

ND Architectural Technology



Major Integrated Project for 2011.

## FUTURE BRILLIANT

An investigation into sustainable educational built projects in Africa.

## DECLARATION OF AUTHENTICITY

I declare that this assignment is the original work of the author. All information directly or indirectly obtained from other sources has been fully acknowledged.

Herman BrandHerhhhh\_\_\_\_\_

September 2011

## LETTER OF TRANSMITTAL

It has been a great experience in researching this project, and it is my honour to submit the following to you.

I have found this investigation extremely interesting and instructive.

I hope my findings and recommendations will be of value.

Yours truly

Herman Brand

Architectural Technology student (second year)

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## 1. Introduction:

Sustainability and green design are not new concepts in our modern world. The perception that the human race should cease its restless search for destruction became only too apparent during the Second World War and the annihilation of the atomic era.

Consuming the earth's resources faster than it can revive is not only irresponsible but, plainly said, very stupid.

Titanic efforts by various NGO's around the globe are merely scratching the surface with the tax on our environment, needless to say, catastrophic. Governmental legislation, Kyoto Accord excepted, is sadly lacking as leaders feel that there are more important matters to attend to. Surely a healthy habitat for the species should be a priority?

As Constructionists, Architects and other built environment specialists our impact is the direst.

Recently, the British Government has coupled grand tax deduction benefits to companies that follow environment friendly construction concepts but, strained African infrastructures can not equal these incentives, yet.

Some Academics consider that the origin of "green building" can be traced to Crystal Palace (fig 1) at the London Exhibition, through the Galleria Vittorio Emmanuelle II memorial to such pinnacles as the Flat Iron Building in New York (fig 2) and the Gregory Bateson Building in California, which aimed at lowering energy consumption in the manufacture of building components.

A rather coarse spin-off from the Exhibition was to become known, in time, as the Industrial Revolution.



Figure 1



Figure 2

This seems to the author to be overly simplified. In the modern Architectural language, these structures can not be considered "green design" nor sustainable.

A strong connection between the Arts & Crafts movement and green design can be ascertained, the fusion between art and industry and its emphasis on vernacular design,

labor and found materials. A relevant relationship between context and technology is forged.

Japanese Architecture has always sought a correlation between nature and emotion. “especially in the austere, essential, geometric character of its interiors, where sunlight entered from great sliding verandas often overlooking splendid gardens. House and garden were in fact joined in a virtually indissoluble whole, so much so that the ideograms house (ka) and garden (tei) denote the concept of home” (Bussagli, 2005, p168). Notable great Architects such as Frank Lloyd Wright looked towards the East for inspiration, resulting in structures such as the Imperial Hotel in Tokyo.

This gives a stronger hint of eco-friendly, healthy buildings where inside spaces merge with outside spaces, creating as it were a whole, both aesthetically pleasing, functional and with minimal impact on its surrounding natural milieu (fig 3).



Figure 3

The sustainability assessment of construction projects has evolved exponentially in the last century.

In the Green Building Handbook (van Wyk, 2011, p169-172), criteria for an excepted sustainable design is listed as follows;

- Continual improvement
- Equity
- Global thinking and local action
- Holistic approach
- Involvement of inter parties
- Long term consideration
- Precaution and risk
- Responsibility
- Transparency

As mentioned above, the logistical difficulties involved in green design in Africa can be overwhelming but, not impossible.

As a case study, I have commenced an examination into an academic, sustainable and low cost initiative in Burkina Faso, West Africa by award winning Architect Diebedo Francis Kere.

## 2. Methods of Investigation:

-Information requests granted by Diebedo Kere Architects, Berlin, Germany (21 September 2011)

-Magazines

### 3. Findings:

3.1 This commitment of a man to make a difference in his home village of Gando, a remote settlement in West Africa, came from a desire to improve conditions for children growing up in this poverty stricken country.

It represents the involvement of the whole community and symbolizes the first step towards development and a more clearly defined, hopeful future. He construed, with the help of a sole Government institution, to construct a building using local materials and labor.

The end result combines passive solar design and cross ventilation with the use of earth as the basic construction material. Use of timber was not required and that of concrete minimized. The roof is made of a very light material which required little skill and simple tools to erect. It has become not only a local, village-only focal point, but also for the surrounding area with children pouring into the school and gives the locals a sense of accomplishment and pride.

Historical background,

Gando, population 3000, lies on the southern plains of Burkina Faso (fig 4 & 5), bordering Togo and the Ivory Coast. In 1990 it was one of the towns included in the government's Secondary Towns Development Programme ( PDVM – Programme de Developpement des Villes Moyennes) which aimed to create local economic centers that would reduce the migratory flow to the countries two major cities, Ouagadougou and Bobo-Dioulasso.

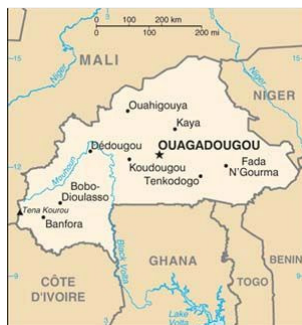


Figure 4



Figure 5

The first governmental effort to supply the village with a primary school deteriorated greatly due to lack of maintenance funds and bad structural material quality and had to be abandoned.

The Architect, the first person from his village to have access to formal, higher education, and with funds accumulated by himself, determined to “build a new school that would be exemplary in its design which would sympathize with the local climate, resources and materials” ( Fernando Varanda, 2004).

There was a large amount of help from the local population and even some stirrings from a lackluster government to provide training for brick layers in the technique of working with compressed stabilized earth.

#### Topography & Climate,

Gando, the village, is located on a flat plateau at an altitude of 200 meters in the Sudano-Sahelian climate zone, characterized by the alteration of a dry and rainy season which can last up to five months, a strong eastern wind and an average temperature of 25°. The vegetation is mostly wooded and arboraceous savannahs. The country is suffering a climate crisis, expressed as desertification and aridification, characterized by a serious drop in rainfall and increase in extreme temperatures. These conditions are exacerbated by large scale destruction of plant cover, overexploitation of land, overgrazing and repeated, uncontrolled bush fires.

#### Settlement Patterns,

The rural dwellings of this region consist of round, quadrangular one room compounds closed in by walls with a central open space. Concrete blocks or sun-dried mud bricks are most commonly used (fig 6). The main living area is lifted from the ground for protection against moisture and pests (especially termites, hence the no usage of timber). The volumetric and spatial relations of these elements are sometimes very complex, housing and extended family and which can be extended if necessary. Cattle are often also sheltered here. Some measure of waterproofing is obtained by adding Shea butter to mud the rendering.



Figure 6

#### School Topography,

40 Compounds on 150 hectares make up the village, with dirt tracks and a few tarmac roads leading from it to the southern edge where the school is located.

Programme,

The programme was informed by the principles of designing for climatic comfort with low cost construction and with vernacular found materials and adapting technological contributions from the industrial world. Underlying the project was a strong didactic component to educate the locals in the value of traditional materials.

The functional programme designated a school complex for 360 pupils, ablution facilities, a kitchen, vegetable garden and a sport field. The addition of residential housing for the teaching staff was also planned.

Data,

The allocated site comprises of 30 000 square meters, sports field included. The school itself has a footprint of 526 square meters. It is a long rectangular volume (fig 7), raised 500mm on a platform on an east-west axis with exposure to the north and south. Roof overhangs provide shade to the south. The walls are built with compressed stabilized earth blocks. These are ribbed with pilasters for structural soundness. In the interior the niches that are created by the pilasters are made into cupboards, re-using the timber shuttering from the wet works.

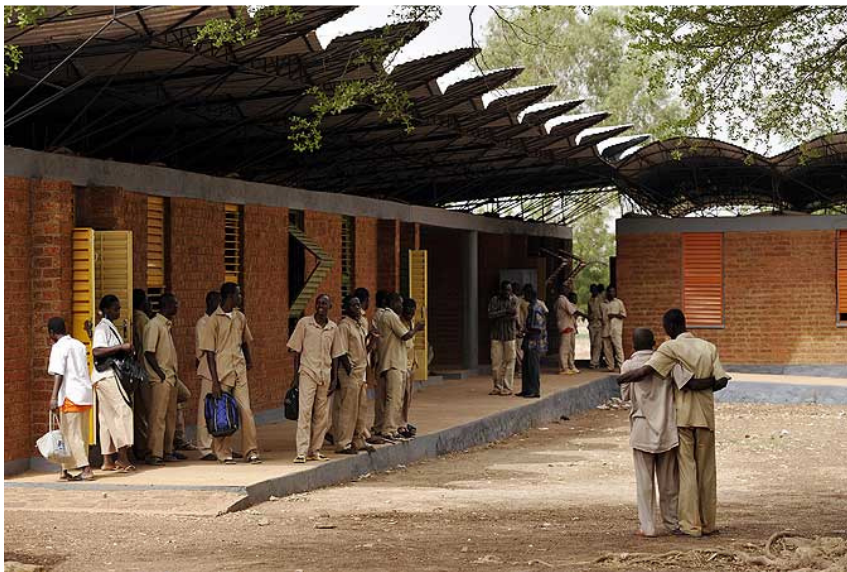


Figure 7

Climatic comfort is insured by the buildings orientation, the wall materials and the unimpeded flow of air between the roof structure and the ceiling. Cross ventilation is further enhanced by the use shutters (fig 8 & 9).



Figure 8



Figure 9

Evaluation of design concepts,

In the words of the Architect himself, “this project is intended to adapt to the needs and the economic situation of the people in the region and be responsive to the prevalent climatic conditions and thus achieving sustainability”. A high value is placed on education by the Architect by “evolving higher grade planning concepts and constructive architectural solutions”.

A diagrammatic drawing has been done to endeavor to communicate the volumetric massing of the compound, its orientation and the sustainability principles engaged in the design process (fig 10 A & B).

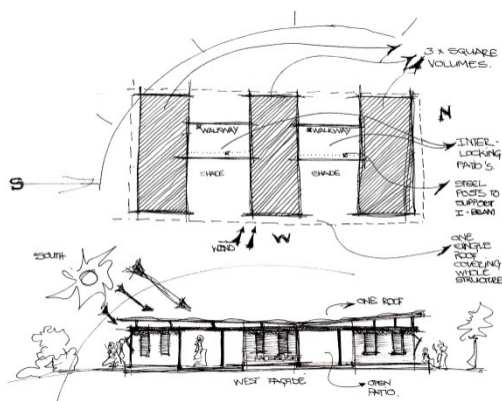


Figure 10 A

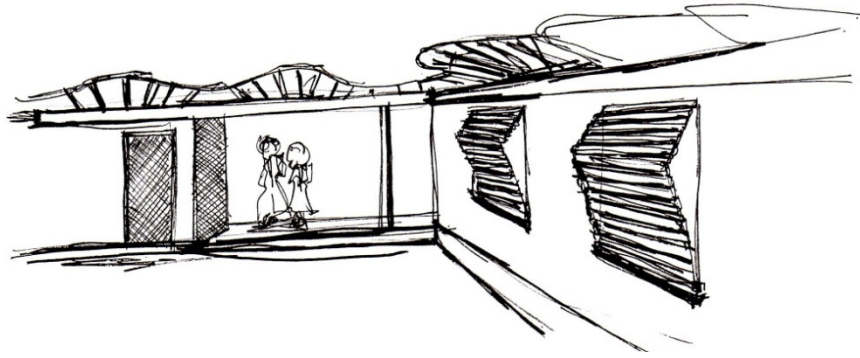


Figure 10 B

A considered symbolism (fig 11) is evident in the elevations, especially the single, continuous roof, referring to the central trees that act as a meeting place for the village elders and yet performs the added task of collecting rainwater to irrigate the sports field and surrounding garden.

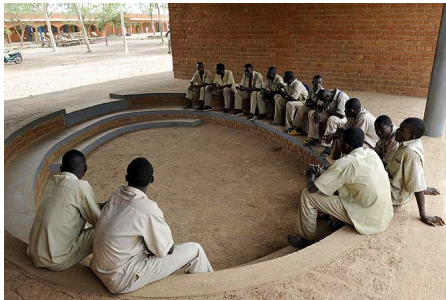


Figure 11

Structure,

The basic structure of the school comprises load-bearing, hand pressed earth blocks with an 8% cement mortar, foundations of stone, some re-enforced concrete beams to support the ceiling, floors of rammed earth and dilatation joints formed by embedding small I-beams into the concrete lintels so that the end of one beam simply lies on top of the other, thus permits material movement. The roof is corrugated metal sheeting laid over a space frame which is tied to the concrete beams that are set in parallel to the width of the building. At the end of each classroom there is a 100mm gap between ceiling blocks (fig11), running from wall to wall, whereby light and air is allowed to enter and circulate freely (fig 12). Local, blacksmith, steel shuttered fenestration allows for maximum use of natural light. Unfortunately, the children use these shutters as ladders to climb into the ceiling space and create an additional weight on the ceilings.

The use of timber was not an option due to the lack of proper treated wood and presence of insects.

To ensure quick drainage, concrete gutters run along the valley between continuous vaults and on top of the side walls, descending to a hollow buttress.

The ablution block was made in concrete and is a 'cesspool' type, as has been used elsewhere in the region.



Figure 12



Figure 13

Construction Costs,

The estimated budget for the development was USD 28 954.00 and the actual cost came to USD 29 830.00. This brings the cost per square meter to USD 58 but no value was put to land or on community volunteer labor.

Teachers at the school have noted that there is a definite larger pupil success rate than previously. This stands as a testimonial to the sustainable thinking that went into the planning and construction of this school.

### 3.2. Domestic Built Projects.

#### 3.2.1. Seven Fountains School, Kwazulu-Natal.

Background,

A need for a new structure had been recognized by the Shayamoya Township, to house 500 pupils whom had been evicted from a farm school outside of town. What emerged was a new modular design in public and privately funded educational projects and attracts more than 1000 pupils.

“A new architectural logic is born. One not revealed through compatibility with formal, iconic principles of studio design. Rather, it emerged from an examination of the manner in which different levels of voice were incorporated at various stages in the design and construction process. In this OAN funded project, the agreed objective was to move away from the one-size-fits-all practice of parachuting blueprint based structures into rural areas, to allow for the architecturally guided emergence of a school organically connected to the community that built it and which it serves. The choice of materials for the site was

informed by a skills and materials audit conducted at an early stage within the township. Sustainability on a holistic, social, economic and ecological level was well exhibited in this delightful project. This school represents an outstanding example of a new, inclusive and successful form of architectural expression and merits an award for excellence". The citation is by the South-African Institute for Architects adjudication panel, September 2010.

Structure,

The concept of a central "rondawel" (fig 14) with sections spreading outward from it (fig 15), symbolizes the historical hierarchy with which villages had been built. It accentuates the originality and individuality of the project. originality and individuality of the project.

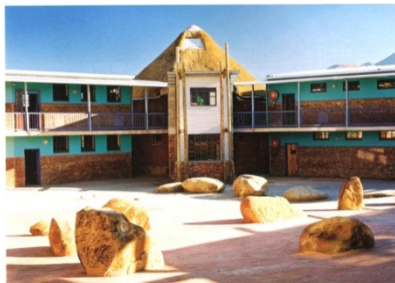


Figure 14

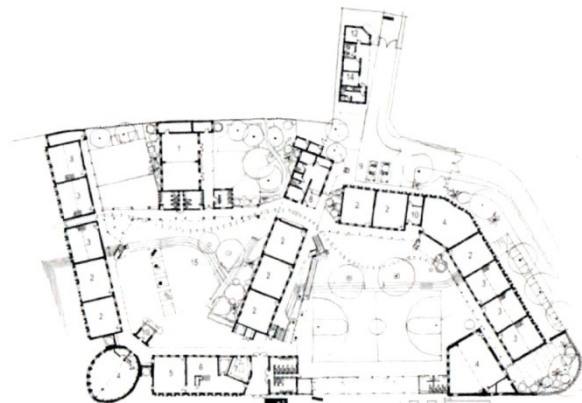


Figure 15

The primary structure consists of a rock foundation, double timber framed poles and trusses supporting a thatched roof (fig 16 & 17). The secondary structure is non-load bearing 450mm thick sun dried adobe as well as cement bricks walls manufactured by the parents and grandparents of the learners, totaling 18000 hand pressed bricks, uniply pole joists and a traditional dung floor. Fenestration consists of hardwood frames and recycled glass. A 250mm thick thatch is laid atop the pole trusses and 9mm light clay filled ceiling attached to it.

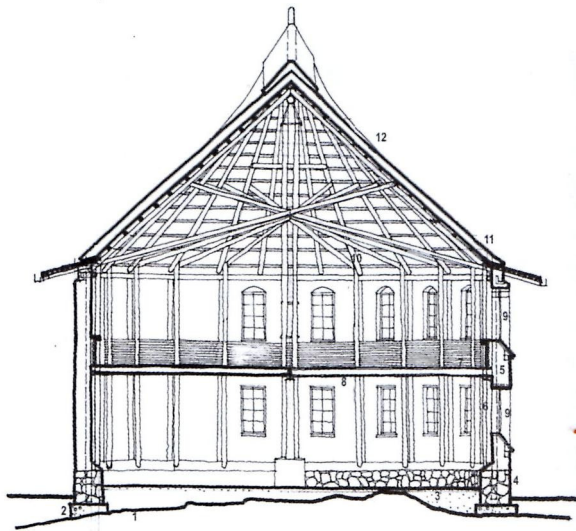


Figure 16

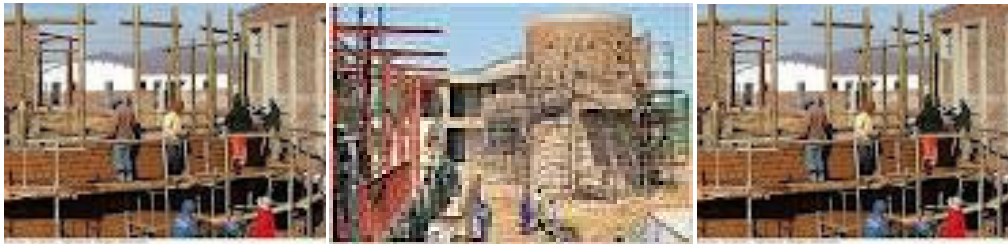


Figure 17

The result is a well-resolved plan within a block which skillfully mediates the natural fall of the site and the curvilinear and orthogonal layout of the surrounding township while interacting with dedicated playgrounds and sports fields, accessible to both the school and the community (fig 18).

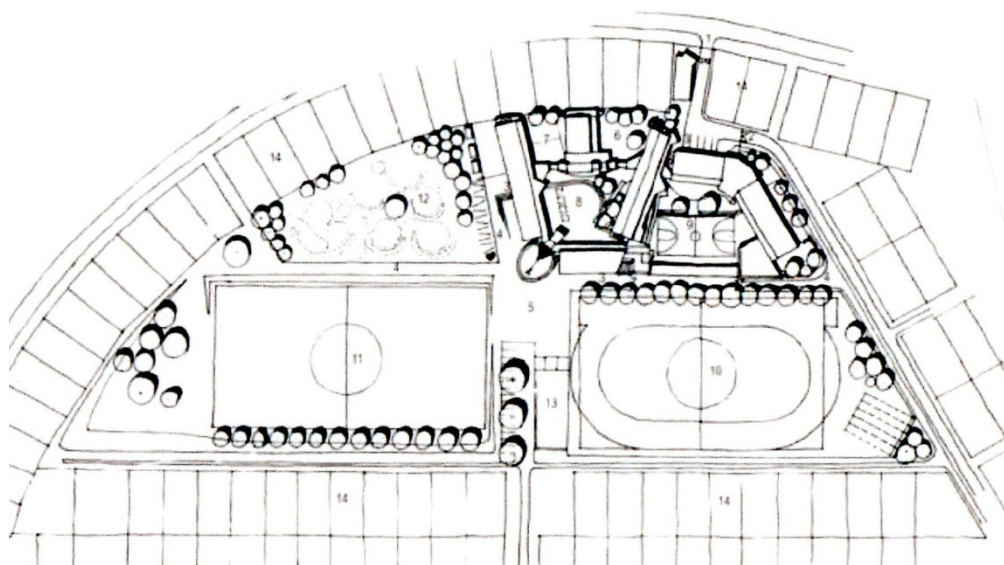


Figure 18

Sustainability,

The sustainability of this design can be classified as a Passive Low Energy Design. The strategies employed are:

- Carefully considered solar orientation of main learning areas.
- Learning and administrative areas are well insulated to improve thermal properties.
- Use of natural light with glare and heat gain restricted by use of appropriate positioning of solar shading and light shelves.
- Collection of rainwater from all impermeable surfaces and other grey water channels, which is stored in an underground reservoir and pumped via a windmill to flush toilets.
- Use of low consumption fittings and appliances for lower water usage.
- Creation of “breakaway” areas such as lofts and mezzanines to increase space.
- Alternative learning spaces, outdoor areas in good weather.
- Traditional methods of round construction for activities.
- Specialized spaces for a library and computer room, utilizing a central information hub which is easy to access.

In its entirety, this project incorporates many of the aspects that make up “green design” put forth in the introduction. The main focus of community involvement can not be emphasized enough, with the long term consideration and responsibility generating a discipline in the local society with its insistence on education.

Relevance,

Continual electrical monitoring of the developments effectiveness is elemental in our understanding and ever changing perception of sustainability. Sensors measure data such as room temperatures, light levels and energy consumption.

The relevant value of such information is very important. For sustainable projects to work, we need to understand which projects, ideas and technologies succeed and which doesn't.

3.2.2. Vele Secondary School, Limpopo Province.

This development forms part of the Oprah's Angle Network, the charity organization founded by Oprah Winfrey that involves a number of educational project throughout South-Africa. This was the third such academy built with the funding provided by OAN.

One of its key aspects is "community participation and dynamic community responsibility, thus reducing the risk of vandalism, burden of maintenance and extends the schools usable hours" says Steve Kinsler, a partner in East Coast Architects, the firm that took up the project. The choice of this particular firm, was logically taken by OAN for they had just completed an eco-friendly research facility (Africa Centre for Health and Population Studies) which had won them such accolades as The Sustainable Building Best Practice and an award for excellence from the South-African Institute of Architects (Earthworks, June-July 2011, p24).

The holistic nature of the programme guided the development. After completion in May 2011, it became known as Vele High School in the district of Vhembe.

#### Background,

This project was proposed in a community with vast social and economic issues, such as poverty, unemployment and substance abuse. The development aimed to concentrate the involvement of the locals in as many ways as possible. Local labor and volunteers supplied the workforce and thereby embedded the school in the community consonance.

The school also took an active part in the village economy by utilizing localized materials and outsourcing as a last resort. By doing this, the project managers also individualize the school and give it a singular, locality defining characteristic.

#### Structure

The functional programme called for a new structure to house 460 pupils with spaces allocated to 17 classrooms, 2 science laboratories, a computer room, library and administrative offices. In addition to all these functions, there needed to be an assembly hall, stores and ablutions with spaces for food gardens and sport fields (fig 19).

The primary structure is concrete columns and slabs, supporting, in part, a vegetative flat roof section that provides insulation and open timber trusses with sky lights (fig 20) in other sections. As the secondary structure, clay bricks are used for walls; steel rods and sheeting are utilized in creating walkways (fig 21) that link the seven formal structures to one another. All materials in the construction were produced within the local community (Earthworks, June 2011, p30).

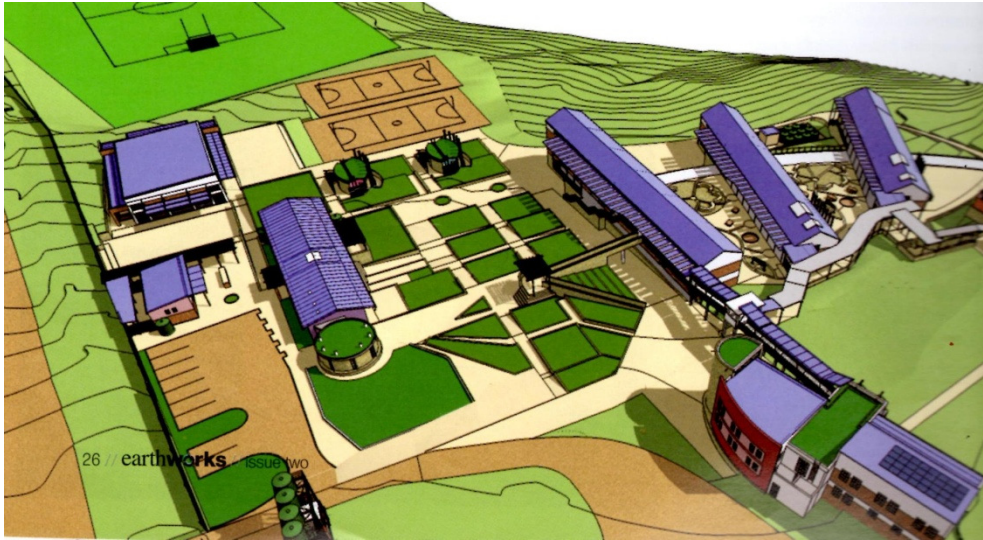


Figure 19



Figure 20

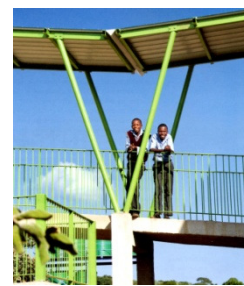


Figure 21

The ablution facilities draw attention to its imaginative use of materials and surfaces as well as the primary structure which consists of a gum pole frame (fig 22) with stonework infill as walls.



Figure 22

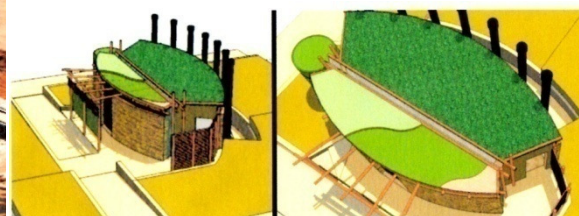


Figure 23

## Sustainability,

The focus of this project does not reside in the structure but, more in the services and engagement of these services in academic value (such as the food growing initiative and educational energy awareness). The sustainability of this design can be classified as a Passive Low Energy Design. The strategies employed are:

- Extensive community involvement in energy renewal.
- Rainwater harvesting with 150 000 liters storage capacity.
- 50 square meters of photo voltaics which supply 80 computers with electricity.
- Vernacular found materials and labor.
- Natural lighting (fig 24).
- Dry composting sanitary facilities.
- Green Roof concept.
- Use of natural cross ventilation systems.
- Shared use of facilities.
- Biodiversity, food gardens to supplement the school nutrition programme.
- Sustainable design concepts placed into learning curriculum.

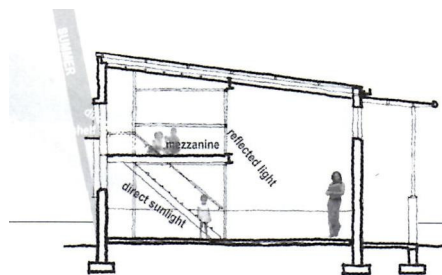


Figure 24

## Relevance,

As an exercise in the value of education into the complexities of sustainable design and construction, Vele rates as a high-quality example. This school formed part of the Angel Network of projects which aims to bring environment friendly systems into the mainstream architectural landscape. Environmental context is becoming as an important design matrix as are social, economic and historical context.

“Architecture must remain experimental and open to new ideas and aspirations in the face of conservative forces that constantly push it toward the already proven, already built and already thought” (Steven Holl)

### 3.2.3 Cosmo City, Gauteng

The American University of Cornell, has created a thirty-one student led team, Schoolhouse South Africa, which designs and build sustainable, low cost educational projects throughout Southern Africa. One of its chief developments is the Cosmo City multigrade School in Johannesburg, Gauteng Province.

Background,

Schoolhouse South Africa united with Education Africa (a non-profit organization working to reduce poverty through education), Play with a Purpose (an early childhood educational program focusing on parental guidance), Basil Reed Developments and the city of Johannesburg to improve academic institutions in lower income, mixed housing settlements throughout Southern Africa (fig 25).

The programme involved “promoting projects that have long term effects and incorporates an interdisciplinary understanding of sustainability”. (Barry Beagen)

The design process started off with the team collaborating with a second year Architectural Studio to aim at a structure with zero environmental impact.

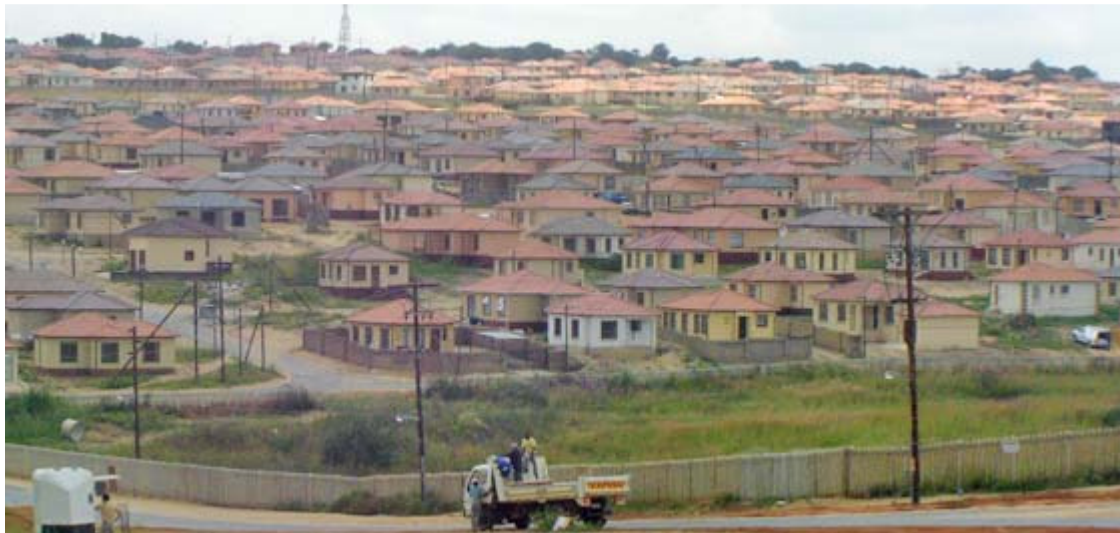


Figure 25

With the design approved by the various parties involved, the project began during the spring of 2010 after a well documented environmental impact study was completed. The social and economical context placed specified boundaries on the project, especially

considering that South Africa was in an economical recession alongside a good number of other continental countries. A ceremonial groundbreaking was held on July 9, 2011.

#### Structure,

The site is located on a 560 square meter plot, situated within the 12500 dwelling, housing complex grounds. Average summer temperature is a stifling 30 degrees Celsius with little wind to amplify ventilation, thus consequently formulating the open plan concept.

The functional programme indicated a need for a structure to accommodate 80 students a year in interactive group learning spaces, classrooms and play areas (fig 26). The structure also needed to act as a teacher training facility and host community activities, whereby doubling up the occupational usefulness of the building.

A horizontal and vertical braced steel frame (fig 27) makes up the primary structure. Bags filled with earth are used as walls, as a secondary structure. This is a construction methodology taken from the very successful Freedom Park Housing project outside of Cape Town. The bags are created from the excavated earth on site. Soil movement and disposal thus become an integrate part of the complex and adding to its sustainability value.

The solar passive design highlights the decreased need for electricity by not requiring artificial heating or cooling pumps. High performance windows and glazing provide natural light, ventilation and insulation.



Figure 26



Figure 27

#### Sustainability,

The true sustainability value of the Cosmo City development lies within the utilization of found materials, community skills and labor, stimulating the local economy. The passive solar design is as evident here as in the Burkina Faso, Vele and Seven Fountains projects. Unlike Vele and Seven Fountains though, financial resources were not as forthcoming for Cosmo City.

Cosmo City inserts a very definitive variation on traditional school models.

- Zero environmental impact.
- Use of earth bag construction technologies.
- Vernacular skills training and materials.
- Rainwater harvesting.
- Shared/Multi purpose use of facilities.
- Emphasis on “open plan” profile by space defining elements.

Relevance,

“Apart from learning to work in a professional environment with an extremely tight schedule, we learned construction management skills, carpentry, organizing suppliers, managing sponsors and events” (Barry Beagan, Construction Engineer at Cornell)

The major sustainable significance of Cosmo City lies within its educational context. The students partaking in it all testify to the psychological effect it has had on them. The very real comprehension that outdated modular systems is no longer an option to developing societies. This project symbolizes the very relevant issues that confront built environment students, industry professionals and the rural or urban communities that yield works such as these.

### 3.3.1. Grabouw District in Context.

“A position paper introducing the Sustainable Communities Programme was approved by the Development Bank of Southern Africa (DBSA) Board in November 2005. Grabouw was chosen by the DBSA for inclusion as one of the initial pilot project communities of the Sustainable Communities Programme (1 of 6 pilots), following the consideration of a number of socially and economically underdeveloped areas. The Programme aims to contribute to the creation of sustainable and viable communities and focuses on addressing the challenges of sustainable development in South Africa. One of the key roles of the Bank would be the provision of bridging finance to the municipality to support the actions proposed in the Programme. The Bank would also actively seek to unlock necessary funding from national and provincial programmes.

The programme represents a shift in the strategic orientation of the DBSA, from larger planning and infrastructure programmes, working at the municipal level via intermediaries, consultants and partners, to a community based approach able to focus directly on lived experiences, problems and tangible solutions”. (Sustainability Institute, Grabouw Case Study, August 2010)

This quotation from the Grabouw case study shows a direct intention in the local authority to address community issues. A strenuous effort to effect change in the area has been troubled by high unemployment, low income rates and a lack of high school education combining to aggravate the social problems in the area including domestic violence, crime as well as alcohol and drug abuse. HIV/AIDS infections are very high in Grabouw, particularly in the informal settlements. The significant crime and HIV rates are seen as a deterrent to potential investors.

Once again, as in all the previously stated examples, it becomes clear that education is the key to unlock the circle of poverty and ignorance.

This is a global phenomenon and is by no means central to the African continent. In the process of researching this topic, some particular parallels can be drawn by looking at some Asiatic developing countries facing the same socio-economic obstacles as South Africa.

### 3.3.2. Sra Pou Vocational School, Cambodia

This building is surprising, both in its Architectural significance and its construction.

Situated in the densely populated central province of Ulong, the village of Sra-Pou is a relocated community. The area drastically lack infrastructure, a sustainable means of income and a secure environment. These are some of the very same issues confronting the Grabouw location.

The Finnish Architectural students Hilla Rudanko and Anssi Kankkunen travelled to the country as part of a design studio class and instantly looked upon the area as an opportunity to promote a sustainable, community based and driven construction programme.

The primary structure of the 200 square metered school is a double storied, open air column and beam structure built with red, sun dried bricks which were manufactured by the inhabitants of the village and timber beams covering some areas. Bricks were laid in a hole pattern in the walls to pull in more daylight and induce natural ventilation (fig 28).



Figure 28

Bright and colourful handmade shutters can be opened or closed providing shade, but also add to the vibrant aesthetic of the building, giving it a specific character (fig 29). A large covered porch creates an outdoor community space, while the interior holds workshops, storage space, classrooms and ablution facilities.



Figure 29

The development can be seen as a success for “the entire project was built by local labourers who received training on the job, and now a local non-profit organization operates out of the building and is teaching the villagers how to earn a living. Sra Pou Vocational School also serves as a space for public gathering and community decision making (Rudanko + Kankkunen Architects, Inhabitat.com, 2011” The construction of this building has enriched the village in both economical and social way of life.

The multi grade classrooms poses a paradox, many teachers are either untrained or trained in single grade pedagogy. Teachers regard the multi grade as a poor relation to the better

resourced single grade classrooms found in large urban schools and staffed by trained teachers (NWREL 2001:1).

### 3.3.3. Maosi Demonstration School, China

This award winning (World Architecture Commendation, 2008) project defines appropriate architectural response to a sustainable, financially limited, but very basic need, that of educating the young people of a rural community (fig 30). The small village of Maosi in the Chinese province of Gansu suffers from an exceptionally poor economy with all the sociological trepidations that arises from unemployment and over urbanization.



Figure 30

These issues amalgamate with fragile ecological conditions and demand a new way of solving housing and institutional built projects. Urban sprawl render individual habitats no longer feasible as can be seen throughout the world.

There are 200 pupils in the village of 2500 inhabitants, and teaching was done in either caves or in simple mud brick huts.

The project emphasises a scientific and transferable methodology “through analysis, computer simulation and field construction” (Architect Jun Mu, 2002), prior to construction commencement.

Furthermore he says that “condition analysis in economy and resource for building, climate and vernacular architecture deduce that the thermal design for this region is the most effective approach to wards ecological architecture. And both design and construction should follow these principles”. It is notable how context (environmental!) and technology combine to form a predominant design matrix. He also states that “by filtering and optimizing locally available (found) materials and techniques ... should be employed”.

The structure comprises of 10 classrooms on two varying levels, with angled window openings to maximise natural light and ventilation. These are not divided into similar grades, but are clan orientated. A tree based landscape contributes to creating a desirable campus ambiance. The structure is timber framed (fig 31) and modelled on the traditional houses of the region.



Figure 31

Thermal mass and insulation are employed in the forms of mud brick walls, an insulated roof and double glazed windows. The semi buried form at the north side together with the passive solar design promotes the buildings thermal performance. The red roof tiles, straw and reed, is recycled from existing structures that have become redundant and embodies minimum energy consumption, and leaving very little waste. Off cuts were recycled for children’s facilities and spare mud bricks mixed with straw for plaster work. The construction has almost no environmental impact (Edward Ng, The Chinese University of Hong Kong, Department Architecture, 2008).

As a charity project, most of the donations were shared within the village community due to employing the local villagers and using their resources. This qualifies the project as sustainable by its stimulation of local economy and the use of found materials and illustrates a feasible way towards an ecological architecture suited to specific regions under specific climatic conditions.

#### 4. Conclusions:

Appropriate, rational responses to problems such as urban sprawl, socio-economic housing and education must be the foremost criterion taught in Universities and schools of design. Contextual (economic, environmental) and technological matrixes should

The very real jeopardy of climate change must not be ignored.

The realization of these projects changed the way in which engage the unique confrontation between tradition and modernity and how we can contribute to the spatial solutions within a changing world and an increase in altered climatic landscape (Ian Low, Digest of South African Architecture, (2010), p 15).

#### 5. Recommendations:

## 6. References:

Bussagli, M, Understanding Architecture, (2005)  
Earthworks, Issue 1, April-May (2011)  
Earthworks, Issue 2, June-July (2011)  
Earthworks Issue 3, August-September (2011)  
KZ-NIA Journal, Issue 2/2009 Vol. 34  
Digest of South African Architecture, (2009)  
Digest of South African Architecture, (2010)  
Journal of the South African Institute of Architects, September (2010)  
Journal of the South African Institute of Architects, (March 2011)  
Cornell Chronicle Online Home Page  
Ng, E, Department of Architecture, Chinese University of Hong Kong, (2008)

<http://www.simplygreen.co.za/articles/picture-special/sustainable-schools-14-smart-green-learning-facilities.html> (accessed on 16/10/2011, 10.15 AM)

<http://inhabitat.com/colorful-sra-pou-vocational-school-is-hand-built-using-local-materials-in-cambodia> (accessed on 16/10/2011, 12.30PM)

<http://architechnophilia.blogspot.com/2011/04/new-work-sra-pou-vocational-school.html>