



1992 Technical Review Summary
by Saïd Mouline

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Pan African Development Institute

Ouagadougou, Burkina Faso



Architect - Engineer

A.D.A.U.A.

Ouagadougou, Burkina Faso

Craftsmen

A.D.A.U.A. trained masons and brick-layers

Ouagadougou, Burkina Faso

Client

Pan African Development Institute

Ouagadougou, Burkina Faso

Completed

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I. Introduction

In 1978, the Pan African Development Institute commissioned the *Association pour le développement d'une architecture et d'un urbanisme africain* (ADAUA) to design and build the future campus of the Pan African Development Institute in the Sahel, West Africa (PDI/AOS) at Ouagadougou, in the Republic of Burkina Faso.

This project was entirely realised in stabilised earth brick. It aimed to demonstrate the creative potential of local materials, their appropriateness to the socio-cultural context and the climatic constraints of the Sahel region. It also sought to give an indication of the many potential applications for building local mass housing and the different forms that community participation could take in the building process.

II. Context

a. Historical Background

From the beginning of the 1970s, it became more and more clear that the African continent, and the Third World, would be unable to resolve the pressing problems that faced them by adopting the Western model of development and by trying to emulate its socio-economic structures, liberal system, and techniques. Not only was the adoption of Western development problematic, it was more and more accompanied by pernicious effects that worked against the desired results. To escape from this situation, it was necessary to abandon many "modern" ideas in favour of inventing new development models that were better adapted to local conditions and resources.

During the same period, the issue of mass housing became one of the priorities for development, along with food and health. It became clear that building efforts would have to concentrate both on the search for new organisations - land use, infrastructures, services - and on the use of building materials and technologies suited to local conditions.

Activities undertaken in Africa and in the Third World in favour of housing improvements have generally benefited from international aid. They have progressively been realized on the initiative of local organizations or technical co-operatives whose principal asset is their close contact with the concerned populations. They are thus in a position to stimulate interest and coordinate their efforts. From this collaboration have emerged new architectural practices characterized by innovation and projects able to draw together a variety of initiatives. The cumulative effect goes well beyond the housing and construction sectors.

By calling on the ADAUA, the Pan African Development Institute showed its desire to promote, to transmit and to disseminate a technology specifically adapted to local materials. Its goal was to make it possible for African groups to acquire some autonomy in setting up the basic infrastructure required for housing.

Through the commission for the PDI/AOS Campus at Ouagadougou, the client gave its support to the goals and objectives of the ADAUA. These were:

- to create national facilities to support local, regional and national programmes that undertake or support the building of low-cost, mass housing;
- to establish production facilities for building materials, such as brickyards for sun-dried or fired bricks, and lime pits;
- to improve local materials and building techniques and to use them to create a more harmonious architecture;

- to train masons and assist in the creation of autonomous building cooperatives;
- to realize buildings that conform to the social, economic and cultural aspirations of the users.

Before undertaking the PDI/AOS project, the ADAUA, founded in 1975, had already realized a number of innovative architectural, social or technical projects in Mauritania, Senegal and Burkina Faso. The projects also involved the subsequent formation of national crafts facilities. The Association employed up to 40 managers, architects, engineers and economists, most of them African, who were responsible for some 400 employees. The commission that the ADAUA received in 1978 for the construction of the campus at Ouagadougou did not come from a regular client but from an institution whose objectives concerning development in Africa coincided with those of the founders of the ADAUA.

Founded in 1965, the Pan African Development Institute is an international African organization. It is a non-profit organization and does not receive government support. Its goal is to promote integrated, participatory development among the rural and urban populations of sub-Saharan Africa.

In 1977, concern for better concentration of its activities in specific geographic areas of Africa and for decentralization of management led to the formation of a Regional Institute for West Africa and the Sahel at Ouagadougou. This institute, the PDI/AOS, was to work to reduce the large quantitative and qualitative shortage of upper and middle-level management and thereby offset the huge distortions created by the difference between the models on which programmes and projects for the area are elaborated and the reality of the rural world for which they are designed.

Today, the PDI runs training and research programmes in 45 English-speaking and French-speaking African countries through its four regional institutes and its General Secretariat at Douala in Cameroon.

b. Climatic Conditions

Burkina Faso is an inland country with a tropical climate and two seasons: a dry season that runs from mid-September to mid-June and a rainy season that runs from mid-June to mid-September. Temperatures average 25°C in winter and rise to 34 to 40°C and above from February to June. The climate is also subject to wide variations in temperature.

c. Site

A building site of six hectares (300 by 200 m) was given in 1978 to the PDI/AOS by the government of Upper Volta (former Burkina Faso) for the construction of the campus. It is a flat piece of land located about 6 km to the east of the centre of Ouagadougou, on the road to Niamey. The campus is surrounded by low density squatter settlements, of which the buildings are predominantly low rectangular constructions with corrugated roofing.

III. Description

a. Elaboration of the Programme

In order to understand the conditions under which the project was conceived, it seems important to present the following accounts of the objectives and activities of the ADAUA and the PDI and how they came together for the realization of the PDI/AOS at Ouagadougou.

The first statement is by Jak Vauthrin, founder and General Secretary of the ADAUA:

*We were a small group of architects, engineers and urban planners from Mauritania, Guinea, Mali, Burkina and elsewhere, who had decided to build in the poorer areas. We did this for 15 years, discovering the cities, seeking out the hidden strengths of regional architectures, from the northernmost points of the Mauritanian and Malian deserts, Ouadane, Chinguetti, and Timbuctu to the forest of Cameroon and the Ivory Coast. Fifteen years during which we covered the ancient cities of the prestigious kingdoms of Mali, ancient Ghana, the Haoussas States, the Songhais and Benin, 15 years during which we studied the great coastal capitals, watching their changes and their growth: we saw high-rise after high-rise, airports and highways, financial and banking headquarters. But we mostly spent our time building in poor neighborhoods and in shanty towns, using our imagination and our powers of invention to build and to set up the first small industries for producing local materials from earth, lime and plaster, if only to show that the local lateritic soil contains everything that is needed to build mosques, cathedrals and especially houses. We lived this adventure like pioneers, but like many adventurers, in return for our passion, we also had to deal with criticism and adversity. (In *Anarchie et raison d'une architecture*, collection Villes africaines, Paris, L'Harmattan, 1989, pp. 8-9).*

The second statement is from Vincent Fernand, founding member and General Secretary of the PDI:

In 1964, a small group, of which I was the leader, laid the foundations of the Pan African Institute. Its aim was to form development managers for the newly independent countries and in particular the middle-level managers that could serve as a link between the people and their leaders. In this spirit, men and women, Muslims, Christians and lay persons, came together and gave form to a project that would be the expression of those in Africa who thought that development should begin from the sense of an African identity, from faith and the will to escape from underdevelopment. In sum, they would seek a solution and, together, make it work. The Pan African Development Institute has grown. It has trained many managers. And when, in 1975-76, we created the French-speaking Institute of West Africa and found it necessary to find office space for it quickly, it seemed appropriate that the space should reflect the basic goals of the PDI project. Of course, by using earth as a construction material, under conditions of which we were well aware, we ran a risk that our Board of Directors made certain I understood when I presented the project and requested the funding. Our desire, our faith, our passion, and perhaps also our naivety made it possible to convince them that this project should see the light of day. Today, it stands as proof that a small group of men can upset received opinion and erect a utopia in its place". (Excerpt from a letter of 7 May 1992.)

b. *General Objectives*

In line with this philosophy of action and this view of development, a project as important as the campus of the PDI/AOS would also have to show that:

- From the technical point of view, the use of local materials merits greater research effort and presents enormous creative and technical possibilities to those who are willing to test and use them. The architect and master-builders of the project were aware that they were entering an area almost completely unknown to those in charge of construction in Burkina Faso and in West Africa. They hoped to be able to prove that this type of construction stood its own next to so-called "modern" buildings.
- From the economic point of view, the project could successfully make maximum use of local resources, both materials and labour, and, by limiting imports, reduce to a minimum the need to spend precious foreign currency; that it could, in addition, obtain good temperature control and adaptation to local climate conditions through the use of earth and good design, and thereby considerably reduce the costs of electricity for air conditioning.
- From the social point of view, the choice of building techniques requiring much labour meant the possibility of creating jobs. Also, for the long term, the training of masons, brick-makers and technicians for other aspects of construction would lead to the creation of co-operatives and the dissemination of techniques for building with earth.

c. *Functional Requirements*

The university campus is subdivided into three main areas:

- a teaching and administrative centre, to which are attached a library and a restaurant and dining area;
- housing for 72 students;
- detached houses for professors; 9 villas;

The entire project covers a ground floor area of 4'505 m² and has a total floor area of 5'658 m².

d. *Design*

The different structures form a dense, urban-like fabric, organized so as to create and surround open places of varying dimensions. The design is inspired by the organization of space in Volta villages. The hierarchy of village planning is also respected: the different areas are marked off by a portico or a threshold that signals the passage into a space of a different degree of privacy. Most of the buildings are designed on an introverted plan, as covered spaces are generally grouped around courtyards. Of varying size, shaded and often planted, the courtyards give a sense of privacy, natural ventilation and coolness.

e. *The Architectural Elements*

The Teaching and Administrative Centre

Situated near the entrance to the campus, the administration area occupies some 560 m². It is organized around a courtyard of pleasing dimensions, embellished with plants and a fountain. A vaulted and domed peristyle forms the inner border of the courtyard. It gives shade and coolness to the passages that lead to the offices of the professors, the researchers and the secretariat. One side of the building has a meeting room that is remarkable both by its proportions and the span of its roof (ca. 10 by 8.5 m). Two separate staircases lead to the second floor, one of which is composed of two flights set against the fountain. The offices occupy two sides of the building, and the washrooms occupy the corner.

The library covers a surface of some 260 m². Its straight axis would allow for building an addition at some future time. The treatment of the light entering the building received special attention. The library can hold some 8'000 volumes, thanks to a shelving system mounted on moveable rails. There are a large number of seats and carrels and two small rooms for groups.

The restaurant area has two parts. One is a covered club room (more than 200 m²) that holds about 100 persons and serves as a self-service restaurant and cafeteria. The other is a series of covered alcoves (four shelters for some 40 persons each) that serve as an open-air dining area. An adjacent kitchen and various annexes serve both parts.

The teaching space is subdivided into several sections. There are four classrooms for 25 persons (60 m²), a large room for 50 persons (almost 100 m²) and a large multi-use room for more than 100 persons (260 m²). This last room can be divided into two. It is composed of six vaults 4.5 m high. The audiovisual equipment used for teaching purposes is grouped at one end of the room; this placement makes it possible to also use the equipment on the terraced space outside the building, between the multi-purpose room and the large room. This space can be devoted to activities such as forums, assemblies, concerts or theatre, and films.

Student Housing

Student lodgings are formed by a group of six buildings articulated around a covered square. Each building is entered through a twisting corridor that gives onto a planted interior courtyard

surrounded by a peristyle on three sides, while on the fourth is the staircase that leads to two rooms and a large upper terrace. Each ground floor has four rooms (with two beds each) set around the courtyard, and a living room, bathroom and service courtyard. In the student lodgings, as in those of the professors, terraces have been fitted out for sleeping during the hot season.

The Houses for Professors

Set apart from the other buildings, the nine villas have a separate entry. They are articulated into groups of three houses and form a little community in which the privacy of each unit is preserved. They all have the same ground floor plan, but are of different sizes, depending on whether they have two, three or four bedrooms (124 to 159 m²). Each house has an entry courtyard with a garage and a service courtyard off the kitchen. A spacious circular entry separates the interior private space from the world outside. Opening off the entry are two areas: One is the reception area - living room, dining room - and the other is the private area - kitchen, veranda, bedrooms. The largest houses also have one or two second-floor bedrooms. The living space is covered by vaults or domes. The overall design articulates distinct and differentiated entities around a central patio, and the spatial disposition creates a remarkable and varied architectural layout.

It is noteworthy that, despite the constraints imposed by the use of earth as the basic building material, which restricts the building possibilities to structures based solely on principles of thrust such as vaults and domes, the visitor is struck by the richness, the variety and the originality of the urban landscape presented by the Institute.

f. Structure, Materials, Technology

The PDI/AOS is entirely built of stabilized earth bricks. The earth was procured from land at approximately 3 km from the building site. The cement used for the stabilization (the only imported material) came from Togo.

The foundations and the shell are built of stabilized and compressed brick. The stabilization of the bricks is obtained by using between 4% and 10% cement, depending on whether the bricks are used in foundations, load-bearing walls, arches, vaults or domes.

The dimensions of the bricks are 8.8 x 14 x 29.5 cm. The weight of a solid brick is 6.7 kg, and that of a hollow brick is 5.7 kg.

Walls are 14 cm, 20 cm or 29.5 cm thick, and the bricks are joined with mortar of the same composition. The vaulted and domed roofs, 11 cm thick and entirely built of stabilized brick, are mounted by the masons without the use of shuttering.

For interior and exterior coatings, improved local materials are also used (lime, cement, sand, earth). The floors are covered with terra cotta or enameled tiles. The bathroom plumbing is concentrated and the washstands are made of enameled sinks set into drainboards of stabilized bricks. These bricks are made on the site by brickmakers' co-operatives, and the terra cotta bricks are produced in local factories.

A crew of brickmakers and of masons trained during the first project undertaken by the ADAUA in Burkina Faso - the Training Centre for rural social workers at Kamboincé - joined the new construction site of the PDI/AOS.

In order to ensure the completion of this large project within the specified time period, the ADAUA encouraged "on the job" training for four new groups of masons. The project was thus sub-contracted, building by building, to the five independent groups of masons, which had jobbing contracts with the ADAUA. All the other non-construction tasks were also sub-contracted to small and medium-sized businesses, or to jobbers in the relevant trades, for electrical and plumbing installation, coatings and painting, producing and fitting doors, and lighting fixtures. The ADAUA's desire to rely entirely on local labour and to work out technical possibilities that make use of local know-how and resources meant that the project managers had to be constantly present on the building site and offer continuous training.

IV. Construction, Schedule and Costs

Studies for the project began in February 1978. A first study was completed in May 1978; it was revised and finished in May 1979. The plans for the entire project were finished in May 1982. Construction took place from January 1982 to April 1984, and the buildings were occupied as of May 1984. The land for the site was provided by the national authorities, and the funds came entirely from international sources.

Initial costs, estimated in October 1980, were XOF 377'850'000 (USD 1'134'700). Finance was assured by two international organizations: the EZE (*Evangelische Zentralstelle für Entwicklungshilfe*) in Bonn for 61%; and the DDA (*Coopération technique suisse*) in Bern for 39%.

The final, total cost on 31 August 1984 was XOF 613'948'000 (USD 1'843'700). This included all financial obligations, the infrastructure of the entire campus, training, exterior finishes and landscaping, and waterproofing of the roofs.

Finance was assured by the EZE (46.7%), the DDA (43.5%) and the PDI-SG, Geneva (9.8%).

Construction costs were of the order of XOF 361'391'000 (USD 1'085'250) and the cost per m² of built floor space was XOF 63'870 (USD 192), low when compared to average costs for "modern" construction at Ouagadougou.

The costs for maintaining reasonable inside temperatures were relatively low because of the characteristics of the materials used and especially because the buildings were designed to take advantage of the interior courtyards to offer protection from the heat.

The maintenance budget for the buildings and the landscaping was to be integrated into the running costs of the Institute.

USD = XOF 333, African Financial Community Francs.

V. Technical Assessment

a. Functional Assessment

The various buildings, both in their overall layout and for their independent functions, are appropriate for the planned use. Indeed, they are extremely modern, thanks to a high level of technical expertise and an exceptional mastery of the technique of construction in stabilized brick.

b. Climatic Performance

The ceiling heights of the buildings, the protection of the openings, the thickness of the earth walls, and the circulation of air under the vaults and domes all serve to ensure an excellent passive response capacity. The architectural design, the conception of the buildings and particularly the use made of interior courtyards, landscaped and lined with peristyles, all reinforce the capacity to adapt to the harsh climatic conditions. The rows of trees designed to protect the exterior walkways from the intensity and brightness of the sun should also be noted.

c. Level of Technology

It is often the case that construction based on earth (formed bricks, sun-dried earth, adobe or stabilized earth bricks) are imagined to be, and in reality are, of a low technological level. Of course, such levels of technology require training and mastery, but they depend more often on

accumulated empirical knowledge than on experimentation, daring, research, and careful calculation.

But this technology, as it is adapted for the conception and execution of the PDI/AOS, makes a show of daring and virtuosity. The domes of stabilized brick, built without the use of shuttering, not only cover rooms of many forms (square, rectangular, circular, polygonal), but also span impressive distances.

In this domain, the ADAUA and Ladji Camara, the head of the PDI/AOS project, achieved spectacular results by setting rigorous standards. The earth domes of 7 to 9 m in diameter bear witness to the success of their efforts, as does the large multi-use room roofed by arch-supported vaults that cover a total surface of 112 m². An example of the rigour of their procedures is furnished by the stress tests, carried out on a full-scale model of an earth brick dome covering a structure of 3 x 3 m². To test its resistance, bags of sand of a total weight of 36 tonnes were placed on the dome and left there for a month without causing the structure to collapse. A number of other novel experiments were undertaken during the course of this project, as others had been on earlier ADAUA projects. These experiments have gradually made it possible to take further advantage, on rational grounds, of earth as a building material in constructions that have become more and more complex and even exceptional (one-storey buildings, water tower built of earth).

d. Maintenance Problems

The principal maintenance problem is the regular upkeep of the buildings and particularly the exteriors (roofs, coatings, exterior finish). For the waterproofing of the domes, an experimental resin was initially used, but it did not withstand the rains of the Sahel. The waterproofing was entirely redone in 1985 with asphalt-covered layered felt, and the results have been entirely satisfactory.

The problem of upkeep has essentially been caused in recent years by the budget deficit of the Institute, due to the reduction of international subsidies. Because of a deficit of about 20%, some irreducible running costs, such as payments due to third parties, take priority. As a result, other expenses, such as replacement of automobiles and building maintenance are no longer assured. Thus, the exteriors show rapid ageing. Without maintenance, this would have been true whatever construction techniques had been used. At present, only one mason is permanently employed to maintain some 6'000 m² of buildings.

VI. Users

a. Trainees, Seminar Participants and National Organizations

From 1984, the PDI/AOS has received in its different training programmes and seminars upper and middle level management from some 20 countries, including some in Europe and America. For the long programmes, the numbers vary from year to year. There are from 45 to 70 trainees, of which the great majority are Muslims (82%). Including the trainees, the seminar participants and the foreign experts, the housing centre assured 3'400 overnight stays in 1984, 6'400 in 1987 and almost 9'500 in 1989, of which 15 to 20% were women. The total number of meals served rose from 23'500 in 1984 to 50'000 in 1986 and 36'300 in 1989.

Given the diversity of the users of the campus, it is difficult to measure adequately their level of satisfaction. Two comments can be made on the basis of a number of reports and from direct observation: One is that the trainees for long-term programmes have expressed regret at not having individual rooms; the second has to do with the absence of a mosque; to make up for its absence, the trainees traced on the ground, with stones, a sketch of a mosque in which the prayers take place.

In addition to its teaching and research activities, the PDI/AOS also accommodates on its campus the activities of certain national organizations, such as those of the Burkina Theatre, UNICEF meetings, the FIDA Workshop, the IDE Workshop, and the World Bank. It also offers accommodations to the guests of the Ministry of Information and Culture. Finally, it assures the projection of films for FESPACO (The Pan African Film Festival at Ouagadougou).

b. Researchers and Training Personnel

University staff of different disciplines and nationalities, both those that reside at the Institute and those that live in Ouagadougou, express full satisfaction concerning the living space and the opportunities for teaching, work and meetings that the Institute offers. This is not surprising in light of the fact that they are active supporters of the PDI/AOS and subscribe explicitly or implicitly to the principles underlying the building of the campus and the objectives of the ADAUA. For this reason, they have been gradually mobilizing over the past two years in order to contribute in their way to the resolution of the problems posed by the maintenance and renovation of the Institute. First, they have undertaken the steps necessary to have the PDI/AOS campus complex listed as a site for preservation. This would make it possible to obtain direct or indirect subsidies from the public authorities or, at least, their support and recommendation with respect to outside donors. Second, they have started up a new course devoted to applied research for agricultural development in a rural setting. The new course will have a vegetable garden and an experimental farm for promoting certain types of cultivation and breeding. There is enough available space on the campus, and the planned production would contribute to the needs of the restaurant kitchen. In addition, and also with a view to improving and bringing the teaching of the PDI/AOS up to date, those responsible for the courses envisage the possibility of setting up practical training courses in the techniques of building with earth on the campus itself.

VII. Persons Involved

Ladji Camara	Engineer, Workshop Cooperative, ADAUA/Burkina, Ouagadougou.
Philippe Glauser	Architect, Workshop Cooperative, ADAUA/Burkina, Ouagadougou.
Ibrahim Dialo	former Director of the PDI/AOS, Ouagadougou.
Jak Vauthrin	founder and former General Secretary of ADAUA, Ouagadougou.
Vincent Fernand	former General Secretary of the PDI, Geneva.
Faya Kondiano	Professor, Director of Studies, PDI/AOS, Ouagadougou.

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Rabat, May 1992