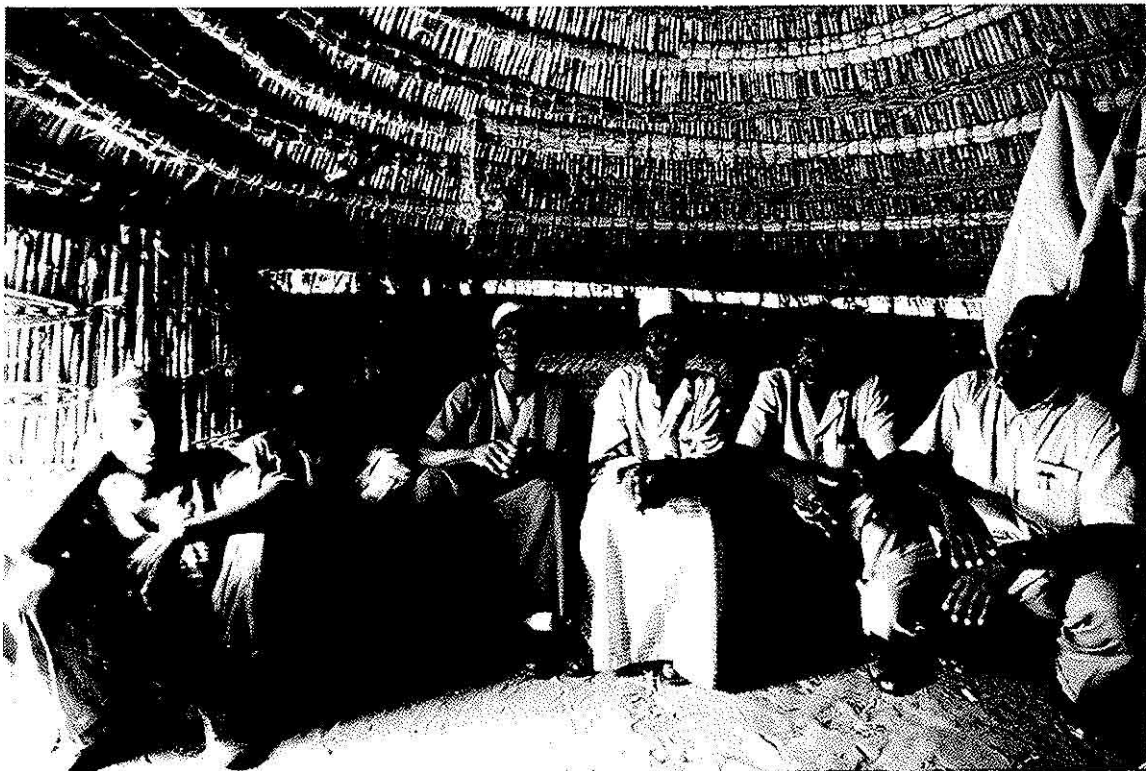
Dan toudou, village selected by the project

## 2. WORK METHODOLOGY

### 2.1. Participatory method

The development project of Mayahi puts into practice a strategy of "Participatory Development". This participatory process implies that a dialogue is established with the population in order to diagnose the situation and define the needs.

A strong partnership is also researched by their participation in the decision process. This should lead to efficient and realistic responses, adapted to the difficult reality of these rural communities and to a programme of actions as the project unfolds.



Discussion with the villagers

## 2.2. Launching of the construction section

The construction section is launched according to a method developed over the years by CRATerre-EAG. This method is based on the successive realisation of four types of complementary activities:

- Study and analysis of the construction sector and its environment.
- Technical conception and definition of a development strategy.
- On site take-off.
- Evaluation of obtained results.

This cycle of four phases is repeated as often as necessary to allow a permanent amelioration and adaptation of the technical propositions, in line with the people's capacities of absorption.

Beyond this working methodology in several phases the progress of activities happens by taking care of the following objectives:

- The possibility for the population to appropriate to themselves the proposed technical solution. Therefore the technical reflection takes the financial means of the populations into account.
- the responsibility of the local partner for the overall carrying out of activities. Therefore an enlarged partnership (area of competence, level and

amount) is researched. This is formed during the realisation of activities and responsibility is given progressively based on everyone's capacities.

The proper anchoring of the project cannot happen without respect to the existing, especially:

- The existing mentality of the local populations, of the local civil servants as well as the project experts. This is done by taking into account what is already well functioning locally and by giving this value. Sometimes this imposed technical compromises especially concerning the performance and appearance of public buildings.
- Certain aspects of the socio-economic organisation such as traditional hierarchies, economical interests, etc. By trying to improve the conditions of the most marginalised and by aiming to avoid risks of disturbing fragile equilibrium, an effort is made not to neglect the various operators.

Finally it is proposed to address the issue under the widest possible angle by taking into account to a maximum degree the environment of the construction sector. This by envisaging complementary activities, especially in the area of protection and regeneration of the environment and in the area of creation of artisan activities and micro enterprises.



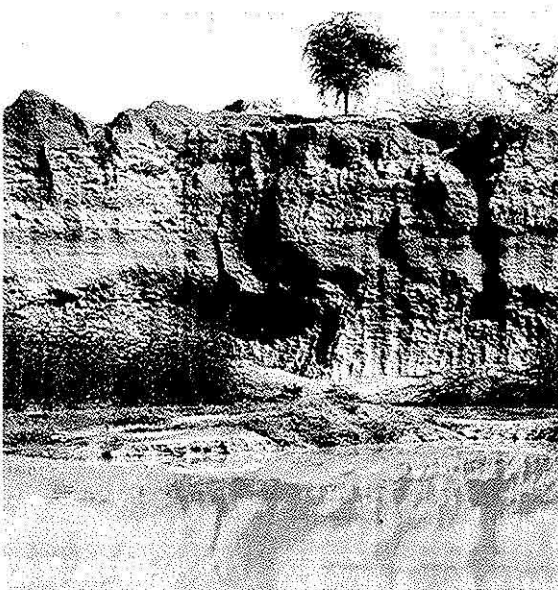
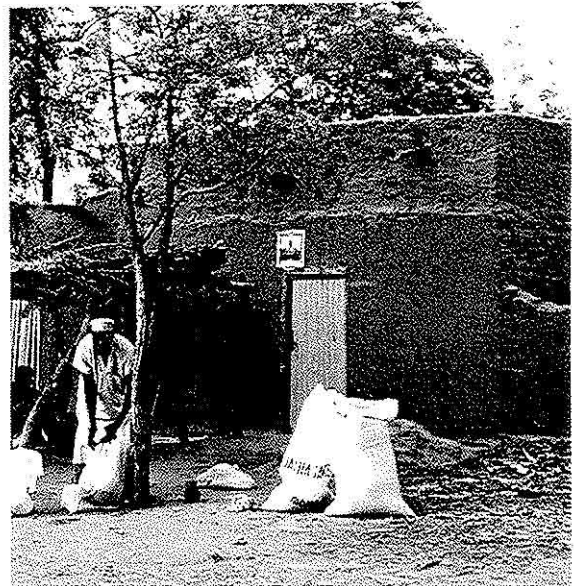
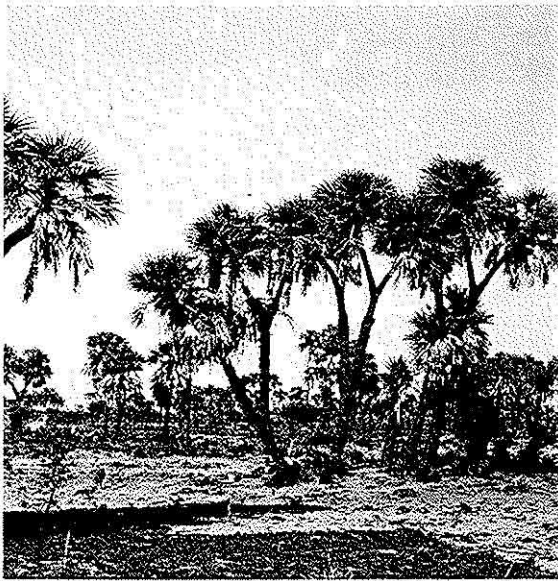
The programme is based on the study of the building sector and its environment

### 3. ACTIVITIES CARRIED OUT

#### 3.1. Technical, socio-cultural and environmental diagnosis

A preliminary diagnosis has been realised during the first mission in September 1994. It included several different activities such as a bibliographic research, investigatory missions on the field, interviews of building professionals, construction cost analysis and a simplified feasibility study to determine the people's and partners capacities.

This first diagnosis has been widely enriched after listening to the population and artisans appreciation as the project unfolded, and thanks to the numerous exchanges which occurred between the partners on site. The evolution of the demand in the area and the spontaneous appropriation by the people of new models seen on prototype houses also helped to understand the needs.



The local resources



### 3.2. Technical proposals and implementation strategy

The proposed technical solutions have been determined according to the diagnosis results. These environmentally friendly solutions correspond to a social demand and answer technical problems. The problem of technical and financial accessibility for the different levels of the population was the major issue to address. They also had to respect the people expectations in terms of space, standards, use and maintenance.

Almost all the work realised is based on the fine analysis of the local know-how in order to improve them and adapt them to the changing physical and cultural environment.

A special attention has been paid to ensure that the technical objectives correspond to the human and material means of the project.

These objectives have been gradually defined as the project evolved and results allowed to widen the knowledge and understanding of the area.

The diffusion of the proposed techniques has been developed mainly on the training of the local artisans

and technicians (experts from the "génie rural du projet" and "Service Génie Rural de Mayahi"). Their training abilities have been cultivated in order to increase progressively their training skills and ensure the sustainability of the project.

The demonstration buildings, well situated have played an substantial role in spreading the information. They allowed to bring confidence in the entire team of partners and to launch the discussion and necessary exchanges between the people and experts to fine tune the proposals.

The global strategy adopted by the project has allowed to implement various activities, complementary to the construction programme.

- the farming of vegetal species used in traditional building methods,
- the disposal of tools and equipment and carts,
- the disposal of diverse technical options, more or less innovative,
- the training of artisans and assisting technicians,
- the training of trainees



The Kanem Bakatché school : a well appreciated demonstration which has inspired most of the other infrastructures built by the project.

### 3.3. Training

The on-site training sessions have been an especially efficient tool to spread the information as they allowed to have a direct feed back from the builders and experts participating to the construction of the demonstration project.

However, they generally require a long preparation and a sufficient supervision by people who can master the proposed techniques and the site organisation. The on site training sessions also permitted to choose some masons for their special abilities in training.

To facilitate the communication with the artisans, pedagogical models have been prepared to illustrate the theoretical part of the training. For the same reason, specific tools and drawing techniques have been set.

Recycling sessions have been necessary to inform the artisans about the current evolution of the project and the new technical details, but also to alleviate some technical defects observed by the experts on site (Service GR de Mayahi).

In addition to this, the local entrepreneurs have received technical assistance to answer to the tenders launched by the project.

The on site training sessions, too short in time, do not allow to offer a complete training for new artisans and thus, do not replace neither the technical teaching, nor the traditional handing over of know how. This type of training is more adapted to bring additional knowledge to artisans who are well experienced. Very different types of buildings have been erected during these training sessions, to adapt to the technical abilities of the artisans and to the specific needs expressed by the local people.

The "expert GR du projet" has followed a 3 week intensive course on low-cost housing organised by CRATerre-EAG in Grenoble, France.

Several artisans have learnt how to fabricate models of the proposed buildings and how to present them to the public.



The on-site training sessions have been an especially efficient tool to spread the information

### 3.4. Construction

The planning of the construction programme has been done with the participation of the entire team of the development project in Mayahi. The programme takes into account the needs expressed by the beneficiaries and the different services which will be responsible for the management of those buildings (health, education).

Management groups in the communities have been organised before constructing every new structure to ensure the proper management of the building by the villagers.

The construction of infrastructures has been given to local entrepreneurs (except for the site training sessions) who had to employ at least one of the masons formerly trained by the project. Certificates have distributed to the trainees for this purpose. Entrepreneurs from Mayahi have been chosen first. However, once the number of professionals trained was sufficient, other entrepreneurs from Maradi were also accepted to help on the more important sites.

In order to avoid cheating the professionals working on those low cost buildings using local materials and voluntary villagers, their fees were calculated on the basis of what they would have been paid on a similar project using conventional materials, because the service offered is the same, although the building material differs.

All the construction work has been supervised by the "service Génie Rural" which has been specially trained for that purpose. Their fees represent 2% of the total cost of construction. Supervision was sometimes difficult to achieve because small buildings are erected very quickly and due also to the fact that organising a trip to a site is not always easy in the district (lack of transportation means). For the more important structures (classrooms, health centres) the representative of the "service GR" was permanently staying on site. This involved additional expenses to cover the accommodation and feeding costs.

Construction of houses has only been done at the occasion of on-site training sessions. It is foreseen that each entrepreneur should have the possibility to build at least one prototype building in his village with the assistance of a skilled mason when needed.

The construction of the project offices and houses which needed to be built urgently has been done in a more conventional way. The plans have been designed by the service GR and construction was carried out by entrepreneurs from Maradi. However, other infrastructures exist in Mayahi (cereal store), which have been built according to the project strategy.



Health centre in Cake: every building is constructed with the active participation of the villagers



### 3.5. Follow up, assessment and adaptation

These activities are essential to ensure the smooth unfolding of a development project, more especially on this project, where so many different partners are involved. But also, despite the fact that it was almost impossible to make a precise diagnosis of the situation in the short given time, it was difficult to foresee the real capacities of every partner, to measure the interest of the population for the different technical innovations proposed but also their capacity to assimilate them. The project had to adapt the work constantly as time went on and new information and results were gathered concerning the achievements by the beneficiaries, their demands, the general appreciation by the public and the spontaneous appropriation by the beneficiaries.

This flexibility in the action has been well accepted by the project partners, and made the adaptation to the general environment possible. This resulted in various changes at different levels like in the programming of the assistance missions, the technical details, the fields of experiment and action. This allowed to be very innovative concerning the activities realised and their location without altering the general objectives of the project which had been set during the programming mission.



Spontaneous appropriation of the earth bricks by the population

## 4. RESULTS

### 4.1. Construction of infrastructure

In the course of two and a half years of activities, the project (programmed for 4 years) has realised close to 213 of the constructions foreseen in the project document (project office and residences not included).

This solid result is principally due to an accelerated rhythm of construction made possible by:

- Training of a sufficient numbers of artisans capable of reproducing the proposed models of construction.
- The communal finalisation of works with the population to define their needs.
- Making available the necessary budget as well as sufficient take-off grants by the financiers.
- The enthusiastic and efficient village participation even if this is reduced as from the beginning of the period of farm work.

The construction are archived by local enterprises. Six are from around Mayahi, and two from Maradi. With the help of training and the conditions imposed on the enterprises to employ at least one mason trained by the project for this level of work, the technical executions have actually been well mastered. At all times little errors are inevitable and should be corrected by the services supervising the construction works. For some artisans, more training is necessary.

The construction works are archived by a direct involvement of the people. Due to the sensitization work of the project team, involving the technical adaptation of activities to the villagers capacities, this participation is easy to organise and seen to be very effective. It is noteworthy that the buildings that have been constructed over two years ago are very sound and their adaptation to climatic condition is visible. Their appearance is well appreciated is well appreciated by the population of the target villagers.

It is important to note that exceeding the construction of public building has participated in the improvement of the habitat. In effect, using simple techniques and local materials, facilitating transport by supply of oxen carts and putting tools (brick, moulds, shovels, diggers, etc.) at the disposal of the people, has spontaneously allowed them to develop a new form of habitat especially using adobe blocks. In 2 out 3 pilot villages in which the project has been introduced, 90% of the construction archived in 1995 had been in adobe where before only vegetative material (straws and reeds) was used. This phenomenon was observed up again in 1996.



Cereal store in Janrwa

## 4.2. Housing improvement

After having received first results during the construction of infrastructure, the first five prototypes were designed. Six months after their construction, which also served for the training of village artisans, first tangible results have been observed.

One mason, trained during the construction, was able to reproduce the most complex prototype for a client and disseminated the new construction ideas in his village.

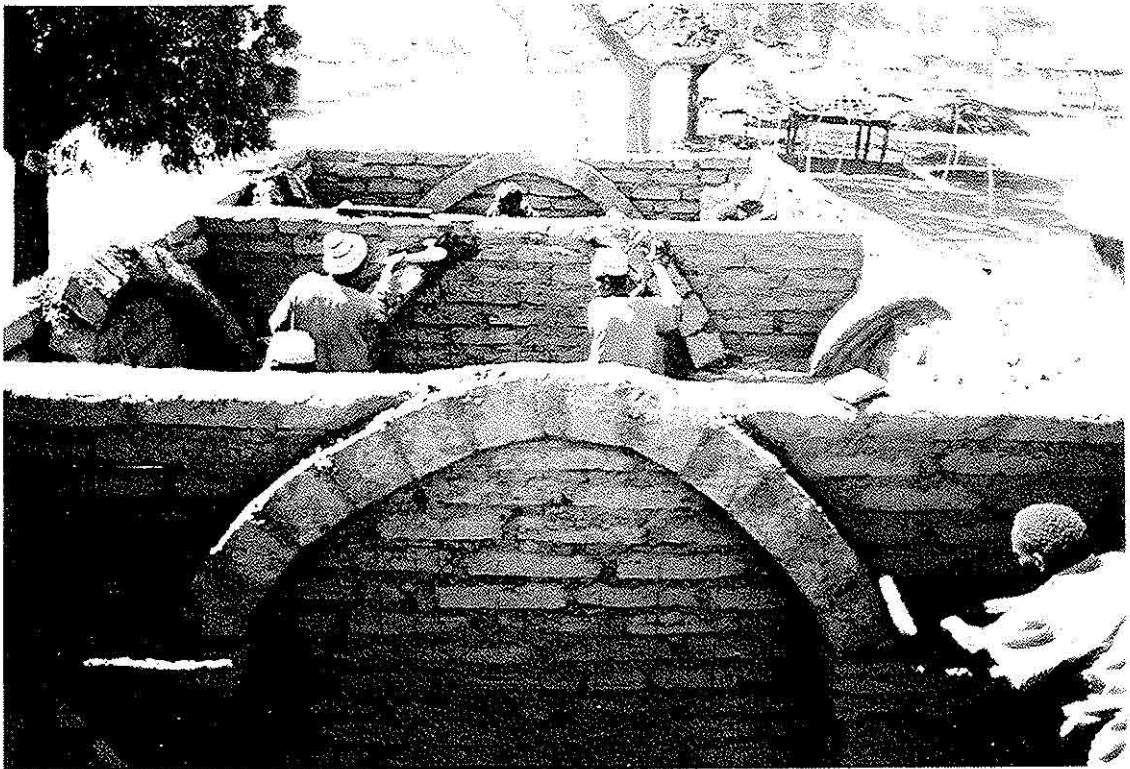
The other masons trained expressed their desire to put into practise more technical solutions that they see to be the most adapted to the resources available in the village. Many villagers who had the opportunity to visit the experimental site expressed the same desire.

This rapid results is fruit of the thorough observation of the construction sector and of a realistic appreciation of the population capacities to innovations which allowed the project to finally find the adopted prototypes.

The variety of proposed models was appreciated as it allowed a choice as well as the possibility of responding to varieties in the village context (natural resources) and the very varied financial possibilities of villagers (with costs of construction varying from N1,500 to 7,500 per m<sup>2</sup>).

Based on this first experience the proposed models were improved with the help of observations made by the artisans and visitors. On this new base a much more ambitious construction-training project (20 constructions with 35 masons to be trained) has now been undertaken in the town of Cake, taking as base the proposal of the improvement of the local market by construction of 20 shops.

Several thousand people have been exposed to this site, which therefore should have an important impact. Based on remarks made, it was decided that each mason trained will be given the task of constructing one prototype in his village using the model of his convenience to prove his ability to reproducing what was trained.



Construction of stores in the market of Cake

### 4.3. Protection of the environment

Right from the beginning of the project, the problem of the habitat appeared to be extremely linked to questions of the protection and the regeneration of the environment.

This several recommendations were made to introduce tree species, which can be used in the construction, into the reforestation programme. Along the same line the protection of the Shibeï, grass species used in the confection of local mats, was recommended.

The possibility of substituting wood and other vegetative materials used in construction by new products WAS also explored.

Most of the proposed habitat prototype point in this direction. Unfortunately all alternatives studies for the replacement of wooden beams proved to be much more expensive than the purchase of illegally cut wood.

Each year there is need for some 3500 beams to satisfy the needs of the region (this means the cutting of some 1,000 local palm trees. Arcs and cross vaulting are for the moment the only viable solutions.

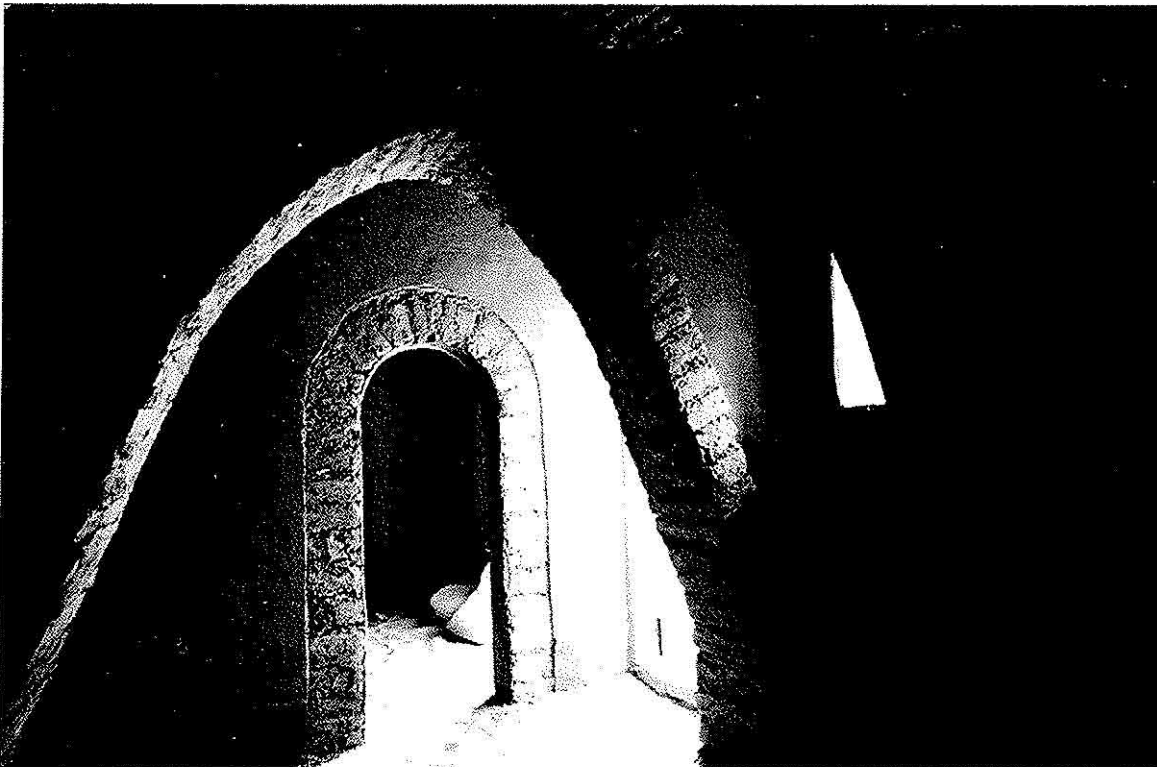
The villagers have realised this and it was these alternatives that attracted their attention.

The research needs to be continued. The first experiments realised using the species *Calotropis procera*, which is widely available in the region, should also be brought to bear on the findings.

A more specific research was realised for the support of granaries for which very interesting results were obtained.

In fact the proposed models can be produced at very competitive prices (less than 50% of the cost of wooden forks) and are the highly appreciated and even researched by the populations where this models were used experimentally.

Alternatives for the beams frequently used in the construction of shops and shelters in the markets and also in local fences also need to be explored. Solutions in these new domains will also be of interest for animals pans.



Replacement of palm beams by arches

#### 4.4. Other positive results

- **at the level of the rural development programme Mahayi:**

Apart from the amelioration of the quality of life, the section "Improvement of the habitat" also participates in the section "Protection of the environment" of the project and also contributes to the section "Creation of Small and Micro Enterprises" and its complementary section "Credit Support".

Further, by obtaining rapid and visible results, the construction section of the project encourages and motivates the population to participate in other activities of the project which need more time to show results.

- **at the level of rural development programme N'guigmi :**

Following a visit of the Mayahi by various national and international decision takers, it was envisaged that another Rural Development Programme, the one of N'guigmi (extreme, east, bordering the lake Tchad) receives a support from the Mayahi project.

- **Dissemination of the construction techniques in the Mayahi region and the department of Maradi :**

The collaboration of technicians from the rural engineering services of Mahayi with the project inspired them to modify several technical details of co-operative grain stores which they constructed for UNICEF, by using techniques stated in the project.

Inspired by the methods developed, they proposed a construction training workshop for the realisation of these modifications.

The director of the rural engineering services even convinced the administrator of the region of Mayahi to employ the system used in the construction of infrastructure in the project, for the realisation of three school classrooms, six market shops and the accommodation of a doctor.

Apart of the indirect effects which resulted from the construction of public infrastructure for the improvement of the habitat in target villages, numerous cases of spontaneous appropriation of demonstrated techniques could be observed in the region of Mayahi and even in the next big town, Maradi.

The combined work on rural habitat and infrastructure compelled the project to reflect on buildings with extremely varied costs. This allowed for touching all social classes of the population as each could find interesting technical solutions adapted to their means.

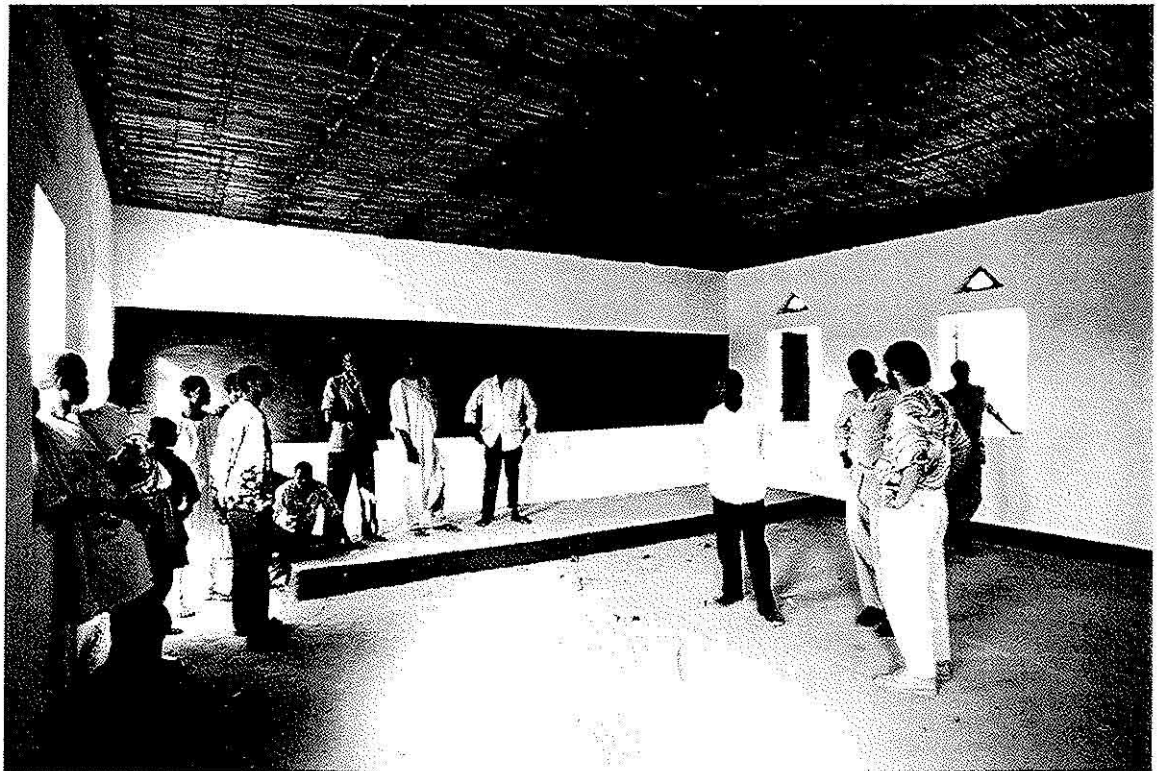
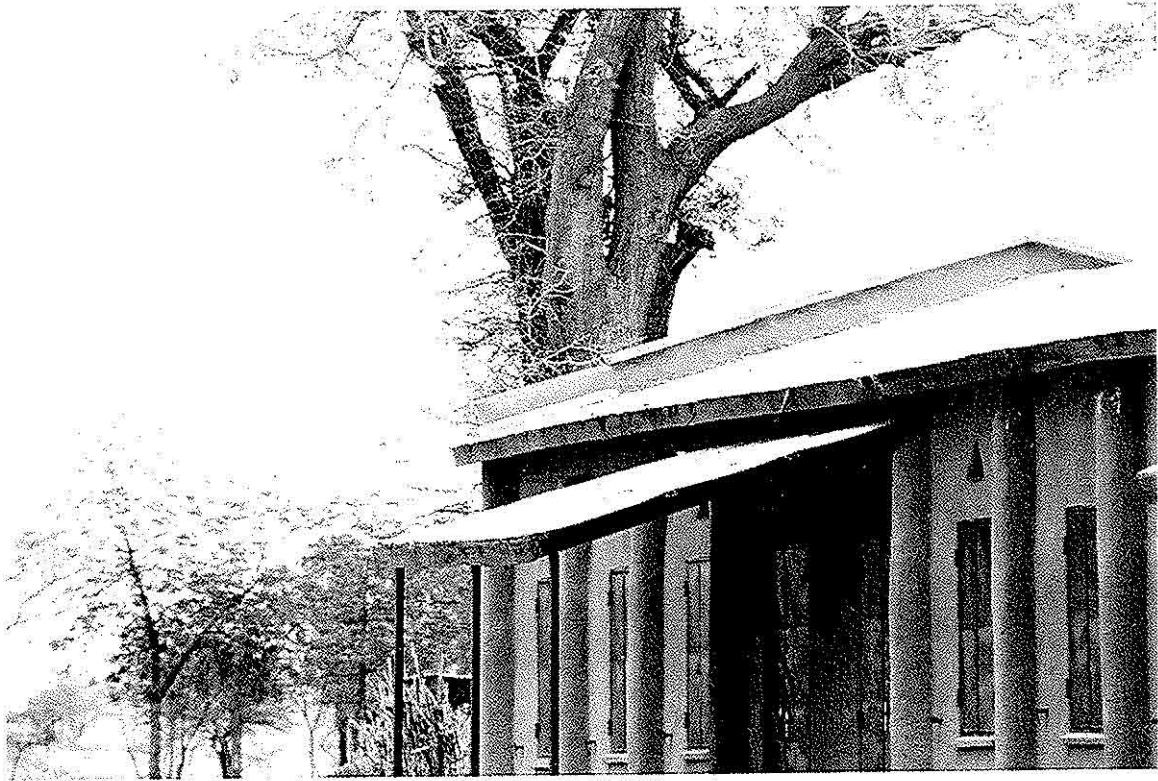
In the same line a training centre in the neighbouring region (Agié district) is also interested to introduce the technical solutions developed by the project during its training.

The possibilities offered by the construction - training workshops are of great interest to them.

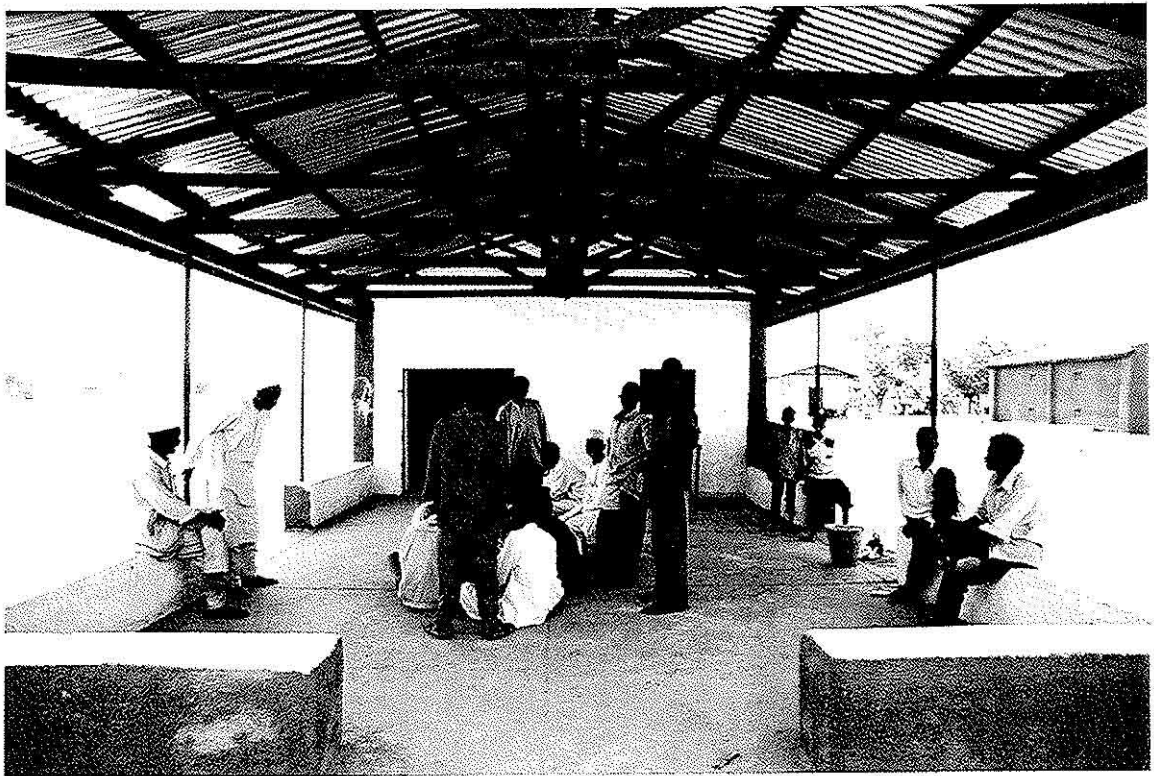


The plants used for construction are integrated in the reforestation programme.





The Kanem Bakatché school



grinder shed and social centre

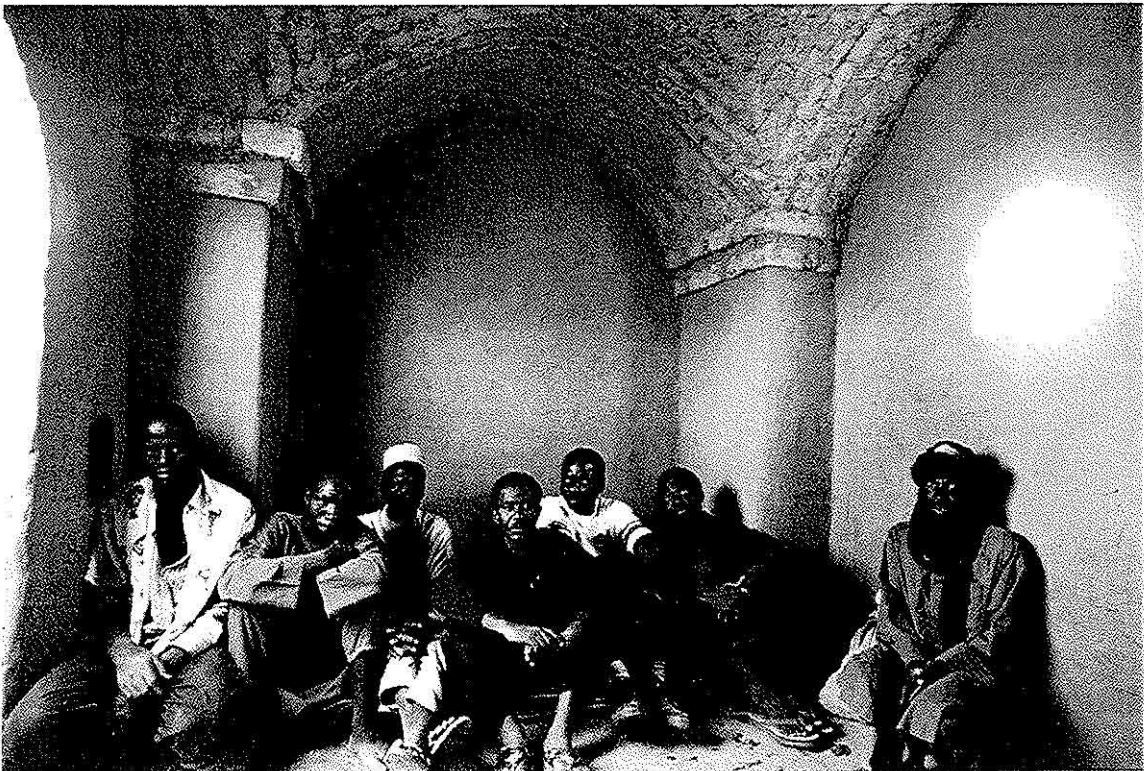
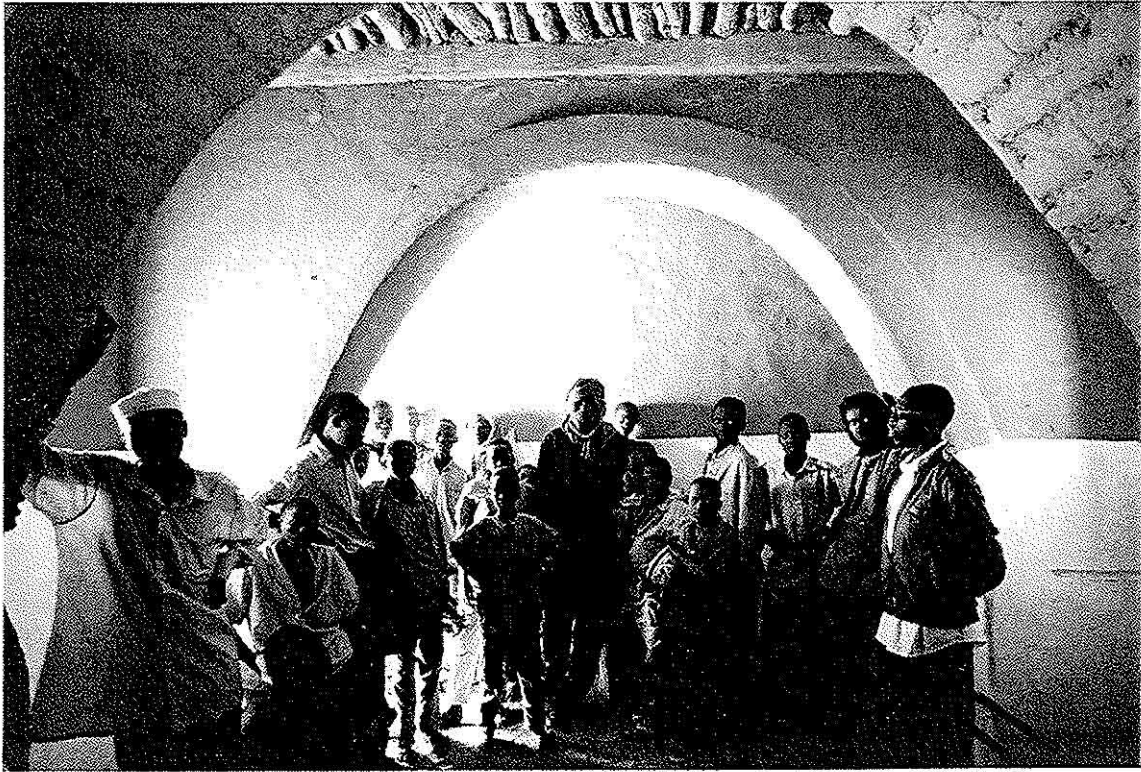


market shops in Wangarawa showing different plan and roof options





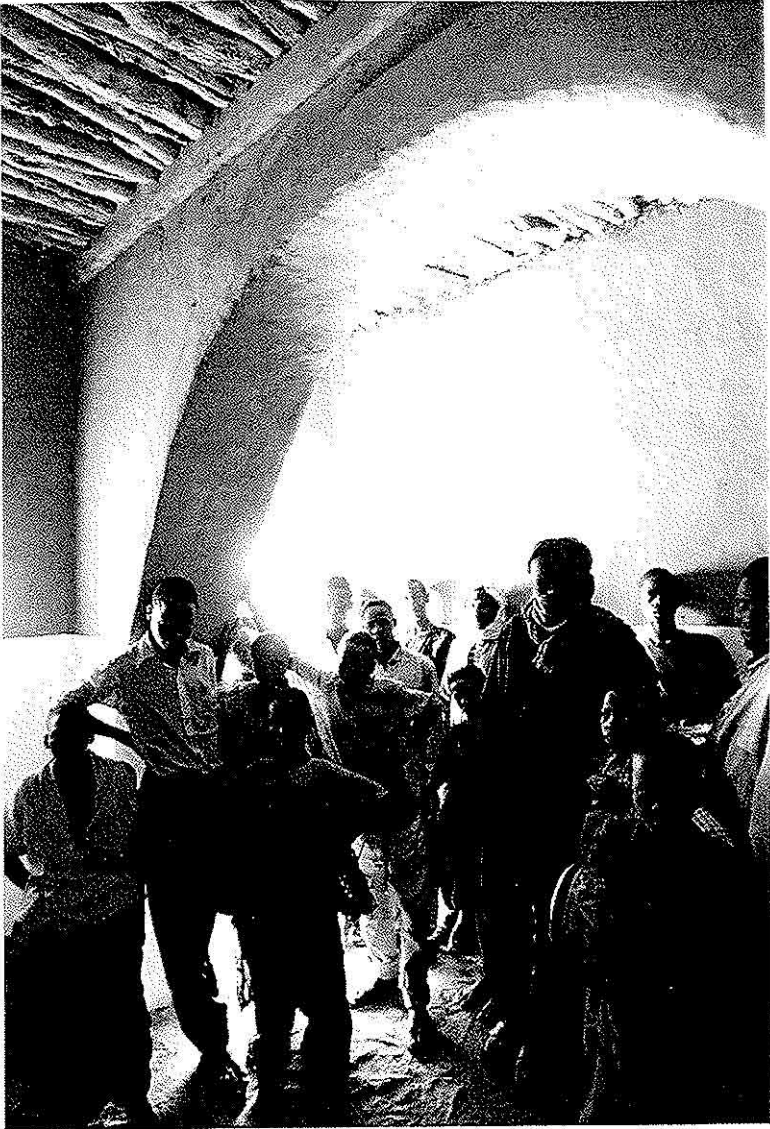
granary stands



Two roofing options protecting the environment : the arches (top) and the cross vault (down)



Long span arches





# APPENDIXES



## LIST OF ACTIVITIES CARRIED OUT

### 1- Study and diagnosis

- In France:
  - bibliographical research on construction in Niger and the sub-region
  - analysis and study of the content of 25 books.
- In Niamey :
  - research of information at the "Ministères de l'Habitat et de l'Éducation", at the F.A.O., at the UNDP, Nigetip and INRAN.
- In Niger :
  - visit of development project involved with building activities: Niamey, Filingué, Zinder, Miria, Gafati,
- In the district:
  - qualitative study of the building heritage and the construction sector,
  - cost analysis and study of the investment capacities of the villagers in the building sector,
  - evaluation and follow up of the results obtained by the "construction sector" of the project.
- In the villages selected by the project:
  - inventory of the different housing forms existing in the region and their number,
  - inventory of the artisans acting in the construction business,
  - inventory of know-how,
  - determination with the population of their needs in terms of infrastructure and housing

### 2- Setting up technical proposals

- Technical files :
  - several proposals have been elaborated for the preparation of the project basis until the target cost was respected,
  - a technical file for the construction of public equipment and a preliminary document for the improvement of housing (January 95),
  - a file for the rehabilitation of the school (3 classes and 1 accommodation), and the dispensary in Issawan,
  - a file for the construction of a reinforced concrete water storage,
  - a revised technical file for the construction of public equipment (July 95),
  - A file for the construction of the "service GR" offices in Mayahi
  - an example of tender file which can be used for any building type,
  - a technical file for the construction of 5 housing prototypes, (September 95),
  - a technical file for the production of cement granary stands, based on the laboratory research carried out in Grenoble,
  - a technical file for the production of beams which could replace the traditional Doum, Gao or Nim trunks used in the construction of traditional flat roofs,
  - feasibility study for the replacement of plywood ceiling with reed mats,
  - revised technical file for the construction of 5 housing prototypes (October 96),
- Complementary recommendations for the project direction:
  - introduce the wood species used for construction in the reforestation programme, including the farming of shibci, grass used for thatching which tends to disappear,
  - take into account the important transportation needs to carry the suitable soils from the quarries to the villages in the programme (facilitation programme for the acquiring of carts),
  - give access to basic tools in the villages,
  - study the management possibilities of the quarries when they are close to the villages,
  - sensitise the population on the maintenance practices, one of the best way to avoid the waste and reduce the destruction of the environment.

### 3- Training

- 18 masons and 5 carpenters trained to the construction techniques chosen by the project for public equipment at the occasion of the realisations of two sites (Kanem Bakatché school and "service GR de Mayahi" offices),
- after fine tuning the technical proposals, recycling training sessions have been organised during the construction of the "service GR" offices and the dispensary in Cake,
- 35 village masons and 7 artisans specialised in the construction of traditional roofs trained in Mayahi at the occasion of the construction of 5 prototypes in Mayahi and the Cake market,
- pedagogical models prepared for each prototype and three artisans trained for their re-production,
- 5 carpenters trained for the manufacturing of Jangalati ceilings,
- 6 masons trained for the production of granary stands,
- 1 carpenter trained for the manufacturing of wooden form work for the production of granary stands,
- 1 carpenter trained for the manufacturing of steel form work for the production of granary stands,
- 1 mason trained for the manufacturing of reinforced concrete beams,
- 1 carpenter trained for the manufacturing of wooden beams,
- 2 mason trained for the manufacturing of calotropis procera beams,
- the 6 technicians of the "service GR de Mayahi" have also be trained on all these sites to become trainees and acquire a specific technical knowledge,
- a part from the experience acquired on site, the National GR expert has followed a "low cost housing" training course in France at the School of architecture, Grenoble.

### 4- Construction results

- In 1994 : (from July to December)
  - 3 cereal stores,
- In 1995 :
  - The project base, comprising offices, 3 bungalows, a meeting room and a storage building (cereal store type ),
  - the Kanem Bakatché school, comprising 3 classrooms, one office, a store and a group of latrine.
  - the "service GR de Mayahi" offices,
  - the rehabilitation of Issawan school (3 classrooms and 1 accommodation),
  - the rehabilitation of Issawan dispensary, including one accommodation,
  - 2 grinder shelters,
  - 1 village shop.
  - 5 housing prototypes,
  - 60 granary stands
  - one ferro cement water tank
- In 1996 :
  - 2 dispensaries, including an accommodation building and a hostel for 8 people,
  - 5 cereal stores,
  - 8 social centres,
  - 3 village shops,
  - 6 dispensaries,
  - 2 cereal stores.
  - 650 granary stands,
  - 20 village shops in the Cake market,
  - 1 prototype using experimental Calotropis beams.

**TECHNICAL ASSISTANCE MISSIONS ON THE PROJECT**

- Mission 1 :** Preliminary study and programming  
Thierry JOFFROY  
30 august to 14 septembre 1994  
Rome and Mayahi
- Mission 2 :** Building design, writing of the specifications  
Programming of activities of mission 3  
Thierry JOFFROY, Olivier MOLES, Lazare ELOUNDOU  
Decembre 1994 to January 1995  
Grenoble
- Mission 3 :** Construction of the first demonstration buildings (school - Kanem Bakatché)  
including the training of entrepreneurs.  
Olivier MOLES  
January to June 1995  
Mayahi
- Mission 4 :** Evaluation of the first realisations and programming according to the results and unfolding of  
of mission 3..  
Thierry JOFFROY  
12 to 27 June 1995  
Mayahi
- Mission 5 :** Revision of the technical files and development of the housing section of the project.  
Thierry JOFFROY, Olivier MOLES, Lazare ELOUNDOU  
July to August 1995  
Grenoble
- Mission 6 :** On site training on housing prototypes and recycling of the artisans trained in Kanem Bakatché.  
Olivier MOLES  
Novembre à décembre 1995  
Mayahi
- Mission 7 :** Evaluation of results on the housing section and programming of the programme last activities  
Thierry JOFFROY  
24 June to 7 July 1996  
Mayahi
- Mission 8 :** On site training on housing prototypes and training of trainees at the occasion of the  
construction of market shops in Caka.  
Olivier MOLES  
Novembre to decembre 1996  
Mayahi



## BIBLIOGRAPHY

- Document de projet, NER/87/CO2- NER/90/013 - Développement rural de Mayahi.
- FENU, Série des notes documentaires du FENU, pour la préparation et la mise en oeuvre des programmes d'éco-développement participatifs, La connaissance de l'espace social, Aspects méthodologiques de la formulation participative.
- Abeillé B., Lantran J.M., Posma C., Theunissen P. *Pratiques de construction des infrastructures sociales dans les pays du Sahel. Volume 1. Rapport.* Sénégal, Dakar, Banque Mondiale, 1991.
- Guide des pratiques de construction des infrastructures sociales dans les pays du Sahel.* Etats-Unis, Washington, Banque Mondiale, Région Afrique, Département du Sahel, Division Population, Ressources Humaines, et Infrastructures.
- Abeillé B., Lantran J.M., Posma C., Theunissen P. *Pratiques de construction des infrastructures sociales dans les pays du Sahel. Volume III. Etude de cas. Etude sectorielle régionale.* Etats-Unis, Washington, Banque Mondiale, Région Afrique, Département du Sahel, Division Population, Ressources Humaines, et Infrastructures, 1991.
- Abeillé B., Lantran J.M., Posma C., Theunissen P. *Pratiques de construction des infrastructures sociales dans les pays du Sahel. Volume IV. Fiches d'enquête. Etude sectorielle régionale.* Etats-Unis, Washington, Banque Mondiale, Région Afrique, Département du Sahel, Division Population, Ressources Humaines, et Infrastructures, 1991.
- Giglio P., Reynaud P. *Constructions sans bois. Projet NER 88/01A. Formation et appui aux entreprises artisanales du Niger.* Niger, Niamey, BIT, 1990.
- Hammer D., Tunley P. *Iférouane - Habitat en évolution.* Niger, Niamey, Development Workshop, 1991.
- Development Workshop. *Domes not domes. A case study. The introduction of earth brick domes and vaults to the Ouallam region of Niger.* France, Lauzerte, Development Workshop, 1992.
- Development Workshop. *"Woodless construction" workshop. Atelier "construction sans bois". Report on the workshop. Rapport sur l'atelier. Agadez, Niger. 9-14 December / décembre 1991.* Niger, Agadez, IUCN - The World Conservation Union, 1991.
- Tunley P. *Etude économique : bâtiments en adobe, Niger. Comparaison de coûts : constructions traditionnelles et avec voûtes et coupôles.* Suisse, Gland, L'alliance mondiale pour la nature (UICN), Programme Sahel, pour le Projet pour la Conservation et la Gestion des Ressources Naturelles dans l'Air et le Ténééré, 1991.
- Taton D. *Architecture traditionnelle au Niger.* Niger, Niamey, Ministère des Travaux Publics, des Transports et de l'Urbanisme, Service central de l'Habitat et de l'Architecture, division habitat.
- L'habitat nigérien.* France, Paris, ORTN, Agence de Coopération culturelle et Technique, 1978. (Vidéo)
- Ragnout C. *Projet de développement rural de Maradi. Le développement rural, de la région au village; Analyser et comprendre la diversité,* G.R.I.D., Université de Bordeaux.
- Elhadj Harouna Amadou, Plaquette de présentation de la Brigade Hydraulique.
- Etude de l'état du parc construit appartenant à l'état, Ministère de l'équipement du Niger, 1985.
- FENU, *La connaissance de l'espace social, Aspects méthodologiques de la formulation participative,* Série des notes documentaires du FENU.
- Farm structures in tropical climates,* FAO/SIDA cooperative programme, rural structures in East and South Africa, FAO, 1988.
- AGSE, *Building construction guidelines for FAO field projects.*
- Proctor D.L., *Grain storage techniques, Evolution and trends in developing countries,* GASCA, FAO agricultural services Bulletin N°109.
- Africa 70, Projet MAU/92/006, *Plan pour la réalisation des banques de céréales,* FAO, 1994.
- Arc En Terre, Projet PNUD/FAO/CHD/88/001, Renforcement du service national de la protection des végétaux, Construction des bases phytosanitaires, Rapport intermédiaire d'exécution, 1994.
- Joffroy T., CRATerre-EAG, rapport de mission, Septembre 1994.
- CRATerre-EAG, Dossier technique provisoire, Décembre 1994.
- Joffroy Thierry, Lazare Elundu, CRATerre-EAG, Amélioration de l'habitat, Février 1995.
- Joffroy Thierry, Moles Olivier, CRATerre-EAG, Rapport de missions, Juin 1995.
- Moles Olivier, CRATerre-EAG, Rapport de mission, Décembre 95
- CRATerre-EAG, Dossier technique, Septembre 1995.
- CRATerre-EAG, Dossier préparatoire aux formations, Septembre 1995.
- Joffroy T., CRATerre-EAG, rapport de mission, Juillet 1996.
- Pierroni M., rapport de mission, Aout 1996.
- Moles Olivier, CRATerre-EAG, Rapport de mission, Décembre 96

## COSTS OF THE INFRASTRUCTURES REALISED BY THE PROJÉT

Village	construction type	Year	Construction cost in FCFA	Construction surface in m <sup>2</sup>	Cost per m <sup>2</sup>
<b>Janrwa</b>	Cereal store	1994	1 970 700	43	45 830
	market shop	1995	869 580	17,5	49 690
	Grinder shed	1996	814 810	17,5	46 561
	Social building	1996	1 093 493	54	20 250
	Dispensary	1996	573 690	15	38 246
<b>Dan Toudou</b>	Cereal store	1994	2 147 260	43	49 936
	Cereal store	1996	869 580	17,5	49 690
	Grinder shed	1995	814 810	17,5	46 561
	Social building	1996	1 093 493	54	20 250
	Dispensary	1996	573 690	15	38 246
<b>Goumza</b>	Cereal store	1994	2 068 300	43	48 100
	market shop	1996	871 170	17,5	49 781
	Grinder shed	1995	814 810	17,5	46 561
	Social building	1996	1 093 493	54	20 250
	Dispensary	1996	572 930	15	38 195
<b>Kanem-Bakaché</b>	Classroom	1995	2 850 000	63	45 238
<b>Guidan Cima</b>	Cereal store	1996	1 944 115	43	45 212
<b>Ganaw</b>	Social building	1996	1 093 493	54	20 250
<b>Zodi</b>	Cereal store	1996	1 936 415	43	45 033
<b>Agalali</b>	market shop	1996	878 514	17,5	50 201
	Dispensary	1996	572 930	15	38 195
<b>Kaka</b>	Cereal store	1996	1 936 415	43	45 033
<b>Jali</b>	Social building	1996	1 010 870	54	18 720
	Dispensary	1996	572 930	15	38 195
	Grinder shed	1996	758 410	17,5	43 338
<b>Alasan</b>	Cereal store	1996	1 942 075	43	45 165
	Social building	1996	1 010 870	54	18 720
<b>Gaya</b>	Cereal store	1996	1 942 075	43	45 165
<b>Gakudi</b>	Social building	1996	1 010 870	54	18 720
	Dispensary	1996	572 930	15	38 195
<b>Guje</b>	Social building	1996	1 010 870	54	18 720
<b>Cake</b>	Rural dispensary	1996	11 194 683	222	50 427
	- accomodation	1996	2 454 855	47	52 231
	- dispensary	1996	6 579 220	117	56 233
	- Rest room	1996	2 165 610	58	37 338
<b>Amumun</b>	Rural dispensary	1996	11 833 250	222	53 303

## COST OF THE HOUSING PROTOTYPES AND GRANARY STANDS

## HOUSING PROTOTYPES :

	ROUND HUT	SQUARE HUT	ARCHES	VAULTS
Surface in M2	8	7,9	20,7	11,4

## TOTAL COSTS (Fcfa)

Materials/workmanship	92 000	104 000	285 000	270 000
Contractor	115 000	130 000	360 000	345 000
Contractor with participation	76 000	87 000	250 000	226 000
Self building	19 000	24 000	90 000	84 000

## COST / M2 (Fcfa)

Materials/workmanship	11 500	13 300	14 000	21 000
Contractor	14 500	16 600	17 500	29 000
Contractor with participation	9 600	11 000	12 000	19 000
Self building	2 350	3 100	4 400	7 200

## GRANARY STANDS :

number produced per bag	10	14	16	22	11	15	9
cement	400	286	250	182	364	267	445
sand	41	33	26	19	34	24	15
water	1	1	1	1	1	1	1
chicken mesh	49	27	18	18	33	14	14
8 mm iron rod	0	0	0	0	0	0	190
workmanship	40	36	30	26	40	32	40
amortisation	10	10	10	10	10	10	20
sub-total	541	393	335	256	482	348	725
profit margins and fixed costs	135	98	84	64	121	87	181
TOTAL	676	491	419	320	603	435	906



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