



engineers without borders uk

RIBA/ICE McAslan Bursary Award Report

NAKRUDA Project 2008-2009 Dadiya, Gombe State, Nigeria

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Introduction

This report summarises the activities and projects carried out by three EWB-UK volunteers during their 6-10 month placements hosted by the local CBO Nakwai Rural Development Association (NAKRUDA). The volunteers have worked extremely hard on this placement. Funding limitations have demanded inspiration and innovation to create more benefits for the host community with fewer resources. The volunteers have not let EWB-UK down, and have managed to research, design, procure and deliver numerous projects ranging from stream crossings to wind turbines. It also must be emphasised how challenging day-to-day activities are in this environment, which makes their achievements even more impressive.

Background

In 2004, NAKRUDA (Nakwai Rural Development Agency) was formed as a CBO and subsequently registered to further the sustainable development of the Dadiya people. It operates solely in the Dadiya region of Nigeria.

The Dadiya people are a small ethnic grouping occupying a large rural area of savannah and hills, with streams, springs and a major seasonal river. There are over 55 settlements spread throughout its lands and its main settlement is Lokulakali where the volunteers stay.

NAKRUDA and EWB-UK have been working together since 2005. There have been three 9-month placements of two volunteers along with the present 3 volunteers. All of the volunteers have had good experiences with NAKRUDA, and the organisation itself has expressed a keen interest in maintaining links with EWB as well as hosting volunteers.

The volunteers main role, prior to this placement, was involved in the improvement and development the earthen road network which links the small villages of the region.

The volunteers were due to continue this work, with a particular focus on constructing permanent water crossings. However, early on in the placement it became clear that funds that were believed to be in place to carry out this work would not be released in time for the volunteers to work on the crossings. Thus, the volunteers developed a number of other projects to enable to deliver maximum input with the reduced funds available to the CBO.



Projects

Adobe Building

One of the first projects for the team was the construction of an additional adobe building within the Nakruda guest compound to provide additional accommodation and space for the organisation. This was primarily led by Ash and Phil whilst Jon worked on other projects. Upon departing Dadiya, the foundations had been laid, all walls erected, lintels put in place, and veranda constructed.

Following the fundamental rule for earthen buildings of providing “good hat and boots”, the shallow ring beam rock foundation uses the only cement in the structure to prevent damage in the rainy season. The walls are of two layer thick adobe blocks creating an overall wall thickness of approximately 300mm. The wall thickness was primarily dictated by structural requirements though its significant thermal mass will also provide a more comfortable space. The intended column based veranda design was unworkable for various reasons. Several alternative options were considered and a novel Arabic inspired approach was chosen to fulfill the brief of providing an external shaded space. The two-layer adobe block construction was continued around the veranda, with various shaped rectangular openings in the construction.

The roof is intended to be thatched, acting as a breathable membrane whilst also protecting the adobe walls from rain. The primary roof structure was to be four pairs of tied timber rafters, with bamboo purlins spanning between these. However, the timber available was very poor quality and relatively expensive. It was decided that traditional Dadiyan roof construction would be replicated using bamboo rafters and purlins. This has several advantages of being more sustainable and cost effective compared to a timber primary roof structure. A team collected bamboo from the sacred bamboo forest in the Dadiyan Hills to use for the roof construction. It was fired for treating purposes and ready for use by the end of January.



Work on the building was put on hold until the other EWB-UK volunteer returned back to the village to help with the remaining construction. Unfortunately other project work meant that the building had not been completed when the volunteers returned to the UK. However, as the remaining work is relatively simple it is hoped that Nakruda can mobilise the necessary resources to complete the building. The structure will provide extra living and working space for NAKRUDA and has demonstrated how Dadiya’s local resources can be used to create an aesthetic and sound structure with integrated environmental features. Throughout construction, the building has been highly admired by the community – notably the innovative veranda.

Sand Bag Ring Culvert

Due to a lack of funding from the Community Based Poverty Reduction program for the construction of the planned concrete culverts required in Dadiya, the volunteers proposed an alternative solution of constructing dry- stone culverts for the smaller crossings. However, after an extensive surveying programme it was concluded that the geometry of the culvert sites was not appropriate for dry-stone construction. There were also concerns over the long term safety of such a crossing. Dry-stone construction would have offered the benefit of being low cost, with materials sourced from the surrounding landscape. It would have also offered locals a way of utilising their historic dry-stone craft.

During the dry-stone culvert investigations it was discovered that some of the internal road network had been scheduled to be constructed by the Government, though this wasn't certain. It was therefore decided that an attempt should be made to construct a culvert that was low cost and, to a certain extent, temporary in response to the Government's construction plan.

After an extensive 'optioneering process' an alternative idea for a sustainable and low cost construction of a sandbag ring culvert at the Lotokalan culvert site was developed. Starting in mid-February, over a 4 week period, a team successfully constructed the culvert for a construction cost of £200. The community learnt a lot from this innovative engineering solution and the volunteers discovered the challenges of labour and project management.



The construction process started with the excavation of loose ground material at the base and sides of the culvert, to a depth where firm ground was identified. This solid base was levelled and tamped before a layer of sewn up cement bags filled with sand were laid as a base. Six recycled concrete rings, sourced from a former EWB-UK/NAKRUDA project, were then lain onto the base layer of filled cement bags. Additional sand filled bags were packed around the rings to a height 0.75m above the rings to ensure vehicle loads were able to spread over the rings adequately. Additional filled cement bags were also used to construct the culvert approaches. In total approximately 800 cement bags were used.

A stone wall was then built up against the exposed surfaces of the cement bags to protect the polymeric bags from UV degradation. The stone wall was extended to cover the wing walls. For durability and maintenance purposes, a cement slurry was used to fill the gaps in the stone wall. For the road surface, a mixture of clay, sand, and gravel was applied onto the cement bags, wetted, and tamped. Rocks were placed at both the inlet and outlet of the ring culvert to protect against scour. The wing walls are to be further stabilised and visually improved by planting indigenous grasses and other vegetation.

Renewable Energy for the Health Centre

Following discussions between the Nakruda co-ordinator and one of the volunteers it was decided that it would be possible to power the local health centre using renewable energy. Nakruda had 6 solar panels in storage and, before leaving for Nigeria, Jonathan Baker had participated in a 'How to Build a Wind Turbine' course. The power requirements of the health centre were first calculated. The centre has fourteen lights, one microscope and a computer. The centre also had an autoclave but it would put too much strain on the system as any appliance that uses a heating element draws a lot of current and therefore was not suitable for a renewable energy and would be excluded from the system.

Following an assessment of the suitability of the site, a hybrid solar-wind renewable setup was deemed appropriate to power the centre. The system was to work by either the solar cells or wind turbine, or both, charging a battery array providing steady power for the centre.

The turbine took 6 weeks to build at 'Unique Fabrication', an engineering company in Gombe. They were very generous in providing the workshop, metal and labour for free, without them it would not have been possible to complete this project. The team are extremely grateful for the excellent workforce provided by the manager, Hassan; there was mutual learning and many friendships formed. Should any work need to be carried out in the future there are several people there who worked on the turbine and are now fully trained to service and repair it.

Raising the turbine was a great day for the team and Jonathan in particular who had taken ownership of the project. Once up and running the turbine provided a great morale boost to both the volunteers and the community. Having never seen this type of technology before the community were clearly very grateful and proud to have such a system built specially for them.

Once the turbine was erected and running work commenced on the solar array and completing the integrated system. The local community were very involved in the project and the volunteers were keen to ensure that they built up local capacity with regards to maintenance in the future.

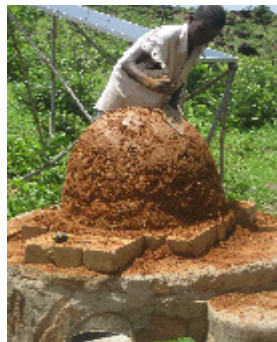
It was a fun day installing the lights around the health centre, there were lots of people helping and the fruits of their labour were beginning to take shape. It took all day and went into the night and for the first time the lights were used with free power from the renewable energy source; it was enormously satisfying. It was fantastic to see the building lit up at night in the middle of the bush with no noise from a generator. It could be seen around the whole of Dadiya.



Smaller Projects

In addition to the larger projects discussed, the team also put their skills and efforts to dealing with a number of smaller challenges. These projects considered the local infrastructure and the day-to-day challenges faced by the community. The team investigated alternative cooking stoves to improve the use of firewood as well as researching and constructing a clay oven. This was in response to Jonathan noticing that nobody in the community was able to bake bread despite always returning from town with some. The oven was put to good use producing numerous loaves much to the enjoyment of the local children. This demonstration oven could easily be replicated within the community.

Ash and Phil focussed on infrastructure, assessing and recording the existing road network as well as producing GPS references for use in producing a map of Dadiya. They also addressed drainage problems around an existing borehole where stagnant pools of water had formed due to excess water runoff.



Cultural Experiences

As in previous years, the volunteers formed strong bonds with the local community, taking part in various social events and celebrations. The volunteers were lucky enough to be present for the five yearly 'Kall' festival, which is a two week long coming of age celebration where the local youth officially become men. The volunteers also witnessed the Lokalokali District Head, Baba Kena, get turbaned at separate ceremony. The volunteers were also turbaned and given Dadiyan titles; Phil - 'Jakada' (Ambassador of Dadiya), Ash - 'Maidala' (One who is dedicated and cares for Dadiya), Jon - 'Tamarao Lo Kalokoli' (Star of Lo Kalokoli - the name of the village). In addition, there was the requisite sampling of the local tonic, guinea-corn juice, which has always been a talking point of returning volunteers.



Summary

Whilst this placement did not yield the projects that were originally planned, it has undoubtedly been very successful with the volunteers adding significant value to the community and building local technical capacity in many different areas of need. This success is largely down to the initiative of the volunteers and the willingness and openness of the host community and CBO in developing the team's ideas. None of the projects would have been possible without the support from the community and Nakruda, in particular the local chairman, Bitrus Adamu, and the founder, Beryl Kirk. Financially the volunteer placements would not have been possible without the funding from all of the sponsors as well as EWB-UK directly, to whom the whole team are very grateful.

Future of the placements

Whilst the 2008-2009 project was a success, it is clear that until a definite source of funding is available via Nakruda there is a potential risk in sending volunteers who may struggle to utilise their skills effectively. Thus, it has been decided that in order for EWB-UK to deliver maximum value with its limited placement funding volunteers will not be sent over 2009-2010. EWB-UK will maintain links with the organisation and look forward to sending new volunteers once project funding is more definitely in place and the efficacy of the placement can be more certain.

Funding Acknowledgements

These three placements were made possible by a RIBA/ICE McAslan bursary award to Dr. Heather Cruickshank – a chartered civil engineer – who has overseen the technical work on the project since 2007. The nature of the bursary fitted perfectly with the project's aims and technical standards. The particular need for a chartered civil engineer was due to the challenges of working in such a remote area, working with a partner organisation with no other engineering expertise available and the nature of the public works undertaken.

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