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AGENCE FRANÇAISE DE DÉVELOPPEMENT

PRE-OPERATIONAL GUIDE

NUBIAN VAULT ECO-CONSTRUCTION IN THE SAHELIAN AND DRY CLIMATE REGIONS OF AFRICA

A ROOF
A SKILL
A MARKET
The Nubian Vault

Foreword

The world is currently facing growing infrastructure needs and the need to reduce the associated greenhouse gas (GHG) emissions. AFD Group is firmly committed to working alongside emerging and developing countries to promote the energy transition.

This transition will not only rely on developing renewable energy production capacities but also on implementing energy efficiency measures, particularly in buildings, which today account for 40% of total GHG emissions. These measures will mobilise new technologies, which are still sometimes costly and emit greenhouse gases, as well as affordable low-tech construction methods that have a low environmental footprint and draw on local know-how and materials.

This is the case of the Nubian Vault, a 3000-year-old construction method originating in Nubia. For the past 10 years, Agence Française de Développement has been supporting the Nubian Vault Association and its programme to disseminate this alternative architecture on a large scale in the Sahelian countries. Reflecting ancestral know-how, this low-carbon eco-construction technique has enabled Sahelian populations to design and build real architectural jewels, adapted to an environment with extreme climatic conditions.

This construction technique is resolutely modern, with reduced energy consumption for satisfactory comfort of use, good resistance to rain and violent winds, construction costs lower than or equivalent to those of other types of construction, controlled maintenance costs and incomparable aesthetics.

Agence Française de Développement is proud to be associated with the development and distribution of this guide, co-written by the Nubian Vault Association and the teams from the Programme for Energy Efficiency in Buildings. The guide aims to encourage project owners, project managers and construction sector players working in sub-Saharan Africa to rediscover the art of building and roofing using one of the world's oldest building materials: earth.

Emmanuel Baudran
Deputy Director,
Agence Française de Développement

PEEB
PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

PEEB, a European partnership for energy efficiency in buildings

The Programme for Energy Efficiency of Buildings (PEEB) is a Franco-German initiative launched in 2016 at COP22 in Marrakech under the aegis of the Global Alliance for Buildings and Construction (GlobalABC).

PEEB has been implemented jointly by Agence Française de Développement (AFD), GIZ and ADEME since 2018. The programme combines the expertise of these three implementing agencies: project funding, public policy support and capacity building of building stakeholders.

PEEB has provided technical assistance and targeted funding to:

- **50 building construction or renovation projects in 30 countries;**
- **the development and application of building codes for sustainable construction** in Morocco, Senegal and Tunisia, supplemented by sector guides, training, IT solutions;
- the **revision of construction regulations** and **the development of technical guides** for the hotel sector in Mexico and the hospital sector in Tunisia;
- the development of **national programmes to promote green buildings** in Indonesia, Morocco, Turkey and Vietnam.

In 2022, the programme is scaling up by involving new donors and putting in place financial incentives (investment grants and concessional loans). In this context, 4 new initiatives are launched: PEEB Cool, PEEB Med, PEEB ASEAN and PEEB Overseas. Thanks to financing from the Green Climate Fund, the European Union, AFD, the French Facility for Global Environment, the German government's Federal Ministry for Economic Affairs and Climate action (BMWK) and the French Fund for Overseas, these initiatives aim to support the implementation of sustainable construction projects with a financing volume of €1.7 billion.

Summary

The Programme for the Energy Efficiency of Buildings (PEEB) joins the Nubian Vault Association (AVN) in presenting the Nubian Vault construction technique, a validated response to environmental, social and economic challenges in many regions of Africa. This construction technique can be integrated into Agence Française de Développement (AFD) projects in eligible regions.

Nubian Vault buildings have the following benefits:

- **Climate Change Mitigation** with a sustainable and low-carbon construction technique using local materials;
- **Adaptation to climate change** with buildings offering satisfactory thermal comfort in the event of high temperatures;
- **Access to robust, affordable buildings with low maintenance costs for** different sectors of activity (housing, schools, health centres, offices, granaries, workshops, markets, etc.);
- **Strengthening of the local economic environment** with vocational training, labour-intensive construction sites and the mobilisation of local actors in the context of construction projects.

The major benefits of this technique include the following points:

- The technique is more economical than conventional concrete and tin roof construction, both in terms of initial investment (between 20 and 40% cheaper for the structural work) and usage over time due to better indoor thermal properties;
- The buildings are waterproof against rain and regulate ambient humidity;
- Different interior and exterior architectural configurations are possible for different uses (see part 1.1);
- AVN has significant experience in disseminating technical know-how and in different specific uses of the technique, and can provide project management assistance;
- Nubian Vault construction can create off-season jobs for rural youth.

The following checklist summarises the **constraints** to be aware of before adopting the Nubian Vault technique:

- ☑ Not feasible in regions with high rainfall levels (see map in part 2.3);
- ☑ Maximum building width of 3.3m, but unconstrained length;
- ☑ While the construction of single-story buildings (R+1) has been validated, there are currently no examples of R+2 or R-1 structures. However, experiments in this regard are feasible.
- ☑ Not suitable in flood prone areas.
- ☑ Need for the presence in the region of a sector with craftsmen and entrepreneurs trained in the technique, or a region with potential for development of the sector (see map in part 2.3).

Summary

Granaries of the Ramesseum - Egypt[1]

History of the Nubian Vault construction technique

Invented during Antiquity in Nubia (present-day Upper Egypt and North Sudan) to respond to a lack of timber resources, and historically unknown in other African regions, the Nubian Vault technique makes it possible to build dwellings with vaulted roofs without formwork, using local materials (mainly earth), simple tools and basic technical skills. After more than 3500 years, ancient earth brick granary vaults are still standing at the site of the *Ramesseum* in Luxor.

This technique was identified in the 1980s by the NGO *Development Workshop* as a potential response to the serious housing and construction problems faced by the populations of Sahelian Africa.

The Nubian Vault Association (AVN) was created in 2000 by its co-founders Thomas Granier, a French mason, and Séri Youlou, a farmer from Burkina Faso, to explore and promote the technique. Following tests in Burkina Faso, they simplified and standardised it in order to facilitate both its appropriation by local populations and its large-scale dissemination. The result is a refined and frugal method – the Nubian Vault technical concept – adapted to the climatic conditions and the traditional know-how of the Sahelian regions.

African Nubian Vault eco-construction is therefore both ancestral and innovative in its origins and its ability to respond to the many current challenges (demography, climate adaptation and resilience, economic strengthening, appropriate vocational training and employability, etc.). Its many advantages make it, to date, one of the most promising green building techniques to respond to the necessary evolution of the construction and housing sectors in Africa.

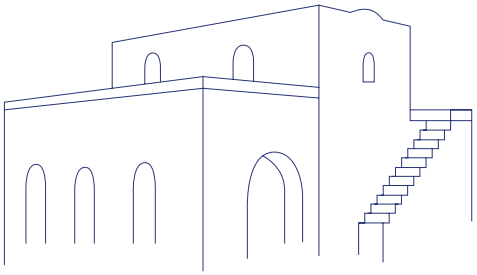
[1]https://hal.archives-ouvertes.fr/hal-02320382/document

Part

01

Relevance of the Nubian Vault construction technique

Typology of buildings



Here is a non-exhaustive list of demonstration construction projects carried out under the AVN program:

↗ Health

Type of buildings
- Community health centres
- Advanced health posts
- Maternity clinics
- Nursing and midwifery accommodation
- Hospital extensions

↗ Agriculture and local development

Type of buildings
- Livestock buildings (henhouse, pigsty, etc.)
- Processing and marketing buildings (jatropha, mango, honey, cashew, spinning, shea, etc.)
- Storage buildings and warrantage (onions, shallots, potatoes, millet, corn, cashew nuts, cotton, etc.)
- Boutiques
- Workshops (welding, mechanics, ice production, etc.)
- Hotels

Education

Type of buildings
- Classrooms (3 models: 45-60 students, 25-30 students, 2 x 25-30 students)
- Cultural centres

Administrative and community

Type of buildings
- Offices
- Municipal offices, town halls
- Libraries
- Multi-service centres
- Religious buildings (mosques, churches, prayer rooms, *tata somba*)

Residential (modulable)

Type of buildings
- Private houses (rural and urban)
- Social housing (demonstration projects)
- IDP Shelters (Internally Displaced Populations)
- Two-storey buildings

Examples of projects

Here are some examples of major integrated construction programs already completed:

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↗ UN-HCR

Burkina Faso
(Kaya – Centre North Region)
City for IDPs - 160 buildings
4000 m²

https://bit.ly/3OmAzp2

↗ *PATRIP - WHH*

Mali and Burkina Faso
60 community buildings in 10 municipalities
- 3000 m²

https://bit.ly/3OqhvX3

↗ WHH - SOS SAHEL

Burkina Faso (Centre North Region)
50 poultry houses for family use - 750 m²

↗ GERES

Mali
6 Electrified Activity Zones (ZAE)
- 2400 m²

https://bit.ly/3N4OmiJ

↗ *Maison des Yvelines*

Senegal (Department of Matam)
Administrative complex including offices, meeting rooms, housing, etc.
600 m²

https://bit.ly/3QurQD9

↗ Departmental office buildings

Senegal (Departments of Podor, Kanel, Matam)
3 departmental office buildings completed or under construction

↗ *Maison des Énergies de la Région Rhône-Alpes*

Senegal (Department of Kanel)
Garages, hotel, offices, classrooms, workshops, etc.
700 m²

↗ *Dubaï Charity Association*

Mali (Cercle de Dioila)
Village Housing Program
50 houses - 1500 m²

https://adobe.ly/3xxR2Qu

Dubaï Charity Association

Mauritanie (Diakré)
Refugee Relocation Program
50 houses - 1500 m2 + community buildings

https://bit.ly/3zHtHh0

Polish Cooperation

Burkina Faso (North Region)
Donation of houses to vulnerable people
60 houses - 1800 m^2

https://bit.ly/3xwqVct

AWAC - SOS Faim Belgique

Burkina Faso (North Region)
Buildings for the benefit of producer groups

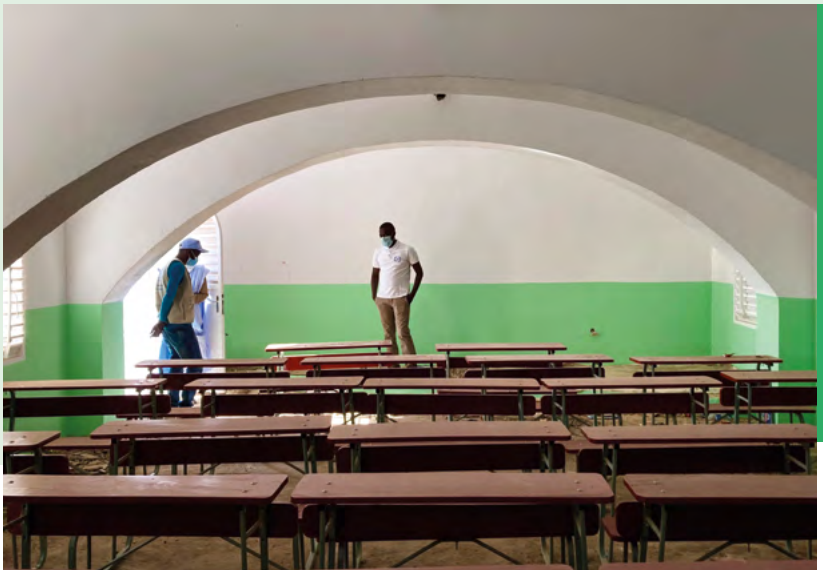
Danish Refugee Council

Burkina Faso (North and Centre North Regions)
60 IDPs shelters - 1500 m²

AVSF

Mali (Mopti Region)
10 agricultural storage buildings - 500 m²

https://bit.ly/3zIGAIo

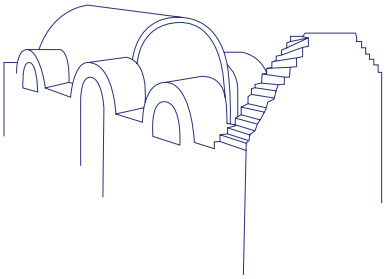


BIT

Mauritania

Classrooms designed by the architect Mathieu Hardy (Al Mizan Sahel design office)

Architectural concept

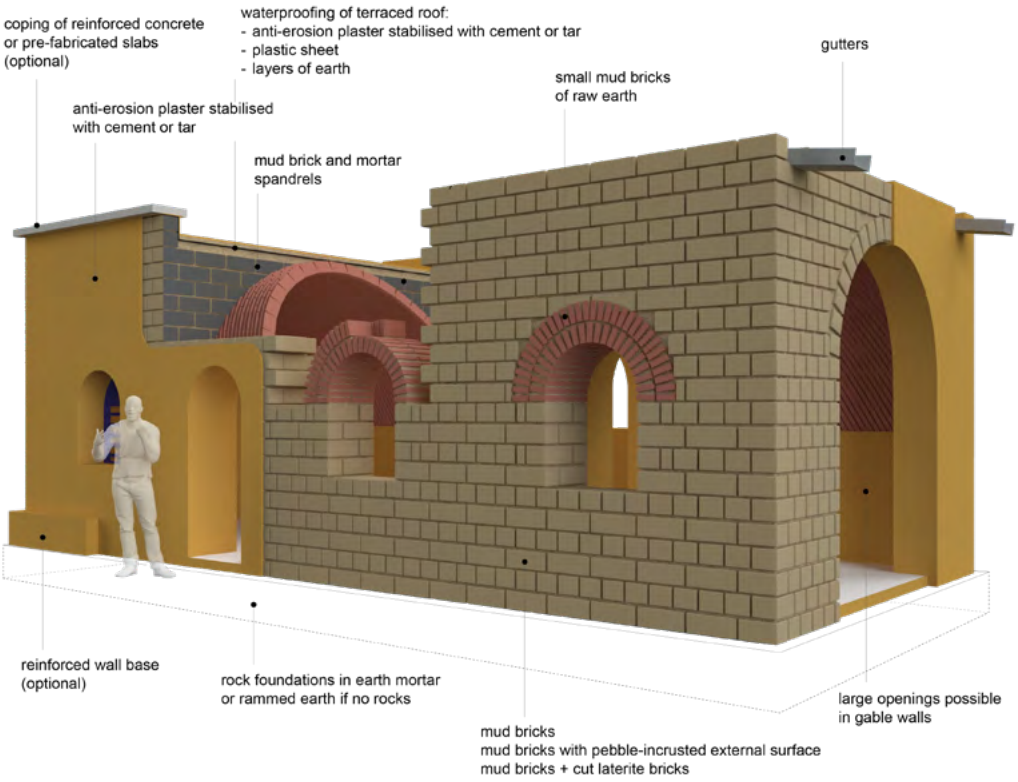


The diagram below presents the Nubian Vault architectural concept as simplified and standardised by AVN. These simplifications and the standardisation enable the widest possible dissemination of know-how and the minimisation of the risks of poor workmanship and damage. This architecture is characterised by a quasi semi-circular vaulted roof of 330 cm maximum width, constructed with small earth bricks and earth mortar without any formwork. This vault rests on large load-bearing walls, built with traditional adobes, which rise to the height of the vault, the space between the vault surface and the wall being infilled to protect and strengthen the vault and create a flat roof terrace.

Walls and roof must be protected from rain erosion using a variety of techniques such as traditional earth coatings, bituminous coatings, cement coatings on stone-encrusted adobes to enable it to adhere (only on walls), stone rubble, reinforced acroteria and wall footings, etc

The entire structure is made of earth bricks and mortar. Foundations are made with rocks and/or rammed earth and earth mortar. Load-bearing structures in earth or concrete (arches of solid blocks) or reinforced concrete (post/beam system) allow for wider interior spaces by replacing or supplementing load-bearing walls, gables and partitions.

This architecture, which can include a second storey and the use of flat roof terraces, is well adapted for later additions and extensions.

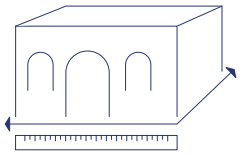


For more information, the stages and techniques of Nubian Vault construction are illustrated in a simple manner in the following document:

Nubian Vault Construction Stages and Techniques (FR)

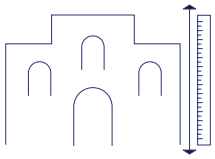
Technical possibilities

The following points show the architectural possibilities of Nubian Vault construction.



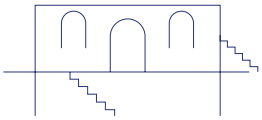
Width and length of constructions

In the standard concept approach simplified by AVN, a vault cannot exceed 3.30 m in width. The load-bearing walls are 60 cm thick so they can withstand the tensile and compressive stresses for vaults of this width. Several vaults can be connected laterally by arches or concrete post-beam systems to enlarge rooms in width. There is no length constraint.



Building height

Except for certain specific structures requiring significant heights (classrooms), the usual interior heights under vaults are between 3m15 and 3m50.



Floors and basements

It is possible to build upwards. There are no examples of Nubian Vault construction over two stories, apart from minarets and a bell tower, but experiments are possible. The construction of below-ground basements would require significant additional costs to waterproof underground surfaces, but there is nothing technically to prevent this.

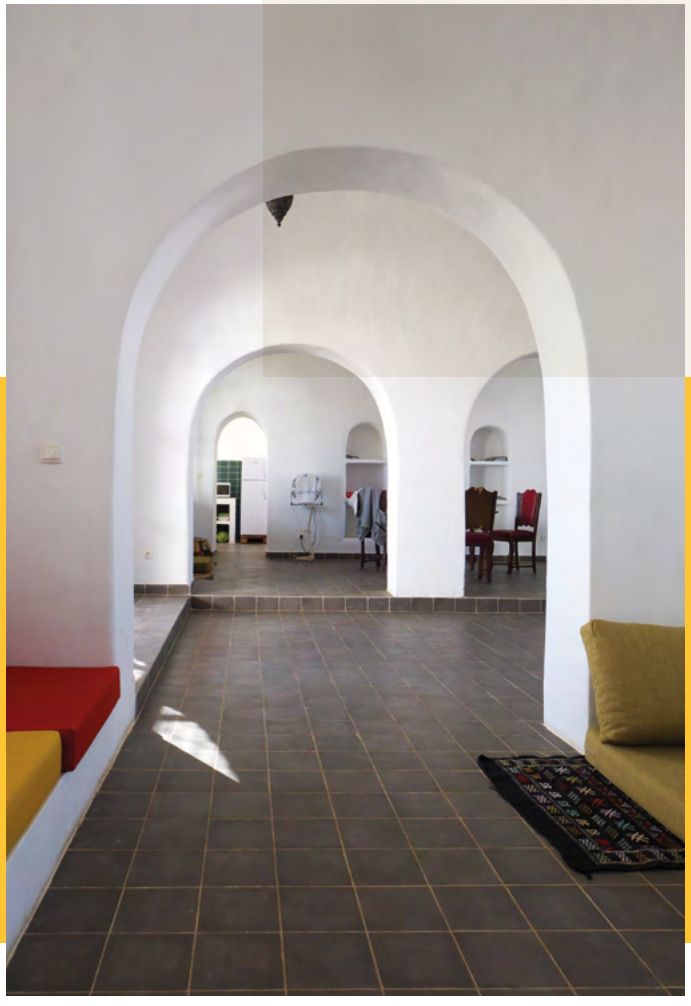
Open space between the vaults thanks to solid concrete block arches for a classroom with a length of 9m50 and a width of 6m50.

Examples of construction with a second storey.

Roof terrace: the Nubian Vault structure is strong enough for flat roofs to support heavy loads. The acceptable load data is considered to be substantially equal to that of a conventional post-beam and concrete slab building (approximately 150-250 kg/m²).

Openings: the load-bearing adobe walls used to support the vaults allow limited openings, i.e. +/- 30% empty for 70% full. If necessary, these ratios can be increased to allow more openings by using materials with a higher compressive strength than adobe (cement blocks, cut stone, etc.) and by checking the structural assumptions. Gable walls and interior partitions can support large arched openings without any particular constraints.

Example of roof terrace.



Interior view of a Nubian Vault building with large "reinforced" openings in the load-bearing structures.

Resistance of a Nubian Vault construction

Flooding and erosion of exterior surfaces

AVN's technical proposals, if properly implemented, make it possible to build in regions subject to rainfall of up to 1100 mm/year. Two important considerations should be taken into account:

Regarding rainwater management

The waterproofing of the roof is done by water saturation of a layer of tamped clay soil and is guaranteed by a plastic sheet as an underlay. A slight slope on the roof terrace drains rainwater towards gutters. For urban, administrative or community buildings, the use of anti-erosion bitumen stabilised renders for the roof, cement or bitumen stabilised renders for the external walls, and reinforced parapets and wall bases is strongly recommended. AVN's technical proposals permit the implementation of such exterior surface protection at a reasonable additional cost.

Regarding flooding and standing water

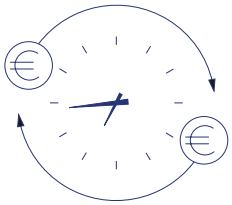
Nubian Vault architecture, like most other architectural proposals, is not suitable for flood zones or low-lying sites. It is therefore not possible to build in these areas. The Nubian Vault earth building technique is particularly susceptible to damage from stagnant rainwater around the side walls, water which is absorbed by the earth bricks through capillary uptake, weakening the foundations and walls and the overall stability of the building. Several incidents of structural damage have been recorded linked to significant stagnation of rainwater less than 2 metres from the buildings, caused by poor siting of the building and/or water drainage issues. AVN's training programmes and awareness raising among its various clienteles and project managers, combined with AVN's experience and quality control of construction sites by specialist masons, makes it possible to anticipate these risks.

Maintenance, upkeep and durability

The technical standards proposed by AVN include resistance to erosion and external events over periods of between 15 and 30 years, after which periodic maintenance work is necessary on the exterior renders and protective elements. Given the emerging nature of the Nubian Vault sector, quality control based on the professional ethics of Nubian Vault project managers, craftmens and contractors who apply the Nubian Vault code of practice produced and made available by AVN (cf. *the Nubian Vault Mason's Manual*, in the process of being approved in Senegal), is the main guarantee of the proper execution of the work and the durability of buildings. Defects found over the life of a Nubian Vault building are no greater than those found over the life of other types of construction. AVN has control, monitoring and intervention capacities should there be problems in the regions where the sector is developed.

The Nubian Mason's Manual

Estimated production costs and times



The following figures are based on AVN's experience and data collection over the last 20 years.

Construction costs (structural work, finishes, project assistance and monitoring):

In the formal market, Nubian Vault construction costs are approximately **20 to 40% cheaper than a "classic" construction for the structural work**. This is mainly due to the use of local materials and the increasing cost of imported materials. This frugal technique does not require the use of any motorised construction machinery.

When it comes to finishing work (joinery, tiling, electricity, plumbing, painting, etc.), there is no difference in cost or use.

In summary, almost all of the cost of the major structure of a Nubian Vault building is for local labour and material.

Maintenance costs:

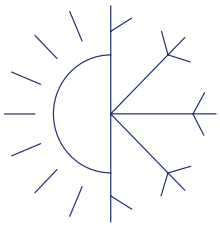
Feedback shows that if the work is carried out according to good Nubian Vault construction practice, there are no more maintenance costs than for any other type of building.

The **energy savings** due to the absence or limitation of air conditioning or ventilation imply a significant **and measurable reduction in the operational costs** of Nubian Vault buildings. The Nubian Vault building offers good thermal performance, thanks to the inertia of the thick mud walls and their excellent hygrothermal regulation of the interior spaces.

Construction times:

The construction time for a building (main structure + finishes) is estimated at between **40 and 45 days for a 50m² living space**, assuming a team of 6 - 7 Nubian Vault masons and apprentices.

Thermal, hygrometric and environmental performance



Thermal comfort: The passive thermal performance of Nubian Vault buildings means that the average annual daytime temperatures indoors are reduced by 6 to 7°C, and interior temperatures are relatively stabilised, providing proven thermal comfort. This strong inertia allows the building to remain cooler during the day and release warmth at night.

The hygrometric conditions are more efficient than in a classic concrete construction - a Nubian Vault building feels less dry indoors. As well as being more comfortable and healthier, Nubian Vault buildings also provide:

- A reduction, or even absence, of air conditioning/ventilation needs and the associated energy costs;
- Better conditions for the conservation and processing of agricultural and livestock products (supervised comparative studies should be carried out);
- Increased lifetime for electric batteries in solar installations.

Raw earth construction considerably reduces the use of imported materials with a high carbon footprint (iron/zinc roofing sheets, cement, rafters) and materials with a high environmental footprint (gravel, sand) and presents a very satisfactory embodied energy balance. So the carbon **and environmental footprint of Nubian Vault eco-construction projects are particularly interesting**. According to a calculation based on a protocol drawn up by *Myclimate*, a 25 m^2 Nubian Vault house[2] and its use for 30 years entails the avoidance of 20 tons eq. CO_2, at the same time generating many co-benefits for local communities in terms of adaptation and development.

Possibilities of complementary techniques

Nubian Vault buildings are not only secure, comfortable, and durable, but can also be aesthetically pleasing. A Nubian Vault construction can accommodate the same finishing techniques as a concrete construction. This includes:

Connection to an individual or collective water and sanitation network, and installation of standard sanitary equipment.

Connection to an individual or collective electricity network and connections of electrical equipment.

Solar thermal and/or photovoltaic installations.

Secure doors and windows, internal staircase, etc.

Internal and external architecture according to the taste of the client (tiles, flooring, interior coatings, paint, etc.).

Part

02

Areas of intervention and production capacity

The deployment of Nubian Vault construction sites depends on two main criteria:

Geography

Nubian Vault construction can only be carried out in climatic zones with low or medium rainfall, so that the stages of production of materials (raw earth bricks) and construction of the building are not hampered by episodes of excessive rain.

In addition, Nubian Vault construction requires ready local access to water resources close to the sites.

Availability of an appropriate trade sector and a qualified labour force

The Nubian Vault technique requires specific know-how. The conventional construction sector, with a business model largely based on the resale of imported materials and part of a dominant «all concrete» culture, is difficult to mobilise for Nubian Vault eco-construction.

A fundamental issue in the development of a Nubian Vault sector is the training of project management operators and a workforce willing to work with earth as the principal raw material. In addition, the Nubian Vault technique is mainly deployed today in the informal sector, yet the involvement of public actors is essential to bring the Nubian Vault technique to scale by disseminating it to community and/or urban projects in a formal and official approach.

AVN has started this work of structuring and expanding the sector in certain regions of West Africa. This approach is discussed in Part 3 of this Guide.

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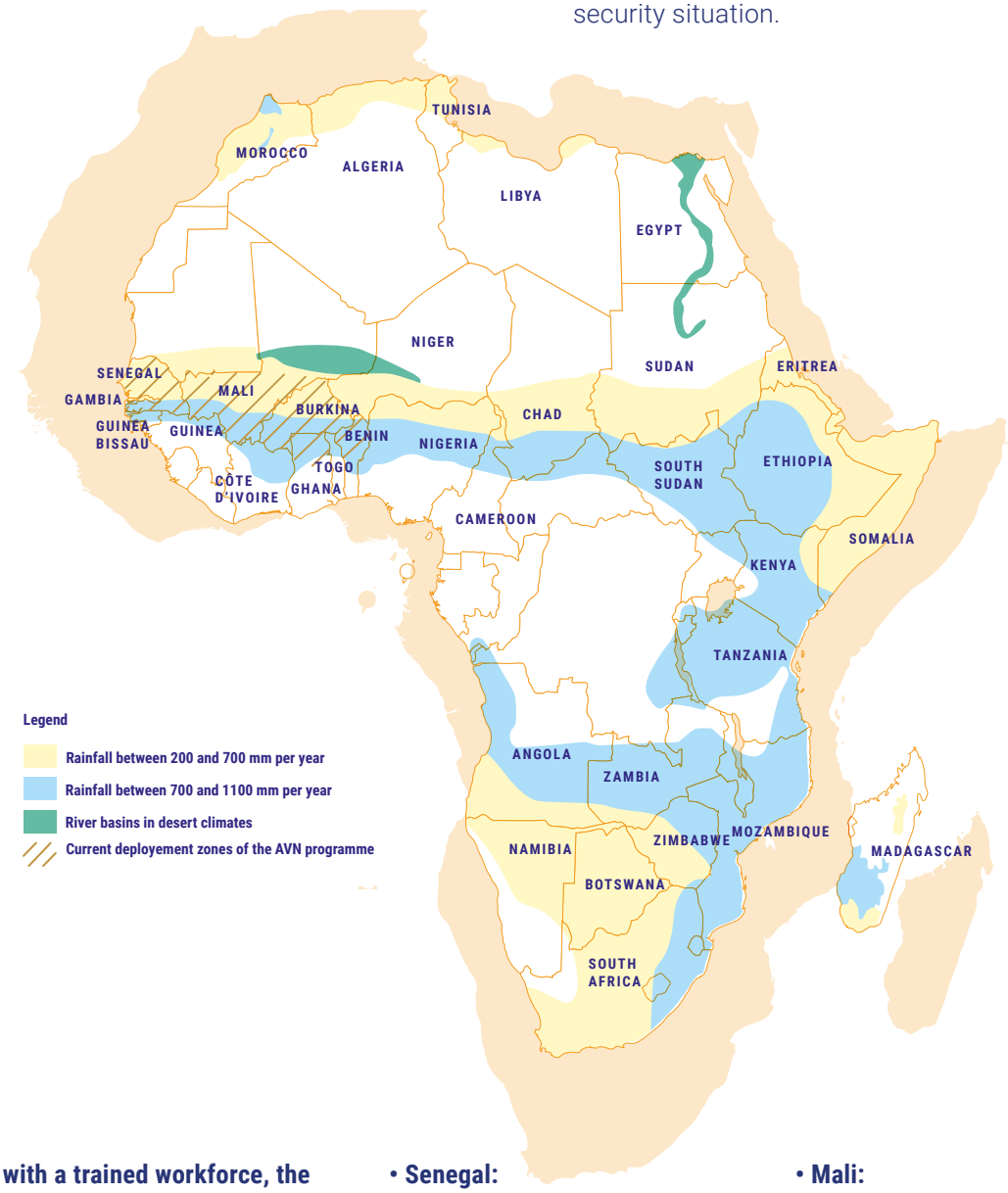
Map

The yellow, blue and green areas on the map below represent different areas of rainfall and water availability, and are conducive to the deployment of a large-scale Nubian Vault sector. The hatched area indicates the regions where a Nubian Vault sector has already been developed by AVN.

The feasibility of constructing a Nubian Vault building in a specific locality of a suitable area can then be studied on a case-by-case basis according to finer criteria, such as the availability of Nubian Vault artisans and other players in the sector, the distance to a water supply, the quality of the local earth, the flood risk of the site, or the security situation.



In areas with a trained workforce, the numbers of Nubian Vault artisans who can be mobilised on site, with their teams, are as follows (*figures given as of January 2023*):

- **Burkina Faso:**
  130 Nubian Vault artisan masons for 600 sites per year (10,000 m²/year)
- **Senegal:**
  about 10 Nubian Vault artisan masons for about 30 sites per year (800 m²/year)
- **Mali:**
  120 Nubian Vault artisan masons for 600 sites per year (10,000 m2/year)
- **Ghana:**
  about 10 Nubian Vault craftsmen for about twenty sites per year (800 m²/year)
- **Benin:**
  about 20 Nubian Vault craftsmen for about a hundred sites per year (3000 m²/year)

Part

03

Development and structuring of a Nubian Vault sector

AVN's approach for the deployment of the Nubian Vault sector in new regions

It is possible to mobilise stakeholders for the construction of a Nubian Vault building in regions where the Nubian Vault sector is already structured. In this case, project management standard terms of reference can be provided and AVN can be consulted for project management assistance. In regions where there is no Nubian Vault sector, it is possible to launch "pilot" projects. However, in line with the AVN strategy and to meet the socio-economic challenges that characterise the eligible regions, it makes more sense to aim for the emergence and structuring of the Nubian Vault sector, as detailed below.

In addition to the climate benefits (mitigation and adaptation), the creation of a Nubian Vault sector allows many social and economic co-benefits in addition to the environmental benefits described above:

- **A response to decent and affordable housing needs** for the greatest number, both in rural and urban areas;
- **Improving access to basic services** by promoting the comfort and durability of community buildings (health, education, agriculture, administration, etc.);
- **Local employment and off-season employment** in rural areas with a labour-intensive worksite approach (HLI);
- **Vocational training for young rural people**, vulnerable people and professionals in the construction sector, with the acquisition of know-how that does not require advanced academic skills and in accordance with current climate challenges;
- **Reinjecting construction costs into local economies** by the sharp reduction in the need for imported materials.

Since its creation, AVN has promoted the market as the main vector for the large-scale dissemination of Nubian Vault low-carbon eco-construction in a bottom-up approach.

This market dynamic is based on three main axes that run in parallel:

- **Constitution of a sector** able to respond to the formal and informal needs of both rural and urban clienteles, including specialist human resources, training courses and tools enabling the strengthening and growth of this sector;
- **Emergence and growth of a demand** extended to the different types of clienteles and contracting authorities;
- **Mobilisation of a multi-stakeholder business environment** at the regional, national and international levels promoting the growth, autonomy and sustainability of the Nubian Vault market.

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It is estimated that the cost of creating a Nubian Vault market in a country where the AVN programme has not yet been deployed, including the corresponding training and structural inputs, is just over 1 million euros, over a three year period.

AVN's methodology to empower the sector is structured as follows:

1. Preliminary studies (geology, climate, socio-economic and cultural contexts, material resources, potential stakeholders, etc.)
2. Construction of demonstration and pilot buildings
3. Consultations of potential stakeholders
4. Structuring of a national or regional AVN office
5. Deployment of the Nubian Vault market dissemination methodology at municipal and regional levels
6. Mechanisms for raising awareness, mobilising and training stakeholders (ministries, training institutes, business federations, NGOs, etc.)
7. Implementation of the support system for the Nubian Vault market at the national level
8. Implementation of data collection, evaluation, monitoring and quality control systems and procedures

Structure of the sector and actors

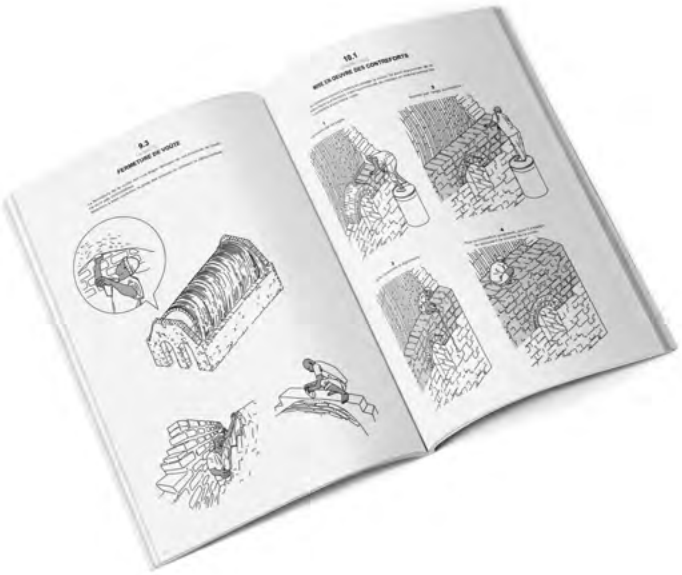
In order to ensure the development and completeness of a Nubian Vault sector, AVN supports a number of experienced Nubian Vault artisans in gaining formal recognition, while mobilising and training players in the conventional construction sector in Nubian Vault techniques (technicians, engineers, design offices, companies, architects).

The players in the sector are listed below, with the corresponding challenges:

- **Nubian Vault artisan mason** from the informal sector: organisational and entrepreneurial strengthening and continuing technical training.
- **Construction company**: Recruitment of Nubian Vault artisans, training of site managers in Nubian Vault techniques, training and awareness-raising of sales teams.
- **Technician**: Training in Nubian Vault techniques, training in site organisation.
- **Engineers**: Systematic integration of a Nubian Vault offer as a design option.
- **Architect**: Systematic integration of a Nubian Vault offer as a design option.
- **Technical management of institutional actors** from the municipal to the ministerial level: integration of these construction methods in the terms of reference for public procurement, standardisation, recognition of experience in the sector, institutionalisation of training courses and trainers.

Training materials

Underpinning this dynamic of strengthening the players, AVN produces and makes available «inclusive» and «open source» technical and educational reference documentation, with, at its centre, *the Nubian Vault Mason's Manual*, which covers the rules and basic technical recommendations for the construction of Nubian Vault. In addition, the Nubian Vault Learner's Booklet is used to monitor and guide the vocational training of future Nubian Vault craftsmen. Built around these fundamentals is a constantly evolving collection of useful technical documents: standard plans, complete technical files for typical sectoral buildings, various studies, etc.



The Nubian Vault Mason's Manual

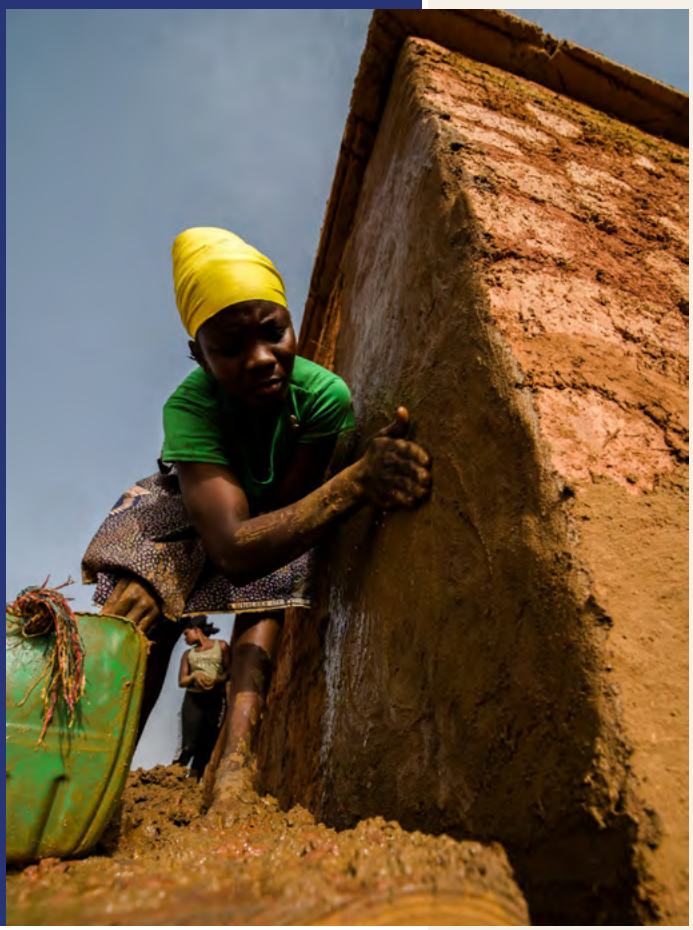
ADDITIONAL RESOURCES AND STUDIES

AVN has made available a set of programme evaluations and environmental, technical and quality, and socio-economic studies which can be viewed ***following this link***.

In addition, testimonials from beneficiaries, in video or written format, can be consulted ***following this link***.

Evaluations and studies

Testimonies



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The Nubian Vault Association (AVN) is a French NGO dedicated to providing access to climate-adapted affordable housing in West Africa. For nearly 25 years, we have pioneered the development of an earthen eco-construction sector across Burkina Faso, Mali, Benin, Ghana, and Senegal. We are dedicated to disseminating the 3,000-year-old Nubian Vault earth eco-construction technique, which offers thermal comfort and durability. To this end, we provide vocational training to local masons, financial support mechanisms to rural families seeking to build their Nubian Vault houses, and project management assistance to community-building project owners. This initiative concurrently improves living conditions, provides green employment opportunities for rural youth, and fosters local economic development, contributing both to climate adaptation and mitigation.

AVN operates through national coordinations or partnerships across six countries: Burkina Faso, Mali, Benin, Ghana, Senegal, and Mauritania. To date, our program has facilitated over 7,000 projects in 1,750 towns and villages, benefiting approximately 70,000 individuals. Since 2020, an average of 1,000 Nubian Vault buildings are completed annually, offering training and employment opportunities to over 1,000 masons and apprentices.

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Towards a world in common

AFD Group contributes to the implementation of France's policies for sustainable development and international solidarity. The Group includes Agence Française de Développement (AFD), which finances the public sector, NGOs, research and training; its subsidiary Proparco, which is dedicated to the private sector; and Expertise France, a technical cooperation agency. The Group finances, supports and accelerates the transitions needed for a fairer, more resilient world.

With our partners, we are building shared solutions with and for the people in more than 150 countries, as well as in 11 French Overseas Departments and Territories. As part of the commitment of France and the French people to achieving the Sustainable Development Goals, our teams are at work on 4,200 projects in the field. Our objective is to reconcile economic development with the preservation of common goods, from peace, the climate and biodiversity to health, education and gender equality. Towards a world in common.

AFD GROUPE

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