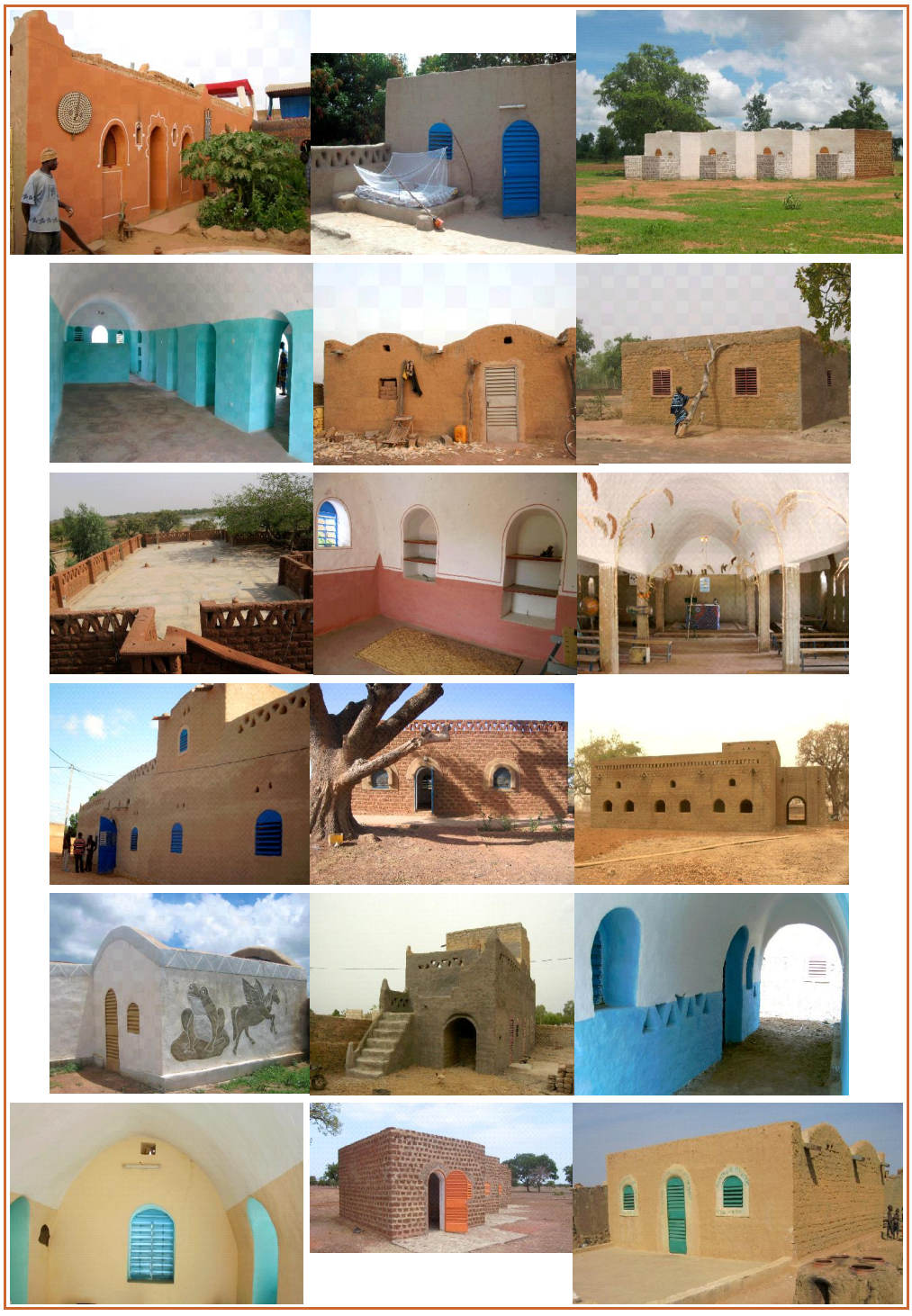
The Association « La Voûte Nubienne » (AVN)

The AVN – Zambia Programme



Examples of buildings constructed using the Nubian Vault technique

1. The Context

Since 2000, the *Association la Voute Nubienne* (AVN) has been providing an affordable, ecologically sustainable system for building roofs. Through the *Earth roofs for the Sahel* programme, farmers and masons are trained to construct houses with vaulted earthen roofs, using locally available materials. This programme helps to create a growing construction market for sustainable, affordable, carbon-neutral buildings. The carbon dioxide savings associated with the VN technique, as compared with the alternatives, are significant. In 2009 AVN's success was recognised by funding from the World Bank, in its Development Marketplace Competition on *Adaptation to Climate Change*.

At the end of 2009, a new AVN programme was launched in a region of Zambia with similar environmental conditions to those in the Sahel.

In sub-Saharan Africa, bush timber has traditionally been used for roofing and for load-bearing supports. However, climate change, deforestation, and increasing population growth, mean that these traditional building techniques are no longer feasible. Even in regions where some tree cover remains, the use of bush timber for construction is either illegal, or requires purchase of expensive permits.

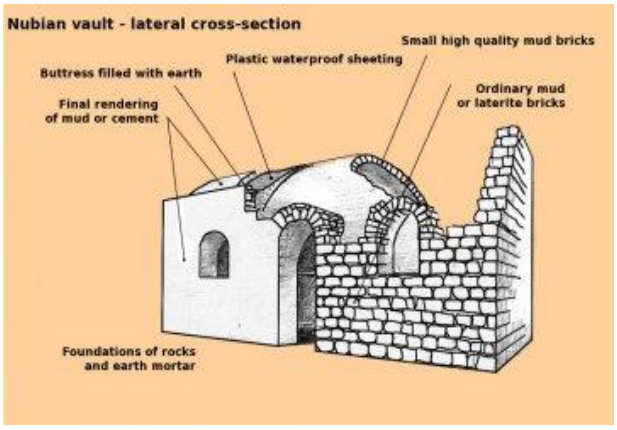
So rural families resort to buying corrugated iron sheets and sawn timber for roof-building. Such roofs have many disadvantages, especially the poor thermal and sound insulation, making houses too hot in the day, often too cold at night, and extremely noisy during the short but intensive rainy season. They are relatively fragile, can easily be damaged by wind and rain, and may even be at risk of theft. The average life of a sheet metal roof is only around ten years, as a result of rusting and corrosion, and their very fragility is a source of danger. Moreover, they are often beyond the means of many people. They have to be paid for in cash, which is often a problem for the many families who live outside the cash economy. Finding the necessary funds can become a major drain on family resources, forcing them into a vicious circle of poverty.

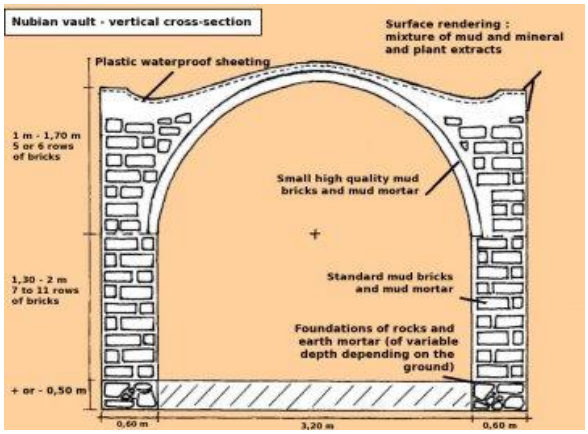
2.The Nubian Vault (NV) technique

The NV technique is derived from an age-old method of timberless vault construction, originating in upper Egypt. It uses only earth bricks and mortar. Vaults of unfired earth bricks at the Ramesseum, the funerary temple of Rameses II in Luxor, are still standing after 3,250 years. The NV technique is virtually unknown elsewhere in Africa. AVN has successfully introduced a simplified, standardised version of this ancient technique in Burkina Faso, Mali, and Senegal - a good example of 'South to South' technology transfer.

Nubian vaults in Luxor (1,250 BC)

AVN masons in Burkina Faso (2008)





The Nubian Vault construction method is:

- e*cologically sustainable* because it uses neither corrugated iron roofing sheets, which are expensive and difficult to recycle, nor timber beams, rafters, or supports;
- is *carbon neutral*, because none of the building materials need to be manufactured or transported long distances, nor do any trees need to be cut down;
- e*conomically viable,* because only locally available raw materials (earth and water) are used, thus favouring local economic circuits and self-sufficiency;
- c*omfortable,* because of the excellent thermal and acoustic insulation properties of earth construction;
- *durable*, because such buildings have a far longer lifetime than those with corrugated iron and timber roofs, and maintenance is simple;
- *modular,* because it can be used for a wide range of buildings (houses, schools, health centres...), of different styles (flat terrace roofs, two-storey buildings, courtyard buildings...), which are easily extendable;
- *vernacular,* because incorporating tradtional practices and aesthetics of earth architecture.

3. The Association La Voute Nubienne (AVN)

AVN, founded as a not-for-profit association in 2000, is formally registered as an NGO in France, Burkina Faso, and Belgium, with six local staff based in Boromo, Burkina Faso, and Bamako, Mali. The budget for 2010 is approaching 300,000 euros.

AVN does not, *per se*, finance the construction of VN buildings and houses. Its mission is two-fold:

- to *recruit and train* local masons in the Nubian vault technique, and to *support* them in their development as independent entrepreneurs,
- to *generate* and *promote* a self-sustaining and growing Nubian vault construction market on a local and human scale.

Financial support and sponsorship of AVN's developing programme has come from individual supporters / investors, and various organisations and foundations, including the French Ministry of Foreign Affairs, the World Bank, and the French *Veolia*, *PPR*, *Hermes*, and *Ensemble* Foundations.

Between 2000 and 2009, through the *Earth Roofs for the Sahel* programme in Burkina Faso, Mali, and Senegal, AVN has:

- facilitated the construction of 750 vaults[1], equivalent to around 15,000 M2 of floor space
- trained 140 masons, with 230 apprentices undergoing training in the 2009/10 season
- reached 7,800 beneficiaries, directly and indirectly
- generated over 300,000 euros worth of local salaries
- made estimated carbon savings of over 1,500 tonnes, compared to alternative, traditional and modern, construction materials and methods.

AVN has a proven track record of successful project management and partnerships for construction of public-use buildings (schools, dispensaries, community centres, mosques, churches, literacy centres...) and micro-credit schemes, in Burkina Faso and neighbouring countries, working in co-operation with a wide range of NGO's and other organisations, including, for example:

- in Burkina Faso: *Sini Landa* from PIAMET*, Arquitectos Sin Fronteras, Entrepreneurs du Monde*
- in Mali*: Africabougou, Intervida, AIADD-EDF*, *Arquitectos Sin Fronteras, Terre&Humanisme*
- in Senegal: *Mozdahir International Institute*, *La Communauté des Communes du Val de Drome*
- and now, in Zambia: *Abantu-Zambia* and *Tuchafwane Community.*

In addition, AVN has been successful in obtaining major international accolades, including::

- winner of the *Ashoka Changemakers* Competition on *How to provide affordable housing*, 2006
- *Tech Awards* Laureate (Economic Development), 2007 (as a result of which AVN figures on the *Global Giving*-USA and *Global Giving-UK* websites)
- nomination for the *Aga Khan Architectural Award*, 2007
- winner of the *Ashoka France -IMPACT* Competition for social entrepreneurship, 2008
- one of 11 "*...outstanding finalists*" for the *World Habitat Award*, 2009
- one of the 25 laureates (out of over 1500 initial submissions) in the *World Bank Development Marketplace Competition on Adaptation to Climate Change*, 2009.

By the end of the 2009/10 construction season (Sept – May in the Sahel region), the number of AVN masons will be approaching 200, and another 250 or so vaults will have been built, bringing the total to around 1,000. A major innovation this season is the introduction of four-year Pilot Zone Deployment Programmes (PZDP), to help generate a sustainable local construction market in two selected regions of Burkina Faso and Mali.

The kernel of each PZDP is a local 'champion' and a core group of potential apprentices and clients in an area including several villages. AVN makes available teams of experienced NV builders to train local villagers in the technique and to supervise the construction sites.

These programmes are being supported by a $100,000 grant from the World Bank Development Marketplace Competition on Adaptation to Climate Change, with matching funds raised by AVN, notably from the French *Ensemble* Foundation.

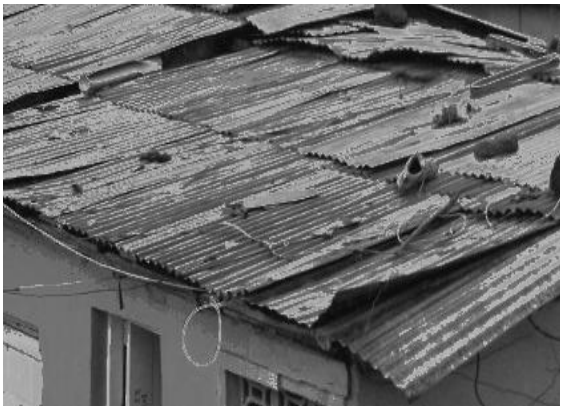
1 AVN uses as a basic unit of measurement for record-keeping purposes a vault of 20 M2 of habitable floor space (approx. 3,25 M width X 6M length); an average size VN village house would consist of the equivalent of 2 vaults of this size (c. 40 M2).

4. The AVN-Zambia Programme

4.1 Background and context

Following discussions with the NGO, Abantu-Zambia (www.abantuzambia.org) and with the Zambian Ambassador in Brussels, Thomas Granier (Director of Operations, AVN) and Jean Stasse (President of AVN-Belgium) visited Zambia in September 2009 to assess the possibilities of starting a Nubian Vault programme in that country.

The traditional village houses there are made out of mud, with a grass roof over a wood frame; These houses are disappearing slowly due to increasing shortages of wood and grass. Moreover, they have a limited life (the wood is often eaten by termites, the grass needs to be replaced every 2 to 3 years), and burn easily (frequent bush fires). Although they may seem picturesque, they are not very hygienic, and require constant and time-consuming maintenance – generally carried out by the women in the family.



Hitherto, the only alternative had been for the people to build houses made out of bricks with a corrugated iron roof supported on timber beams. The cost of these materials is beyond the means of many rural families. The lifespan of the roofs – although longer than for a grass roof - is limited; they give little protection from seasonal and diurnal variations in temperature (5C min > 35C max), and are, of course, uncomfortably noisy during the heavy winter rains.

4.2 Conclusions from the exploratory mission

As a result of this first visit, an initial three-year programme was drawn up, in partnership with Abantu-Zambia, based on the model of the Pilot Zone Deployment Programme (PZDP) currently being implemented in Burkina Faso and Mali.

The programme is targeted on the Chibombo district, 60 kilometres north of Lusaka, where Abantu Zambia is working in 16 villages. Since 2003, it has been active in education, health, agriculture, and micro-credit. The local arm of Abantu is the Tuchafwane Cooperative Society, and with their help, 6 villages were visited (Kalola, Kayoba, Muntemba, Mutakwa, Katole, and Lukata); in each village, a crowd of about 20 to 50 people attended the AVN presentations. Each meeting was very well conducted by a chairman: an agenda was always in place – the level of organisation most impressive. Representatives from three other villages in the district also attended the meetings, and want to be involved.

Initial planning had already been started by the end of the mission:

- a central coordinator was named at the level of Tuchafwane.
- a local coordinator had already been elected in each village,
- lists of potential clients were established (15 - 20 per village),
- lists were drawn up of potential masons and apprentices,
- 65 potential clients for VN houses were identified,
- 18 VN masons were identified, from nine villages.

Finally, it was agreed that two Zambians, from two different villages, will go to Burkina Faso for a six-month training period, starting in November. The rainy season in Zambia being exactly opposite to Burkina, this is ideal. They would return to Zambia in May 2010 with two experienced Burkinabé VN masons (C5), and start building houses.

The initial plan is to aim to build 10-20 houses during the 2010 building season, and the programme will continue over the following three to four years, until such time as the Zambian VN masons, and the project coordinators and managers, are able to operate autonomously.

During this five-year programme, AVN's role will be two-fold:

- to organise and manage the training of selected Zambian masons, initially through apprenticeships in Burkina Faso, coupled with 4 month attachments of experienced Burkinabé masons to the programme in Zambia during the Sahelian rainy season (May – Sept), and to ensure quality control of their work
- to promote self-sufficiency, by preparing for local staff from Abantu-Zambia and Tuchafwane Community the resource materials, planning tools, and training programmes in project management, supervision, costing, and quality control they need, thus enabling them to become autonomous and to gradually take over the future management and development of the programme, allowing AVN to withdraw and target its resources elsewhere.

Houses will be the prime focus. Later, schools and community buildings can be included. In many cases, schools are extremely basic: almost no roof, bricks to sit on; with children often walking ten kilometres and or more just to get to school, and the same to get home.

4.3 The current situation

Seven months on from the date of the exploratory mission, the situation looks very promising. In December 2009 the first two Zambian villagers completed their apprenticeships in Boromo, Burkina Faso; training manuals have been translated into English for them, and their progress has been remarkable. They are apparently learning the vault construction technique faster than many local Burkinabé apprentices. They returned to Zambia in May 2010 with an experienced VN master mason, to start construction of the first Nubian vault houses in the Chibombo district. At least six Zambian apprentices will be working with them throughout the summer. Based on past experience, once people in the villages see the first Nubian vault houses completed, there will be a significant increase in the numbers of potential clients, above the 65 who had already committed themselves purely on the basis of presentations made to them in September 2009.

Fund-raising in Belgium to support the programme has got off to a good start, with over 5,000 euros already raised. The programme is receiving strong political and practical support from the Zambian Ambassador in Brussels - an important factor in helping overcome the administrative and bureaucratic difficulties encountered in making travel and visa arrangements for two Zambian villagers to travel from Zambia to Burkina Faso.

4.4 Forecast budget and impacts

The table below indicates the results and impacts that can be forecast for the projected level of funding of the PZDP programme between 2010-2015. Minimum and maximum ranges are given for impacts – a cautious assumption would be take the mid-point figure for each cell in the table. However, given the excellent start that has already been made, and the efficiency of the Abantu and Tuchafwane networks on the ground, it would be reasonable to assume that the higher figures are achievable.

Year	*Budget (€)*	*Masons trained*	*Apprentices in training*	*Vaults built**	*Direct beneficiaries***	*Local salaries generated (€)****
2010	20000	3 > 4	4 > 6	10 > 20	56 > 102	5,000 > 10,000
2011	20000	5>7	10 > 14	20 > 35	110 > 182	10,000 > 17,500
2012	24000	7 > 10	14 > 20	30 > 50	162 > 260	15,000 > 25,000
2013	28000	10 > 14	20 > 28	40 > 70	220 > 364	20,000 > 35,000
2014	33000	13 > 18	26 > 36	50 > 90	277 > 468	25,000 > 45,000
Totals	**125000**	**38 > 53**	**74 > 104**	**150 > 265**	**825 > 1376**	**75,000 > 132,500**

* *1 standard vault 'unit' = 20 M2 of living space*

** *Direct beneficiaries: 1 mason = 4; 1 apprentice = 1; 1 VN = 4*

*** *Based on 25€ / M2, assuming I vault = 20M2*

The current estimate of funding that can be raised through AVN-Belgium is approximately 50% of the above budget level for the first three years. If matching funding could be raised, then it is reasonable to assume that the above targets could be reached over the full five year period of the PZDP.

4.5 Why should you help this project?

Steps taken to improve housing conditions, and, at the same time, create employment, will have an impact on the priority areas of health care and education in the region. .

AVN's experience in the Sahel strongly suggests that families living in Nubian vault homes find them to be healthier, more comfortable, and safer than the alternatives. Elimination of the need to spend scarce cash resources on the periodic purchase of imported metal roofing sheets and sawn timber helps family budgets.

In Zambia, replacement of grass / thatch roofs with solid earth vaults will provide a healthier family home, eliminate the fire risk, and release women from the drudgery of maintenance and replacement of roofing materials. On the economic front, the gradual development of a self-sustaining market in Nubian vault homes in the regions where AVN is active in the Sahel has provided incomes so far to around 200 masons and their families. There is no reason to doubt that similar, if not more significant (given the higher Zambian literacy and educational levels) results will be obtained through the programme in Zambia.

In partnership with other NGO's and local organisations in Burkina Faso and Mali, AVN masons have built a small number of health centres, schools, and adult literacy centres (as well as a church, mosques, and community centres)[2]. Once there is a sufficient core of skilled and experienced VN masons working in Zambia, the construction of such larger, community-use, buildings would be a logical next step..

The World Bank has already recognised AVN's contribution to issues around adaptation to climate change with the subvention of $100,000 from the WB Development Marketplace for to the AVN programmes in Burkina Faso and Mali. Projects in this area have been cited as a priority for development assistance. Clearly, earth brick vaulted buildings (whether houses, schools, or clinics..) will cope better than metal-roofed structures with the predicted changes in climate towards hotter summers and wetter winters because the thick vaulted roofs lead to cooler buildings in the summer, and dryer and warmer ones in the winter..

Investment in this pilot programme in Zambia would result in the development of training manuals, resource materials, and project management tools, in English, which could then be applied in Nubian vault construction and employment creation programmes not only in other regions of Zambia, but also in anglophone African countries with similar climatic and environmental conditions (e.g northern Nigeria, northern Ghana).

The two first Zambian AVN apprentices in the programme, Jaspan Moobela and Christopher Phiri (foreground), working on construction of a school library in Boromo, Burkina Faso (Jan, 2010)

2 See AVN website for details e.g. www.lavoutenubienne.org/Partnership-projects