INTRODUCTION






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This book was created by the Cornell University Sustainable Design: Schoolhouse South Africa design-build team in the fall semester of 2010 at Cornell University under the supervision of Jeremy Foster and Kifle Gebremedhin, Professors of Landscape Architecture and Civil & Environmental Engineering, respectively.

This book was finished on December 22, 2010. It was created in Adobe InDesign CS4 and CS5. It utilizes the Gotham and Router font family. The official colors are orange and lime. This book was created in an 11" x 17" (tabloid) format. It is available as a digital PDF.

The majority of students involved in this book used InDesign for the first time this semester.

This book is an incredible accomplishment - the actual production took less than a month! Thank you to everyone for your superb work and unrelenting dedication.

Editor-in-chief: Karen Chi-Chi Lin
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INTRODUCTION

CHAPTER 1: CASE STUDIES

CHAPTER 2: CITY AND REGION

CHAPTER 3: SITE AND LOCALE

CHAPTER 4: BUILDING AND STRUCTURE

CHAPTER 5: PRE-DESIGN BRIEF

CHAPTER 6: APPENDIX

INTRODUCTIONS

CORNELL UNIVERSITY SUSTAINABLE DESIGN (CUSD)

Formerly known as Cornell University Solar Decathlon, CUSD participated in three U.S. Department of Energy Solar Decathlon Competitions. In October of 2009, the organization rebranded itself to reflect a new focus on a comprehensive understanding of social and environmental sustainability. Since restructuring, CUSD has partnered with two organizations, Education Africa and the Institute for Computational Sustainability and is simultaneously pursuing two distinct projects. CUSD is now recognized as one of Cornell's premier sustainable student groups, and is poised to become an active component of the sustainable discourse at Cornell.

The team applies the knowledge and experience of several returning members and augments decisions with the fresh perspectives of newcomers. Our efforts are further enhanced by the sustained involvement of exceptional faculty and professional mentors who work tirelessly to ensure our aspirations become a reality.

As the new CUSD, we currently manage two design-build projects. One project is our Sustainable Research Facility (SRF), which provides Cornell students the opportunity to participate in the design and development of a "Living Laboratory" on Cornell's Ithaca campus. The project featured here is the Schoolhouse South Africa project.

EDUCATION AFRICA'S SOCIAL ARCHITECTURE PROGRAM

ESTABLISHED IN 1992, EDUCATION AFRICA STRIVES TO REACH AND UPLIFT THE POOREST OF THE POOR. THEY AIM TO ASSIST DISADVANTAGED SOUTH AFRICANS IN THEIR QUEST TO OBTAIN A QUALITY, RELEVANT EDUCATION IN ORDER TO ENSURE THAT THEY ARE IN A POSITION TO BECOME GLOBAL CITIZENS AND A COMPETITIVE, PRODUCTIVE ELEMENT IN THE LOCAL JOB MARKET. EDUCATION AFRICA AIMS FOR AN EDUCATED NATION, WHICH IN TURN WILL LEAD TO A PROGRESSIVE NATION THAT IS IN A POSITION TO SUSTAIN ECONOMIC GROWTH.

Education Africa (EA) is a philanthropic non-profit organization based in Johannesburg, South Africa. Their Social Architecture Program partners with universities worldwide, enabling architecture students to design and build structures such as childhood development centers, skills-training centers and primary schools. To date, the program has produced eleven buildings in disadvantaged townships through successful collaboration with international universities. Students work side-by-side with local residents throughout the building process, encouraging the transfer of skills and knowledge.

MAKING IT HAPPEN WITH...

EDUCATION AFRICA

A non-profit organization that aims to reduce poverty through a number of educational development programs. Their Social Architecture Program works with international universities to design and build schools for underprivileged children.

THE CITY OF JOHANNESBURG

Cosmo City, a public private partnership between Basil Read and The City of Johannesburg, is a revolutionary mixed- income, socially-integrated housing development outside Johannesburg.

BASIL READ DEVELOPMENTS

Basil Read is a premier construction and development group in South Africa. They have initiated various community support activities in Cosmo City and the our crèche is one of the projects they support.

PLAY WITH A PURPOSE

In Cosmo City, Education Africa will implement the Play with a Purpose curriculum to train teachers to apply innovative educational programs in underprivileged pre-schools to ensure children receive the best possible preparation for grade school.

EXECUTIVE SUMMARY

HTTP://CUSD.CORNELL.EDU/SSA

ABOUT THE PROJECT

Schoolhouse South Africa is an interdisciplinary student-led design-build project and research endeavor orchestrated by Cornell University Sustainable Design (CUSD). The project succeeds Cornell's 2009 entry in the U.S. Department of Energy's Solar Decathlon competition, with the intention of promoting a greater sense of social responsibility. We have partnered with Education Africa, a non-profit organization that focuses on counter poverty measures through education.

Within the 2010-11 academic year, Cornell students will catalogue existing and potential sustainable practices in South Africa and create a comprehensive atlas of their research. The atlas will inform the design of a 6,000 square foot Early Childhood Development center (known as a crèche) which will be constructed by volunteer students during Summer 2011 in Cosmo City, South Africa.

PROJECT PHASES

The built result will put into practice the theories developed in its production and integrate itself into the newborn city as a critical social amenity. Throughout the 2010-2011 academic year, CUSD will research, analyze, and map existing patterns in housing, employment and social structures. Students will catalogue building systems and fabrication techniques, and investigate design and programmatic potentials. Local material-use, construction processes and waste-energy cycles will all be considered.

All research will be compiled into a comprehensive design-brief that will inform the development and production of working drawings in Spring 2011, and initiate the collaboration between CUSD and the comprehensive design studio (sixty second-year architecture students). As the construction drawings are completed, 35 Cornell students will travel to Cosmo City, South Africa, to participate in the construction phase. Student-community interaction, participatory design workshops, and skills transfer in prototyping and construction will empower both the Cornell and South African communities.

This pre-school will accommodate up to 80 of the city's neediest children as part of a national initiative to improve Early Childhood Development. The facility will include classrooms, a dining area, a kitchen, a health center, indoor and outdoor play areas, and an office. Interactive spaces will create a sanctuary for group learning, creative play, and social development. The structure will also house training seminars for teachers within Cosmo City to improve the quality of education in crèches throughout the community.

APPROACHES

We have partnered with several organizations to realize our project. CUSD is the first American student-organization to partner with Education Africa. Since 2004, their Social Architecture Program has constructed over 10 educational centers and schools that are now important neighborhood resources for their communities. After each crèche is constructed, Education Africa ensures that the facility is well staffed and will operate smoothly for years to come. Education Africa implements the Play with a Purpose Early Childhood Development lesson plan and teacher training program. In addition, they provide each school with educational material based on comprehensive skill development. The City of Johannesburg has allocated a site for us to build on in a low-income neighborhood within Cosmo City. Basil Read, the local developer, will provide professional assistance and guidance throughout the design process, and will help secure support during construction.

COSMO CITY

Cosmo City is a pioneering public-private partnership between the City of Johannesburg and Basil Read to house previously informal inhabitants into a socio-economically integrated housing development along with basic infrastructure and public amenities. Located 15 miles northwest of Johannesburg, Cosmo City was first populated just 5 years ago and will accommodate approximately 70,000 people by the end of 2010. As part of the South African government's Reconstruction and Development Program (RDP), Cosmo City has the potential to become an example for sustainable and socially responsible urbanization, and help overcome inequalities that persist in the post-apartheid period.

COMMUNITY

The community is our focus in all aspects of the project – from creating an open data platform for research that is accessible to the public, to capacity-building and participatory design workshops for the future students and teachers. In addition, the construction of the crèche will provide an unmatched platform for skills transfer between Cornell students and Cosmo City construction workers. The cultural exchange between Cornell students and the Cosmo City community and the relationships formed will be invaluable to both.

A TRULY SUSTAINABLE PROJECT

This will be the first official crèche in the low-income neighborhood of Cosmo City. Currently, day care centers are found in small homes with up to 80 children in a 6m x 6m shelter. Our project will provide proper facilities for children to learn and grow for generations.

HOW TO USE THIS BOOK

HOW WAS THIS BOOK CREATED?

This book is the final product of a semester's worth of research by students in engineering, architecture, design and environmental analysis, landscape architecture, city and regional planning, and hotel administration. Our team is compromised of all 7 undergraduate colleges as well the graduate Johnson School of Management at Cornell University, each represented by the diverse content within this book. Our multi-disciplinary team, enables us to present a wide variety of information specific to the context of our project. This book was created under the advise of Jeremy Foster, Professor of Landscape Architecture, and Kifle Gebremedhin, Professor of Civil and Environmental Engineering.

WHO WILL USE THIS BOOK?

CUSD: SSA compiled this book primarily to help students designing the crèche to better understand the context and depth of the project. The information and research gathered in this book is not limited to those students. It can act as a resource for (1) second year architecture students designing the crèche, (2) future CUSD: SSA team members, (3) other design-build project teams, (4) individuals interested in learning more about sustainable building systems and solutions, (5) educators, and (6) CUSD sponsors and partners, just to name a few. This book will also assist to incorporate sustainable solutions in projects in the departments of architecture, landscape architecture, planning, and others.

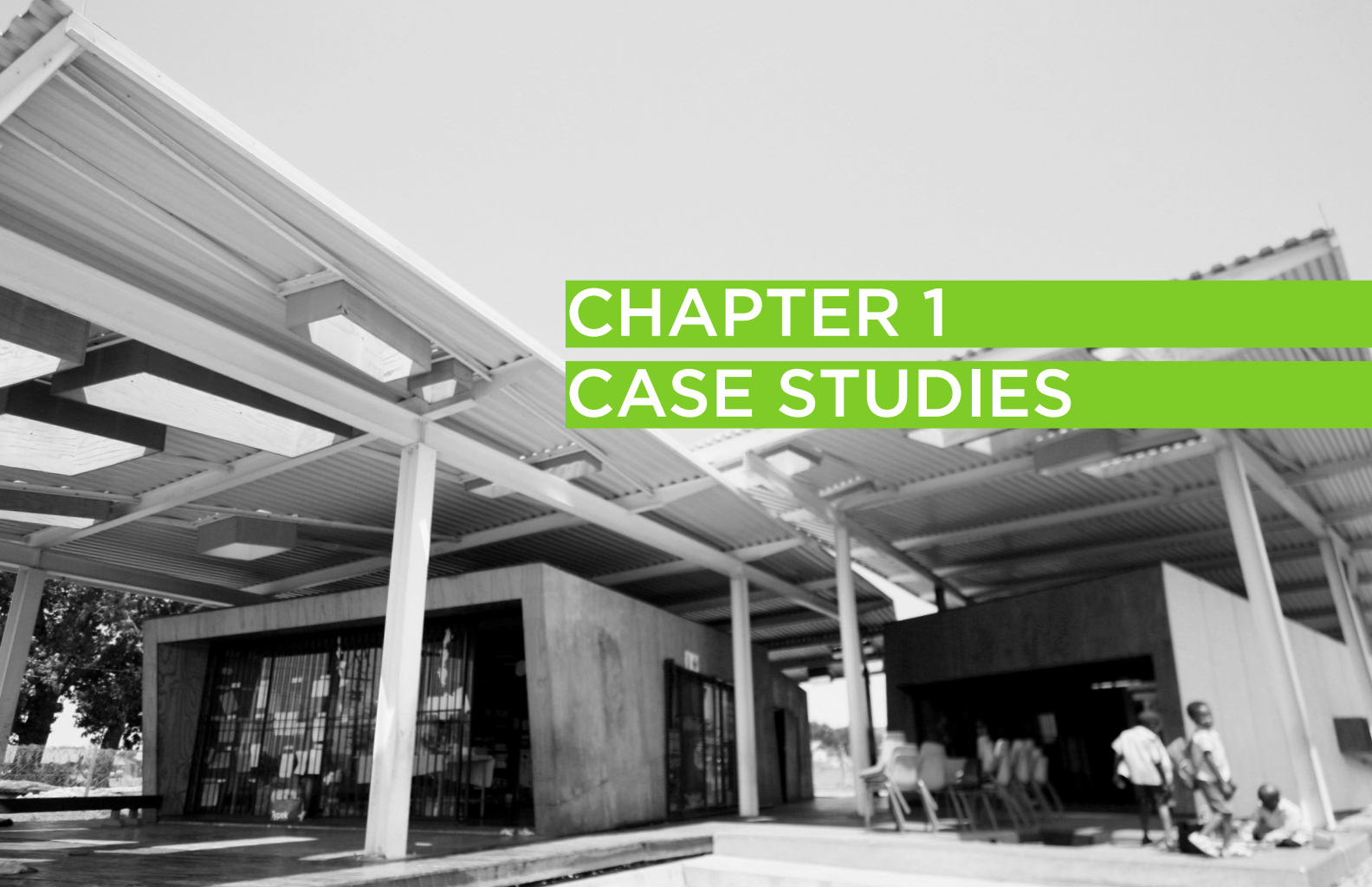
Educators, project sponsors and CUSD: SSA partners may also be interested in perusing this book as this book acts as an almanac, documenting the team's progress and comprehensive work.

HOW SHOULD THIS BOOK BE USED?

Readers are encouraged to use this book as a resource to initiate discussion, inspire design, and promote sustainable building materials and systems. This document is not intended to be an all-encompassing, didactic set of rules. Rather, it presents a diverse field of research from which readers can elicit both information and inspiration.

GLOSSARY

crèche	A day-care center for young children
CUSD	Cornell University Sustainable Design
EA	Education Africa
ECD	Early Childhood Development
RDP	Reconstruction Development Program
spaza	Informal convenience store
tuck shop	Informal convenience store
SSA	Schoolhouse South Africa
ZAR	South African Rand (currency of South Africa)



CHAPTER 1
CASE STUDIES

1.1.1 TETON COMMUNITY SCHOOL

PROJECT NAME
TETON VALLEY COMMUNITY SCHOOL

LOCATION
Victor, Idaho, U.S.A.

AUTHOR
[DC] WORKSHOP - DESIGN COLLABORATIVE

LINKS / REFERENCES
HTTP://TETONVALLEYCOMMUNITYSCHOOL.COM/
HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/4128

SUPPORTING FOUNDATIONS
THE MODULAR BUILDING INSTITUTE
RUMI SCHOOLS OF EXCELLENCE
ARCHITECTURE FOR HUMANITY

HISTORY / BRIEF DESCRIPTION
The planning for the Teton Valley Community school began in the early 1990s, with a strong mission to provide education to underprivledged children. After denied charter school status by the state of Idaho, the TVCS established itself as a non-profit independent school with a strong financial aid program. Between 2002 and 2010, enrollment increased from 15 to 90. Previously a one-room classroom and part of a renovated garage, the school faculty hired [DC] Workshop to realize a new space. The plans for the new TVCS won the 2009 Open Architecture Network Challenge, and continues to "nurture and inspire life long learners by providing a state of the art learning community."

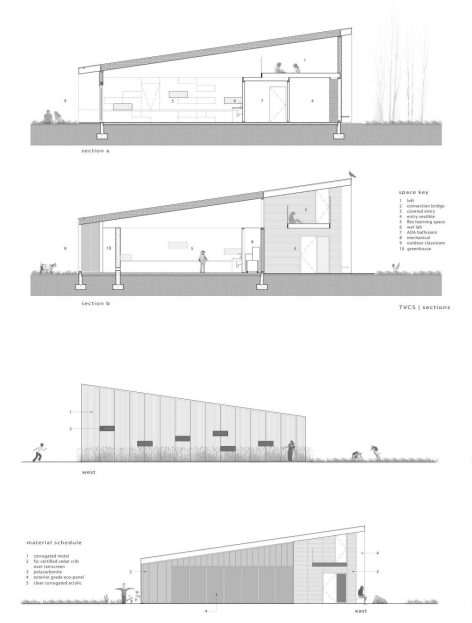
CONDITIONS OF SITE
Victor is a small, residential community surrounded by pastoral fields and gardens. Previously a rural settlement of Native Americans and agricultural workers, the town has grown since the opening of Rand Targhee Ski Area in 1969. The school embodies its context by utilizing both indoor and outdoor educational opportunities. The existing school has an organic garden, greenhouse, chicken coup, and goat barn. All students go through the "Farm and Garden" program, where they learn about planting soil, harvesting crops, composting waste, cooking fresh vegetables, preserving food, etc. Older children learn about economics while creating a business plan for an egg selling business.

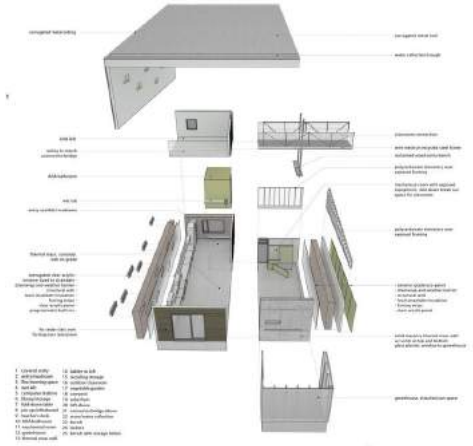
DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES
- Modular design allows for "pay-as-you-go" expansion plan. As the school gains funds, classrooms can be added easily.
- Bridge element (central room, hallway, locker space, etc.) is vital for the connectivity of the students who might be separated by age or class all day.
- Greenhouse functions as a threshold to the outdoor classroom.
- Moveable walls allow for the students to design the space. Students can form smaller spaces or remove walls to allow for a larger indoor/outdoor threshold.
- High windows reduce the amount of distractions in the classroom and cork boards function both as pin-up space and acoustic tiles, minimizing noise scatter.
- Play areas utilize natural site features (trees, rocks, beams, etc.) and drought resistant plants.
- TVCS's mission is to provide individual attention, collaborative learning, hands-on-experience, a strong connection to environment, development of personal responsibility and sense of place through real world learning, and active stewardship to community and the environment. The curriculum involves lessons enhancing connections to earth and nature. In addition to state required subjects, the students learn by working with farm animals, gardening for sustenance, and local field trips.
- The school is heated and cooled geothermally, and the mechanical systems are labeled with large, colorful lettering and are on display behind glass panels so students can understand how the building functions and operates.

TECHNICAL ASSESSMENT

CLIMATIC PERFORMANCE
- Masonry walls (thermal mass) absorbs heat from the outside
- Southern prevailing windows flushes hot air out of the classrooms and allows for natural ventilation
- Roof is properly insulated to absorb radiant heat from the metal roof
- Rain water is collected from the metal roof and can be used to irrigate the agricultural fields and organic garden.
- Uses "clearstory lighting", which responds to the directly overhead sun, that Idaho experiences, and provides maximum lighting with minimal heat gain.





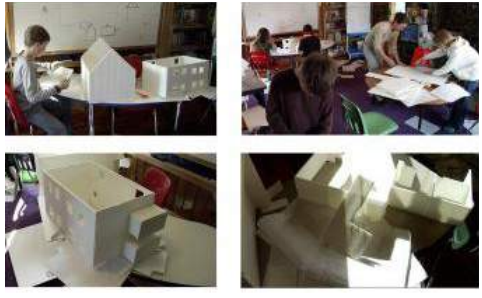
CHILDREN FROM THE TETON VALLEY SUMMER CAMP SHOW THEIR APPRECIATION FOR NATURE.

MATERIALS

Bricks (made on-site), Concrete, Wood (harvested on site), Sheet metal, Slate panels for chalkboards, Re-bar, Hardware

SERVICES

Greenhouse serves as a storage unit for irrigation water and provides greywater for flushing toilets.



CHILDREN WERE ASKED TO DESIGN A SCHOOL BASED ON WHAT THEY WANTED TO SEE BUILT. THE YOUNGER CHILDREN WERE TAUGHT HOW TO DRAW FLOOR PLANS AND THE OLDER CHILDREN BUILT 3-D MODERLS.

USER RESPONSE

WHO ARE THE USERS? INTENDED AND UNINTENDED:

Up to 120 students and a dozen faculty. The school is in fact much more than a school: the main library space is used as a community meeting space, the greenhouse is open to public use, and many summer camps take advantage of the nature gardens and recreational space.

IMPACT / RESPONSE

Teton Valley Community School strives to "educate the whole child by integrating creative expression, social responsibility and academic excellence", and this is accomplished by a supportive community.

Currently, the school is in the construction phase, in part funded by the money from the Open Architecture Network ($50,000) . The school hopes to become a prototype for other schools as well as a community hub for Teton Valley.

1.1.2 OLELESHWA PRIMARY SCHOOL

PROJECT NAME
OLELESHWA PRIMARY SCHOOL

LOCATION
Ewaso N'giro, Rift Valley, Kenya

SIZE
80 square meters

AUTHOR
ALEX RING
KARL SARKIS
GEOFFREY WASONGA

LINKS / REFERENCES
HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/HARAMBEE4HUMANITY
HTTP://HARAMBEE4HUMANITYLINKINGHANDS.BLOGSPOT.COM/

SUPPORTING FOUNDATIONS
HARAMBEE 4 HUMANITY
MAASAI COMMUNITY OF EWASO NGIRO,

HISTORY / BRIEF DESCRIPTION
The Rift Valley is home to the Maasai, a nomadic ethnic group of Kenya and Northern Tanzania. The educational system of Kenya was enforced by the English colonists, and has since been a source of tension. The Oleleshwa School strives to establish an open, malleable space for a nomadic culture, while also providing a permenant education system and community center.

CONDITIONS OF SITE
Kenya is mostly dry and hot, with very flat land. However, Rift Valley experiences a lot of humidity and wind since it is close to the coast. Drought season is often problematic and buildings must be resistant to animal stampedes.

DESIGN ASSESSMENT
DESIGN CONCEPTS, STRATEGIES AND FEATURES
- "Why four doors?" Karl and Alec are often asked. The design idea behind having four doors is to open the interior to a large outdoor learning area. The four doors create a very permeable facade and invite the outdoors to become part of the classroom and vice versa. When the classroom is used for community gatherings or celebrations, the openness is key and allows for free traffic flow.
- The windows were designed very specifically with slanted ledges to allow for water run off away from the building. The windows are three-part, with lower windows opening like shutters, and an upper window to allow for air flow. The stone walls have ridges on them that act as vertical shading devices.

PROGRAM
- Community Center and Education Facility

TECHNICAL ASSESSMENT
CLIMATIC PERFORMANCE
- Masonry wall (stone and earth bag construction) acts as a form of thermal massing.
- Double roof system acts as cooling element which provides shade and reduces the acoustic interference between the classrooms. In both school and teachers' houses the ventilation is achieved by spacious gaps in the gable end walls.
- Fabric used in the ceiling is lined with reflective material so the sunlight is reflected inside of entering and heating the interior.
- A 10 000 L water tank collects rainwater from the roof of the classroom.

STRUCTURE SYSTEMS
- Double roof system with a steel corrugated deck, wood trusses and fabric ceiling.
- Four corner pillars made out of concrete
- The walls are common clay bricks walls with exterior buttresses to resist lateral loads.
- Beams over windows, to support roof's substructure and porches were made with concrete.
- Foundation consists of large stones.

THE ROOF CONSISTS OF CORRUGATED METAL AND IS RAISED FROM THE INTERIOR ROOF BY WOODEN TRUSSES CONSTRUCTED ON THE GROUND AND THEN FASTENED IN PLACE. THE TRUSSES ARE LINED WITH TRADITIONAL SHANGA FABRIC MADE BY LOCAL WOMEN.

EARTH BAG WALL BEING COVERED BY CLAY COATING

MATERIALS

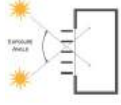
- Ceiling: corrugated steel deck, cedar trusses, and Maasai Shukas (African fabric, similar to tartan plaid
- Windows: bi-fold, louvered windows with a glass pane at the top, which can be opened to allow air flow
- Black oxide paint on a concrete wall (creates chalkboard surface)
- Walls: stone topped with "earth bags" (a form of both insulation and thermal massing. Made with burlap bags and filled with a mixture of soil and cement joined together with barbed wire. Coated with plaster create rounded edges and give the appearance of manyatta

ECONOMIC ASSESSMENT

1 complete school building for around 200 pupils 15000 USD

ROOF SYSTEM COVERED WITH INSULATED SHUKA FABRIC MADE BY LOCALS

WINDOWS WITH VERTICAL SHADING DEVICES (PROTRUDING STONE UNITS), SHUTTERS, AND AN UPPER WINDOW FOR VENTILATION



COMMUNITY INVOLVEMENT

- "We do not only want to give them a school, we want to give them one that they have helped design, build, run and grow. This will hopefully instill an ownership within the community allowing them to learn, move forward, and grow in what is currently a difficult shift for the Maasai from a nomadic society to permanent villages."
- Local architect, contractor, and labors were a part of the team. Professional architect (Alec Ring) collaborated with the locals and mainly designed the roofing system.
- By having a co-operative for the women's group, the school will be economically productive as well as symbiotic. The women will produce cloth bags (recycled materials as well as Kenyan prints) to reduce plastic in the community and the sewing of washable sanitary pads. These women will learn valuable business skills as well as give back to the school by making uniforms for the children.
- This school is symbolic in that it provides a stable and permanent structure for an otherwise nomadic culture. Built for the children and women of the community, it will emerge as a central, communal hub.

USER RESPONSE

WHO ARE THE USERS? INTENDED AND UNINTENDED:
150+ pupils, teachers, and up to 6 womens' groups

IMPACT / RESPONSE

- Eventually, Oleleshwa Primary hopes to expand to become a large community center on the school property (30 acres). A Co-operative for various women's groups will operate from it and eventually create a gift-shop to draw tourists and other school groups.
- "We are not just here to build a school but to develop a relationship between two communities" says Alec Ring.

1.1.3 PROJECT KHAYELITSHA

PROJECT NAME

EKHAYA EKASI COMMUNITY CENTER

LOCATION

Khayelitsa, Cape Town, South Africa

AUTHOR

HARVARD GRADUATE SCHOOL OF DESIGN STUDENTS:
*ASHLEY HEEREN MARCH I, *PATRICK JONES MARCH I, JESSICA LISAGOR MARCH I, DK OSSEO-ASSARE MARCH I, VANESSA PALMER MLA I, *LAURA SHIPMAN MAUDM *ANGIE THEBAUD MUP, *GENA WIRTH MLA I, ULISES DIAZ LOEB FELLOW '07, *STEVEN LEWIS LOEB FELLOW '07
(*TRAVELED TO KHAYELITSHA DURING THE SUMMER OF 2007)

LINKS / REFERENCES

HTTP://WWW.ARCHINECT.COM/FEATURES/ARTICLE.PHP?ID=65752_0_23_0_C
HTTP://WWW.LOWDO.NET/PROJECTS/PROJECT-KHAYELITSHA/
HTTP://HARVARDPK.BLOGSPOT.COM/

SUPPORTING FOUNDATIONS

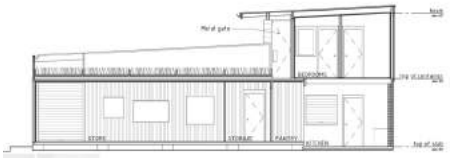
MONKEY BIZ (DIRECTOR: BARBARA JACKSON)
ARTS AID ART

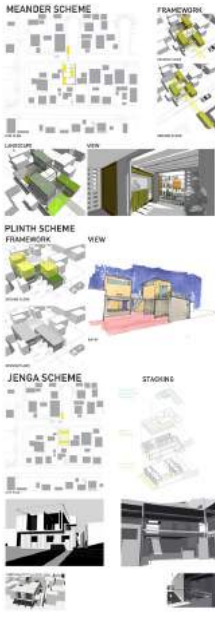
HISTORY / BRIEF DESCRIPTION

ProjectKHAYELITSHA was an effort to design and assist in construction of a new multipurpose community center in Khayelitsha, on the outskirts of Cape Town, South Africa. The site provided an opportunity to create a center that would foster a sense of community ownership and a space serving an entire neighborhood with education and development projects. This project was affiliated with Art Aids Art and MonkeyBiz, nonprofit organizations working with a South African collective of women artists to create employment and empowerment for disadvantaged women through beadwork in the township.

Security was of primary importance, given the high crime rate in the township. The team explored a variety of siting options until determining the safest option while maintaining an open configuration.

Throughout the design process, the projectKHAYELITSHA team focused on continuing research in several areas: alternative energy strategies including solar panels and passive heating/cooling, and green roof construction, in an on-site mockup (far right). The mock-up experimented with various soil/sod bases, depths, and plantings in order to determine the most effective use of the intended roof-garden.





DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

The resulting design centers around a large, flexible community room that can be opened to the busy cul-de-sac in front or, more privately, to the inner courtyard. Also on the ground floor are a boutique/salon and community kitchen, with bedrooms for guests and the green roof above.

Shipping Containers:

- In Khayelitsha shipping containers are used for everything from offices and shops to homes, this project recognizes their ubiquitous use and utilizes them in new ways. The shipping containers provide appropriate structural rigidity to most of the building as well as for the roof gardens. The rest of the building is constructed using local materials and techniques.

Vegetation:

- Used as part of the passive cooling strategies, as insulation, for water retention, and for a vegetable garden that will supply the community kitchen.

Water Retention:

- The project will apply water catchment and reuse strategies on site to help mitigate the severe environmental conditions of Khayeltisha.

PROGRAM

The students, in conversations with the community, wanted to create entrepreneurial programs to attract people from outside the township and better the quality of life of the community. The main program for the building consists of:

- 1. gallery and store for Monkeybiz,
- 2. hair styling salon,
- 3. bed and breakfast,
- 4. community kitchen/snack bar,
- 5. space for education and community events.

eKhaya eKasi community center

Khayelitsha, South Africa

eKhaya eKasi combines education and economic development, addressing local needs while achieving sustainability.

EDUCATION
Supporting healthy, self-sufficient living through adult education and early childhood literacy.

Family Literacy Program
Adults will receive instruction in read-aloud methods, with emphasis on their role as first teachers for children in their care.

Healthy Cooking
This class, our most requested, will provide training in nutritional home-cooking with affordable ingredients.

Edible Roof
Using part of the rooftop, participants will learn to raise an edible garden with limited soil, space and water.

ECONOMIC DEVELOPMENT
Four micro-businesses will make eKhaya eKasi a featured township tourism destination, generating income for local residents.

eKasi Boutique
Unique handcrafts from local collectives, including Monkeybiz Bead Project and Wired Women.

eKasi Styles
African hairstyling and facepainting.

eKasi Kitchen
Nutritious snacks and light meals featuring local cuisine.

eKasi Bed & Breakfast
Overnight lodging and authentic cultural immersion for tourists and artists-in-residence.

Ground Floor

Upper Level

SUPPORT eKHAYA eKASI
Art Aids Art invites you to participate in this historic American-South African collaboration to support women and children in Khayelitsha. We are accepting tax-deductible donations, and offer opportunities to Adopt-a-Room. Contact us for further information about adopting any of the following:

Kitchen
Boutique
Salon
Community Room
Bed & Breakfast
Edible Roof

COMMUNITY INVOLVEMENT

The team led a participatory process involving the craftswomen and community members to provide transparency and openness for the artistic design process while maintaining security. The community was engaged throughout the project and participated in charettes and exhibitions.

TECHNICAL ASSESSMENT

CLIMATIC PERFORMANCE

- The community center required natural ventilation and needed to be predominantly self-sustaining (a small garden provides much of the food cooked in the cafe for the artisans and visitors).

STRUCTURE SYSTEMS

- CMU columns
- Timber roof structure
- Maxibrick wall
- Polycarbonate roofing - allows light in
- Corrugated metal roofing
- Shipping Container
- Concrete and the upper part of big stones.

MATERIALS

Use of local/found objects to create a porous yet secures façade. The final material palette:

- Brick,
- Timber,
- Polycarbonate,
- Glass block
- Metal container work together to bring light and warmth to each space.

1.1.4 SCHOOL IN GANDO

PROJECT NAME

GANDO PRIMARY SCHOOL

LOCATION

Gando, Tenkodogo, Boulgou, Burkina Faso

AUTHOR

FRANCIS KÉRÉ ARCHITECT
SCHULBAUSTEINE FÜR GANDO E.V., A GERMAN ASSOCIATION FOUNDED BY FRANCIS KÉRÉ

LINKS / REFERENCES

HTTP://WWW.FUERGANDO.DE
HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/707
HTTP://WWW.KERE-ARCHITECTURE.COM/BF/BF_001.HTML
HTTP://WWW.AKDN.ORG/AKAA_AWARD9_AWARDS_DETAIL2.ASP

SUPPORTING FOUNDATIONS

HEVERT-ARZNEIMITTEL GMBH & CO. KG
TECHNICAL UNIVERSITY OF BERLIN

HISTORY / BRIEF DESCRIPTION

When Francis Kéré was studying abroad in Germany he realized the link between education and development and decided to build a school in his village. The aim was always helping people to help themselves, therefore the people was included in the process from the beginning.

CONDITIONS OF SITE

Gando is a village of 2,500 people in whousually live together in multi-generation houses. The village is in Burkina Faso, one of the poorest countries in West Africa. Climatically there are 2 seasons: a dry season from November until June and a short rainy season from July to October.

DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

- The school is part of a whole development project which also includes the construction of a water collection unit, teachers' housing, and latrines.
- Rooms are on pedestals and covered with a projecting roof to protect the clay walls. The rooms were planned as simple rectangular modules.
- Buttresses, which serve to brace the walls, stage a play of light and shade which communicates plasticity as well as structure.
- Teachers' houses are arranged forming a yard that imitates a traditional homestead and allow community living, but also provides a private yard to each family

PROGRAM

- Initially it was a School for 350 pupils built in 2001. Two years later houses were constructed for teachers and their families. In 2008 a second school building was finished with some improvements.
- The project is still in course, with the aim of create a library, school kitchen, healthcare centre, energy-saving clay ovens, residential houses, etc.

TECHNICAL ASSESSMENT

CLIMATIC PERFORMANCE:

- Clay walls absorb heat, moderating room temperature.
- Double roof system acts as cooling element which provides shade and reduces the acoustic interference between the classrooms. In both school and teachers' houses the ventilation is achieved by spacious gaps in the gable end walls.

STRUCTURE SYSTEMS:

- Double roof system. The lower roof was made with BTC-bricks (more compression strength by adding a small amount of cement). Local citizens made bricks with a mechanical press and placed them over a steel mesh connected with concrete roof's beams. In the second School they improved upon this method with a parabolic roof that makes bricks work better under compression.
- The walls are made of common clay bricks with exterior buttresses to resist lateral loads.
- Beams over windows, to support roof substructure
- Foundation consists of concrete and the upper part of big stones.

The roof consists of corrugated metal and is raised from the interior roof by steel truss. This allows air circulation between roofs, protects the clay building, and gives shade to the large exterior area.

Lightweight steel elements of the roof were assembled onsite, saving on logistical costs.

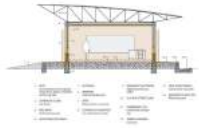
Local irrigation system.

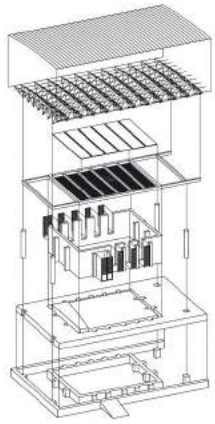
MATERIALS
Clay, Corrugated Metal Sheets, Concrete

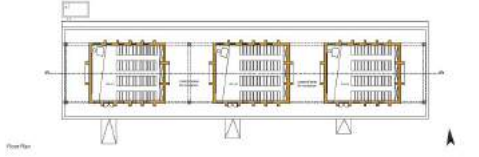
SERVICES:
Instead of watering the plant two times a day, they devised an innovative system which uses local clay pottery full of water, with a hole in the bottom of the pot. That provides a continuous irrigation directly to the ground, in order to prevent evaporation. The clay pots need to be filled just once a week.

ECONOMIC ASSESSMENT

1 complete school building for 400 pupils 70,000 USD







COMMUNITY INVOLVEMENT

- The first school serves children not only from Gando, but also students from surrounding villages. Everything was made by local people, who were trained to use handsaws and welding machines.
- Professional contribution was utilized only in the design; a local architect took the initiative to assist in the design process.
- Community members were involved since the beginning of construction. It was a cooperative effort and served as an example for two nearby villages which also built their schools through community effort.

USER RESPONSE

WHO ARE THE USERS?
500 pupils, and 6 teachers' families.

IMPACT / RESPONSE
Skills learned were applied to further initiatives in the village and elsewhere. The local authorities recognized the project's worth and continue to support it with teaching staff, as well as employ people trained during the school's construction for the town's public projects.

1.1.5 DRUK WHITE LOTUS SCHOOL

PROJECT NAME

DRUK WHITE LOTUS SCHOOL

LOCATION

La-Dakh, Northern India

AUTHOR

OVE ARUP & PARTNERS

LINKS / REFERENCES

HTTP://WWW.DWLS.ORG/
HTTP://WWW.ARUPCOM/PROJECTS/DRUK_WHITE_LOTUS_SCHOOL.ASPX

SUPPORTING FOUNDATIONS

HIS HOLINESS GYALWANG DRUKPA
DRUKPA TRUST, A UK-REGISTERED CHARITY
DRUK PADMA KARPO EDUCATION SOCIETY

HISTORY / BRIEF DESCRIPTION

The school was started at the request of the people of Ladakh who wanted a school that would help maintain their rich cultural traditions, based on Tibetan Buddhism, while equipping their children for a life in the 21st century. The masterplan and school buildings combine local building techniques and materials with leading edge environmental design to make them effective in the extreme climate.

CONDITIONS OF SITE

The Leh Valley is in Northern India near Cashmere, between two of the tallest mountain ranges, including the Himalayas. High altitude dessert of about 3,500m with strong sun exposure despite biting cold temperatures. The area is remote: the main road linking Ladakh with the rest of India is cut off by snow for at least half of each year.

DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

- PASSIVE SOLAR HEATING. The tombe wall system is painted black and the south-facing facades are double glazed to gather the sun's energy. Granite and mud walls have high thermal inertia to store gained heat.
- SUPERINSULATION. The roofs are constructed of local poplar rafters, willow sheathing topped with mud and rock wool and felt insulation. The weather skin is sand and aluminum sheets.
- AIR LOCKS. Entries to classroom buildings are all air locks to act as a buffer between winter cold and warm interiors.
- DAYLIGHTING. The classrooms are designed for optimum daylight. In the wider Nursery and Kindergarten Building, light from direct solar-gain windows is balanced by toplighting from north- and south-facing clerestories and a splayed ceiling. Typically, electric lighting is not necessary in the classrooms.
- NATURAL VENTILATION. All the rooms have well-shaded operable windows that allow natural cross-ventilation which provides a cool and glare-free high-quality teaching environment.
- MIGRATION. Courtyards between classroom buildings are sub-divided into smaller spaces appropriate for teaching during mild sunny days. Buildings and trees provide shade and wind protection to these spaces.

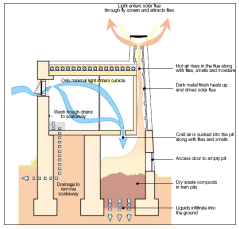
TECHNICAL ASSESSMENT

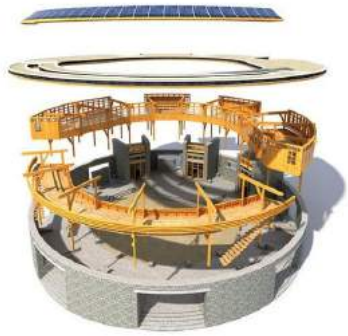
CLIMATIC PERFORMANCE:

- The goal for the school was to import no energy, maximize solar potential of the high desert, and supply and treat all water on site.

STRUCTURE SYSTEMS:

- Trombe walls made of ventilated mud brick and granite cavity walls with double glazing
- Timber portal frames to resist earthquake loads
- Timber roof structure with steel plate connections to provide large clear spans





MATERIALS:

- Solid granite blocks (used for the outer wall) from stone found on or adjacent to the site.
- Inner walls are made of local mud brick, forming cavity walls for significantly improved insulation and high durability.
- The roof is of a traditional Ladakhi mud construction, including poplar and willow from local monastery plantations, and provides good protection from the cold.

SERVICES:

- SOLAR VIP TOILET. These waterless ventilated improved pit toilets were designed to use solar-assisted stack ventilators to help create odorless compost which is an excellent fertilizer.
- SOLAR ENERGY. It uses an initial installation of 9 kWp of PV panels, which also act as external shading devices for three of the school buildings. The PV installation was 60% funded by Arup Associates, who used this project to offset their carbon footprint for 2007.

ECONOMIC ASSESSMENT

Built Area: 1,240 sqm
Cost: USD 424,810

COMMUNITY INVOLVEMENT

- Local construction techniques were employed, maximizing the potential of local community involvement.
- Tourists worked along side local community in construction.

USER RESPONSE

WHO ARE THE USERS?

750 pupils from nursery age to 18 years old

IMPACT / RESPONSE

- The school is concieved as a model for appropriate and sustainable development in Ladak.
- It won World Architecture Awards in 2002 as Best Education Building of the Year, Best Green Building of the Year (joint winner), and Regional Winner—Asia

1.1.6 TEKSING BAMBOOWOOD SCHOOL

PROJECT NAME
TEKSING BAMBOOWOOD SCHOOL

LOCATION
Teksing, Nepal

AUTHOR
DESIGN TEAM: PETR KOSTNER, MARTINA SOBOTKOVÁ AND SOŇA HUBEROVÁ

LINKS / REFERENCES
HTTP://TECH.NEPALKO.INFO/2009/07/OPEN-ARCHITECTURE-CHALLENGE-FINALISTS-ANNOUNCED/
HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/4064

SUPPORTING FOUNDATIONS
ORIENT GLOBAL
ARCHITECTURE FOR HUMANITY

HISTORY / BRIEF DESCRIPTION
Teksing Primary School is an expansion of an existing building that needed more space and more teachers. The school is large enough for 40-50 students per class. By enlarging the classes and providing education up to Year 10, the school strives to help limit the rural-to-urban migration. By inforcing education and pride in the local town, the school will become an example to other rural communities in Nepal.

CONDITIONS OF SITE
Teksing is in a remote location and has no access to a power grid or water source. The topography is rough and the climate is subtropical; long, hot summers and high humidity and mild rainy seasons.

DESIGN ASSESSMENT
DESIGN CONCEPTS, STRATEGIES AND FEATURES
- The vernacular architecture of Nepal, including material, construction, typology, etc. were studied in the initial design phases as a starting point. The architects then tried to re-think certain elements of vernacular principles to increase the quality and comfort of the school environment.

PROGRAM
- Education Facility - Secondary School

TECHNICAL ASSESSMENT

MATERIALS
Because of the remoteness of site, the design tries to avoid using foreign construction materials. All materials are local and "vernacular" for practical reasons and to raise appreciation for the traditional architecture.
Concrete: Typically used for foundation (poured over stones, forms basment and floor of current school buildings. However, cement has to be imported from the city so the builders avoided using it. Instead, hewn stone flooring was laid into sand or clay bed. Concrete ring beams can be replaced with linear members made of bamboo or wood.
Stone: Usually used for masonry walls. Stone was accessible locally from nearby landslides.
Rammed earth: Rammed earth, along with cob walling, is a traditional way of construction in Nepal. The result is very durable, has good load-bearing capacity, and is a good alternative to stone masonry since dirt is more readily available than stone. However, rammed earth is highly susceptible to corrosion when wet or untreated so the walls are only situated in areas that are shielded from the rain.
Bamboo: Bamboo is an indigenous plant and is sustainable since it grows quickly. Bamboo is very lightweight and flexible as well as strong in tension.
Wood: Not widespead, but some random patches of trees grow on the site and were used in construction. Reed grass was also considered since it is traditional in Nepal construction; however, it has a shorter lifespan than wood and is highly flammable.
Corrugated iron: In recent years, traditional grass roofing has been replaced by corrugated metal, even though it is an imported material. It is quick to mount and can also be used as formwork for rammed walls. Gravel and grass is still placed over metal roof to reduce the noise distraction when it rains. Steel was considered, but imported steel is highly dependent on political stability.

SERVICES
Without water, a power supply, or access to any efficient fuel resources, the school embraces a "zero technology" philosophy. The school only operates during the daytime so there is no need for artificial lighting.

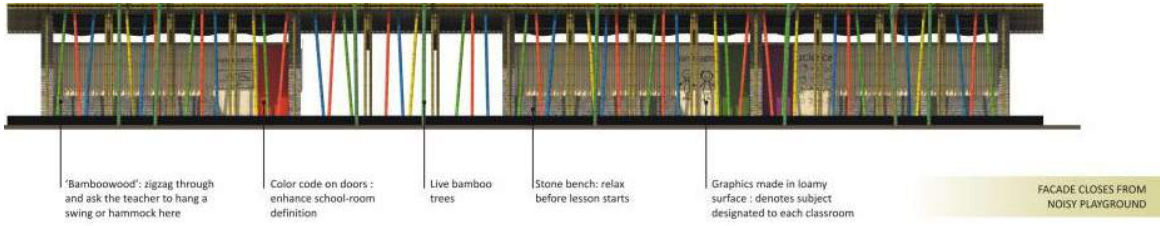
COMMUNITY INVOLVEMENT

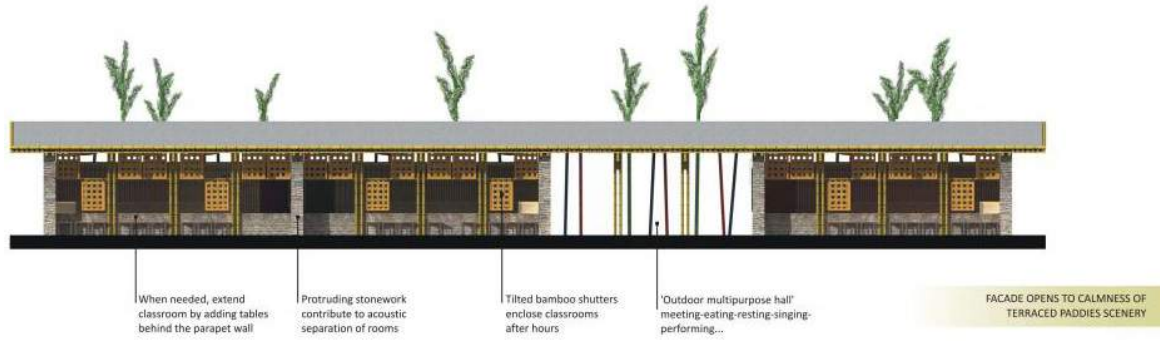
The village has no professional craftsman since everyone must know to repair one's own home. This project took advantage of enlisting everyone's help for maximum local community participation, sustainability, and affordability.

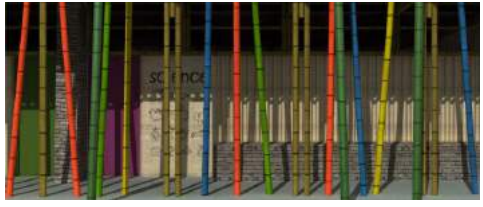
USER RESPONSE

WHO ARE THE USERS?
300 students (ages ~ 12-16) and teachers

IMPACT / RESPONSE
Although not yet built, the Teksing School has attracted a lot of attention due to its status as a finalist in Open Architecture Competitions: Classroom. The designers hope that this school can be a prototype for other schools in the area, and prevent education from suffering in rural regions of Nepal.







1.1.7 NADUKUPPAM COLONY WOMEN'S CENTER AND BALWADI

PROJECT NAME

NADUKUPPAM COLONY WOMEN'S CENTER AND BALWADI (NCWCB)

LOCATION

Auroville, Tamil Nadu, India

AUTHOR

ARCHITECT: PURNIMA MCCUTCHEON
PROJECT AND COMMUNITY COORDINATORS: PITCHANDIKULAM BIO RESOURCE CENTER

LINKS / REFERENCES

HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/1162
HTTP://ARCHITECTUREFORHUMANITY.ORG/ NODE/838

SUPPORTING FOUNDATIONS

ARCHITECTURE FOR HUMANITY

HISTORY / BRIEF DESCRIPTION

The aim of this project was to provide a place for: a local association, called the Women's Self Help Group; a training center for women empowerment; and a day-care center for children. The community realized that this building could hold a significant amount of meaning, and they placed a lot of attention on developing other programs that the building could facilitate, such as support groups, town meetings, literacy classes, etc.

CONDITIONS OF SITE

Auroville is located in the north-east region of India, in the state of Tamil Nadu. It was founded in 1968 and has a population of around 2,000 people. The site is adjacent to a large banyan tree, perfect for shade in the hot sun. The climate is tropical: hot with a monsoon season from October to December.

DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

The building is 40 square meters; enough for a small meeting place but still adherent to the small budget. An older building existed adjacent to the new building, and it was included into the design as a restoration project. To maximize sustainability and minimize costs, the building uses passive technology and locally available materials. Specific features include:

CSEB: The building is primarily constructed using CSEBs (Compressed Stabilized Earth Bricks). Local workers use a manual press to compress raw soil with stabilizers to create the bricks, which have a curing time of 4 weeks. CSEBs are biodegradable, nonpolluting, made from local material, and a good source of thermal massing in cold weather.

NATURAL VENTILATION AND LIGHT: a lofted, mangalore terracotta tile roof over the Balwadi is similar to a gable roof. It is multi-level and split at the ridge with a protected opening to let in indirect light and air for ventilation.

FENESTRATIONS: the windows are secured with grills and have metal screens for light and air can enter, while insects cannot.

TOILETS: a toilet for the teachers and adults is provided and adjacent, another toilet exists for the children. Shaded by bamboo and a low wall, the toilet is a necessity and an opportunity for education about personal hygiene.

OUTDOOR MEETING SPACE: large stones were laid flat over compacted soil to create an outdoor shelter, shaded by a bamboo roof. The space is soothing and comforting and can be used except in very wet weather.

PROGRAM

The building is divided into 3 areas, based upon the programmed uses:

1. Southern Entry Area: includes the covered space and the renovated storage room.
2. Central Multipurpose Hall: a space for creative play, focused in an interaction between learning and productivity.
3. Northern playground, courts, and toilets.

DETAILED IMAGE OF THE ROOF (SHOWS CORRUGATED DECKING, WOODEN FRAME, AND CSEB WALL WITH GAPS FOR AIR VENTILATION AND LIGHT PENETRATION.

TECHNICAL ASSESSMENT

STRUCTURE SYSTEMS

- The clay roof tiles are supported by a wood frame, corrugated decking, and masonry columns.
- Masonry (CSEB) walls are self-supporting and allow for large windows spaces for natural lighting.

MATERIALS

Compressed mud bricks, tile flooring, clay roof tiles, timber framing, recycled glass mosaic, bamboo trills with coir connections, stone taken from the site, and CSEBs (Compressed Stabilized Earth Bricks).

ECONOMIC ASSESSMENT

1 complete school building for $ 5,436

COMMUNITY INVOLVEMENT

- A labor team of 25 was hired. An additional labor team of 20 was hired to produce the CSEBs (Compressed Stabilised Earth Blocks). These masons not only gained valuable skills and received payment, but now earn a consistent income with acquired skills and teach them to others as far away as Chennai city (160 kilometers away).
- The balwadi strives to generate income through facilitating direct low interest loans from the State Bank, training in medicinal plant use and cultivation, organic farming principles, health and hygiene awareness, and family planning. Several classes for adults are hosted at the NCWCB including tailoring courses, nursery training, and local investment in ecologically sustainable initiatives. Education combined with vocational training generates income and enforces economic self-sufficiency.

USER RESPONSE

WHO ARE THE USERS? INTENDED AND UNINTENDED:

Balwadi: 30 children, 11 boys and 19 girls, ages 3 to 5 years (daily)
WSHG members: 20 women, 24-40 years old (3 times a week)
40 WSHG Federation members, married women, ages 25-50 (once a month)
25 Children's Parliament members, children ages 11 to 14 (once or 2 times a month)
50 Community members, male and female, all ages (once a month)
1 Literacy teacher, male, age 30
1 Balwadi teacher, female, age 30

IMPACT / RESPONSE

Overall, the aim of the project is women empowerment. Furthermore, the community has been strengthened and many local workers have benefitted from the training that the NCWCB now supplies.

1.1.8 METI - HANDMADE SCHOOL

PROJECT NAME

METI – HANDMADE SCHOOL

LOCATION

Rudrapur, Dinajpur district, Bangladesh

AUTHOR

DESIGN / CONCEPT: Anna Heringer
TECHNICAL, DETAILED PLANNING: Anna Heringer and Eike Roswag
STRUCTURAL ENGINEERING: Dr. Christof Ziegert, Uwe Seiler
CONSULTING, BUILDING SUPERVISION AND TRAINING OF WORKERS IN BAMBOO CONSTRUCTION: Emmanuel Heringer (basket weaver and carpenter) and Stephanie Haider (blacksmith)

LINKS / REFERENCES

HTTP://WWW.ANNA-HERINGER.COM/
HTTP://WWW.METI-SCHOOL.DE/DATEN/ENTWICKLUNG_E.HTM

SUPPORTING FOUNDATIONS

Dipshikha/ METI (Modern Education and Training Institute)
Bangladesh in cooperation with Partnerschaft Shanti – Bangladesh and the Kindermissionswerk Aachen

HISTORY / BRIEF DESCRIPTION

Rudrapur lies in the north of the most densely populated country on the earth. Poverty and lack of infrastructure drive many people from the countryside into the cities. The local NGO Dipshikha attempts to follow new paths with its development program: the intention is to give the rural population perspectives and to help people learn about the value of the village in all its complexity. Part of this is a special school concept that instills in its students self-confidence and independence with the aim of strengthening their sense of identity.

CONDITIONS OF SITE

Bangladesh is one of the most densely populated countries on Earth. Each year, large amounts of agricultural land is lost to development. This school aims to preserve local building techniques (use of bamboo and loom) as well as preserve the strong ecological aspect of the vilage.

IN BANGLADESH, A STRONG CONTRAST EXISTS BETWEEN URBAN AND RURAL LIFE

DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

- The school is two stories. The ground floor is dimly lit, with earthen caves and tunnels that create intimate spaces for the children. The second floor is open, airy, with bamboo shutters that let in plenty of natural light. The second floor is malleable and is often divided into two or three seperate classroom spaces.
- These "caves" become an interface between the inside and outside and are crucial to the development of children's sense of space and exploration.
- Footprint: 275 m2
- Floor area: 325 m2

PROGRAM

- Primary School / Business Cooperation

PLAN AND SECTION SHOWING CAVE AND TUNNEL SPACES.

IN MANY INSTANCES, BAMBOO IS MORE APPROPRIATE THAN WOOD OR STEEL. IT IS EXTREMELY LIGHTWEIGHT AND HAS A HIGH ELASTICITY AND TENSILE RESISTANCE. ESPECIALLY IN TROPICAL CLIMATES, WHERE MOISTURE PLAYS A BIG ROLE, BAMBOO'S BENDING AND SHEARING PROPERTIES MAKE IT VERY USEFUL. (TOTAL OF 2300 BAMBOO STICKS USED!)

TECHNICAL ASSESSMENT

CLIMATIC PERFORMANCE

- Thick, flowing sharis fabric line the doors of the ground floor. They keep out critters and heat but let in a nice breeze to allow for air circulation.
- The school is elevated off the ground to prevent any flooding during the rain season, and rain water is collected from the roof.
- A vertical garden facade shades the openings in the walls and also protect the earthen walls from erosions. While being an interactive learning surface for the children, it also helps reduce the indoor temperature through evaporation and helps create cleaner air.

STRUCTURE SYSTEMS

Foundation and walls are made of Earth through a process called cobwalling or "Wellerbau". Wet earth is mixed with straw and applied to a wall in layers. Each layer is dried and trimmed to create a regular, flat wall surface. The Earth from this area is well suited for this process and can be made more stable with the addition of more straw, rice, or jute.

The ceiling is comprised of three layers of bamboo poles arranged perpendicularly to each other with bamboo boards and earth for the flooring. The frame construction of the walls and roof are layers of bound together bamboo poles (acts as beams), vertical bamboo posts and diagonal bamboo members. The joints are made with nylon lashing and steel pins.

MATERIALS

Strong emphasis on local materials to reinforce socio-cultural pride: Earth, straw, bamboo sticks, nylon lashing, and sharis (fabric).

ECONOMIC ASSESSMENT

Donations are asked for in the following ways:
10 Euros = 1 tree
20 Euros / month = Scholarship for a student
70 Euros = Further education course for a teacher
150 Euros = training for an unemployed person to give them a perspective and skills needed for the future

Total Cost = $22,835

COMMUNITY INVOLVEMENT

- Construction period: 6 months (September to December 2005, March to April 2006)
- Construction team was roughly fifty percent professional (from Austria/ Germany) and fifty percent local.

USER RESPONSE

WHO ARE THE USERS? INTENDED AND UNINTENDED:

500 pupils, parents, faculty, and various business co-operations.

IMPACT / RESPONSE

"Architecture is a tool to improve lives.
The vision behind, and motivation for my work is to explore and use architecture as a medium to strengthen cultural and individual confidence, to support local economies and to foster the ecological balance. Joyful living is a creative and active process and I am deeply interested in the sustainable development of our society and our architecture. For me, sustainability is a synonym for beauty: a building that is harmonious in its design, structure, technique and use of materials, as well as with the location, the environment, the user, the socio-cultural context. This, for me, is what defines its sustainable and aesthetic value."

Anna Heringer

1.1.9 DWABOR KINDERGARTEN

PROJECT NAME

DWABOR KINDERGARTEN

LOCATION

Ghana, Africa

AUTHOR

ARCHITECT: ARUP, DAVID LANGDON
A-KON CONSULTANTS (GHANA)
ATELIER (GHANA)

LINKS / REFERENCES

HTTP://WWW.ARUP.COM/PROJECTS/DWABOR_KINDERGARTEN.ASPX

SUPPORTING FOUNDATIONS

SABRE CHARITABLE TRUST (A SMALL CHARITY WORKING TO IMPROVE EDUCATION PROVISION IN THE KEEA DISTRICT OF GHANA) IN PARTNERSHIP WITH THE MUNICIPAL EDUCATION OFFICE

HISTORY / BRIEF DESCRIPTION

Designed for a remote region of Ghana, the structure is modular and scalable to serve as a prototype for 30 or more schools in the district. Arup, symbolically, hoped to establish a strong sense of community involvement so that the school would be innovative, sustainable, but also site-specific and contextually intimate.

DESIGN ASSESSMENT

DESIGN CONCEPTS, STRATEGIES AND FEATURES

- The Dwabor kindergarten is a modular, scalable design in hopes to become a prototype design.
- While located in a hot climate, the building is focused on maximizing daylight and ventilation while minimizing heat and noise to allow for a comfortable learning environment.
- Local and sustainable materials are implemented whenever possible.
- The metal roof collects rainwater for reuse. Coconut husks line the inside to reduce noise from rain.
- Colorful slatted bamboo windows pivot to let in light and air, without any glare.
- Soil-stabilized blocks were used for the walls: proven to be stronger than concrete blocks. Pozzolana made from fired palm kernels replaced Portland cement, reducing cost and environmental impact.
- Outdoor classrooms transform the natural environment into a teaching aid for children.

PROGRAM

- Kindergarten school: flexible inside space for activity-based learning and learning through play as well as "outdoor classrooms".

A NORTH-SOUTH ORIENTATION IS KEY TO MINIMIZE THE INTENSITY OF THE HOT GHANA SUN.

COMMUNITY MEMBERS HELPING WITH SITE EXCAVATION AND THE FORM WORK FOR THE FOUNDATION.

NATURAL LIGHT AND AN OPEN, AIRY SPACE IS IDEAL FOR THE CLASSROOM SETTING.

ABOVE: IMAGES SHOWING THE PIVOTING BAMBOO WINDOWS.
LEFT: HARVESTED BAMBOO, READY TO BE ASSEMBLED BY LOCAL LABORERS.

TREES CUT DOWN DURING SITE PREPARATION WERE CUT IN TO SECTIONS AND USED TO MAKE A PLAYFUL WALKWAY.

Jo da Silva, Arup's head of international development, comments:
"With the input of local people, we've created a model which can be adapted throughout the region to vastly improve access to education. The project demonstrates how global design expertise and local knowledge can combine to change the lives of this and future generations."

1.1.10 THE YELLOW SUBMARINE

PROJECT NAME
THE YELLOW SUBMARINE

LOCATION
Tongo, Segou, Mali

AUTHOR
ARCHITECT: MARY ALTHOFF, AND ARCHITECT FOR PEACE CORPS VOLUNTEERS.

LINKS / REFERENCES
HTTP://OPENARCHITECTURENETWORK.ORG/PROJECTS/TONGOSCHOOL
HTTP://WWW.MARYALTHOFF.COM/TONGOSCHOOL.HTML
HTTP://MARY-IN-MALI.BLOGSPOT.COM/
HTTP://ARCHITECTAFRICA.COM/MALI-SCHOOL-IN-TONGO

HISTORY / BRIEF DESCRIPTION
This project emphasises the collaboration between Peace Corps volunteers and the local community as they serve to construct a new 6-room schoolhouse for the village of Tongo, Mali.

CONDITIONS OF SITE
Tongo is a small village located 50 kilometers southeast of Segou in Mali. The population is less than a thousand inhabitants, made up primarily of the Bambara ethnic group. There is no electricity or running water in the area and most families survive on a small income from subsistence farming of millet, corn, and peanuts. The West African climate has two seasons: a dry season and a wet season. The wet season consists of an average of 500 mm per year, but more importantly, monsoons affect the area. The Harmattan, or the West African trade wind across the Sahara and in to the Gulf of Guinea, is dangerous and comparible to a dense fog since it picks up and carries fine dust and sand particles.

ECONOMIC ASSESSMENT
1,800 square feet complete school building = 35,000 USD

EARTH BRICK WALL IN
CONSTRUCTION WITH GAPS.

ABOVE, MOVING CLOCKWISE:
SLATTED WINDOWS THAT CAN BE CLOSED OR PROPPED TO ALLOW FOR MORE LIGHT AND AIR CIRCULATION. FRONT FACADE WITH EARTH BRICKS AND CIRCULAR VOIDS FOR THE WINDOWS. SEMI ENCLOSED AREA WITH A BENCH FOR PLAY WHEN ITS TOO HOT IN THE SUN.

BOTTOM: THE CISTERN, CONNECTED
TO THE SLOPED ROOF FOR STORING RAINWATER THROUGHOUT THE YEAR.

TECHNICAL ASSESSMENT

CLIMATIC PERFORMANCE

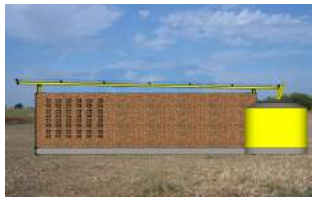
- On top of each wall, a gap between the roof and the top block allows cross ventilation inside the space.
- The roof is sloped sufficiently enough to collect rainwater.
- Circular windows can be propped open to increase air circulation.
- Walls are constructed of earth blocks, and some are constructed with gaps to allow light penetration and interface with the outside.

SERVICES

- The harvest rainwater system allows for the storage of water in two yellow cisterns (tanks), inspiring the name for this school. In the dry season, the garden is irrigated with collected water.

MATERIALS

- Compressed earth bricks (for walls and foundation) were made by using a manual press machine
- Corrugated metal sheets (used for roof)
- Steel truss (Used for roof)
- Reinforced concrete for the columns



1.1.11 CASE STUDY: GHANA SCHOOL LIBRARY INITIATIVE

PROJECT NAME

GHANA SCHOOL LIBRARY INITIATIVE

LOCATION

Accra, Ghana

AUTHOR

ENGINEERS WITHOUT BORDERS, PRINCETON UNIVERSITY CHAPTER

LINKS / REFERENCES

HTTP://WWW.DOSOMETHING.ORG/PROJECT/THE-GHANA-SCHOOL-LIBRARY-INITIATIVE
HTTP://WWW.PRINCETON.EDU/~EWB/GHANA_FILES/GHANA%20SCHOOL%20LIBRARY%20INITIATIVE%20-%20FULL%20PROPOSAL.PDF

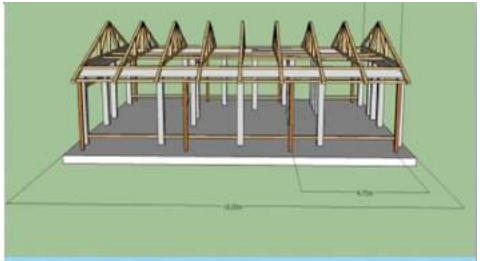
SUPPORTING FOUNDATIONS

Asheshi University College
Osu Children's Library Fund
Volta Realty

HISTORY / BRIEF DESCRIPTION

For the last 16 years, Ghana has "enjoyed a strong democratic government and a growing economy". However, the Engineers Without Borders team fears that this could be "dimmed" if its education system isn't strengthened. Only 72% of children attend primary school, 60% of school teachers are trained, and there is a lack of access to computers and information technology. In response, the team came up with a proposal for a School Library Initiative that will focus on English language fluency and digital literacy.

"...they must gain improved English-and computer literacy skills. By intervening in the education of these children early, EWB-Princeton believes that we can make definite improvements in their livelihoods for the future."



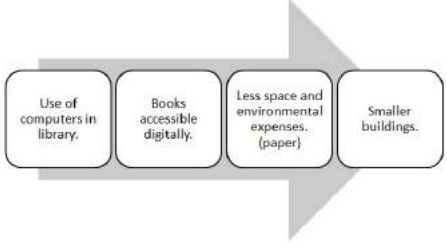
Student from Engineers Without Borders, Princeton Chapter Team, during a visit to the site.

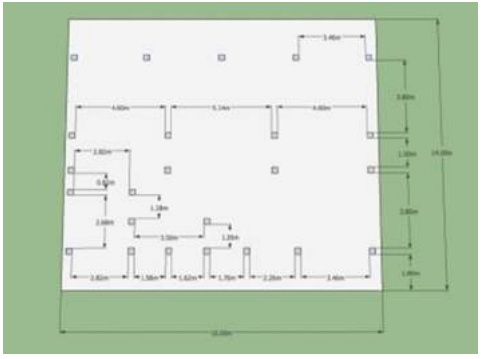
DESIGN ASSESSMENT

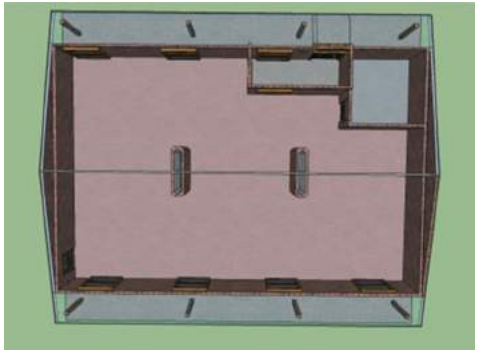
- The design of the structure is fairly simple. It is based on a simple column grid, and gabled roof and a series of trusses as structure.

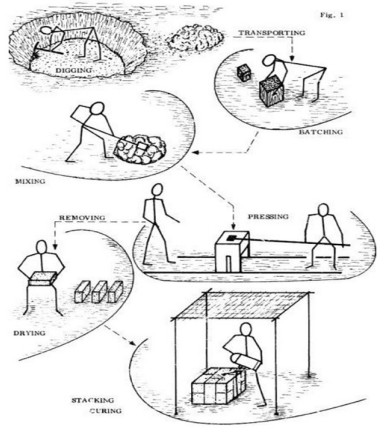
PROGRAM

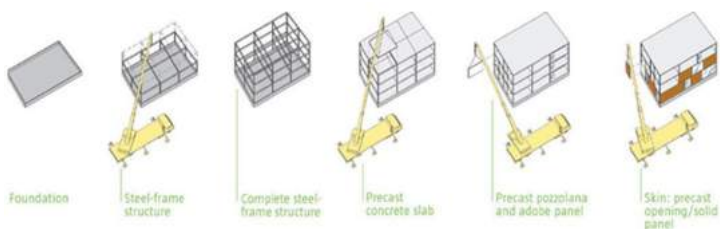
- The school/library is intended to broaden students' knowledge of English language fluency and literacy. Also, it is meant to help students associate themselves with technology, computers, and the internet. The library will have a collection of 1000 English books, supplemented by 20-25 computers.
- Why a library? The Engineers without Borders team believes it is a cost-effective tool toward improving literacy and reducing poverty.
- The design of the school emphasizes the use of computers. The team believes that computers will reduce the number of books the library holds by providing digitally accessible books. This provides the opportunity to reduce environmental expenses and space, thus the building itself may be smaller and more simply supported.











SERVICES

Buildings are usually constructed of concrete blocks and have 6" to 12" thick walls. Natural light and ventilation reduced need for electricity. For computers, energy usage would come from hydropower (95% of Ghana's electricity production)

MATERIALS

Louvered windows, ceramic floors, fiber cement roof. Block walls made of laterite clay with 5% concrete mixed in.

POZZOGHANA

One of the most interesting features of this project is the innovative use of material for its foundation. The Engineeers Without Borders Team decided to use a different material to reduce cost: Pozzoghana. Pozzoghana was engineered because of rising costs for importation of portland cement. It was developed by architects Stephen Kanner and Joe Ado (from Ghana) and tested in a twenty-year effort. It is a variation of pozzolana ash that stretches the use of a portland cement bag up to 30%. It is comprised of clay soil from the construction site, topsil (which does not require strip mining), palm tree kernal caps (waste from palm oil production). The installation and pouring of pozzoghana is very similar to pozzolana. However, its components make it a very efficient alternative to aid in the building's sustainability.

1.2.1 TEDDY BEAR CRÉCHE

AUTHOR University of Art, Linz

LOCATION Orange Farm, South Africa

YEAR 2006

USERS
- 3 teachers
- 1 gardener
- 1 cook
- 150 children

PROJECT DESCRIPTION
Teddy Bear Creche was built in 2006 at a time when there was very little growth on the land surrounding the area. The site is subject to harsh winds and storms.

PROJECT COST
The project cost is unknown. Since the University of Art, Linz, was unable to raise enough funds to construct the office and sickbay area, Thembi - the headmaster of the creche - stepped in to raise funds to complete the rest of the building on her own with the help of the community.

DONORS + SPONSORS
(Unknown)

COMMUNITY AND LABOR
During this project, there were about 20 unskilled laborers from the community and an additional 20 students from the university. This generated exchange and the community volunteer laborers obtained a certificate at the end of the project.

TOP VIEW OF THE NORTH-FACING BUILDING. THE PINK BUILDING IS THE EXTENSION FOR WHICH THEMBI RAISED FUNDS.

BOTTOM-LEFT VIEW OF THE TWO STRUCTURES WITH OUTDOOR AREA
BOTTOM-RIGHT NORTH ELEVATION DEFINING THE EXTENSION BUILDING ON THE RIGHT.

MATERIALS

- Concrete Floor
- Concrete bricks
- Compacted Clay and Gravel Wall
- Corrugated Tin Sheets
- Sealed Timber
- Plaster
- Steel Brace Cables
- Fiber Glass Insulation
- Canvas
- Steel Security Doors with Bars
- Used Tires
- Metal Window Grilles
- Glass Window with Wood Frame
- PVC pipes for windows
- IBR sheets

NOTABLE MATERIALS

EARTH WALL

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Soil and gravel is relatively cheap. Soil is obtained from site excavation reducing logistical cost.	Cost of transportation of gravel needs to be covered. However, soil mix can be obtained on site from excavations.	The wall is durable when it is not exposed to water or suffer from water infiltration due to leakages. The wall is relatively easy to maintain.	The wall is non-toxic. However, children tend to pick the gravel out of the walls. This can be easily overcome if the clay part was out of reach.	Locally found material. Using soil from site reduces energy for production and transportation.	The reddish brown color of the clay with the gravel mix can create warm pleasant spaces. With an innovative gravel mix, the clay-gravel wall does not look like a mud hut.

CONCRETE BRICKS

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Easily available. Local laborers are familiar with masonry construction.	Depending on the source, cost may vary. Because of high availability, cost will be low. It is easily transportable because of its size and modular forms.	Highly durable if constructed properly. It will require good mortar and proper masonry skills.	It is not usually compatible because of the water soluble composition. It can be used for external purposes.	It is not a green product. Its low cost and efficient construction can allow for more innovations. More sustainable variations of masonry can also be used.	They can be appealing when employed appropriately. Although it is associated with the RDP or public structures, it is accepted as a permanent and solid structure.

CANVAS ROOF COVER

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Commonly found.	It is easily transportable.	Canvas is fairly durable. It is also easily replaceable when broken.	It is non-toxic and gives soft texture to spaces.	Light-weight material and can be used for ventilation purposes while defininf space.	(none)

CANVAS ROOF COVER

PIPE FOR WINDOW

CONNECTION DETAILS

DESIGN ASSESSMENT

PROGRAM / PERFORMANCE	CLASSROOMS	KITCHEN	ABLUTIONS	OFFICE + SICK BAY	PLAY SCAPE / LANDSCAPE
DESIGN / AESTHETICS / CHILDREN / MATERIAL USE	There is adequate space for classroom activities. Different colored doors denote classrooms. They are conventional rectangular spaces.	The kitchen was built after the university. It is a corrugated metal shack that lacks proper ventilaiton and lighting.	Toilet is spearated into boy (blue), girl (red) and adult or staff (yellow). It is at the back of the builiding facing East, separated from other classrooms for hygenic reasons.	Office space was built by the community and Thembi, the headmaster. An internal window from the office to the classroom, allows her to oversee ongoing activities.	The playscape is one of the most engaging. The used tyres interact with the children very well. They also use it to roll around and for competitive races.
SUSTAINABILITY / CLIMATIC / VENTILATION / ECOLOGICAL	The classtooms on the northside can open to the outdoors and receive a good amount of sunlight. The southern classrooms get really cold in the winter because it is shaded.	The temperature inside the kitchen gets really hot especially in hot and sunny days.	Toilet uses conventional Water Closet flush toilets. Conventional toilets uses up lots of water and may not be sustainable.	(conventional)	There is little vegetation and shade in the play scape. The vegetable garden grows spinach and olives but it does not receive enough sunlight being on the South side.
FUNCTIONALITY / STORAGE / USER RESPONSE	Classrooms lack storage spaces in general. There is a separate food and computer storage area that required extra security. This resulted in the loss of clasroom space.	There is not enough room for the large pots in the kitchen. Because it is lower than the other buildins, water also comes in to the kitchen during rain.	There are 8 children toilets total, 7 sinks and 1 adult toilet. It has adequate capacity.		During hot sunny days, children prefer to stand by the shade or hide under the shaded parking area.

BUILDING SYSTEMS

BUILDING SYSTEM	DESCRIPTION
FOUNDATION	Reinforced concrete, slab-on, grade foundation The surrounding site is covered in gravel
WALL SYSTEMS / ENVELOPE	Mainly conventional concrete masonry bricks Compacted clay-gravel wall system for aesthetics
FLOORS	Sealed concrete floors
ROOF SYSTEM	Simple timber truss system with corrugated tin Canvas material covers double-roof system
CEILING	Some ceiling is bare corrugated metal In classrooms, ceiling is covered with plywood
INSULATION	There are no envelope insulation Fiber glass wool insulation on the roof
WINDOWS	Windows are on the N-S side for ventilation Little light comes into the office and classroom
DOORS	Colored wooden doors Additional steel security doors are required for external doors
PLUMBING	Standard toilets and sinks with PVC pipe connected to main water line and sewage line
LIGHTING	Standard fluorescent tubes or bulbs Daylighting is low, especially on South classroom
FINISHING	Paint over plastered concrete walls Wood veneers on plywood ceiling

FEATURES

CONSTRUCTION + DESIGN

- Cross-bracing of timber frame keeps structure in place during storms
- Canvas covers double roof system to prevent birds

ISSUES

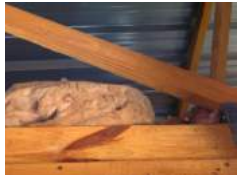
- The school enrolled more than 80 children due to high demand and compromised the productivity of the classroom spaces.
- Children picked at the gravel of the wall, eroding materials and compromising integrity
- Not enough money was raised for the school - kitchen and office spaces were compromised first
- Rainwater was not channeled to stormwater pipe and leaves surrounding site wet during rain
- Parallel layout of buildings copromise solar access of southern building
- Lack of shade in outdoor spaces

POTENTIAL STRATEGIES

- Canvas is a great material to prevent birds from nesting in the double roof structure.It provides shade, ventilation, and is lightweight and durable
- Corrugated tin can be a wall system, creating more material palette for wall design
- Create spaces where children can hang their bags and put on their shoes
- Generate outdoor spaces that are shaded - through vegetation or through large overhangs which blend indoor and outdoor spaces





1.2.4 EMMANUEL DAY CARE CENTER

AUTHOR Technical University of Vienna
YEAR 2006
WEBSITE http://twoday.tuwien.ac.at/emmanueldaycare
LOCATION Orange Farm
STAFF AND STUDENTS

- 3 teachers
- 1 security
- 1 gardener
- 1 cook
- 100 children

PROJECT DESCRIPTION
Emmanuel Day Care Center - an entirely new facility replaced a pre-fabricated shack to accommodate many more children, with adequate play and sleep areas.

PROJECT COST
The project cost is unknown. After construction, the school was facing financial difficulties. Fortunately in recent years, Hollard Insurance has adopted the facility and finances the maintenance.

DONORS AND SPONSORS
Hollard Insurance

COMMUNITY AND LABOR
(Unknown)

TOP
THE MAIN CLASSROOM WITH A MEZZANINE

BOTTOM LEFT
VIEW OF THE CORRIDOR WITH BUILT-IN SEATING BY THE WALL

BOTTOM RIGHT
EASTERN BUILDING WITH BRIE SOLEIL INTO THE PLAY ROOM

BUILDING SYSTEMS:

BUILDING SYSTEM	DESCRIPTION
FOUNDATION	• Reinforced concrete, slab-on-grade foundation • The surrounding site is covered in gravel
WALL SYSTEMS / ENVELOPE	• Corrugated metal cladding with plywood panels • Wood horizontal strip cladding that becomes brise soleil in some parts of the building
FLOORS	• Sealed concrete floors and floor carpets
ROOF SYSTEM	• Timber frame system with corrugated metal sheeting • Ventilation cut-outs on corrugated metal
CEILING	• Ceilings are covered with plywood panels
INSULATION	• Vapor barrier
WINDOWS	• There are a number of operable windows • Large, inoperable corner windows allow for day-lighting without the need for clerestories
DOORS	• Sliding patio doors open to the semi-outdoor space and corridor
PLUMBING	• Standard toilets and sinks with PVC pipe connected to main water line and sewage line
LIGHTING	• Daylighting performance is adequate • Standard fluorescent tubes where/when needed
FINISHING	• Plywood finish for interiors • Exterior paint is done annually by Hollard Insurance as part of their CSR program

NOTABLE MATERIALS

CORRUGATED METAL SHEETS

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURAL SYMBOLISM
Corrugated metal is widely available. They are sometimes sold in the local market pre-fabricated and made ready for shacks or homemade extensions	Transportation cost is low because of its high availability	With proper detailing, corrugated metal sheets can last a long time. It has to be painted and maintained. However, it is easily replaceable	Proper detailing should prevent sharp edges of the metal sheets from endangering children.	It is not ecologically sustainable per se. However, it is a material that can support small local businesses.	When used creatively as roof or cladding, it can produce impressive results. Be wary of its associations with shacks and poverty.

CONCRETE BRICKS

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURAL SYMBOLISM
Easily available. Local laborers are familiar with masonry construction.	Depending on the source, cost may vary. Because of high availability, cost will be low. It is easily transportable because of its size and modular forms.	Highly durable if constructed properly. It will require good mortar and proper masonry skills.	It is not usually compatible because of the water soluble composition. It can be used for external purposes.	It is not a green product. Its low cost and efficient construction can allow for more innovations. More sustainable variations of masonry can also be used.	They can be appealing when employed appropriately. Although it is associated with the RDP or public structures, it is accepted as a permanent and solid structure.

CANVAS ROOF COVER

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURAL SYMBOLISM
Commonly found.	It is easily transportable.	Canvas is fairly durable. It is also easily replaceable when broken.	It is non-toxic and gives soft texture to spaces.	Light-weight material and can be used for ventilation purposes while defininf space.	(none)

LEFT
A BUILT-IN SLIDE TO FROM A LITTLE NOOK.

MATERIALS:

Concrete Floor
Plywood Panels
Corrugated Tin Sheets
Timber
Fiber Glass Insulation
Transparent Corrugated Polyvinyl Glazing
Metal Window Grilles

1.2.5 TEBOGO HOME FOR HANDICAPPED

AUTHOR University of Art, Linz

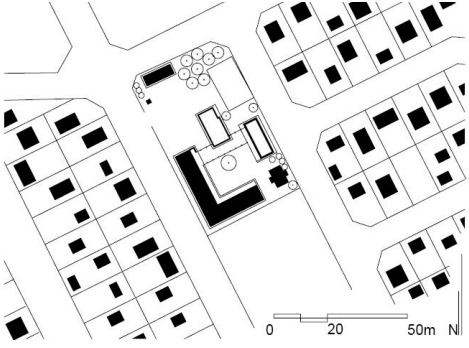
LOCATION Orange Farm Ext. 1, South Africa

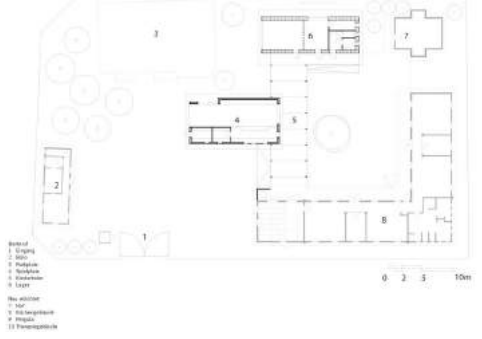
YEAR 2004 - 2005

USERS

- 28 staff
- 35 students (as of 2010)

TOP LEFT: View of the North-facing Building. TOP RIGHT: Images from construction of Tebogo Home BOTTOM LEFT: Surrounding site in Orange Farm township BOTTOM RIGHT: Plan of the two building extension to the Tebogo Home for Handicapped





PROJECT DESCRIPTION
BASEhabitat and University of Art Linz were commissioned by the Tebogo Home for Handicapped Children. The home for almost 50 children had become too small. A group of 25 students planned and built a dining building with a new kitchen, and a therapy building with sanitary facilities. A generously dimensioned pergola, a garden hall, connects the buildings with each other.

PROJECT COST
(unknown)

DONORS + SPONSORS
SARCH Wien (Austrian NGO)

COMMUNITY AND LABOR
Local workers, particularly women, were integrated in the project. The building materials were acquired directly from the township: concrete blocks, earth, clay, straw, timber, grass mats.

MATERIALS

Concrete Floor
Concrete bricks
Straw Bale and Earth Plaster
Corrugated Tin Sheets
Timber (unsealed)
Wire Mesh
Thatch Fabric
Recycled Glass Bottle
Corrugated PVC panels
Plywood
Glass Window with Wood Frame
PVC pipes for windows

NOTABLE MATERIALS

STRAW BALE & EARTH

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Straw Bale is relatively easy to find. Earth is locally dug from the ground. It is a free product from excavation.	Cost of transportation is relatively low as materials can be found locally or even aruond the environment.	The strawbale and earth mix was not durable as it was susceptible to weathering and water intrusion. Waterproof plaster needs to be applied appropriately to prevent such issues.	The wall is non-toxic. because of naturally found materials. However, earthen clay materials that cracks and break apart into little pieces may be potentially hazardous when consumed.	Locally found material. Using local soil from site reduce embodied energy for production and transportation.	The wall system was not well received by the users despite winning an award for sustainable buildings. The community felt that the structure was unfinished or temporary as it reminded them of a mudhut.

RECYCLED GLASS BOTTLE

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Easily available.	Cost of transportation can be minimal. Bottles can be collected around the area in local shops that sell drinks.	When installed appropriately - casted within concrete, the glass bottle can last a long time. Its shape also allows for great strength.	The colorful glass bottles can create playful lighting on the wall.	Recycling of bottles can help reduce waste in the area. However, they are mostly aesthetic. They can provide light but not natural ventilation.	They can be appealing when employed appropriately.

THATCH CEILING

COST / AVAILABILITY	COST OF TRANSPORTATION	DURABILITY	COMPATIBILITY WITH CHILDREN	SUSTAINABILITY	AESTHETICS / CULTURE
Commonly found.	It is easily transportable.	Thatch is relatively durable when kept dry. However, it does not perform well under force. It easily breaks and punctures.	It is relatively fragile and delicate. It should be applied in areas where children cannot come into contact with it and potentially damaging it. It can also fray to cause injuries to the skin.	It is light weight, made of local vegetative materials and it also allows for a breathable roof when used as a ceiling.	Thatch fabrics and patterns are found in indigenous cultures. It can be sued effectively to reflect cultural relevance while being a decorative shading device or ceiling material.

THATCH SHADES

PLYWOOD EGG CRATE WINDOWS

CONNECTION DETAILS

DESIGN ASSESSMENT

PROGRAM / PERFORMANCE	CLASSROOMS	KITCHEN	ABLUTIONS	OFFICE + SICK BAY	PLAY SCAPE / LANDSCAPE
DESIGN / AESTHETICS / CHILDREN / MATERIAL USE	The classrooms were typical rectangular blocks adjacent to one another. There is a lack of design in the spaces with little finishing.	The kitchen is connected to the living area defined by a half-height partition and tiled walls.	Standard toilet fixtures. They are required to be accessible by the handicapped children.	The office space is located in the older building prior to the extension	The play area is donated post construction. It uses a tent structure for shade
SUSTAINABILITY / CLIMATIC / VENTILATION / ECOLOGICAL	The classroom is lighted mostly by the large single-pane window that creates both glare and loss of heat.	n/a	n/a	n/a	n/a
FUNCTIONALITY / STORAGE / USER RESPONSE	There is adequate daylighting. However, the drywall ceiling does not correspond with the design language of the rest of the building	Space is large enough to accommodate high quantity of foor preparation. There is ample storage space in the kitchen area.	n/a	n/a	n/a

BUILDING SYSTEMS

BUILDING SYSTEM	DESCRIPTION
FOUNDATION	Reinforced concrete, slab-on, grade foundation The surrounding site covered in gravel
WALL SYSTEMS / ENVELOPE	One building is made of straw bale and earth plaster tied together and supported by wood frames. The other building is made of concrete blocks with plaster perforated by recycled glasss bottles.
FLOORS	Sealed concrete floors and tiles
ROOF SYSTEM	Prefabricated simple timber truss system with corrugated tin. Semi outdoor spaces use corrugated PVC sheets for lighting. Wire mesh used to prevent bird intrusion.
CEILING	Drywall ceilings.
INSULATION	Wall insulation is natural to the straw bale and earth wall system. Fiber glass wool insulation on the roof
WINDOWS	Large windows are on the N-S orientation but on the short edge of the rectangular building. Single-pane glass is used throughout the building.
DOORS	Standard wooden doors
PLUMBING	Standard toilets and sinks with PVC pipe connected to main water line and sewage line
LIGHTING	Standard fluorescent tubes or bulbs
FINISHING	Paint over plastered concrete walls








ISSUES

- The roof structure was constructed with unsealed timber. The wood deteriorated over time causing the roof to collapse.
- Large single-pane windows, which transmit adequate light, results in great loss of heat. Rooms are often too cold in the winter and too hot in the summer.
- Large windows are on the shorter edge of the rectangle resulting in uncomfortable glare from the strong one-directional daylight
- Plywood finishes fray and warp considerably resulting in reducing structural integrity and cause hazardous
- Wire mesh is not resilient to weather, wind or bird intrusion. It is easily pliable.
- Strawbale and earth plaster is not resilient to weather conditions such as storms and highly fluctuating temperatures. The dry season cracks the earth plaster and water intrusion causes the timber ties to give way.
- Community felt as if the building is unfinished because of its aesthetics from the erathen wall as well as the structure's lack of integrity

POTENTIAL STRATEGIES

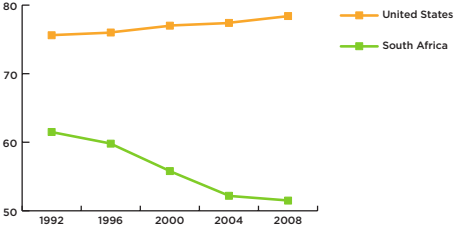
- Use circulation spaces as effective semi-outdoor spaces
- PVC panels can create a pleasant lighting condition for semi-outdoor spaces
- Create connections to local culture by using local materials in design components such as cladding

2.1.1 AT A GLANCE: SOUTH AFRICA

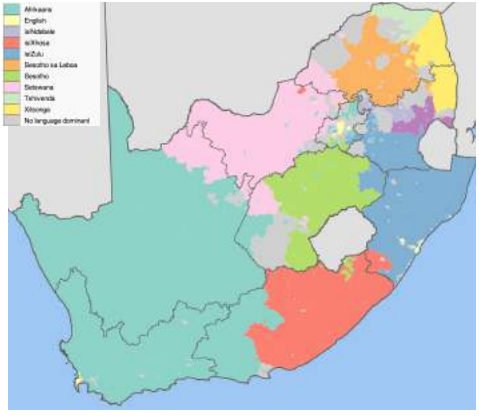
49.7 MILLION PEOPLE

DEMOGRAPHICS

LIFE EXPECTANCY IN YEARS



Two reasons for the decline in life expectancy in South Africa are the proliferation of AIDS and Tuberculosis over the past two decades.



AIDS

UNITED STATES	SOUTH AFRICA
0.35%	28%

(PERCENT AFFLICTED)

TUBERCULOSIS

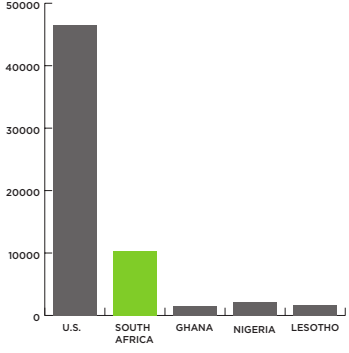
UNITED STATES	SOUTH AFRICA
2	407

(RATE OF CASES PER 100,000 OVER A THREE YEAR AVERAGE)

ECONOMY

$1 U.S.D. 7 RAND

GDP PER CAPITA (PPP)



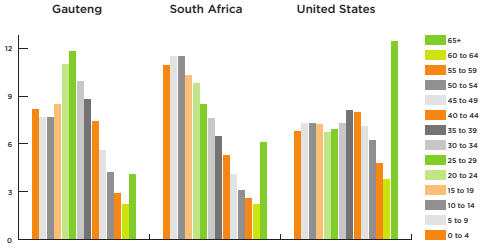
Although South Africa seems relatively poor compared to the United States, it is the wealthiest nation in Africa by GDP per capita Purchasing Power Parity (PPP).

DEMOGRAPHICS

LITERACY RATE

Education attainment has been increasing over the years. For people aged 5-24 the percentage of the people attending an educational institution increased from 71.5 percent in 2001 to 73.6 percent in 2007.

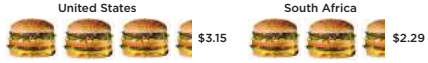
AGE DISTRIBUTION



The United States has a much larger aging population compared to South Africa and Gauteng. In Gauteng the largest percentage of the population is 25-29 years old with a much smaller percentage of aging adults and a slightly larger youth population, although not as large as the rest of South Africa.

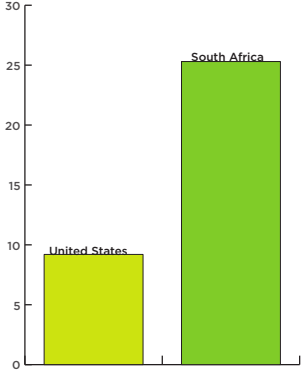
ECONOMY

BIG MAC INDEX



The Big Mac Index is a fairly accurate indicator of whether a currency is under or over valued. Two goods from different countries according to the purchasing power parity be exchanged at the same price. However, when it comes to the Big Mac it appears that South Africa undervalues its currency.

UNEMPLOYMENT RATE



Nearly 1/4 of South Africans are unemployed compared to nearly 1/10 in the United States. A disproportianate percentage of unemployed South Africans are racially non-white showing that post apartheid there still remains unequal conditions racially.

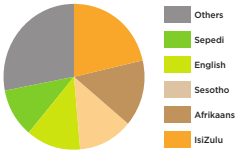
2.1.2 AT A GLANCE: GAUTENG

GAUTENG DEPARTMENT OF EDUCATION

10.5 MILLION PEOPLE

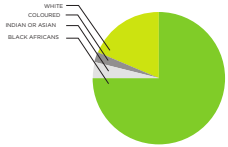
DEMOGRAPHICS

LANGUAGE BREAKDOWN



As denoted by the chart above and the map below, Gauteng Province has a wide mix of languages where no one language dominates the provincial scene.

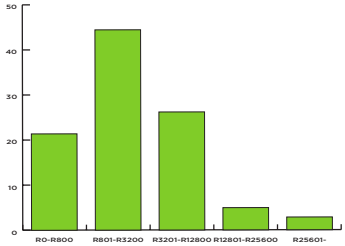
RACIAL BREAKDOWN



Racially the population of Gauteng Province is predominantly Black African. Those who are considered Coloured are those who are multi-racial.

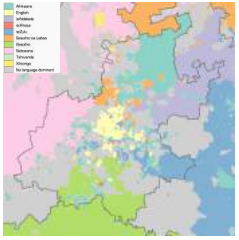
ECONOMY

MONTHLY INCOME DISTRIBUTION FOR SINGLE EARNER

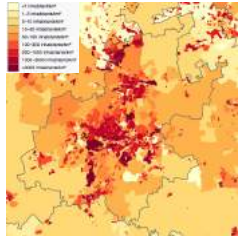


For residents of Gauteng Province a majority of single earners are making between 800 Rand to 12,800 Rand a month with most making closer to 800 Rand. Cosmo City is catering to those people who make between 0 Rand to 3,000 Rand a month for fully subsidized homes and up to 7500 Rand a month for partially subsidized housing.

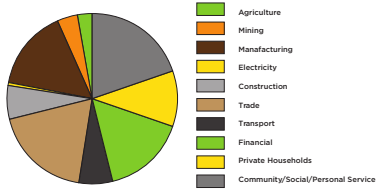
LANGUAGES SPOKEN



POPULATION DENSITY



SECTORS OF THE ECONOMY



The four largest sectors contributing to Gauteng's economy are community, social and personal services, financial services, manufacturing, and trade.

DEMOGRAPHICS

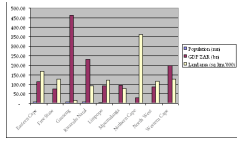
AVERAGE HOUSEHOLD SIZE: 3.3 PERSONS/HOUSEHOLD

Although average household size is comparably higher than the United States (United States has an averge of 2.6 persons per household) it is lower then the South African average of 3.9 persons per household and comparably lower then many nations surrounding South Africa with similar economies.

CHILDREN STANDING OUTSIDE A SPAZA MAKESHIFT RESTAURANT
WHERE STUDENTS GO TO EAT, SOCIALIZE, AND AVOID THE HOT SUN

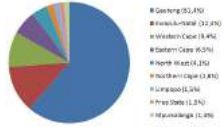
ECONOMY

COMPARISON BY PROVINCE



Gauteng Province is significantly smaller in land area compared to the other provinces, however, its GDP is significantly bigger than any other province. Its population size is also the largest.

EXPORTS BY PROVINCE



Gauteng's large economy is partially centered around trade. As a highly urbanized mass producer of many products as of 2006 it is has by far the largest share of provincial exports in South Africa.

The Witwatersrand Basin is a geological formation known to be the largest natural deposit of gold in the world. Over 1.5 billion ounces of gold has been extracted from this basin. Mining makes up only a small part of the economy in Gauteng (3.8%), however it has a tremendous impact on the local economy of the area by contributing to the local economies of such cites as Krugersdorp and Soweto.

2.1.3 AT A GLANCE: JOHANNESBURG METROPOLITAN REGION

Joburg
a world class African city

3.8 MILLION PEOPLE

DENSITY: 2364 PPL/KM2

AREA: 1645KM2

ELEVATION: 1753M

PEOPLE IN NUMBERS

42% Younger than 24
7% Foreign Born
34% HIV Infected Ages 25-29

THE NUMBERS ON HOUSING

1,006,930 Households
600 Gated Communities
182 Informal Settlements

ECONOMICS FOR THE METROPOLITIAN REGION

70% Of S.A. Banks Headquarter
16% Of National Economy
55% Of The Office Space in S.A.
1% Employment Growth
37% Unemployment Rate

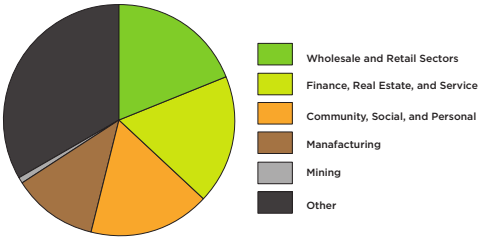
POVERTY

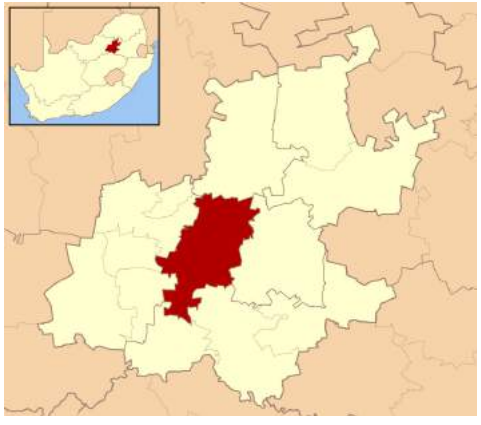
18% Households Without Income
24% Live Below Poverty Line
22% Live in Informal Dwellings

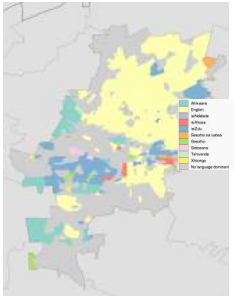
CRIME

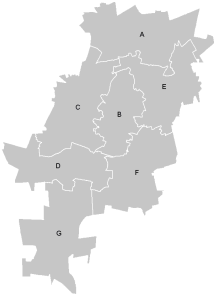
729 Murders a Year
1506 Rapes a Year

ECONOMIC SECTORS

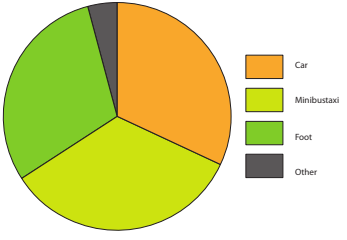






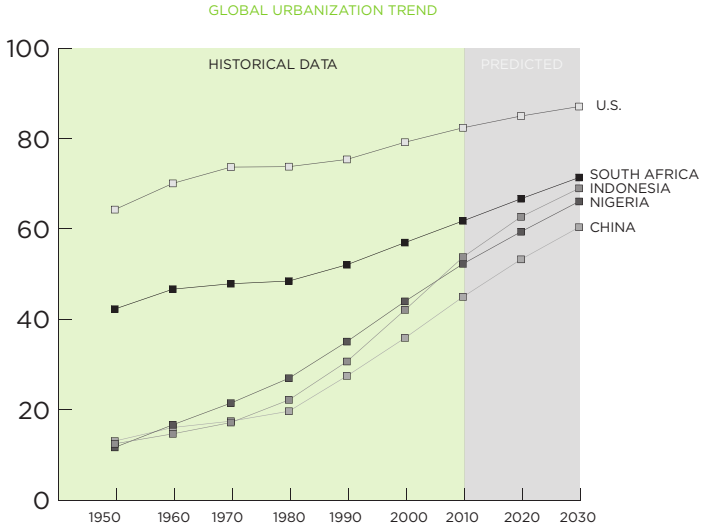


MODES OF TRAVEL

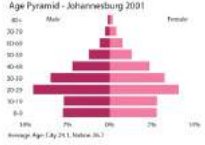


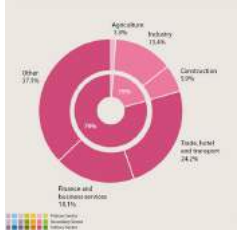
Journeys to Work (%)

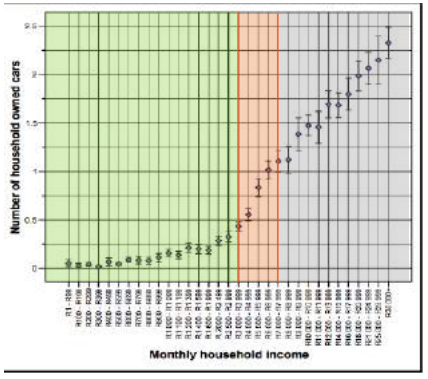
GLOBAL URBANIZATION TREND



BY 2030
82.3% **66.6%** **44.9%**







TRAFFIC JAM ON THE N1 HIGHWAY
IN JOHANNESBURG, ONE OF THE BUSIEST HIGHWAYS IN GAUTENG PROVINCE

Many of the school age children will have parents who are reliant on public transportation.

TAXI RANK IN SANDTON
ABOUT 25 MINUTES BY CAR FROM COSMO CITY

The school that is to be constructed is built to serve mostly populations of the RDP housing. Many of these families will be those who have a higher dependency on public transportation, as many lack the funds to own a car. It can be expected that many of these parents will oftentimes, if they are commuting, be relying on either Non Motorized Transit (NMT) or the taxi rank system.

APPROACHING COSMO CITY BY CAR
PRIOR TO A THUNDERSTORM. IT IS IN CLOSE PROXIMITY TO A MAJOR HIGHWAY.

Many of the children going to the school will be coming from RDP housing. RDP housing is for income groups of 0-3,000 Rand meaning many of those families have no access to a car.

TRANSPORTATION PREFERENCE

The problem that exists today is the lack of transportation options to travel to and from Cosmo City. Without the convenience of an automobile, residents either rely on a taxi rank system, walking, or biking to travel from of Cosmo City. There are evidential patterns of commuting especially on foot from marginalized areas into economic centers. Having a more integrated transportation system is necessary for the success of Cosmo City. It is especially crucial that public transportation is provided for those without a car, mostly those who rely on fully subsidized housing.

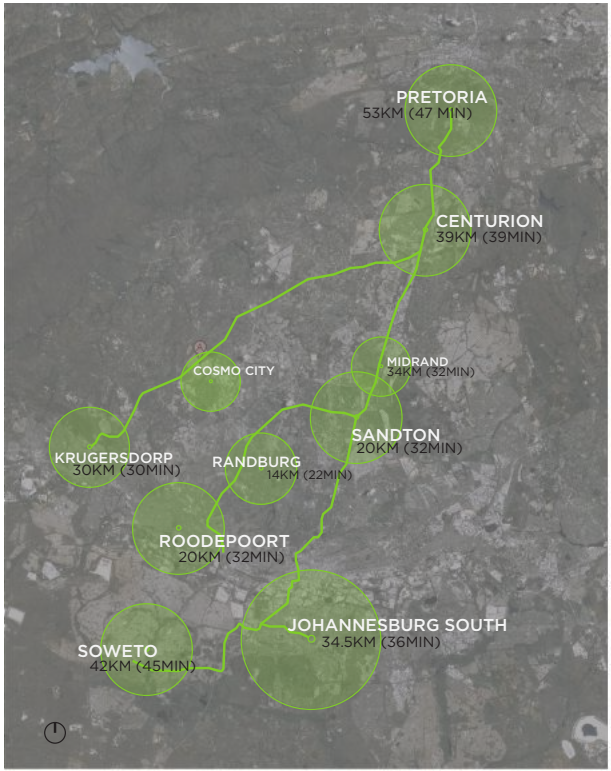
Cosmo City is surrounded by several economic centers that for many residents will be a place for jobs for many of the residents. Many of these economic centers are within a thirty to forty-five minute commuting distance by car and even longer by public transportation.

Because the transportation system is highly car dependent, quality jobs for lower income individuals in Cosmo City will be difficult to find since many of the low-income individuals are unable to afford an automobile. Many wealthier residents, on the other hand, especially in bonded housing, will be expected to locate and easily access jobs in many of these other cities since cars are easily accessible for higher income groups.

Transportation access is a large concern for many of Cosmo City residents. Lower income groups rely heavily on public forms of transportation or walking (Mokoynama, Venter). The high expense of car ownership keeps many low-income households from owning a car. Generally, residents who occupy a fully subsidized house in Cosmo City (0 Rand to 3,000 Rand) will have low rates of car ownership (0 to 1 in 5) per household.

In partially subsidized homes, car ownership escalates, but averages to less than one car per household. Applying the model to Cosmo City, it can be seen that those who live in a bonded (market rate) housing will, generally, be able to afford one or more cars per household.

2.2 NEARBY CITIES: ACCESSIBILITY MAP



CITIES NEAR COSMO CITY

PRETORIA
Administrative capital of South Africa

CENTURION
Center for Information Technology and technical service jobs

MIDRAND
Highway links to Johannesburg, increasing proximity

SANDTON
Wealthy area of "new money" Consists of investment banks and financial consultants

RANDBURG
Entertainment center with abundance in techical jobs

KRUGERSDORP
A mining city: gold, manganese, and iron

JOHANNESBURG
Economic and financial hub of South Africa

SOWETO
Industrial City, where most of the struggle of the apartheid was fought

2.3 TIMELINE OF THE POLITICAL HISTORY OF SOUTH AFRICA

COLONIAL RULE

1652: CAPE COLONY FOUNDED BY DUTCH EAST INDIA COMPANY

1805: BRITISH SECURE COLONY FROM THE NETHERLANDS

1835-1840: THE 'GREAT TREK' BOERS LEAVE CAPE COLONY

1838: BOERS DEFEAT ZULUS IN THE BATTLE OF BLOOD RIVER

BLOOD RIVER MEMORIAL

FORMING THE UNION

1902: TREATY OF VEREENIGING ENDS THE SECOND ANGLO-BOER WAR

1910: FORMATION OF UNION OF SOUTH AFRICA

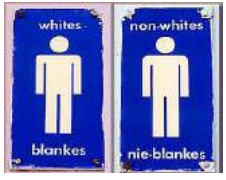
1912: NATIVE NATIONAL CONGRESS FOUNDED, LATER RENAMED THE AFRICAN NATIONAL CONGRESS (ANC)

AFRICAN NATIONAL CONGRESS

APARTHEID ESTABLISHED

1948: NATIONAL PARTY ADOPTS APARTHEID

1950: GROUP AREAS ACT SEGREGATES BLACKS AND WHITES. COMMUNIST PARTY BANNED



SEGREGATED PUBLIC FACILITIES

EVICTION & VIOLENCE

1964: ANC LEADER NELSON MANDELA SENTENCED TO LIFE IMPRISONMENT

1966: PRIME MINISTER HENDRIK VERWOERD ASSASSINATED

1970S: MORE THAN 3 MILLION PEOPLE FORCIBLY RESETTLED IN BLACK 'HOMELANDS'

BLACKS RESTRICTED TO RESERVES

MANDELA RELEASED

1990: MANDELA RELEASED AFTER 27 YEARS IN PRISON

1991: DE KLERK REPEALS REMAINING APARTHEID LAWS, INTERNATIONAL SANCTIONS LIFTED

1993: AGREEMENT ON INTERIM CONSTITUTION

MANDELA FREED FROM PRISON

RECONCILIATION

1996: TRUTH AND RECONCILIATION COMMISSION CHAIRED BY ARCHBISHOP DESMOND TUTU BEGINS HEARING

1996: PROGRESSIVE NEW CONSTITUTION, 'SOUTH AFRICAN SCHOOLS ACT' MANDATES SCHOOLING FOR 7-15 YEAR OLDS

ARCHBISHOP DESMOND TUTU

1650 1800 1850 1900 1910 1930 1940 1950 1960 1970 1980 1990 1995 1996 1998 2000

THE BOER WARS & RICHES

TRANSVAAL GOLD RUSH

1867: DIAMONDS DISCOVERED

1880-1881: THE FIRST ANGLO-BOER WAR

MID 1880S: GOLD RUSH IN THE TRANSVAAL

1899: THE SECOND ANGLO-BOER WAR

RACIAL DIVISIONS

BLACKS KEPT ON RESERVES

1913: LAND ACT INTRODUCED TO PREVENT BLACKS, EXCEPT THOSE LIVING IN CAPE PROVINCE, FROM BUYING LAND OUTSIDE RESERVES

1914: NATIONAL PARTY FOUNDED

1918: SECRET BROEDERBOND (BROTHERHOOD) ESTABLISHED TO ADVANCE THE AFRIKANER CAUSE

CIVIL DISOBEDIENCE

GANDHI JOINS RESISTANCE

1950: ANC CIVIL DISOBEDIENCE CAMPAIGN LED BY NELSON MANDELA

1960: 70 BLACK DEMONSTRATORS KILLED AT SHARPEVILLE, ANC BANNED

1960S: INTERNATIONALSANCTIONS BEGIN, SOUTH AFRICA EXCLUDED FROM OLYMPIC GAMES

1961: MANDELA HEADS ANC'S NEW MILITARY SABOTAGE CAMPAIGN

APARTHEID CRUMBLES

H. PIETERSON KILLED IN SOWETO

1976: MORE THAN 600 KILLED IN SOWETO UPRISING

1983: 'CHILD CARE ACT' MANDATES REGISTRATION OF ALL 'PLACES OF CARE'

1984-1989: TOWNSHIP REVOLT, STATE OF EMERGENCY

1989-1990: FW DE KLERK MEETS MANDELA, PUBLIC FACILITIES DESEGREGATED, ANC UNBANNED

MANDELA TRIUMPHS

FW DE KLERK, NELSON MANDELA

1994: MANDELA AND ANC WIN FIRST NON-RACIAL ELECTIONS, SOUTH AFRICA REJOINS UNITED NATIONS, 'RECONSTRUCTION AND DEVELOPMENT PROGRAMME' INITIATED

THABO MBEKI ELECTED

THABO MBEKI WINS FOR ANC

1996: NATIONAL PARTY WITHDRAWS FROM COALITION FOR BEING IGNORED
1999: THABO MBEKI AND ANC WIN ELECTIONS

PROGRESS WITH MBEKI

2001: HIGH COURT RULES THAT PREGNANT WOMEN MUST BE GIVEN AIDS DRUGS

2002: RIGHT-WING TERRORIST ATTACKS IN SOWETO AND PRETORIA

2004: MBEKI AND ANC BEGIN SECOND TERM WITH 70% OF VOTES

HIGH COURT DEMANDS CLINICS

ANC FLAILS

2007: 'CHILDREN'S AMENDMENT ACT' RECOGNIZES THE ROLE OF ECD CENTRES IN REINFORCING HUMAN RIGHTS

DEC 2007: DESPITE NEW CORRUPTION CHARGES, ZUMA IS ELECTED CHAIRMAN OF THE ANC

MAY 2008: WAVE OF VIOLENCE TOWARDS AFRICAN IMMIGRANTS

ECD GAINS ACKNOWLEDGEMENT

ZUMA ELECTED

APR 2009: ZUMA'S CORRUPTION CASE DROPPED, ZUMA AND ANC WIN ELECTION

MAY 2009: ECONOMY GOES INTO RECESSION FOR FIRST TIME IN 17 YEARS

ZUMA EXCULPATED AND ELECTED

2002 2004 2006 2007 2008 2009 2010

CORRUPTION & DISSENT

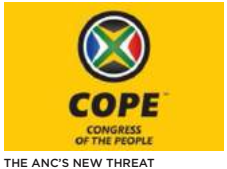
CIVIL SERVANTS GO ON STRIKE

2004: SOCIAL ASSISTANCE ACT CREATES 'CHILD SUPPORT GRANT', 'FOSTER CARE GRANT', AND 'CARE DEPENDENCY GRANT'

JUN 2005: PRESIDENT MBEKI SACKS HIS DEPUTY, JACOB ZUMA, AFTER CORRUPTION CASE

JUN 2007: LARGEST PUBLIC-SECTOR STRIKE SINCE THE END OF APARTHEID DISRUPTS SCHOOLS AND PUBLIC TRANSPORT

COMPETITION FOR ANC



THE ANC'S NEW THREAT

SEP 2008: PRESIDENT MBEKI RESIGNS OVER ALLEGATIONS THAT HE INTERFERED IN THE CORRUPTION CASE AGAINST MR ZUMA

DEC 2008: A NEW POLITICAL PARTY OF MOSTLY ANC DEFECTORS, THE CONGRESS OF THE PEOPLE (COPE) IS THE FIRST REAL CHALLENGE TO THE GOVERNING ANC

FOOTBALL AND FALLOUT

SOUTH AFRICA WORLD CUP 2010

JULY 2009: VIOLENT PROTESTS AGAINST POOR LIVING CONDITIONS IN TOWNSHIPS

JUN 2010: SOUTH AFRICA HOSTS THE WORLD CUP FOOTBALL TOURNAMENT

AUG 2010: CIVIL SERVANTS STAGE NATION-WIDE STRIKE

The greatest glory in living lies not in never falling, but in rising every time we fall.
- Nelson Mandela in "Long Walk to Freedom (1995)

South Africa, so utterly improbably, is a beacon of hope in a dark and troubled world.
- Archbishop Desmond Tutu

2.4 RECONSTRUCTION AND DEVELOPMENT PROGRAMME

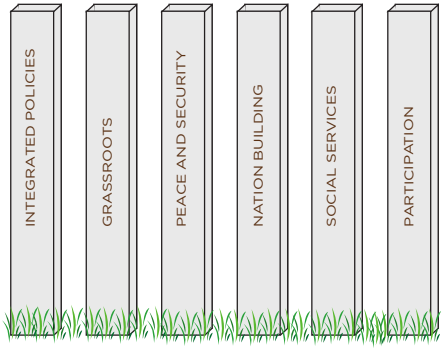
WHAT IS THE RDP?

The Reconstruction and Development Programme (RDP) is a socio-economic policy framework initiated by Nelson Mandela and negotiated by the African National Congress (ANC), allied parties and civic participants. The RDP aims to provide the social services that the former apartheid regime neglected and support equitable economic growth.
The RDP White Paper outlined six fundamental goals of the program:

1. Integrate all branches of government and the private sector
2. Remain a grassroots movement
3. Promote peace and security
4. Promote unified nation-building
5. Spur redistributive development through infrastructure development
6. Encourage those most affected by policies to participate in decision-making

The RDP would not be restricted by political ideologies. Thus far, the RDP has included neoliberal policies, such as aggressive trade liberalization and limited taxes, and socialist policies, such as ambitious infrastructure projects and social-service provisions. The approaches of the RDP are in continuous reform to build on successes and overcome pitfalls.

PILLARS OF THE RDP



WHAT HAS BEEN DONE?

WHAT NEEDS WORK?

1.1 MILLION SUBSIDIZED HOUSES BUILT BY 2001

PROPER HOUSING

POOR QUALITY - ONLY 30% COMPLY WITH REGULATIONS

FRESH WATER PROVIDED FOR 4.9 MILLION BY 2000

CLEAN WATER

POOR AND INCOMPLETE IMPLEMENTATION

500 NEW CLINICS SERVING 5 MILLION BUILT BY 1998

HEALTHCARE

CLINICS HAVE NOT KEPT UP WITH AIDS, LIFE EXPECTANCY FELL 11 YEARS BY 1998

1.75 MILLION HOMES CONNECTED TO GRID BY 2000

ELECTRICITY

LITTLE ALTERNATIVE ENERGY PRODUCTION, MANY RURAL HOUSES REMAIN OFF GRID

39,000 FAMILIES SETTLED ON NEWLY DEVELOPED LAND

LAND REFORM

ONLY 1% OF ASPIRED RESETTLEMENTS OCCURRED, FARMING JOBS HALVED AFTER AGRICULTURAL SUBSIDIES WERE CUT

NEW RDP STRATEGIES

While negligent policies and execution caused many of the shortcomings of the RDP, a shortage of tax revenue is a limiting factor to all RDP initiatives. Tax revenue depends on growth from the private sector. Private sector growth, for developing economies such as that of Johannesburg at least, depends on government programs such as Johannesburg's Local Economic Development (LED) program.

The Jo'burg Unicity manages this conundrum by taking loans, wasting money on interest, and applying for grants from other municipalities, wasting money on bureaucracy. A common solution is to apply for international funding. It is an inherently unsustainable practice, but short-term funding may be all that is necessary to kickstart the private sector and build a tax base. However, as the wealthiest province in South Africa, Gauteng is seldom a recipient of such funds.

A promising new strategy is to match private sector entities with loan or grant programs, without funneling money through the government. LED initiatives are then aligned to sectors where significant funds exist. Education Africa follows this efficient LED model by using external funds from international universities to build schools, which promote both short and long term economic growth.

ECONOMY IN HIGH GEAR

Within the first few years, the government struggled to implement social services reliably. The ANC soon adopted GEAR, a new policy that emphasized neoliberal macroeconomic policies, and no longer explicitly encouraged civic participation. GEAR promoted the devolution of social services to local governments, some privatization, and efforts to attract foreign investment and boost exports. NGOs and architects conducting development interventions in Johannesburg will thus have to be proactive about incorporating public participation.

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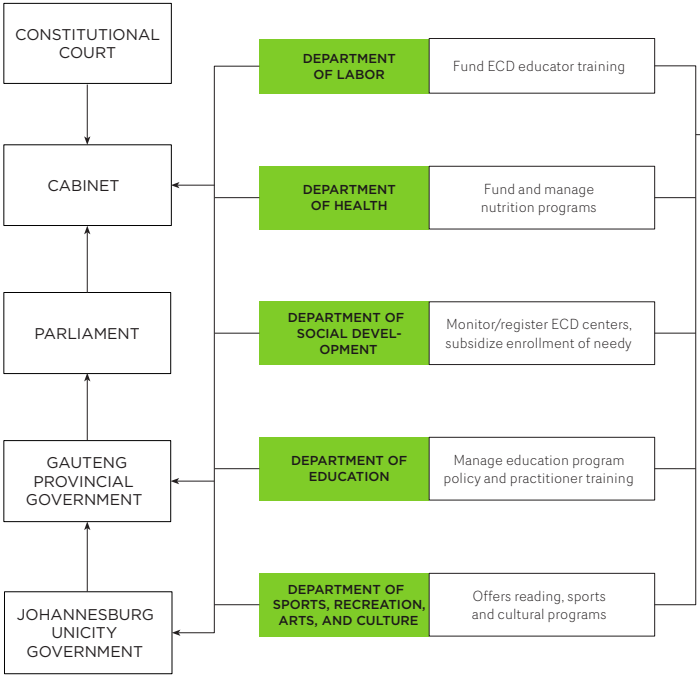
2.5 EARLY CHILDHOOD DEVELOPMENT IN SOUTH AFRICA

2.5 PUBLIC AND PRIVATE ENTITIES INVOLVED WITH EARLY CHILDHOOD DEVELOPMENT

GOVERNMENT BRANCHES AND DEPARTMENTS



EARLY CHILDHOOD INSTITUTE

Established in 2010, the Early Childhood Education Institute is charged with coordinating the various public and non-governmental programs related to ECD. One of the first initiatives, led by the Department of Education, is to require the provision of Grade R, the equivalent of Kindergarten. Eventually, the institute aims to integrate nutrition, HIV prevention, ecological conservation, athletics and culture into all ECD programs.

NON-GOVERNMENTAL ORGANIZATIONS

NKANYISO NUTRITION AND HIV/AIDS	Programs to promote HIV/AIDS awareness, school enrollment, culture and nutrition
BRIGHT KID FOUNDATION	Creates preschools out of discarded shipping containers
ACTIVE LEARNING LIBRARIES – SOUTH AFRICA	Promotes toy libraries
SUNSHINE ASSOCIATION	Promotes intellectual development of children with learning disabilities
SOUTH AFRICAN CONGRESS FOR ECD	Offers social programs, such as reading and HIV workshops

"Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, that a son of a mineworker can become the head of the mine, that a child of farm workers can become the president of a great nation."

-Nelson Mandela

"Early childhood development is one of the best public investments for developing countries because it promotes equality from birth"

-Director of ALAS, ECD NGO

ECD = SUCCESSFUL KIDS AND ADULTS

In their first three years, children develop their abilities to think and speak, learn and reason, and lay the foundation for their values and social behavior as adults. (UNICEF, 2001)

From the first cell division, brain development is a delicate dance between genes and the environment. While genes pre-order the sequence of normal development, the quality of that development is shaped by environmental factors such as adequate nutrition, good health, clean water and a safe environment free from violence, abuse, exploitation and discrimination. (Sykes)

By the age of five, 80 percent of the human brain is fully developed. Stress and deprivation during those essential early years severely hamper a child's long-term development. (Lee)

Studies have shown that those who receive a high quality preschool education earn significantly higher scores on intellectual and academic measures as young adults, attain significantly more years of total education, and have higher earnings over their lifetime. (Schweinhart)

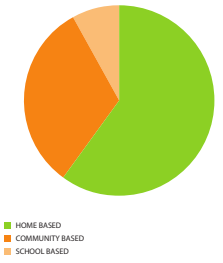
Those who participate in quality preschool programs are less likely to become pregnant as a teen, be dependent on welfare, or engage in delinquency or criminality. (Barnett and Belfield)

Consistently available preschool education is associated with greater maternal educational advancement and higher levels of employment particularly for teenage mothers. (Ramey)

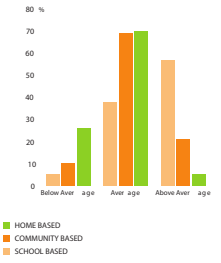
ECD IS LACKING IN SOUTH AFRICA

- The last national audit published on ECD programs in South Africa was in 2001 (UNICEF, 2009)
- 84% of young children in SA do not have access to formal ECD provision and rely on their parents or primary caregivers for stimulation and development. (UNICEF, 2007)
- In 2000, 50% of children enrolled in ECD programs were at the age of 5 or 6 years, 33% were 3-4 year olds, the youngest ones (0-2 years) represented 17% of all enrolled children. (UNICEF, 2009)
- In 2001, only 40% of ECD centers were registered - 8% with the Department of Education and 32% with the Department of Social Development. (GPG)
- The Department of Education promised to create universal enrollment in grade R by 2010 (similar to Kindergarten in the United States). Currently only 70% of age ready children are enrolled in grade R.

EARLY CHILDHOOD DEVELOPMENTS SITES BY TYPE NATIONALLY (2000)



EDUCATOR INDEX IN GAUTENG BY TYPE OF SITE (2000)



SOUTH AFRICAN CHILDREN ARE PAYING THE PRICE

- South Africa is one of only 12 countries that has failed to reduce child mortality since 1990. (CI)
- One in every 17 children born in South Africa die before they reach their fifth birthday. (UNICEF, 2007)
- Children in the 0–4 age group are at the greatest risk of dying and comprise 10.4% of all deaths. (UNICEF, 2007)
- 68% of children belong to households living under the poverty line of R1,200 or less a month. (UNICEF, 2009)
- One in five children between the ages of one and six were stunted, or chronically malnourished, with younger children being the most affected. (UNICEF, 2007)
- One out of two children had an intake of less than half the recommended level of Vitamin A (can lead to blindness and weak immunity), Vitamin C, riboflavin, niacin, Vitamin B6, folate, calcium, iron and zinc. (UNICEF, 2007)

"My dear young people: I see the light in your eyes, the energy of your bodies and the hope that is in your spirit. I know it is you, not I, who will make the future. It is you, not I, who will fix our wrongs and carry forward all that is right with the world."

-Nelson Mandela

ECD INITIATIVES IN SOUTH AFRICA

National Integrated Plan for Early Childhood Development (NIPECD)
This plan aims to enable a more integrated and comprehensive service provision to improve ECD quality across the nation. It aims to provide access to a range of services and programs to support the development of all young children, with extra support for vulnerable children.

Millennium Development Goals (MDGs)
These goals agreed upon by United Nations member states broadly aim to reduce poverty, hunger and disease by 2015 and to ensure children's rights to survival, health and development.

United Nations Convention on the Rights of the Child (CRC)
South Africa is a signatory of the CRC which protects a child's rights to survival, development, protection, and participation. SA must record their progress towards fulfilling these rights and report to the UN committee every 5 years.

Guateng Early Childhood Development Strategy
This strategy aims to develop the ECD Institute to increase collaboration and create the following six strategic outcomes :

1. An environment for expanding access to quality ECD services (Office of Premier)
2. A safe, secure and conducive physical environment for an expanding quality ECD service throughout the province (Department of Social Development)
3. Overall child health and well-being, with particular emphasis on children at risk because of poverty (Department of Health)
4. High quality ECD practice ensures that children are prepared and ready to enter Grade R (Department of Education)
5. Quality information is available to ECD stakeholders and role players (ECD Institute)
6. ECD services within the province are effectively planned, managed and coordinated (Office of Premier)

South African Annual ECD Awards: These awards aim to raise awareness of the ECD sector's goal to break the cycle of inherited poverty while promoting excellence in the ECD sector. The following awards are given:

ECD practitioner of the Year (Provincial and National)
ECD Site of the Year (Provincial and National)
Training and Support Organization of the Year (National)
Innovative ECD Program of the year (National)
Publication of the Year (National)

"With education considered the highest priority of our government, we have placed ECD as our apex priority that needs special attention in many facets including resources and skills development."

-Councilman of Dept.. of Social Development

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KIBERA, SQUATER SETTLEMENT IN NAIROBI

For many residents, these new homes are their first experience with basic amenities and solid building structures.

SANCTIONED INFORMAL YEOVILLE MARKET

JOBURG INFORMAL TRADERS

The presence of a large market next to our school could on one hand designate our area as a central node for Cosmo city, but could also increase crime and pedestrian traffic.

JOBURG SQUATTER SETTLEMENT, SOWETO

2.6 INFORMALITY IN SOUTH AFRICA

To understand the project and the people of Cosmo City, it is important to understand what we mean by informality. In our context, informality refers to informal communities and the informal economy. These terms themselves are hard to define. Informal communities usually refer to people who are either homeless or are considered squatters; live on land illegally. According to some reports (Neuwirth), 1 billion people world wide live in squatter settlements. Although not always the case, squatter settlements are usually characterized by high density, unsafe housing, and scarce access to sanitation. Since these settlements are illegal, they usually do not receive help from local governments.

The informal economy, though tied to squatter settlements, is a general way to describe businesses that operate illegally, and therefore do not pay taxes. In South Africa, the informal economy is made up of smaller trading companies. Although the total revenue is not much from such businesses, it sustains many of the poorest in South Africa.

Cosmo City itself is one of the government's answers to address the large informal community within Johannesburg. Johannesburg was built in the time of apartheid, when the government viewed non-white residents as only temporary visitors, whose role was to work the mines (Tomlinson 3) and so did not want to create housing for them. At the end of apartheid, South Africa tried to address these issues, and, in a progressive policy, declared housing a right for all citizens. Since then, Johannesburg began to work towards creating an integrated housing environment, but it is a slow process. According to a UN report in 2008, Johannesburg is one of the world's most unequal cities in terms of wealth, and the poor are largely black South Africans. Twenty three percent of people in South Africa live in informal communities (thesis). Johannesburg itself is host to more than 70,000 families living in 14 informal settlements in and around the city. Many of these people make a living in the informal economy.

In the Gauteng province (includes Johannesburg) roughly 1.7 million people work in the informal economy (Rogerson 171), more than the amount working in manufacturing. Although most informal work can be seen as traders, they can be further categorized as survival enterprises –run mainly by women with very low income gained – and small growth enterprises – family owned and with a better possibility of growth (Rogerson 171). An informal trader hierarchy was established because of the difficulty in obtaining legal licenses. Though there are trade organizations, in reality the system closely resembles a criminal organization. One becomes a head trader because of ones ability to buy off the police and get 'protection' to control of traders below them. (Thulare 16).

Cosmo city is a visionary project to address the issues of informal living and exclusion. Almost 3,000 housing units were given to people who previously lived in squatter settlements, mainly the nearby Zevenfontain and Riverbend Settlement. Our crèche is also located in the area of these homes and will be primarily used by children from these squatter settlements. For many residents, these new homes will be their first experience with toilets and solid buildings. Most residents are happy to be living in safe housing, however it hasn't been without hardship. The authorities have a no tolerance policy for informal trading, leaving many people without work. Plans were made to create market spaces for these traders (Joburg regional special development framework), but have not yet been built. Residents have gained basic amenities but have lost their source of income. Informal markets do spring up, but are quickly closed down.

According to our own interviews though, the lot across the street from our site is designated to become a sanctioned market for informal trading. The presence of a market next to our school will have a large impact on the area. The area could become a central node for Cosmo City. This could have both positive and negative affects, and our design must prepare for that. Being in a central area it is likely that our site will become a landmark for the area. However, we also don't want the resulting increase in pedestrian traffic to make the crèche unsafe for young children. In previous sanctioned markets in Johannesburg, such as the Yeoville market, there was also a sharp rise in crime in the area. (Thulare 16). This could, however, be addressed with a greater police presence.

ABOVE: INSIDE OF CORRUGATED METAL SHACK

LEFT: ZEVENFONTAIN SHACK HOUSES.

2.7 ZEVENFONTAIN AND RIVERBEND

The vision for Cosmo city originally began in 1999. It was a project meant to relocate residents from the Zevenfontain and River Bend squatter settlement in accordance with South Africa's goal of eradicating squatter settlements by 2014 (Molor, 2007). Although it took much longer then expected, today the majority of fully subsidized and partially subsidized housing units belong to members of these two neighboring informal settlements. As it is this community who will be using the crèche, it is therefore important to understand their history and relationship with the Cosmo City project.

COMMUNITY MEETNG; DIEPSLOOT

ZEVENFONTAIN AND RIVER BEND: A HISTORY

Zevenfontain and River Bend are squatter settlements located in the suburb of Diepsloot, South Africa, about 40 km north of Johannesburg. Diepsloot itself consists mainly of RDP housing and different squatter settlements, surrounded by wealthy suburbs, such as the bordering Duinfern suburb. North Johannesburg suburbs are mainly home to wealthy white South Africans and tensions arise between them and the very poor mostly black South Africans that live in Diepsloot. Zevenfontain is the larger and more established of the two settlements, housing approximately 12,000 people (Moloi, 2007), whereas Riverbend has only around 2,000 residents.

Zevenfontain is one of the oldest squatter settlements in Johannesburg, having been established in 1989 by around 50 families who rented the farmland (Muller 4). The population grew tremendously, with most people not paying any rent. Before the historic 1994 election that marked the end of apartheid, the community began to organize and rallied around the African National Congress (ANC), eventually kicking out members of other parties.

The houses are mostly shacks and there is little access to basic amenities. Bathrooms are communal metal port-a-potties. Water is retreived from communal pumps. These are only located near the RDP housing dispersed amongst the corrugated metal shacks. Shacks are prone to being torn down. Streets are small and home to chickens and garbage (Remember; South Africa). Many residents set up shops out of their homes and sell food or other needed goods. Walking is the primary mode of transportation. There are few schools in the area and daycare centers are usually set up in someone's home. After the Cosmo city plan got underway in 1999, the government wouldn't put any money to help with the squalid conditions in Zevenfontain, due to its temporary status.

Members of Zevenfontain were very happy when Cosmo city was built and thankful to the housing opportunity, however their was some worry about the loss of business.

ZEVENFONTAIN INVOLVEMENT IN COSMO CITY

In 1999, at the beginning of the Cosmo city process, residents of Zevenfontain, with the help of the community organizing NGO Planact, developed a Community Development Forum (CDF). The goal of the CDF was to give the community a say in the Cosmo City process. As facilitators to this process, Planact trained members of the community to be able to run something such as the CDF and how to engage political system. Although aware of Cosmo City project, the CDF was not engaged in the process. There were major delays, because the wealthy community around Cosmo City was against the project. Leaders of the CDF were consulted and updated in the project, but were not given much, if any, power and the larger community was not included except in regular CDF meetings. In the end, less than 3000 homes were given to members of Zevenfontain (a community of 12,000 people) and the CDF did not have a voice in the selection process. Overall, members of Zevenfontain were very happy when Cosmo city was built and thankful for the housing opportunity. However, there was been some worry that the developers did not address social needs, and many people lost their informal businesses.

2.9 ARCHITECTURE AS TRANSFORMATION

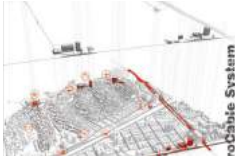
Architecture is the combination of form, the definition of space, and function. Its purpose is to fulfill both a physical and spiritual function. Throughout the years, architects have been able to put their talent to work and build all kinds of structures, which not only posses excellent functionality but have become pieces of art. But as time passes by, global pressures have grown and resources have diminished, leading to the development of several problems, one of them being the development of informal settlements. These settlements are dense, poorly constructed, and suffer from severe social problems. As a result, architects realized design can play a positive role in addressing these issues. It could also serve as a way to demonstrate environmental responsibility and could transform these poor isolated areas into inspiring urban developments.

"Culture is the product of a people's history. But it also reflects that history, and embodies a whole set of values by which a people view themselves and their place in time and space"
-Wa Thiong'o Ngugi

VERTICAL GYM

URBAN THINK TANK / CARACAS, VENEZUELA

The vertical gym was built in the La Cruz Barrio in an existing soccer field. The training facility includes an open-air soccer field, a basketball court, a weight room, a running track, a dance studio, and a rock-climbing wall. Due to overpopulation in the area, the vertical gym had no room for expansion and had to be built upwards. The gym is open during day and night, with about 15,000 visitors per month. The gym not only introduced a new program to this barrio but has also reduced the crime rate by more than 30%. The idea and design concept of this project were developed for La Cruz but can be implemented in many barrios like this one.



METRO CABLE

URBAN THINK TANK / CARACAS, VENEZUELA

The project was developed after a U-TT meeting at Caracas' Central University. In the meeting the government's plan to build a road through the San Agustin Barrio was opposed by planners, barrio leaders, architects and university architects. Thus, new alternatives were explored. The solution, to build a cable car system, not only worked perfectly with the mountainous terrain but would connect these kinds of Barrios to the existing public transit system. The Cable system has gondolas that can hold eight passengers each and transport about 1,200 passengers every hour. There are five stations in total. Two are located in the valley and three are along the mountain ridge. The metro cable system helped to connect the Barrios to public transit and other civic services, something that the people living in these Barrios did not have before.




REDLOCATION MUSEUM OF STRUGGLE

NOERO WOLFF ARCHITECTS
PORT ELIZABETH, SOUTH AFRICA

Red Location, one of the oldest black townships in the city of Port, gets its name from corrugated iron barracks buildings which have rusted to a deep red hue. After the abolition of the Apartheid government in 1994, the city decided that they wanted to have a museum at Red Location to commemorate the Apartheid Era. Noero Wolff Architects won the competition and subsequently developed the museum. The purpose of the museum was to honor the history of the Apartheid Era, and create a new urban development rich in culture and infrastructure. In developing the design and selecting the materials used, the architects took into account the citizens and the surroundings because the citizens were skeptical about bringing something new into their city. As a result, concrete and steel were the primary materials used, which work perfectly with Red Location's industrial surroundings.




LEON DE GRIEF LIBRARY PARK

GIANCARLO MAZZANTI / MEDELLIN, COLOMBIA

The aim of this project was to establish big urban connections through the development of public spaces. The project consists of three squared modules that have been contained, rotated, and adapted to the view and landscape, and one other module that relates and connects the other modules. The program was divided into four programs: library, community center, cultural center, and expository rooms. Many other library parks like Belen, España, Tomas Carrasquilla, and Sacerdote Jose Luis Arroyave have been developed and strategically located around the city to help these isolated and disadvantaged sectors improve. These libraries have strengthened the implementation of education, cultural and sports program in favelas.

CARIN SMUTS

ARCHITECT IN SOUTH AFRICA

Carin Smuts is an architect working in South Africa. Many of her projects have been community projects in black townships. Taking into account that Global warming has become an issue for everyone, Carin and her team have focused on this issue and for that reason they realized that investigating local architecture could be more useful and more complex. They focused on rural vernacular architecture which was relevant to urban informal settlements. They created their own way of designing from their investigations. They discovered that a traditional village is made up of several structures, where social interaction mostly occurs in spaces between these structures. The way and order the structures are placed also tells a lot about cultural and social interaction. As a result, this has become their philosophy, and with it they have been able to utilize space effectively.

KALI CODE KAMPONG

YOUSEF BILYARTA MANGUNWIJAYA
YOGYAKARTA, CENTRAL JAVA, INDONESIA

Kali Code is a river situated in the province of Daerah Istimewa Yogyakarta, in the heart of Yogyakarta. A village called Kali Code Kampong was built right next to the river with about 51 households. In 1983 the government was going to demolish the settlement but architect and Catholic priest Yousef decided to transform this dump site into a settlement. Retaining walls were used to shore up the sloped narrow site. Bamboo was used for joists, walls, and floor coverings and corrugated iron or tile for the roof. Art students decorated the exteriors of the houses and transformed them into works of art.

2.10 SOUTH AFRICAN ARCHITECTURAL HISTORY

"[Joburg is] an open-air vmuseum of the best and worst the 20th century has had to offer." –Henning Rasmuss

HISTORICAL ARCHITECTURE (1652 TO 1994)

YEAR 1882
TYPE BRITISH COLONIAL HOUSE
SIGNIFICANCE THE TIDE GAUGE HOUSE IN CAPETOWN IS AN ICON OF SOUTH AFRICA'S LONG HISTORY AS A SOUTHERN HUB OF GLOBAL TRADE. THE RECENTLY RESTORED BUILDING FEATURES A ROOM WITH WALL-TO-WALL MIRRORS BELOW WINDOWS, WHICH ALLOWS THE DOCK ENGINEER TO MONITOR WITH A 360-DEGREE VIEW. WITH LITTLE POLITICAL ANIMOSITY, THE TIDE GAUGE HOUSE SERVES AS A POSITIVE, PLAYFUL HISTORICAL REFERENCE FOR CONTEMPORARY SOUTH AFRICAN ARCHITECTURE.
SOURCE MERVYN HECTOR ON FLICKR

YEAR 1905
TYPE HOMESTEAD
ARCHITECT JAMES ALFRED COPE-CHRISTIE
SIGNIFICANCE THE CL ANDERSSON HOUSE IS A CLASSIC EXAMPLE OF THE BRITISH HOMESTEAD. IT'S VARIOUS ORNAMENTS, INCLUDING AN OCTAGONAL TOWER WITH AN ONION DOME AND NON-FUNCTIONAL PARAPET, REFER TO A MEDIEVAL PERIOD SOUTHERN AFRICA NEVER EXPERIENCED. THE CLANDERSSON SET THE STAGE FOR A DRAMATIC REACTION OF FUNCTIONALITY AND MINIMALISM WITH THE MODERN MOVEMENT.
SOURCE ARTEFACTS.CO.ZA

YEAR 1920
TYPE ARTS AND CRAFTS HOUSE
ARCHITECT SOLOMON AND MARSHALL
SIGNIFICANCE IN RESPONSE TO A THEME OF UNIFORMITY AT THE GREAT EXHIBITION IN 1851, WILLIAM MORRIS GALVANIZED THE ARTS AND CRAFTS MOVEMENT, WHICH AIMED TO ADAPT CLASSICAL ARCHITECTURE TO LOCAL CONTEXT THROUGH THE USE OF LOCAL MATERIALS. THE BELL HOUSE HAS A CLEARLY EUROPEAN STYLE, WITH ITS HIPPED ROOFS, ARCHWAYS AND SYMMETRY. HOWEVER, ITS CLAY SHINGLES AND STONE PATHWAYS ARE LOCAL ADAPTATIONS.
SOURCE ARTEFACTS.CO.ZA

YEAR 1933
TYPE ART DECO THEATRE
ARCHITECT PETER R COOKE
SIGNIFICANCE INSPIRED BY THE HEAVY ART DECO BUILDINGS OF GLOBAL CITIES, THE COLOSSEUM THEATRE IS A CLASSIC EXAMPLE OF SOUTH AFRICA'S HISTORIC TENDENCY TO IMPORT FOREIGN ARCHITECTURE TO CREATE CONGRUENCY WITH THE GLOBAL ECONOMY. THE THEATRE FEATURED AN EGYPTIAN THEME, WHICH REPRESENTED AFRICA'S ALLURE AS A TOURIST ATTRACTION, BUT THE ARCHITECTURE DOES LITTLE MORE TO RESPOND TO SOUTH AFRICAN CONTEXT.
SOURCE S. A. R. AND H. ON FLICKR

YEAR 1939
TYPE ART DECO BREWERY
ARCHITECT WILLIAM WEIGHTMAN
SIGNIFICANCE BUILT FOR SOUTH AFRICAN BREWERIES, CASTLE BEER HALL IS AN EXAMPLE OF THE TENDENCY FOR GLOBALLY FASHIONABLE ARCHITECTURE TO BE SUPERFICIALLY APPROPRIATED OUT OF CONTEXT. WHILE IT FEATURES ART DECO-STYLE GEOMETRY, THE CASTLE BEER HALL IS NOT BUILT OF THE HEAVY MATERIALS OR TO THE SCALE OF THE INTERNATIONAL STYLE IT REFERENCES. THE RESULT IS AN ARTIFICIAL, PERHAPS PLAYFUL, BUT NOT UNIQUE OR FUNCTIONAL ARCHITECTURAL MESSAGE.
SOURCE WWW.ARTEFACTS.CO.ZA

YEAR 1953
TYPE "LOOKING AROUND" BANK
ARCHITECT NORMAN EATON
SIGNIFICANCE EATON POSTHUMOUSLY WON THE GOLD MEDAL OF THE SOUTH AFRICAN INSTITUTE OF ARCHITECTS. HE TOOK GREAT PRIDE IN "AFRICAN QUALITY" CONSTRUCTION AND THE SIMPLICITY OF THE VERNACULAR BRICK. HIS FAMOUS NETHERLANDS BANK FEATURES CANTILEVERED PRECAST CONCRETE AND VERTICAL BRICK SUNSCREENS, WHICH SHADE THE BUILDING AND CIRCULATION SPACES DURING THE DAY AND ACT AS RADIATORS DURING THE COOL NIGHTS.
SOURCE WWW.ARTEFACTS.CO.ZA

YEAR 1904
TYPE COLONIAL PUBLIC FACILITY
ARCHITECT RENOVATED BY MICHAEL HART
SIGNIFICANCE THE HISTORY OF JOHANNESBURG COULD BE TOLD IN THE SETTING OF THE DRILL HALL, WHICH IS LOCATED AT ONE OF THE CITY'S BUSIEST NODES. ORIGINALLY A MILITARY FACILITY, THE DRILL HALL ALSO SERVED AS A PLACE OF ASSEMBLY FOR ANTI-APARTHEID ACTIVISTS, AND MOST RECENTLY HOUSED REFUGEES OF THE DRAMATIC URBAN DECAY RESULTING FROM THE POST-DEMOCRACY FLIGHT OF BUSINESSES FROM THE CITY CENTRE. AFTER TWO DEADLY FIRES, THE CITY FUNDED ITS ADAPTIVE RE-USE TO CREATE A PUBLIC CULTURAL SPACE THAT PRESERVES HISTORICAL MEMORY AND REVIVES THE URBAN CENTRE.
SOURCE (DECKLER, GRAUPNER AND RASMUSS)

VERTICAL ILLUSTRATOR TIMELINE

DUTCH COLONIAL PERIOD (1652-1920)

NEO-CLASSICAL ERA (1910-1930)

MODERN MOVEMENT (1930-1945)

"LOOKING AROUND" (1945-1960)

MODERN VERNACULAR (1960-1980)

TYRANNY AND UNCERTAINTY (1980-2000)

IT'S TIME FOR AFRICA (2000- ?)

YEAR 1936
TYPE ART DECO MIXED-USE
ARCHITECT EMLEY AND WILLIAMSON
SIGNIFICANCE KNOWN AS "JOHANNESBURG'S CHRYSLER BUILDING", THE ANSTEY BUILDING IS THE MOST PROMINENT REMAINING EXAMPLE OF ART DECO INFLUENCE IN SOUTH AFRICAN ARCHITECTURE. THE BUILDING WAS A PRAISED FOR ITS ELEGANT COMBINATION OF EMLEY'S CLASSICAL, COLONIAL STYLE AND WILLIAMSON'S MODERN AMBITIONS, AND WAS DECLARED A NATIONAL MONUMENT IN 1994 DURING ITS REFURBISHMENT BY DENZIL HERSCH.
SOURCE WWW.JOBURG-ARCHIVE.CO.ZA

YEAR 1973
TYPE MODERN SKYSCRAPER
ARCHITECT SKIDMORE, OWINGS AND MERRILL
SIGNIFICANCE AT 223 M, THE CARLTON CENTRE IS THE TALLEST SKYSCRAPER IN AFRICA, AND A SYMBOL OF SOUTH AFRICA'S AMBITIONS TO BECOME A GLOBAL COUNTRY. IN 2007, TRANSNET ANNOUNCED IT WILL BE SELLING THE BUILDING DUE TO HIGH CRIME RATES IN THE CITY CENTRE. THE FLIGHT OF BUSINESSES TO THE SAFER EDGES OF THE CITY HAS BEEN A TROUBLING TREND IN JOHANNESBURG OVER THE LAST DECADE.
SOURCEV WWW.ARTEFACT.CO.ZA

"Architectures are being lifted out of context to be plonked down in unsuitable circumstances; in conditions that are climatically, economically, socially inappropriate." -Alan Lipman

NEW ARCHITECTURE FOR A NEW ERA (1994 TO PRESENT

"What is the best we can hope for? An architecture that does not turn its back on the world out there, that reflects our awareness of global architectural provduction, but celebrates the local. An architecture that is optimistic, clear, honest in its use of materials, and suited for its purpose." – Henning Rasmuss

YEAR 1986

THE NEW COLONNADE

TYPE CRITICAL REGIONALIST SHOPPING MALL

ARCHITECT OSMAND LANGE ARCHITECTS

SIGNIFICANCE AWARDED BY THE BORDER INSTITUTE OF ARCHITECTS IN 1989 FOR ITS CONTRIBUTION TO THE STREET SCENE, ACCOMMODATION OF EXISTING TREES AND THOUGHTFUL DETAILING, THE NEW COLONNADE IS A RARE EXAMPLE OF CONTEXTUAL ARCHITECTURE DURING A PERIOD MARKED BY UNCERTAIN ARCHITECTURAL IDENTITY. THE EXTERIOR FEATURES A COLONNADE, WHICH CREATES A COOL, SHADED PEDESTRIAN SPACE, COST-EFFECTIVE CORRUGATED METAL ROOFING, AND CLIMATE-MODERATING MASONRY BEARING WALLS.

SOURCE WWW.ARTEFACTS.CO.ZA

YEAR 1990

KOMMAGAS CRECHE

TYPE CRITICAL REGIONALIST MULTI-PURPOSE CRECHE

ARCHITECT CARIN SMUTS STUDIOS

SIGNIFICANCE THE KOMMAGAS CRÈCHE WAS DESIGNED AND BUILT USING A PARTICIPATORY PROCESS, WHICH REVEALED A DESIRE TO REFERENCE THE ROUND HUT VERNACULAR, WHICH WAS EMULATED IN ONE DIRECTION. THE HIGH CEILING, LIGHT-STEEL-FRAME CONSTRUCTION WITH WIDE OPENINGS ON THE NORTH AND SOUTH FACADES, AND WIDE RIDGE VENT ON THE ROOF FACILITATE VENTILATION. THE VERTICAL SKYLIGHT SHADES DURING THE INTENSE SUN, BUT IMPROVES SOLAR ACCESS AT COOLER HOURS. MASONRY WALLS AT THE ENDS PROVIDE THERMAL MASS AND ACOUSTIC MUFFLING. FINALLY, ORNAMENTAL FEATURES, SUCH AS A MURAL OF DYED WOOL RUGS, WERE DESIGNED AND PRODUCED BY COMMUNITY MEMBERS.

SOURCE WWW.CSSTUDIO.CO.ZAW

YEAR 1990

DUDUZA RESOURCE CENTRE

TYPE CRITICAL REGIONALIST RESOURCE CENTRE

ARCHITECT NOERO WOLFF ARCHITECTS

SIGNIFICANCE THE DUDUZA RESOURCE CENTRE IS A CLEAN, SOPHISTICATED AND CONTEMPORARY FACILITY BUILT WITH SOME OF THE MOST AFFORDABLE MATERIALS AVAILABLE: CORRUGATED METAL, COLORED CORRUGATED PLASTIC AND STEEL FRAMING. SHARP GEOMETRIES AND MINIMAL FINISHING LOWER CONSTRUCTION COSTS WHILE MAXIMIZING UTILITY AND PROFESSIONALISM. ELEGANT METAL-FRAME SUNSCREENS MANAGE SOLAR GAIN WITHOUT REQUIRING EXPENSIVE LOW-EMISSIVITY GLASS. THE BUILDING RECEIVED A NATIONAL AWARD OF MERIT IN 1993.

SOURCE WWW.NOEROWOLFF.COM

YEAR 1987

HOUSE COHEN

TYPE HOMESTEAD HOUSE

ARCHITECT AMANCIO GUEDES

SIGNIFICANCE AMANCIO GUEDES PRACTICED ALMOST EXCLUSIVELY IN MOZAMBIQUE, AND ATTEMPTED TO BRING HIS STYLE, WHICH DRAWS MORE HEAVILY ON AFRICAN VERNACULAR, TO JOHANNESBURG WITH HIS HOUSE COHEN. THE ARCHES, SPIRES AND PROPERTY WALLS ARE TYPICAL OF AFFLUENT SUBURBAN HOUSES, BUT THE UNFINISHED BRICK, CONCRETE AND METAL CONSTRUCTION IS DISTINCTLY SOUTHERN AFRICAN. ALAS, HOUSE COHEN NOW SITS VACANT AND VANDALIZED.

SOURCE WWW.ARTEFACTS.CO.ZA

YEAR 1990

HOUSE STAUDE

TYPE CRITICAL REGIONALIST HOUSE

ARCHITECT KATE OTTEN

SIGNIFICANCE IN HER HOUSE STAUDE, KATE OTTEN MANAGES TO ARTFULLY INTEGRATE CORRUGATED METAL, A CHEAPER, CULTURALLY INFERIOR MATERIAL, TO CONVERT AN ELEGANT, AFFLUENT SUBURBAN HOUSE INTO A HOME AND OFFICE. IN THE PROCESS, OTTEN EFFECTIVELY CHIPS AWAY AT THE STIGMA OF CORRUGATED METAL AND THE DIVISIONS BETWEEN THE RICH AND POOR SOUTH AFRICANS. THE CORRUGATED METAL IS ORIENTED UPWARDS TO EXAGGERATE THE HEIGHT AND GRANT PROMINENCE. ON-SITE STONES ARE USED FOR ALL PATHWAYS AND LANDSCAPING FEATURES. SOURCE KATEOTTENARCHITECTS.COM

YEAR 1990

SOWETO CAREERS CENTRE

TYPE CRITICAL REGIONALIST RESOURCE CENTRE

ARCHITECT NOERO WOLFF ARCHITECTS

SIGNIFICANCE GRANTED THE AWARD OF EXCELLENCE FROM THE SOUTH AFRICAN INSTITUTE OF ARCHITECTS, THE SOWETO CAREERS CENTRE IS NOERO'S MOST PRAISED WORK. THE CENTER FEATURES THE SHARP GEOMETRY AND CORRUGATED METAL EXTERIOR OF THE DUDUZA RESOURCE CENTRE, WITH AN EXAGGERATED, HEROIC HIERARCHY OF SCALE THAT RENDERS IT A HOPEFUL PRESENCE IN THE MIDST OF AN EXTREMELY DISADVANTAGED SLUM. PERMEABLE BRICK SCREENS WALL ITS CIRCULATION SPACES, ALTHOUGH ENTRANCES ARE CLEARLY DEFINED, ITS PERMEABLE TRANSITION SPACES ALLOW PASSIVE VENTILATION AND FILTERED SOLAR ACCESS.

SOURCE IMAGE: WWW.NOEROWOLFF.COM, INFO: A. RHEEDER, UNIVERSITY OF PRETORIA, 2005

YEAR 1990

KATLEHONG CRECHE

TYPE CRITICAL REGIONALIST CRÈCHE

ARCHITECT NOERO WOLFF ARCHITECTS

SIGNIFICANCE THE KATLEHONG CRECHE FEATURES SUPERSTRUCTURE COMPOSED OF A SIMPLE STEEL FRAME WITH CORRUGATED METAL ROOF PANELS THAT SHADE THE CLASSROOMS AND IMMEDIATE OUTDOOR SPACES. THE SUPERSTRUCTURE WAS CONSTRUCTED FIRST TO CREATE A FAVORABLE MICROCLIMATE FOR THE REMAINING CONSTRUCTION. THE FLEXIBILITY OF THE MASONRY USED FOR THE WALLS PERMITTED A MORE FLEXIBLE GEOMETRY. WALLS WERE PAINTED WITH VIBRANT COLORS BUT WITH CONSISTENCY, AND SOME STRUCTURES INCLUDED PLAYFUL ELEMENTS SUCH AS SECRET PASSAGES AND INFORMAL OUTDOOR THEATERS.

SOURCE WWW.NOEROWOLFF.COMV

YEAR 1995

BARTELS ARTS TRUST

TYPE CRITICAL REGIONALIST MULTI-PURPOSE CENTRE

ARCHITECT PAUL MIKULA AND DICK BREYTENBACH

SIGNIFICANCE AN AUSTRIAN IMMIGRANT TO SOUTH AFRICA, HUGO BARTEL, APPOINTED MIKULA AND BREYTENBACH TO BUILD A MULTI-PURPOSE ARTS CENTRE, COMPLETE WITH GALLERIES, A RESTAURANT, STUDIOS, AND SHOPS. A DYNAMIC MURAL WRAPS THE ENTIRE EXTERIOR AND BROKEN FACADES CREATE COMFORTABLY SHADED TRANSITION SPACES. THE ECCENTRIC GEOMETRY AND MURAL REFER TO A TRADITION OF ECCENTRIC, IRREGULAR VERNACULAR ARCHITECTURE THAT HAS HISTORICALLY BEEN TYPICAL OF COMMUNITY CENTRES FOR BLACK SOUTH AFRICANS.

SOURCE WWW.BATCENTRE.CO.ZA

HOUSE BESTER

YEAR 1995
TYPE PARTICIPATORY STUDIO
ARCHITECT CARIN SMUTS
SIGNIFICANCE WILLIE BESTER IS WELL-KNOWN FOR HIS INNOVATIVE ARTWORK. BESTER SALVAGES OBJECTS FROM SCRAPYARDS, POLICE STATIONS, ARMOURIES, HARDWARE STORES AND HOSPITALS, AND ASSEMBLES THEM INTO EXPRESSIVE SCULPTURES WITH POLITICAL SIGNIFICANCE. CARIN SMUTS WORKED CLOSELY WITH THE ARTIST, AS SHE HAS WITH ALL OF HER CLIENTS, TO CREATE A STUDIO/HOUSE ORNAMENTED COMPLETELY WITH SCRAPPED OBJECTS THAT ARE PAINTED WITH BRIGHT COLORS AND TRANSFORMED INTO FUNCTIONAL FURNITURE. USING SALVAGED OBJECTS TO CREATE EXPLORATORY SPACES IN A PRE-SCHOOL IS COST-EFFECTIVE, SUSTAINABLE, AND CREATES AN OPPORTUNITY TO INVOLVE THE COMMUNITY, WHICH CAN AID IN THE SALVAGING EFFORT.
SOURCE WWW.CSSTUDIO.CO.ZA

MOKHELE ART THERAPY CENTRE

YEAR 1997
TYPE CRITICAL REGIONALIST CLINIC
ARCHITECT KATE OTTEN
SIGNIFICANCE ART THERAPY USES MATERIALS, IMAGES AND ARTWORK TO TREAT POST-TRAUMATIC STRESS DISORDER AND SIMILAR PSYCHOLOGICAL ISSUES, AS WELL AS BUILD SELF-ESTEEM IN PEOPLE WITH NO HISTORY OF MENTAL HEALTH PROBLEMS. IN HER MOKHELE ART THERAPY AND EDUCATION PROJECT (MATEP) CENTRE IN SOWETO, OTTEN MANAGES TO CREATE A THERAPEUTIC ENVIRONMENT THROUGH THE INNOVATIVE USE OF LOCAL MATERIALS. ALL OUTDOOR CIRCULATION SPACE IS SHADED, WINDOWS ARE KEPT HIGH FOR PRIVACY, ANGLED GUMPOLES AND ORGANIC MATERIALS BLUR THE BUILT AND NATURAL ELEMENTS.
SOURCE WWW.KATEOTTENARCHITECTS.COM

PARKHURST SHOPPING MALL

YEAR 2000
TYPE CRITICAL REGIONALIST SHOPPING MALL
ARCHITECT KATE OTTEN
SIGNIFICANCE OTTEN ELEGANTLY CONVERTS TWO SUBURBAN HOUSES INTO A SMALL SHOPPING MALL IN PARKHURST, ONE OF MANY GENTRIFYING SUBURBS IN JOHANNESBURG. THE PERIMETER WALLS WERE ELIMINATED TO IMPROVE ACCESS, AND SETBACKS WERE PAVED TO CREATE A WELCOMING STREETFRONT. AN ARTISTICALLY FOLDED, CANTILEVERED ROOF MADE OF A STEEL FRAME, WOOD RAFTERS AND A MIX OF TRANSLUCENT CORRUGATED PLASTIC AND REFLECTIVE CORRUGATED STEEL SHADE THE PEDESTRIAN WALKWAY. THE CONTEMPORARY GEOMETRY AND LOCAL MATERIALS DIFFERENTIATE THE VERANDA FROM NEGATIVELY SYMBOLIC COLONIAL VERANDAS. THE USE OF RECYCLED MATERIALS AND LACK OF FINISHING PRESERVE A RESIDENTIAL FEEL WHILE ADDRESSING THE SITES NEW FUNCTIONAL DEMANDS.
SOURCE WWW.KATEOTTENARCHITECTS.COM

WORKER'S LIBRARY

YEAR 1995
TYPE CRITICAL REGIONALIST LIBRARY
ARCHITECT ALAN ROBERT LIPMAN
SIGNIFICANCE LIPMAN'S WORKER'S LIBRARY & MUSEUM WON THE SOUTH AFRICAN INSTITUTE OF ARCHITECTS AWARD OF MERIT FOR CONSERVATION IN 1995, CITED AS "A ROLE MODEL FOR ALL ARCHITECTS FACED WITH THE CHALLENGE OF MAKING OUR BUILT HISTORY RELEVANT TO OUR CHANGING SOCIETY". THE BUILDING WAS FORMERLY ONE OF THE NOTORIOUSLY OPPRESSIVE WORKER HOSTELS, AND ONE WING OF THE HOSTEL WAS PRESERVED AS A MUSEUM. GENERIC FEATURES WERE PRESERVED WHILE A MEZZANINE, RESTORED COURTYARD AND FLOATING DETAILS MODERNIZE THE BUILDING.
SOURCE WWW.ARTEFACTS.CO.ZA AND WWW.SAIA.ORG.ZA

DE BEERS BUILDING

YEAR 1996
TYPE CRITICAL REGIONALIST OFFICE BUILDING
ARCHITECT HELMUT JAHN
SIGNIFICANCE DE BEERS IS THE LARGEST DIAMOND PRODUCER IN THE WORLD AND AS WEALTHY AS ONE WOULD EXPECT. NONETHELESS, ITS TWO MOST RECENT BUILDINGS ARE LEADING THE DEFINITION OF A UNIFIED ARCHITECTURAL STYLE THAT CROSSES RACIAL AND ECONOMIC BOUNDARIES. THE EXPOSED STRUCTURE, BRICK AND STEEL MATERIALS AND UBIQUITOUS SUNSCREENS RESPOND TO LOCAL CONDITIONS. WATER PONDS, REPRESENTING THE RESERVOIRS IN THE MINES AND GRANITE FLOOR TILES, REPRESENTING THE DIAMOND-BEARING KIMBERLITE STONE, ARE ELEGANT REFERENCES TO THE BUILDING'S FUNCTION.
SOURCE (DECKLER, GRAUPNER AND RASMUSS)

SINGITA LODGES

YEAR 2000
TYPE CRITICAL REGIONALIST ECOLODGE
ARCHITECT ANDREW MAKIN AND JANINA MASOJADA
SIGNIFICANCE WINNER OF THREE MAJOR INTERNATIONAL HOTEL AWARDS AND THE SOUTH AFRICAN INSTITUTE OF ARCHITECTS AWARD OF EXCELLENCE, THE SINGITA LODGES ARE BEACONS OF SUSTAINABLE TOURISM FOR THE ENTIRE CONTINENT OF AFRICA. LOCATED IN KRUGER NATIONAL PARK, THE SINGITA LODGES FEATURE NATURAL MATERIALS TO BLEND THE LODGE SEAMLESSLY INTO ITS ENVIRONMENT. UNFINISHED STICKS FORM AN ADJUSTABLE SUNSCREEN THAT DRAPES OVER THE VERANDA ON THE NORTH SIDE. UNFINISHED HEAVY CONCRETE COLUMNS CREATE A RADIATING THERMAL MASS.
SOURCE WWW.JUSTTHEPLANET.COM

RDP HOUSING

YEAR 1990S
TYPE AFFORDABLE RDP HOUSING
ARCHITECT UNKNOWN
SIGNIFICANCE THE RECONSTRUCTION AND DEVELOPMENT PROGRAM HAS PROVIDED HOUSING FOR THOUSANDS OF POOR SOUTH AFRICANS. THE HOUSE ON THE LEFT IS A TYPICAL EXAMPLE OF THE MONOTONOUS, INFLEXIBLE STRUCTURES PROVIDED BY THE GOVERNMENT. RECIPIENTS OF RDP HOUSING INEVITABLY EXPAND AND IMPROVE THEIR HOUSES WHILE ENJOYING UPWARD MOBILITY, AS SHOWN IN THE HOUSE ON THE RIGHT. HOWEVER, MOST RECIPIENTS COME FROM INFORMAL SETTLEMENTS AND HAVE LITTLE EXPERIENCE NAVIGATING GOVERNMENT BUREAUCRACY. AS A RESULT, MOST EXPANSIONS ARE UNAPPROVED AND MANY ARE UNSAFE. THE PROBLEM CREATES AN OPPORTUNITY FOR ARCHITECTS TO REDESIGN MORE ADAPTABLE AFFORDABLE HOUSING FOR THE GOVERNMENT.
SOURCE WWW.FLICKR.COM

UNAPPROVED EXPANSION

GUGA S'THEBE CULTURAL CENTRE

YEAR 1999

TYPE CRITICAL REGIONALIST CULTURAL CENTRE

ARCHITECT CARIN SMUTS

SIGNIFICANCE DURING AN 18-MONTH DESIGN PROCESS, SMUTS ATTEMPTED TO SERVE BOTH THE OLDER CONSTITUENTS, WHO HOPED FOR A TRADITIONAL RURAL DESIGN, AND YOUNGER CONSTITUENTS, WHO FAVORED A CONTEMPORARY DESIGN. BOTH GENERATIONS SOUGHT TO BREAK AWAY FROM THE MONOTONOUS ARCHITECTURE OF APARTHEID TOWNSHIPS. INSTEAD OF ONE LARGE CONTIGUOUS BUILDING, SMUTS CHOSE TO CREATE A VILLAGE OF SMALLER COURTYARD BUILDINGS. THIS STYLE CREATED MORE USEFUL OUTDOOR AND TRANSITION SPACE. DESIRE LINES IDENTIFIED FROM AERIAL PHOTOS DEFINED THE BOUNDARIES OF THE BUILDINGS IN ORDER TO WELCOME PEDESTRIAN TRAFFIC. THE GOLD, TRUNCATED-CONE EXHIBITION SPACE REFERS TO THE TRADITIONAL 'RONDAWEL' VERNACULAR. THE ENTRANCE AND INTERIORS ARE BLANKETED WITH COLORFUL TILE AND PAINTED WITH MURALS BY LOCAL CRAFTSMEN. THE CENTRE WON THE GLOBAL AWARD IN 2008 AND DESIGN AND HEALTH INTERNATIONAL AWARD IN 2010, AND HAS BECOME A POPULAR TOURIST ATTRACTION.

SOURCE WWW.CSSTUDIO.CO.ZA

WOMEN'S JAIL PRECINCT

YEAR 2002

TYPE CRITICAL REGIONALIST LIVING MUSEUM

ARCHITECT KATE OTTEN ARCHITECTS

SIGNIFICANCE OTTEN TRANSFORMED A PRISON WHERE ANTI-APARTHEID ACTIVISTS WERE UNJUSTLY DETAINED AND TORTURED INTO NEW OFFICE BUILDINGS FOR THE SOUTH AFRICAN HUMAN RIGHTS COMMISSION. RECENT ADDITIONS WERE DEMOLISHED TO REVEAL THE HISTORICAL SIGNIFICANT BUILDINGS, AND OTTEN TOOK CARE TO DIFFERENTIATE NEW ADDITIONS FROM THE ORIGINAL STRUCTURES. ONE NEW ADDITION STRADDLES THE PERIMETER WALL AS AN EXPRESSION OF FREEDOM, AND A PERFORATED-METAL SUNSCREEN MIMICS THE SKY THAT GAVE PRISONERS HOPE.

SOURCE (DECKLER, GRAUPNER AND RASMUSS)

JOUBERT HOUSE

YEAR 2000

TYPE CONTEMPORARY STUDIO/HOUSE

ARCHITECT ORA JOUBERT

SIGNIFICANCE AS A PROFESSOR OF ARCHITECTURE AT THE UNIVERSITY OF PRETORIA, ORA JOUBERT ENJOYED BEING HER OWN CLIENT, FREE OF CONSTRAINTS TO HER ARTISTIC EXPRESSION. JOUBERT USED MATERIALS, INCLUDING THE CORRUGATED STEEL MOTIF, SALVAGED FROM A NEARBY STABLE, AND CREATED A WHIMSICALLY WINGED GEOMETRY. ALTHOUGH HER USE OF RECYCLED MATERIALS AND INNOVATIVE STRUCTURAL DETAILS EARNED HER A MERIT AWARD IN 1995 FROM THE SOUTH AFRICAN INSTITUTE OF ARCHITECTS, THE STUDIO IS CRITICIZED FOR FAILING TO RESPOND TO THE CLIMATE.

SOURCE WWW.ARTEFACTS.CO.ZAZ

HOUSE TOUSSAINT

YEAR 2002

TYPE CRITICAL REGIONALIST HOUSE

ARCHITECT NOERO WOLFF ARCHITECTS

SIGNIFICANCE IN GLOBAL CITIES WITH SEVERE INEQUALITY, CRIME AND TRAFFIC, THE WEALTHY OFTEN USE HELICOPTERS AS A FAST AND RELATIVELY SAFE MEANS OF TRANSPORT. DESPITE HIS MEMBERSHIP TO THIS ELITE CLASS, TIM TOUSSAINT REQUESTED THAT HIS HOUSE AND HANGER USE LOCAL MATERIALS ASSOCIATED WITH LOWER INCOME HOUSING: NAMELY BRICKS AND CORRUGATED METAL. THE HOUSE FEATURES ROOF PERFORATIONS THAT PERMIT SOLAR ACCESS WITH WINTER SOLAR ANGLES AND BLOCK THE SUN IN THE SUMMER.

SOURCE WWW.NOEROWOLFF.COM

ZOLANI CENTRE

YEAR 2002

TYPE CRITICAL REGIONALIST MULTI-PURPOSE CENTRE

ARCHITECT CARIN SMUTS

SIGNIFICANCE IN THE 1950S, THE ZOLANI CENTRE WAS BUILT BY LOCAL BLACK AUTHORITIES IN NYANGA, ONE OF THE MOST VIOLENT AND IMPOVERISHED SLUMS IN SOUTH AFRICA. SMUTS USED A PARTICIPATORY PROCESS TO UPDATE THE BUILDING, AND BUILT AN ADDITION THAT BROKE THE STRICT GRID PATTERN REMINISCENT OF APARTHEID OPPRESSION AND CREATED THE TYPE OF ASYMMETRIC TYPOLOGY THEY WOULD HAVE BUILT HAD THEY THE FREEDOM TO DO SO. LOW CONCRETE THRESHOLD WALLS CREATE "IN BETWEEN" SPACES FOR SOCIAL INTERACTION AND GUIDE PEDESTRIAN CIRCULATION.

SOURCE WWW.CSSTUDIO.CO.ZA

BARAGWANATH STATION

YEAR 2003

TYPE CRITICAL REGIONALIST TRANSPORT HUB AND MARKET

ARCHITECT URBAN SOLUTIONS

ARCHITECTS AND URBAN DESIGNERS

SIGNIFICANCE THE BARAGWANATH TRANSPORT INTERCHANGE AND TRADERS MARKET IS A SYMBOLIC BUILDING, CONNECTING THE HISTORICALLY MARGINALIZED SOWETO TO NEW OPPORTUNITIES IN DOWNTOWN JOHANNESBURG. BUILT-IN CONCRETE ALCOVES PROVIDE STALLS FOR INFORMAL BUSINESSES AND SEATING AREAS FOR COMMUTERS. THE FACADES ARE DOTTED WITH LOCAL ARTWORK, ALTHOUGH THEIR HIGH ELEVATION MAKES THEM DIFFICULT TO APPRECIATE. THE LOW-SLOPE CONCRETE ROOF HAS MADE WATERPROOFING DIFFICULT, BUT THE CONCRETE ARCADE EFFECTIVELY SHADES THE COLONNADE IN THE SUMMER ONLY.

SOURCE UNIVERSITY OF PRETORIA

DAWID KLAASTE CENTRE

YEAR 2005

TYPE CRITICAL REGIONALIST MULTI-PURPOSE CENTRE

ARCHITECT CARIN SMUTS

SIGNIFICANCE AS ALWAYS, CARIN SMUTS ENRICHED HER ARRAY OF DESIGN CONSIDERATIONS WITH A PARTICIPATORY PROCESS FOR HER DAWID KLAASTE MULTI-PURPOSE CENTRE. HER CHARRETTES REVEALED DESIRES FOR A WINDMILL IN RESPONSE TO THE WINDINESS OF THE REGION, THE HISTORICAL RISK OF FLOODS, AND THE LOCAL ARCHAEOLOGICAL DISCOVERY OF A GIANT WATER SCORPION FOSSIL. SMUTS REUSED ROOFING MATERIAL AS CLADDING, AND PARTNERED THE FAMOUS ARTIST WILLIE BESTER WITH LOCAL METALWORKERS TO PRODUCE HANDRAILS FROM FARMYARD SCRAPS. THE PLAYFUL LOCALS EVEN REQUESTED THAT THE HEAD OF THE WINDMILL BE SCULPTED LIKE A ROCKET, AND SO IT WAS.

SOURCE WWW.CSSTUDIO.CO.ZA

TRANSNET STORE

YEAR 2008

TYPE COMMERCIAL RETROFIT

ARCHITECT STREY ARCHITECTS (STARCH)

SIGNIFICANCE STARCH WORKED WITH THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR) TO SUSTAINABLY RETROFIT THE TRANSNET PATTERN STORE FROM AN ENGINEERING DRAFTING OFFICE AND LOCOMOTIVE DEPOT INTO AN OPEN PLAN OFFICE. NINETY PERCENT OF THE DEMOLISHED MATERIALS WERE SALVAGED; BRICKS WERE REUSED STRUCTURALLY, MECHANICAL EQUIPMENT WAS TRANSFORMED INTO LANDSCAPE FEATURES, ROOF SHEETING WAS DONATED TO LOCAL SCHOOLS. A SAW-TOOTH ROOF GEOMETRY AND GLASS PARTITIONS IMPROVED SOLAR ACCESS.

SOURCE WWW.CSIR.CO.ZAZ

YEAR 2004
TYPE CRITICAL REGIONALIST COURT HOUSE
ARCHITECT URBAN SOLUTIONS AND OMM DESIGN WORKSHOP

CONSTITUTIONAL COURT

SIGNIFICANCE BUILT ON THE 10TH ANNIVERSARY OF THE NEW DEMOCRACY, THE CONSTITUTIONAL COURT SYMBOLIZES THE CORE VALUES OF TRANSPARENCY, RECONCILIATION, ACCESSIBILITY AND SUSTAINABILITY THAT FORM THE PILLARS OF THE NEW SOCIETY. THE BUILDING AIMS TO OVERCOME THE HISTORY OF ITS SITE, ON WHICH THE WORLD'S ONLY PRISON THAT INCARCERATED BOTH MANDELA AND GANDHI IS PRESERVED. RUBBLE FROM THE DEMOLISHED BUILDINGS ON THE SITE PROVIDES THERMAL MASS IN GIGANTIC GABION WALLS IN THE COURT CHAMBER. BRICKS FROM THE INFAMOUS AWAITING TRIAL BLOCK WERE REUSED IN THE "GREAT AFRICAN STAIRS", WHICH FORM THE ENTRANCE TO THE BUILDING. A BARE CONCRETE FRAME CREATES A THERMALLY RADIATING ARRAY THAT, WHEN COMBINED WITH STRATEGIC ORIENTATION AND SHADING STRUCTURES, ENABLES MOSTLY PASSIVE CLIMATE CONTROL. ANGLED SLOTS WERE CAST INTO THE ROOF PLANKS AND FILLED WITH SKYLIGHTS THAT DECORATIVELY PROTRUDE ON THE EXTERIOR. ON THE EAST AND SOUTH FACADES, MOSAIC CLADDING ATTRACTS THE ATTENTION OF PEDESTRIANS. ON THE NORTH AND WEST FACADES, SUNSCREENS, INDIGENOUS TREES AND PASSIVELY ROTATING PERFORATED PANELS CALLED SUN BAFFLES, MODERATE SOLAR GAIN. THE REX WELSH LIBRARY TOWER CURTAINED WITH FROST GLASS EMULATES THE RISING PRISMS OF THE HECTOR PIETERSON MEMORIAL AND APARTHEID MUSEUM, WHICH SYMBOLIZE A HOPEFUL, PRINCIPLED REBIRTH.
SOURCE WWW.ARUP.COM

YEAR 2003
TYPE CRITICAL REGIONALIST RESOURCE CENTRE

ALEXANDRA INTERPRETATION CENTRE

ARCHITECT PETER RICH
SIGNIFICANCE THE ALEXANDRA INTERPRETATION CENTRE OFFERS TRAINING FOR SMALL BUSINESSES AND TOUR GUIDES, SHOWCASES LOCAL ARTWORK AND JAZZ ARCHIVES, AND PROVIDES PLAZAS, AN INTERNET CAFÉ, A FOOD COURT, AND A YOUTH CENTRE. THE BUILDING SPANS A BUSY PEDESTRIAN WAY, GRANTING IT PRESENCE AND ACCESSIBILITY. THE STEEL FRAME IS EXPOSED AND PAINTED RED, WHICH BECOMES AN AESTHETIC THEME THROUGHOUT THE BUILDING. HEAVY-BRICK MASONRY WAS CHOSEN FOR INTERIOR WALLS FOR ITS THERMAL MASS, ACOUSTIC MUFFLING AND AFFORDABILITY. UBIQUITOUS STAINED GLASS WINDOWS AND OTHER ORNAMENTAL FEATURES WERE DESIGNED BY LOCALS, WHO ALSO INFLUENCED THE DESIGN THROUGH PARTICIPATORY WORKSHOPS.
SOURCE WWW.PETERRICHARCHITECTS.CO.ZA

YEAR 2008

ENERGY WORKS

TYPE SUSTAINABLE OFFICE BUILDING
ARCHITECT ENRICO DAFFONCHIO
SIGNIFICANCE THE ITALIAN-SOUTH AFRICAN STARCHITECT ENRICO DAFFONCHIO HAS TAKEN ON PARTICULARLY SENSITIVE PROJECTS, SUCH AS HIS CRADLE OF MANKIND RESTAURANT AND KRUGER NATIONAL PARK OUTPOST. HIS MOST RECENT ENERGY WORKS BUILDING WON THE GAUTENG INSTITUTE FOR ARCHITECTURE PRIZE IN 2009. DAFFONCHIO ALLOWED THE STEEL FRAME TO PROTRUDE OUTSIDE THE GLAZED CURTAIN, WHERE IT SUPPORTS SOLAR SHELVES WHICH SIMULTANEOUSLY EXTEND SOLAR ACCESS FURTHER INTO THE BUILDING AND SHADE DURING THE MIDDAY. FINISHING IS MINIMAL, AND GREEN TECHNOLOGIES ARE SEAMLESSLY INTEGRATED.
SOURCE WWW.AZA2010.ORG

YEAR 2007

MAPUNGUBWE CENTRE

TYPE CRITICAL REGIONALIST INTERPRETATION CENTRE
ARCHITECT PETER RICH
SIGNFICANCE RICH WON THE WAF WORLD BUILDING OF THE YEAR AWARD IN 2009 FOR HIS MAPUNGUBWE INTERPRETATION CENTRE. TWO GIANT STONE-CLAD VAULTS ARE COVERED IN LOCALLY GATHERED STONES TO EMULATE CAIRNS, PILES OF ROCK USED AS ROUTE MARKERS BY NATIVE TRIBES. THE BOTTOM EDGES OF THE VAULT ARCH UP TO REVEAL THE INTERIOR, RECREATING THE JOY OF THE SEVERAL ARCHAEOLOGICAL DISCOVERIES OF THE SITE. THE BUILDINGS FORM AN EQUILATERAL TRIANGLE, EMULATING THE COMPOUNDS OF LOCAL TRIBES. UNEMPLOYED LOCALS WERE TRAINED TO PRODUCED STABILIZED EARTH TILES AND CONSTRUCT THE VAULTS.
SOURCE WWW.PETERRICHARCHITECTS.CO.ZA

In a landscape defined by the absence of buildings and by cities growing in an anti-urban manner, relevant architecture is thinly spread South Africa still bears the scars of a recent past of separation, discrimination and isolation. Yet ... the rifts of social and political complexity do not tear them apart.

- sharpCITY

NELSON MANDELA BAY STADIUM, PORT ELIZABETH

YEAR 2008

HOUSE STEENKAMP

TYPE CRITICAL REGIONALIST HOUSE
ARCHITECT ELMO SWART
SIGNIFICANCE HOUSE STEENKAMP IS A NOVEL APPROACH TO ADAPTABLE ARCHITECTURE. STARTING WITH A UNIQUE CLERESTORY DOME, ADDITIONS ARE BUILT IN A FRACTAL PATTERN, CURVING AWAY FROM THE CENTRE IN BOTH DIRECTIONS TO CREATE CONTIGUOUS BUT OPEN-ENDED SPACES. STRAIGHT LINES, WHICH REPRESENT THE RIGIDITY OF COLONIAL AND APARTHEID RULE, ARE ALL BUT ABSENT IN THE STRUCTURE. MASONRY WALLS ARE PAINTED A LIGHT BROWN TO RISE PROMINENTLY BUT NATURALLY FROM THE VEGETATED LANDSCAPE.
SOURCE (DECKLER, GRAUPNER AND RASMUSS)

YEAR 2005

HOUSE VAN DYK

TYPE CRITICAL REGIONALIST RESIDENTIAL
ARCHITECT ELMO SWART
SIGNFICANCE THE GUIDING DESIGN PARADIGM IN SWART'S HOUSE VAN DYK IS THE AIM TO MAKE ITS FEATURES DUALLY FUNCTIONAL. THE WING-SHAPED ROOF CREATES SUCTION FROM PREVAILING WINDS TO DRIVE PASSIVE VENTILATION AND LARGE DOORS OPEN THE LIVING ROOM INTO THE GARAGE, BLOCKING THE WORKBENCH IN ORDER TO RENDER IT A LIVING SPACE AS WELL. RAW MATERIALS ARE CHOSEN TO PRODUCE AESTHETIC CONTRAST AND ELIMINATE THE NEED FOR FINISHING. A STRUCTURAL ELEMENT OF THE CURTAIN WALL SEAMLESSLY PERFORATES THE GLAZING TO BECOME A HANDRAIL.
SOURCE (DECKLER, GRAUPNER AND RASMUSS)

2.11 SOUTH AFRICAN ARCHITECTURAL FEATURES

VERANDAS AND SUNSCREENS

ANDREW MAKIN'S VERANDA, ABOVE, AND DRAPING SUNSCREEN, RIGHT, FILTER THE INTENSE SUNLIGHT TO CREATE A COOL MICROCLIMATE ON THE PATIO.

ELMO SWART'S ADJUSTABLE SUNSCREENS, TOP RIGHT, ALLOW USERS TO MANAGE SOLAR GAIN.

CORRUGATED SHEETING

PETER RICH USES CHEAP AND DECORATIVE TRANSLUCENT CORRUGATED POLYCARBONATE SHEETS TO FILTER SUNLIGHT ON THE NORTH FACADE, ABOVE.

KATE OTTEN USES DURABLE, CONSTRUCTIBLE, AND AFFORDABLE CORRUGATED STEEL CLADDING, RIGHT.

CLERESTORY ROOFS AND SKYLIGHTS

JO NOERO INSERTS A CLERESTORY SKYLIGHT TO GRAB LOW-LEVEL SUNLIGHT, ABOVE.

ROELOF UYTENBOGAARDT CREATES A CLERESTORY CORRUGATED METAL ROOF, TOP RIGHT.

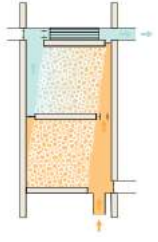
URBAN SOLUTIONS DESIGN TRANSLUCENT LIBRARY TOWER AND SLANTED SKYLIGHTS, RIGHT.

PATTERNED BRICK

NORMAN EATON LAYS DECORATIVE AFRICAN BRICK PATTERN, TOP LEFT, AND SHADES HIS NETHERLANDS BANK WITH A BRICK SCREEN, LEFT.

BOB VAN BEBBER WRAPS SOCCER CITY STADIUM IN LIGHT-FILTERING AND HEAT-TRAPPING BRICK SCREEN, ABOVE.

THERMAL MASS



URBAN SOLUTIONS AND ARUP DESIGNED AN INNOVATIVE GABION WALL THAT USES VALVES TO CONTROL PASSIVE VENTILATION THROUGH IT, LEFT.

STUDIOMAS SANDWICHES A LIVING ROOM BETWEEN TWO TEMPERATURE-MODERATING GABION WALLS, ABOVE.

COLOR

PETER RICH HAS LOCALS CREATE STAINED GLASS WINDOWS, TOP LEFT.

THE NDEBELE TRIBE HAVE PAINT THEIR HOUSES WITH A RICH LANGUAGE OF SYMBOLISM THAT EXPRESSES ALMOST ANY EMOTION APART FROM RELIGIOUS DEVOTION, ABOVE.

THE MURALS ON THE ORLANDO POWERSTATION COOLING TOWERS IN SOWETO SERVE AS NAVIGATIONAL MONUMENTS FOR THE CITY AND EXHIBIT CULTURAL REFERENCES, LEFT.

2.12 SOUTH AFRICAN CULTURAL SYMBOLS

PILLARS OF PROGRESS

TOP LEFT: APARTHEID MUSEUM
DEMOCRACY, RECONCILIATION, DIVERSITY AND RESPONSIBILITY

ABOVE: H. PIETERSON MEMORIAL
COMMEMORATES THE DEATH OF A YOUNG BLACK PROTESTER

LEFT: FREEDOM TOWERS
WALTER SISULU SQUARE

MONUMENTS

TOP LEFT: FREEDOM PARK
MEMORIAL IN PRETORIA, EACH BRICK NAMES A VICTIM OF RACIAL VIOLENCE

ABOVE: VOORTREKKER MONUMENT
COMMEMORATES THE GREAT TREK

LEFT: FREEDOM CHARTER
MONUMENT AT WALTER SISULU SQUARE

SPORTS

NATIONAL FOOTBALL TEAM
TYPICALLY FOOTBALL IS PLAYED BY BLACK SOUTH AFRICANS

NATIONAL RUGBY TEAM
TYPICALLY RUGBY IS PLAYED BY WHITE SOUTH AFRICANS

PILLARS OF THE AFRIKAANS

WINBURG VOORTREKKER
MONUMENT COMMEMORATING THE GREAT TREK

TAAL MONUMENT
COMMEMORATING THE DEVELOPMENT OF THE AFRIKAAN LANGUAGE

INFORMALITY

TOP LEFT: KAFFI HUTS
TRADITIONAL HOUSE OF NOMADIC TRIBES

ABOVE: RONDAVEL HUTS
TRADITIONAL HOUSING OF SOME TRIBES

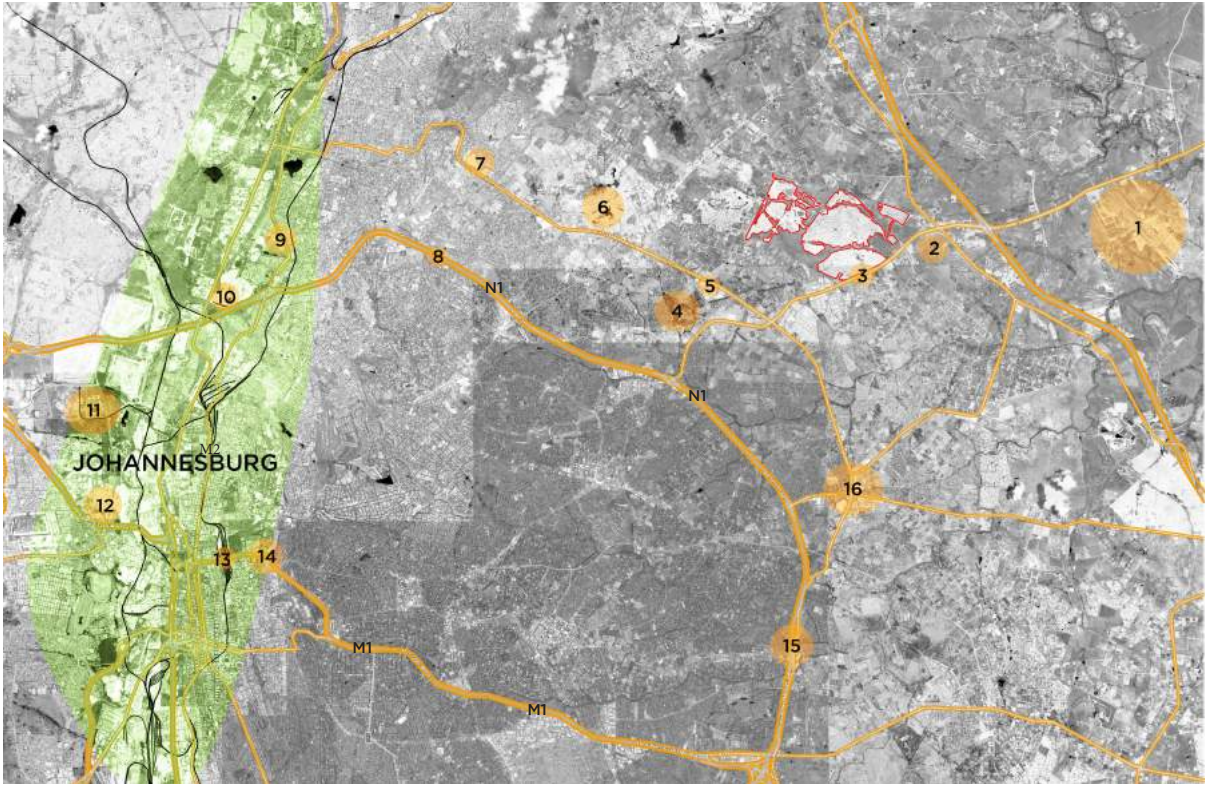
LEFT: 'SPAZAS', SMALL INFORMAL
CONVENIENT STORES ARE UBIQUITOUS IN BLACK SETTLEMENTS

"If we mean to civilize the natives we must enforce order and regularity, and naturally the round Kafir hut cannot find place alongside of the square or oblong white man's house. There should be an interdict against the round hut. It certainly breeds vermin." (Hahn)

BUFFER ZONES

500 METER BUFFER ZONES OF UNDEVELOPED LAND WERE REQUIRED BETWEEN BLACK AND WHITE SETTLEMENTS. GREEN BELTS MEANT FOR RECREATION COULD EASILY INSINUATE THE FORMER MECHANISM OF APARTHEID.

2.13 INFRASTRUCTURE



LEGEND

- Highways
- Gautrain Metro Railway
- Numbered Image Indicator
- Johannesburg

MAP INDICATING HIGHWAYS
AND HOW THEY CONNECT THE OUTSKIRTS OF JOHANNESBURG TO ITS CENTER.

Transportation to and from Johannesburg is almost entirely through the highway system. Johannesburg is surrounded by three major freeways that allow for the transportation of people and goods. The N3 Eastern Bypass, which extends to Durban; the N1 Western Bypass, which extends to Pretoria and Cape Town and the N12 Southern Bypass, which extends to Witbank and Kimberley. Running through the city are the M1 and M2 freeways, which allow for people to quickly enter and exit the city. Some people commute daily from the neighboring suburbs and towns, spending an average of 3-5 hours a day getting to and from work. This makes the highway an important part of a person's life and a cities identity.

While 37% of households in Johannesburg own cars, the remaining 63% is dependent on public transportation. For the people living in the peripheries of the city, transportation is a major issue. Since the large majorities cannot afford cars, they rely on public transport for any activity that requires commuting. Unfortunately, in many instances the density of the neighborhood is not large enough to support public transportation, leaving people with no other option but to walk to the nearest place offering it. This too is a problem since the number of pedestrians killed by vehicles or while riding a public vehicle is not insignificant, around 1,100 in 2003. In addition, fare prices, crimes and accidents are issues of concern to those riding public transportation. Unfortunately these issues are far from solved, though some improvements occurred for the FIFA Football World Cup 2010.

The highway, however, is an excellent way to get a glimpse of the city in an honest light. It allows you to quickly see the different conditions and amenities offered (as shown on the images on the following page). On the map to the left, the highways have been highlighted and to the right, images that correspond to what you would see while on the N1 (from Cosmo City) on the way to Johannesburg.


1


2


3


4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11


12


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15


16

1.LANSERIA AIRPORT 2.LION PARK 3.COSMO CITY 4.GOLDEN HARVEST PARK 5.COCA DOME 6.EAGLE CANYON GOLF ESTATE CLUB HOUSE 7.CLEARWATER HARLEY DAVISON 8.14 AVE. PEDESTRIAN BRIDGE 9.SPARROW RAINBOW VILLAGE AIDS HOSPICE 10.MINES 11.SOCCER CITY (SOCCER STADIUM) 12.GOLD REEF CITY 13.HIGHWAY (UNDERNEATH THE BRIDGE) 14.THE PLANETARIUM 15.CEDAR SQ. SHOPPING CENTER 16.TECHNOLOGY PARK

Modes of transportation used by Joburg residents to travel to work

TRAIN	8.2%
BUS	4.4%
MINIBUS TAXI	34.6%
WALK	8.7%
BICYCLE	0.2%
PERSONAL CAR	42.2%

PEOPLE USING HAND SIGNALS TO INDICATE TO MINIBUS TAXI DRIVERS, THEIR DESIRED DESTINATIONS

TRANSPORTATION

Of all the public transport trips, 72% (372,000) are in taxis, 15% (72,000) are in trains and 9% (44,000) are in buses. There are two types of taxis, the minibus taxi, which is a small-scale bus service that operates without any timetables or formal stops, and the metered taxi which is summoned by telephone. For those on foot, the minibus taxi is the cheapest and most convenient way to get around, operating 1259 routes from 444 starting points. On average, taxis arrive in under 10 minutes, and, if no connection is needed, the travel time on a taxi is about 50min. A connection trip from taxi to taxi can take up to 80 minutes or more. In general riding the taxi requires some knowledge of the hand signal system (charts to the left). To stop a minibus taxi a hand signal indicating the desired destination is necessary. The metro railway system connects Central Johannesburg to Soweto, Pretoria and some other towns near Witwatersrand. Unfortunately, it does not extend to northern Johannesburg. Plans are underway to organize the transportation system; analytic assessments of traffic, possible routes and its possible future financial implications are in the works.

Bus Routes

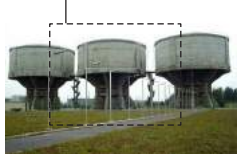
MiniBus Routes

Metro Railway Routes

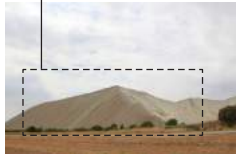
HOUSING DEVELOPMENT

ROADSIDE SHACKS

WATER TREATMENT



SAND/MINES

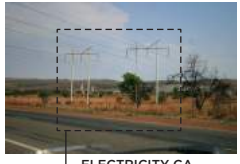


BRIDGES

ANIMALS

CITY

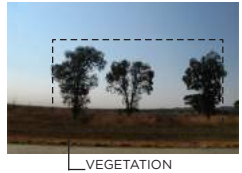
PLAYGROUND/PARKS



ELECTRICITY CABLES

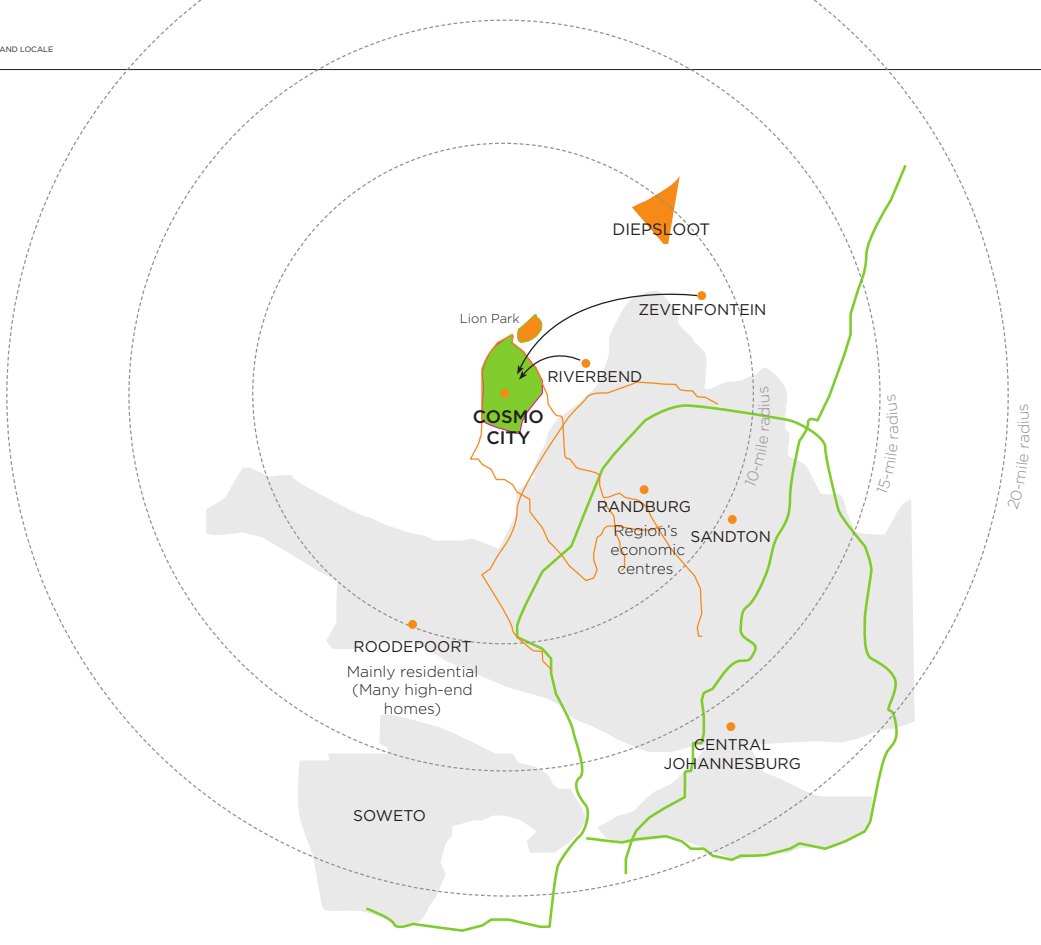
TOLLS/ BUS STATIONS

TRAFFIC



VEGETATION

CHAPTER 3
SITE AND LOCALE



SURROUNDING COSMO CITY AREA

HIGH-DENSITY AREAS
SECONDARY ROAD
MAJOR HIGHWAY

There are several economic centers, including central Johannesburg, within 20 miles of Cosmo City. Unfortunately, poor public transportation to and from Cosmo City makes commuting, and consequently maintaining a job, a difficult task. Commuters must rely on private transportation or taxis, both of which are not affordable options for RDP-housing members.

3.1 INTRODUCTION: COSMO CITY'S VISION


2004


2007


2009

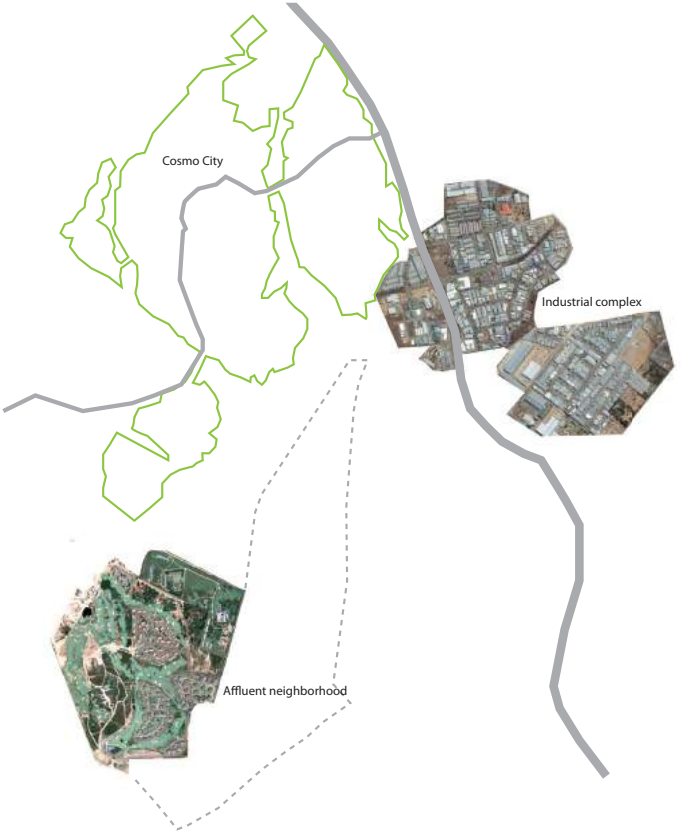
Cosmo City Land
Cosmo City is built on previously undeveloped land. Construction Began in 2004. The first residents moved in 2005. (Google)

Since the end of Apartheid, the South African government has pursued the goal of providing housing to all. In its landmark 1996 Constitution, South Africa declared that every citizen has a right to housing (Lebeta). Efforts to provide viable low-income housing solutions, however, have been slow. Tired of waiting, poor residents build informal settlements on open land. The resulting slums are substandard and lack access to basic amenities (Onatu). Cosmo City is a development initially created to provide formal housing for people who had previously settled illegally in two such settlements, Zevenfontein and Riverbend. With little or no income, many settlers will relocate to fully subsidized Reconstruction and Development Program (abbreviated to "RDP") houses (Cowden). This is the first time such a population will be exposed to the civil rights and responsibilities associated with living in a permanent and legally constituted community. These homeowners will have access to amenities such as hot water, paved roads, water sanitation and refuse removal.

During the apartheid era, Johannesburg was strictly segregated, with whites living in the City's northern suburban edges and blacks zoned to the south of the city in townships. Previous RDP housing developments have been exclusively for blacks to live in homogeneous residential units (Onatu). In contrast, Cosmo City developers in partnership with the City of Johannesburg strive for a diverse and integrated neighborhood that confronts South Africa's apartheid legacy. Developers incorporated four different housing types in the neighborhood plan: fully subsidized, credit linked, social housing rental units, and bonded free market houses (Cowden). With each housing type intended for a specific income group, Cosmo City attempts to set a precedent as an economically varied neighborhood. The mixed use development is comprised of environments conducive to interaction between social classes. Parks are placed within 10 minutes walking distance from every home (Cowden). Schools are easily accessible. As an example, students from all different housing types attend the S'godiphola Secondary School (Kgowedi).

South Africa's national housing policy not only stipulated the necessity of integration, but also specified that housing developments should be environmentally conscious (Cowden). The Gauteng Department of Agriculture, Conservation and Environment (GDACE) approved the neighborhood's construction with the expectation that Cosmo City would be developed and managed with the environment in mind (City of Johannesburg). Cosmo City was built on previously undeveloped wetlands, prompting the enclosure of 200 hectares of land for conservation. The community's Operational Environmental Control Officer (OECO) further manages the neighborhood environment, acting as a liaison between residents and the GDACE, and educates residents on civil and environmental responsibilities before they move into their home. Cosmo City also piloted a Climate Proofing Program, focused on bringing green technologies to its homes and encouraging sustainable behavior among its residents (Naidoo). Under this program, solar water heaters were installed in many of Cosmo City's low income homes to limit electrical expense. In its attempt to be one of the first housing developments that complies with South Africa's sustainable housing policies, Cosmo City educates and empowers its community to act responsibly towards the environment.

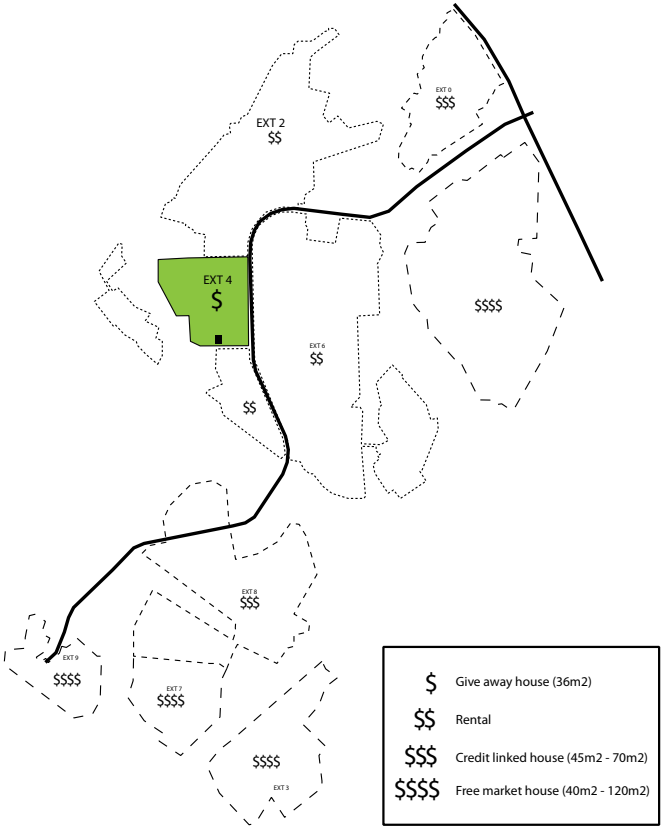
The overall sustainability of Cosmo City is still questionable, since the development is located on Johannesburg's periphery. This characteristic may also be responsible for the presence of informal shops, known locally as spazas or shebeens. Living in a neighborhood far from the city, RDP housing residents cannot afford to travel far to work elsewhere. Instead they set up shops within Cosmo City to earn a living, as many did when they lived in informal settlements (Lebeta). Although their housing is now formalized, homeowners from Zevenfontein and Riverbend are still relying on informal sources of income. Cosmo City by-laws stipulate that all shop owners must submit requests of approval and set up only in specified market areas. Despite these regulations, many shops have sprouted outside such spaces, without any approval (Lebeta). Even with regulatory personnel like the OECO, residents may still be reluctant to follow the bylaws because of economic needs. Developers may not have fully accounted for residents' survival strategies. Though formal trading centers are scheduled to be built, it is uncertain whether such measures will completely alleviate the community's economic and social needs or leave much to be desired (Lebeta).



3.2 IMMEDIATE NEIGHBORHOODS

During South Africa's apartheid regime, Johannesburg's northern suburbs were exclusively "white." Cosmo City was developped within the urbansism scope of the 1994 Reconstruction Development Program, and is located North of Johannesburg in a semi-rural area historically occupied by smallholdings and estates of wealthy white suburbanites. Several established and luxurious gated communities built around golf courses border Cosmo City. Some gated-community members opposed the construction of Cosmo City, claiming that their property would consequently depreciate in value (Cowden). Cosmo City's construction sparked racial and economic tensions with the surrounding population, indicating that the "Not-in-my-Backyard" issues still prevail in the area.

NOTE
Cosmo City's residential area is in great contrast to its immediate surrounding area.



3.3 COSMO CITY INCOME MAP

Cosmo City was planned with the understanding that mixing social classes was a necessary strategy to overcome the characteristic segregation of the apartheid regime. Cosmo City developers have created zones of different income, known as Extensions, which allow various income levels to exist within close vicinity while maintaining contextual typographies. There are four kinds of housing types, undermined by four distinct financial plans. The lowest income level house "Give away house" is fully subsidized by the government, as part of the Reconstruction and Development Program (RDP). The second least expensive house is the "credit linked house" which is partly subsidized. There are also "free market houses," which are the most luxurious units within Cosmo City.

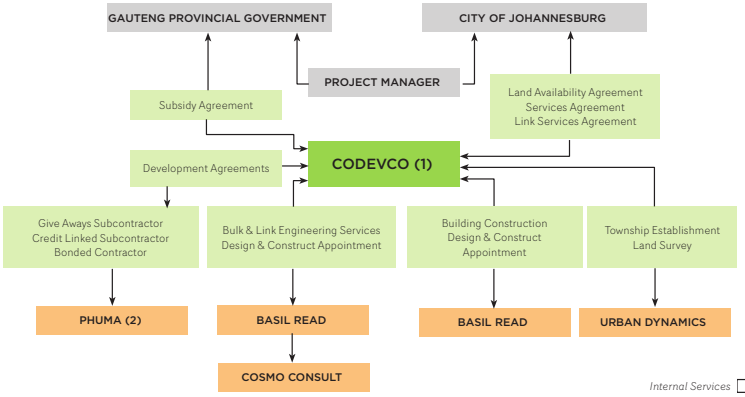
Developers may have attempted to ease tensions with the more affluent neighborhood to Cosmo City's south, by constructing higher income housing bordering the gated community.

3.4 PROJECT MANAGEMENT AND FUNDING

The City of Johannesburg and Gauteng Provincial Government has partnered with Codevco in the development of Cosmo CIty. Codevco is a "joint venture between Basil Read, one of South Africa's oldest construction companies, and the Kopano ke Matla trust, of which the Congress of Southern African Trade Unions (Cosatu) is the sole beneficiary" (South Africa). While the City and the Provincial Government provide land and subsidies, Codevco manages the overall project. The developers viewed the public private partnership (PPP) as a good "balance between social responsibility and financial sustainability" (Cowden).

The project overall costs R3.8 billion based on rates applicable to 2008 (Cosmo City, a place under the sun for anyone). The breakdown of costs shown was presented in 2005. Beyond total costs, the proportions taken by government and private groups have remained largely the same. Codevco, Phuma Developments, and other private sector groups bore most of the costs. Phuma Developments was in charge of construction for the more expensive bonded houses, as well as the housing top structures (Cowden). Such major participation of the private sector was made possible through government support, which provided land and subsidies for the houses.

The Gauteng Department of Education will fund the construction of 12 schools (Cosmo City, a place under the sun for anyone). Additionally, according to 2005 estimates, the Gauteng Provincial Government plans to spend R 700,000 on building formal crèches (Cowden). No formal crèches have been built. More broadly, a lack of funding and budget costs may be responsible for the slow development (Cowden).



(1)CODEVCO (PTY) LTD

Shareholders

BASIL READ	50%
KOPANO	50%

Directors

Marius Heyns
Des Hughes – General Manager
Collin Matjila
Ivor Isaacs

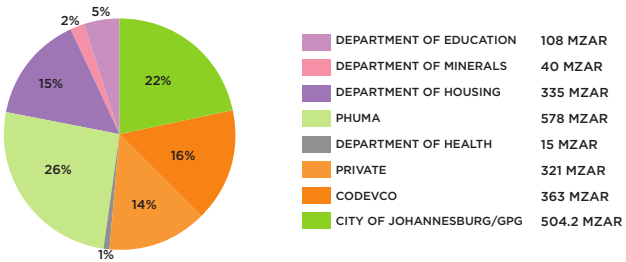
Manco

Des Hughes – General Manager
Brian Mulherron – General Manager
Ivor Isaacs – Marketing Manager
R. Zama – Comm. & Liaison Manager
Brent Parrott – Financial Manager

(2) PHUMA responsible for:

- Top structures
- Give away social facilitation
- Credit linked & bonded market

From Cowden (2006)



From Cowden (2006)

Top: Organization Structure of Cosmo City's Management
Codevco is the main manager of the project
Bottom: Cosmo City Project Funding
A 2005 report presentation estimated the amount funded by the partners to the project, with a majority coming from the private sector

3.5 COSMO CITY COMMUNITY

COMMUNITY INVOLVEMENT

During Cosmo City's development, Codevco, the developer, attempted to incorporate the opinions and views of its future community members. Through workshops, a select number of informal settlers and other future residents voiced their concerns and needs to both the developer and the City of Johannesburg (Cowden). An interview study conducted in 2008 found that most future beneficiaries, however, were informed only of the project's phases and not consulted for opinion (Lebeta).

With Cosmo City now occupied, Codevco and the City of Johannesburg continue to communicate with the community through residents associations formed by each extension's homeowners (Kgowedi). Through meeting with the associations, the City informs residents about town by-laws. Residents, in return, can voice their concerns and recommend possible improvements to Cosmo City's management. These associations also maintain a cohesive and responsive community, holding regular meetings to deal with issues such as crime and repairs.

Codevco distributes a monthly newsletter to keep residents informed (Kgowedi). The developer has also initiated a few websites for the newsletter, where homeowners can post crime reports and housing sales notices. This has shown to be an efficient policy: residents in Extension 5 reported that 24 hour security patrols were effective measures towards a safe neighborhood. One post urges other Extensions to implement similar measures to achieve a safe community (Lehlohonolo). These last posts, however, date to 2008 (Cosmo City News). No updates have been posted since then.

The developer is clearly trying to collaborate with the residents and empower them with a voice they may not have had previously. The effectiveness of Codevco's communicative efforts, however, remains debatable. The website was once a medium that attempted to connect residents across extensions. Its current inactivity may indicate that the community and developer are focusing on other more effective mediums of communication. In particular, attempts of workshops and notifications during Cosmo City's planning may not have been enough to fully anticipate residents' needs. Though the first residents moved in during 2005, no formal trade centers were constructed in Cosmo City's vicinity (Cosmo City, a place under the sun for anyone). Residents had to either travel far for shopping and work or find ways of growing food and earning money within Cosmo City. Coupled with its peripheral location, Cosmo City's lack of formal facilities led interviewed RDP residents to feel that their needs were not fully considered (Lebeta).

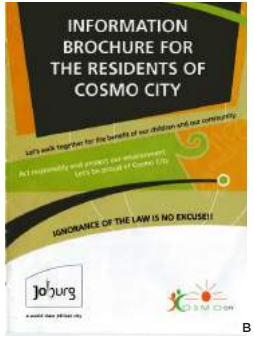
THE BROCHURE

The City of Johannesburg also informs residents through an informational brochure, which the developer requires residents to read before moving into their home. The brochure introduces the Operational Environmental Control officer (OECO), a liaison between the City of Johannesburg, Gauteng Department of Agriculture, and utilities (City of Johannesburg). As a liaison, the OECO instructs residents on social and environmental responsibilities (City of Johannesburg). The OECO also assists residents on techniques they can use to save energy and improve their environment, such as choosing the appropriate light bulbs and garden plants (City of Johannesburg). Many aspects of the brochure indicate what Cosmo City anticipated about the neighborhood's residents-to-be. The brochure advises residents who cannot afford much electricity to use Imbhawulas, braziers that can used for heat and cooking (City of Johannesburg). Each page features comic illustrations, indicating that Cosmo City expected some of its residents to have limited literacy. Because many residents are from informal settlements, the brochure also covers rules regarding building extensions and shops. Though homeowners have the opportunity to renovate and improve their homes, most of these actions are heavily regulated.

Generally, the brochure emphasizes that residents must be socially responsible by reporting leaks, damages, or policy violation. Both text and illustration take on opposite tones when stipulating these regulations. The brochure's front cover provides a good sample of these two tones. The subtitles start positive with "Let's walk together... Let's be proud of Cosmo City." The last line of the cover, however, declares "Ignorance of the law is no excuse!" in all capital letters (City of Johannesburg). The comic illustrations take on a similar pairing of tones. Bright green and yellow are usually used in the illustrations labeled with check marks. Images that illustrate illegal activities are labeled with bright red X's that contrast with darker colors.

As a result, the text and comics that delineate the same policies seem to take on opposite tones. In one instance the brochure states that use of fire hydrants for water can lead to prosecution. The comic strip that illustrates this restriction depicts a man using the hose pipe to wash his car. He then receives a bucket of water and cloth from a faceless character (City of Johannesburg). The strip ends with the car washer smiling, glad that he is saving resources. The comic downplays the severity of using the fire hydrants, emphasizing instead the benefit of environmental awareness. Through opposite tones the neighborhood brochure heavily discourages illegal activity while exposing residents to the positive side of obeying. Cosmo City attempts to educate and ensure a civically and environmentally responsible population.

A



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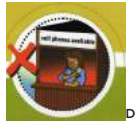

D

E

Figure A:
Imbhawulas or braziers are suggested as means of cooking for those who cannot afford electricity
Figure B:
Cover of the brochure; note the text
Figures C and D:
Small Comic illustrations; note the contrast colors
Figure E:
A Comic strip on illegal fire hydrant with an environmental spin

3.6 GREEN INITIATIVES

South Africa's past housing policies called for more sustainable housing developments. Cosmo City attempts to be one of the first to comply with these stipulations. Ironically, the neighborhood is located far from Johannesburg's center, which poses huge transportation and environmental costs. However, Cosmo City has initiated many programs that promote environmental awareness and protection in other areas.

The community's Climate Proofing Program intends to educate residents on green technologies and practices. Under this program, many RDP and credit-linked houses in Extension 2 and 6 have been upgraded with fluorescent light bulbs and ceiling insulation including solar water heaters shown at right (Naidoo). These mounted evacuated tubes expose water to the sun, harnessing the sun's heat for hot water. Because they run without electricity, homeowners garner savings. Installing such upgrades in RDP housing educates and enables low income residents to conserve the environment's resources. Moreover, many residents were trained by industry professionals to install these heaters (Mungoshi). A recent article elaborates that the installation training will equip RDP residents with sustainable skills that could become valuable in a "growing sector of the economy" (Mungoshi).

Cosmo City also utilizes social events to invoke residential activism and responsibility. Residential leaders worked with Pikitup, the City's refuse removal agency, to organize a week in which neighborhood children picked up trash around each extension (City of Johannesburg). Cosmo City also holds a garden contest every year where each housing class (subsidized, credit-linked, and bonded) has a division (Visser). Through this initiative, Cosmo City hopes to inspire homeowners to improve their own environment. Basil Read, Cosmo City's developer, has established a pilot nursery in the neighborhood, which offers free training to residents on how to maintain their vegetable gardens (Basil Read Developments).

Formalized tree planting further spreads environmental awareness and participation among residents. Hundreds of trees have been donated from both the City and charitable organizations (Kgowedi). A reported 300 trees have been planted by Food and Trees for Africa (FTFA) outside homes in Extension 4, an RDP housing extension (Madumo). These tree planting events are publicized as steps towards improving Cosmo City's environmental awareness and well-being. FTFA's initiative particularly targets low income residents. Cosmo City hopes to demonstrate the benefits of environmentally conscious behavior to residents of all economic backgrounds.

Top: Solar Water Heaeters
Cosmo City's Climate Proofing Programs focuses on bringing green technologies to low-income homes
Bottom: Basil Read Green Nursery
Basil Read, one of the co-developers of Cosmo City, runs a nursery that educates community residents about garderning and peri-urban agricultural practices

3.7 HOUSING

CITY RESIDENTIAL MAP

SITE

NOTE
All houses in Extension 4, in the vicinity of our site, are RDP type houses, given away by the government to disadvantaged South Africans. The residents of those houses are among the lowest income bracket of Cosmo City. Residents of Extension 2 are also fairly poor.



Lowest income bracket
"Give Away" house
= the house is provided for
free by the government,
on the condition that the
resident lives there for 5yrs.



Square mt: 36m2 on 11m x 20m plot
One story
Minimum amenities
Three rooms







Medium income bracket

= The government provides
subsidies for residents
to have access to a mortgage

Square mt: 45m2 to 70m2
on 200m x 280m plot
One story
Good level of amenities
Three rooms



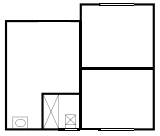




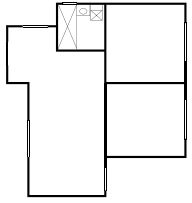
Highest income bracket

= Free market
Housing is neither subsidized
nor given for free

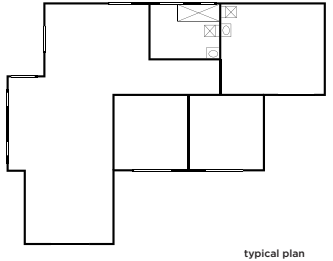
Square mt: 40m2 to 120 m2
on 250m2 to 600m2 plot
One to two story
Amenities: garage, two
house entrances,
large windows, tiled roofs
Avg six rooms



typical plan



typical plan



typical plan

HOUSING PLUG-IN: SELF BUILT DWELLINGS

TYPES

house + house

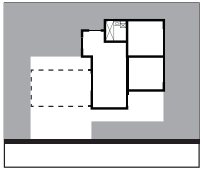
house + garage

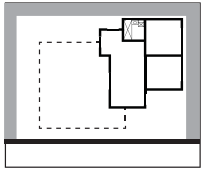
house + car shed

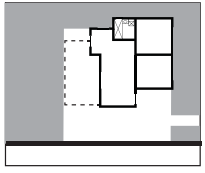
house + shop

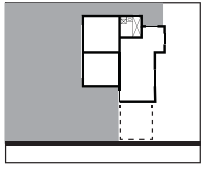
house + house

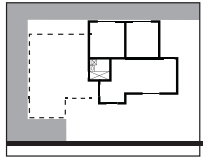
TYPICAL PLAN











MATERIAL PALETTE

concrete
metal framings
brick

concrete
aluminium
corrugated metal

concrete
corrugated metal
wood

brick
corrugated metal
wood

Self-build processes are integral to the life span of most individually owned buildings in this community. These self-build processes are more often found in lower income neighborhoods. Although illegal, they are perceived as necessary and directly implicate the economical development of individuals. They also contribute to a rich diversity within the preliminary homogenous housing stock, produced by the developper. They contribute heavily to social community activities, particularly because of their relationship to the road. They usually produce a one room extension or shop, though greatly increase the overall square footage of the dwelling.

NOTE
Self-build processes are more often found in lower income neighborhoods (particularly in extensions 2 and 6). Most houses near our site feature such transformations.

3.8 SCHOOLS AND INFORMAL CRECHES IN COSMO CITY

INFORMAL CRÈCHES (see locations on opposite page)


01


02


03


04


05


06


10


11


12

Cosmo City is dotted with informal day care centers, known locally as crèches. Around three people—one owner and two assistants—operate each crèche. Many crèche owners previously lived in informal settlements and started their child care businesses before moving to Cosmo City. They continue operating their crèches in their new Cosmo City homes. Correspondingly, the majority of crèches are located in lower-income (RDP and subsidized) extensions. Each crèche cares for approximately 80 children from the immediate neighborhood. As a result, the crèche's two 1.8 x 2.1m rooms are each filled with around 40 children. Houses originally intended for residential use are now serving as day care centers, indicating that there are not enough formal facilities to accommodate the community's needs. The Gauteng Provincial Government initially planned to fund construction of formal crèches in 2005. There have been no further updates or development since that time.

SCHOOLS (see locations on opposite page)

01 COSMO CITY SECONDARY SCHOOL

02 COSMO CITY PRIMARY NO. 1 SCHOOL & COSMO CITY JUNIOR PRIMARY SCHOOL

03 COSMO CITY PRIMARY NO. 1 SCHOOL & COSMO CITY JUNIOR PRIMARY SCHOOL

04 COSMO CITY WEST PRIMARY SCHOOL & TIRISANO-MMOGO JUNIOR SECONDARY SCHOOL (no photos available)

LOCATION OF SCHOOLS AND INFORMAL CRECHES IN COSMO CITY

SCHOOLS IN COSMO CITY

SCHOOLS

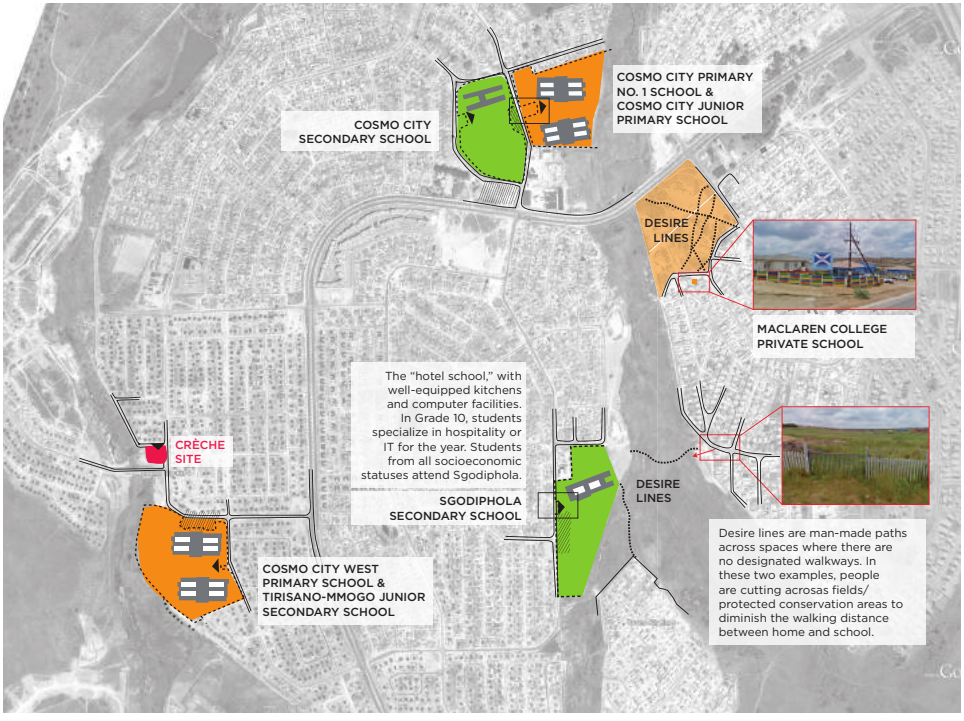
- PRIMARY SCHOOL
- PRIMARY SCHOOL (planned)
- SECONDARY SCHOOL
- PARKING
- ENTRANCE

All government primary and secondary schools in Cosmo City are "no-fee"—schools cannot charge mandatory school fees.

There are currently 4 primary and 2 secondary schools, each having 832–1056 students. Primary schools are generally grades 1–6 (children aged 7–12) and secondary schools are grades 7–10 (children aged 13–16). Under the South African Schools Act (1996), school is compulsory From Grades 1 to 9 (ages 7–15). Six more primary and 3 more secondary schools are being built in Cosmo City.

There are private schools in Cosmo City, such as the MacLaren Private College. Wealthier homes may send their children to private schools within Cosmo City or in surrounding cities such as Randburg and Sandton.

Our crèche will the first official crèche in Cosmo City. Children who graduate from the crèche will move on to Cosmo CIty West Primary School down the street.

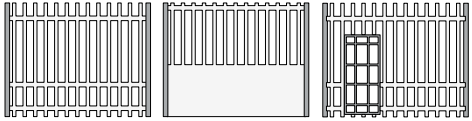


N

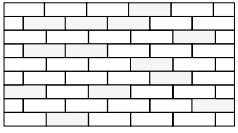
CRÈCHE AND SCHOOL SITE STRUCTURES

SECURITY

CRÈCHES

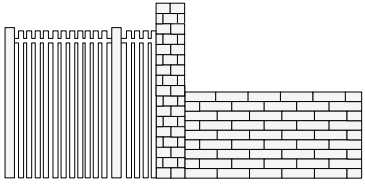


In crèches, fencing provides a strong demarcation of territory, but current designs do not necessarily prohibit trespassing. Spacing of elements provide foot and handholds. In comparison to brick walls, fencing allows for greater visibility of the surrounding area.



Brick walls around crèches are not as high as fences. While they create a sense of enclosure, they may also 'box in' a site. Compared to fences, they are more difficult to scale.

SCHOOLS



Schools' fencing systems are better-designed than those of 'informal' home crèches. Schools are secured with brick walls and tall fencing. Fences are constructed of rectangular posts thick enough to prevent handholds and spaced close enough to prevent footholds.

DESIRE LINES

Wherever schools and homes are separated by conservation areas or fields, users will cross the fields instead of using roads. Fences protecting conversation areas are breached.

ENTRANCE

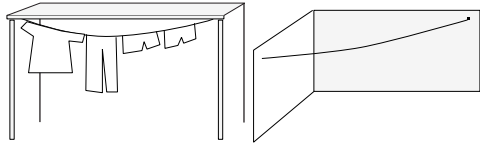
There is only one entrance to the school(s). Given the large plots of land, buildings are set back from the perimeters. Perimeters are fenced off, except for borders with conservation areas.

PARKING

All schools have nearby parking. Most children walk to school, however, school teachers and staff may drive.

LAUNDRY

(From observations, creche only. Possible that laundry is also a feature of primary schools.)



Laundry is hung outdoors, covered by makeshift canopies or directly under the sun.

COLORING

Schools are characterized by their bright blue roofs.

Crèches take advantage of wall and building surfaces to present colorful murals and signage. Principal colors are bright green, blue, red, and yellow.

3.9 PERI-URBAN AGRICULTURE & GARDENS IN COSMO CITY

PERI-URBAN AGRICULTURE (see locations on opposite page)

RDP HOUSING


01


02


03


04


05


06


07


08


09


10


11


12

GARDENS (see locations on opposite page)

RDP HOUSING


a


b


c


d

CREDIT-LINKED & FREE-MARKET HOUSING


e


f


g


h

(A SAMPLE OF) LOCATIONS OF PERI-URBAN AGRICULTURE + GARDENS IN COSMO CITY

3.10 PERI-URBAN AGRICULTURE

Peri-urban (places near cities) or urban (within cities) agriculture (UPA) is the practice of growing and distributing food within cities. In post-apartheid South Africa, it is advocated as a method for relieving poverty as UPA gives households food security and can provide a small source of income (Thornton, 2008). It is unclear what percentage of households, in particular RDP households, within Cosmo City practice UPA, but the strong presence of agriculture plots around RDP homes, vegetable and fruit spazas, and roadside markets all suggest that UPA is a popular and perhaps essential activity in the community.

According to Egal, Valstar, and Meershoek (2001), "the urban poor spend 60–80% of their income on food" (p.4). UPA can provide families with enough food so that money saved and/or income earned from selling crops can be diverted to other basic necessities, such as clothing, transportation, and health care. One common practice is to grow staple crops such as maize, beans, cassava, potatoes, beans and some fruits for household consumption, and to sell fruit and more 'valuable' crops to higher-income households.

UPA can further add value to households by eliminating the need for some family members (usually females) to commute to work. They can instead spend more time at home with their children, while still taking care of the crops and the home.

Though UPA is generally advantageous for households and their community, there can be drawbacks:

- Plots may not be large enough to grow food for all members in a household;
- Relying solely on home-grown food can negatively impact nutrition;
- High water costs can constrain the amount of food grown;
- Runoff can pollute drinking water supplies and damage surrounding natural resources; and
- Food theft is common.

SITE STRUCTURE OF PERI-URBAN AGRICULTURE & HOME GARDENS

RDP HOUSING (EXT. 2, 4, 6)

PERI-URBAN AGRICULTURE

COMMON ADDITION TO RDP HOUSING.

- Crops are planted between, behind, in front of houses.


side


back


front

- Often, though not always, protected by fencing.


heavily secured (brick wall)


wire fencing


no fence; one will likely be built in the future

- Creates barrier between street and home.


marks boundary between road and home while maintaining openness (using elevated beds, short fencing/posts)

GARDENS

OCCASSIONALLY SEEN IN RDP HOUSING (could be spurred by garden contests)

- Mixed with crops.
- Small plots of lawn.
- "Informal" arrangements

DEFINING CHARACTERISTIC OF CREDIT-LINKED AND especially FREE-MARKET HOMES.

- Formalized, rectilinear arrangements.
- Lawns, shrubs, small trees are planted.
- Small plot of lawn with shrubs lining property exterior to wall.

- Decorative security walls
- "Outside" (exterior to wall) vs. "Inside" (interior to wall)


"designed" walls


outside—lawn & plantings
inside—lawn & fountain

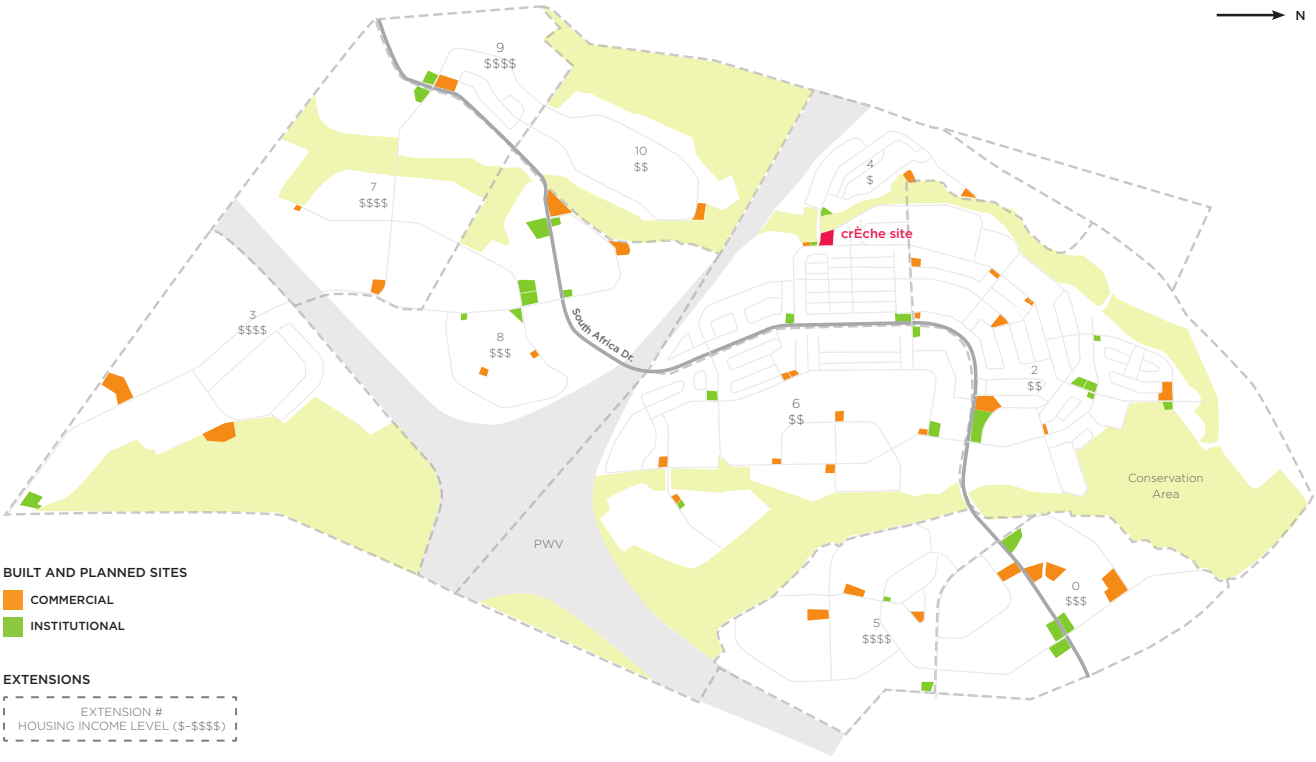

strong inside vs. outside
outside presents a 'face' with landscaping

- Driveways become design considerations.

CREDIT-LINKED & FREE MARKET HOUSING (EXT. 0, 5)

NONE IN CREDIT-LINKED & FREE MARKET HOUSING.

COMMERCIAL + INSTITUTIONAL SITES IN COSMO CITY



3.11 PARKS IN COSMO CITY

OFFICIAL PARKS (see locations on opposite page)

LANDSCAPING, PLAY STRUCTURES, PLAY SPACES, SEATING, SCULPTURE




cosmo ext. park



cosmo ext. 5 park



parks 1, 2 (no name)



tennessee park



cosmos city park




cosmo ext. 0 park

INFORMAL AREAS (see locations on opposite page)

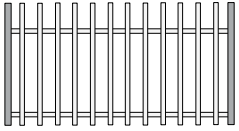
SHADE, SEATING

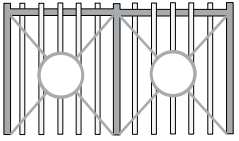

informal play structure


informal seating

COMMON ELEMENTS

FENCES





Parks are enclosed by green metal fencing. They act more as boundary markers than security measures, as the fences are not tall nor difficult to climb.

SURFACE

All parks have a blacktop for play. The ground under play structures are laid with blacktop, gravel, or both. Paths are cobblestone.

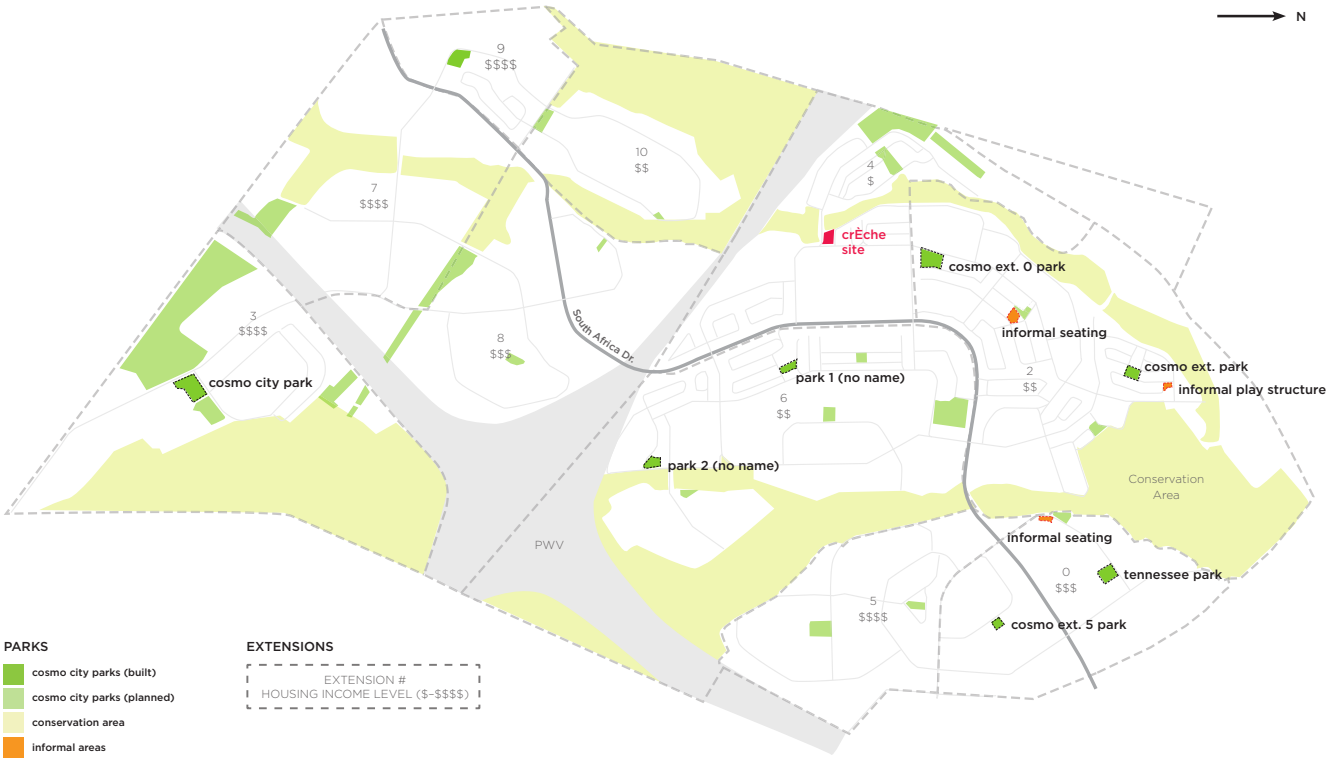
PLAY STRUCTURE

Parks have colorful play structures with a variety of swings, slides, and climbing equipment.

SEATING

The parks are usually separated into two sections: a play area for children, and a grassy, open area with benches and gazebos. The gazebo/sitting and play areas are similar in size. Grassy areas bound the park. Except for the gazebos, there are few shaded areas. Informal areas, by contrast, are always situated near or under trees. Seats are make-shift, composed of rocks and other natural materials.

LOCATION OF PARKS IN COSMO CITY



3.10 COMMERCE

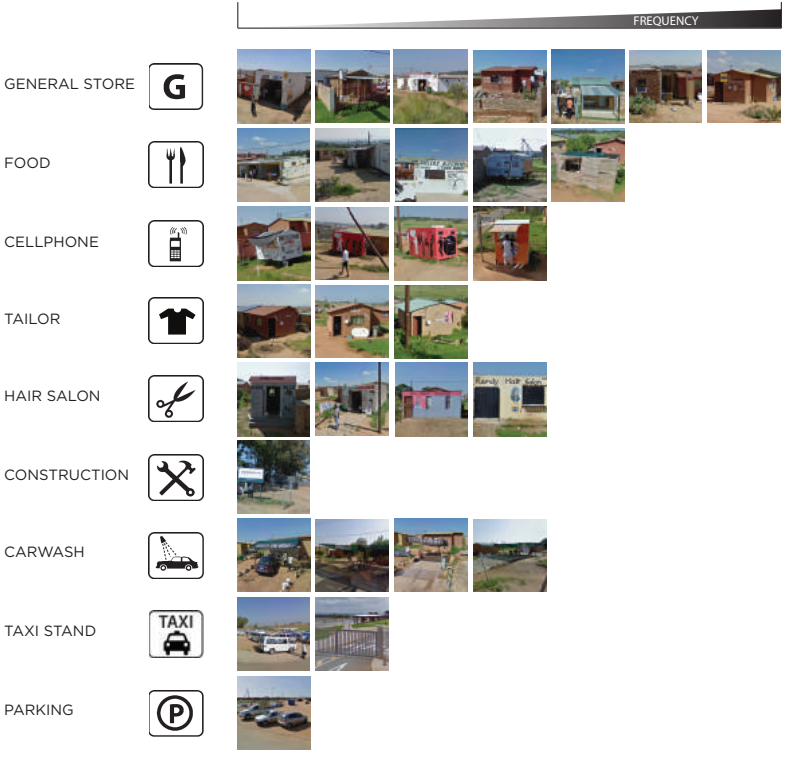
Many people in the Cosmo City RDP rely on the revenue from their spaza shops to sustain themselves.

The most common shop is a general store which sells a variety of items including food and supplies. Construction varies depending on the type of commerce. For instance, a car wash would not require a permanent structure, but rather an open space and a large sign. More often, extra rooms are added onto the RDP housing, sometimes with a long overhang, that becomes the new shop. In the case of hair salons, entire new structures are usually built, independent of the house. Cell phone kiosks usually have a prefabricated stall or storage unit, perhaps for security reasons, or to give re-assurance of the legitimacy of the store.

Even though spazas are considered illegal to the City, they are strategically located around major streets, busy corners, and schools. Different types of shops, open in these areas because of constant activity throughout the day. In the morning before school and in the afternoon after school, additional temporary stands are installed to anticipate increased crowds. Some view the informal trading as beneficial to the neighborhoods because they provide security to the area into the night, while others associate the spazas with illegal activity. Regardless, these types of shops will inevitably dot our neighborhood.

Will the benecial aspects of these spazas be considered for the design of our school? The developer has told us that a dual-functioning program area cannot be integrated into our property (that is, a school that is also used as a spaza), so how can the design reach out beyond its boundaries and influence the property around it?

Note: A spaza shop is an informal convenience shop business in South Africa, usually run from home by a single family or small group of friends.



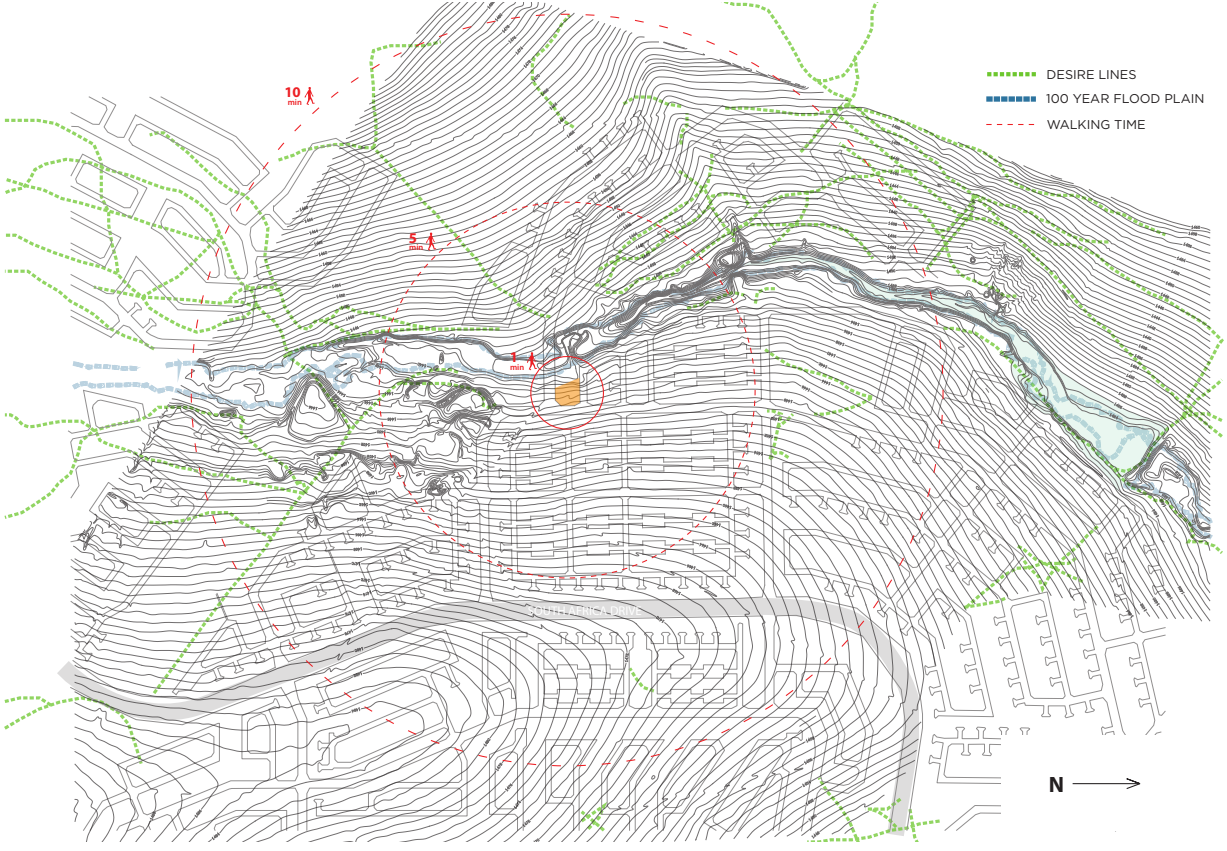

N
extension 4
extension 2

3.12 TOPOGRAPHY, FLOOD PLAIN, DESIRE LINES

Our site is adjacent to a designated "Conservation Area," which features a river and wetland. This exists naturally in the valley formed by the two surrounding hills. The potential views and wind-tunnel effect may and should influence the orientation of our crèche.

The flood plain is designated in blue and shows a hundred year flood. This coincides with the topography and the allocated conservation area. The depth of the lake to the north of our site fluctuates depending on annual rainfall amounts.

Desire lines show the pedestrian links that exist between properties. Because the conservation area is enclosed and trespassing is discouraged, we can expect most people visiting our site will walk along Australia Avenue from that side of the river. It is difficult to predict travel paths from the other direction because of the small number of desire lines (shown on the aerial map). It is safe, however, to assume that most people will navigate around private property to find the shortest route possible.


DESIRE LINES
100 YEAR FLOOD PLAIN
WALKING TIME
10 min
5 min
1 min
N

3.13 ROADS AND PROPERTY

Our site is located at the intersection of three roads: Brazil Avenue, Australia Avenue, and Grenada Street. Grenada is the smallest of the three and has the least amount of traffic. Those arriving by car would most likely travel on South Africa Drive and turn on Liberia Street or Brazil Avenue. We can expect significant vehicular traffic along Australia Avenue in the future because of the planned business and community areas across the river.

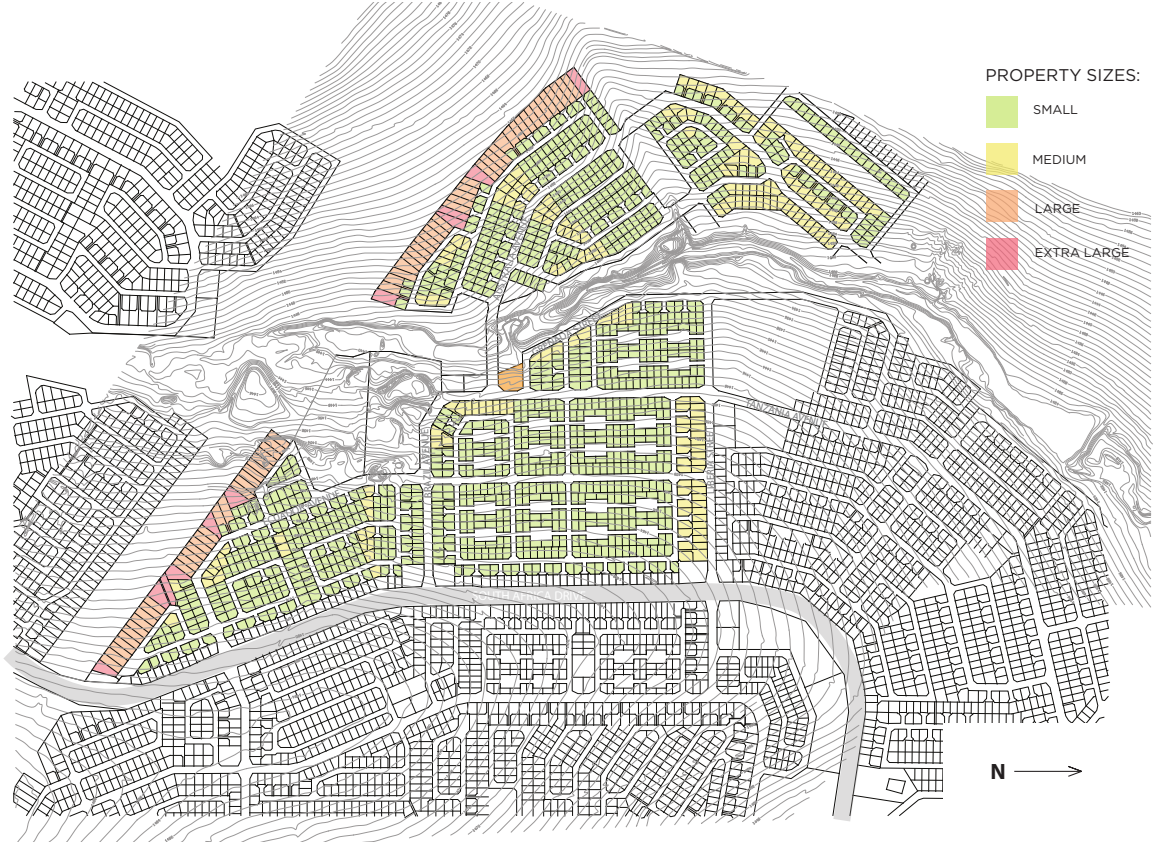
Aside from several notable exceptions, most lots in Extension 4 are similar in size. The strip of land along the southern portion marked in orange and red are much longer and larger. Land ownership is a status symbol in South Africa, and this creates a hierarchy of ownership in a city that is promoting equality. Will this disparity affect who attends our school and how the neighborhood is viewed by others?

Two strategies are employed to optimize the use of pavement (as little pavement is used as possible). The first is a "branch layout" which affords car access to five houses. The second is a "cluster layout" which creates a "courtyard" scheme around which eight houses are grouped. This creates public no-build space to avoid density. Maintaining the image of the city as a departure from cramped townships is essential to keep the project attractive to new residents.

When a plan layout bends and strays from a grid, distorted properties are larger than standard properties. These triangular lots create unique conditions where a particular family can have more land than the adjacent family. Several of these properties exist near our site, so how can we anticipate these circumstances and still unify the community?


SOUTH ELEVATION


NORTH ELEVATION


PROPERTY SIZES:
SMALL
MEDIUM
LARGE
EXTRA LARGE
N

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4.1 LIGHTING STRATEGIES

DAYLIGHTING

Daylighting is the practice of illuminating building space with natural light. Daylighting brings direct and indirect natural light into a space, minimizing the need for electrical lighting and connecting occupants to the outdoors. It is essential to provide adequate lighting for students through careful consideration of window placement, color choices, and shading.

TOPICS TO CONSIDER IN DAYLIGHTING DESIGN

Light Penetration
Light Balance
Surface Colors
Shading
Glare
Thermal Comfort

RECOMMENDATIONS

- Include high, operable clerestory windows on the north wall with light shelves to reflect light deeper into the space.
- Place smaller windows on the south façade to balance light levels in the room
- Place light tubes in bathrooms and closets
- Use light-reflective colors on the ceiling with slightly darker walls and floors that are darker still
- Avoid glare on walls and floors

DIRECT VS. DIFFUSE LIGHT

Direct Sunlight

Bright light coming directly from the sun. Intensity and direction vary depending on season, weather, and position of the sun during the day. It is a major component of lighting and thermal comfort and a large contributor to glare.



Diffuse Light

Light reflected by nearby surfaces and light from the surrounding sky. Do not underestimate the potential of diffused light to contribute to a room's light levels.



LIGHT PENETRATION

It is important to light all space within the crèche. The amount of light that penetrates the building's interior is a function of window height (the level of the top of the window) and light reflection.

Window Height
Windows placed higher on a wall result in greater daylight penetration.




Clerestory
High windows above eye level. They allow light to penetrate deep into a space while providing privacy.

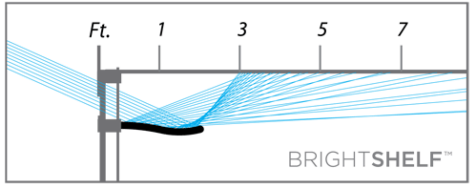


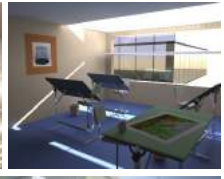
Skylights
Skylights effectively introduce daylight into spaces far away from fenestrated walls, but can bring in excessive heat if sized too large. Application and sizing in design of skylights must be carefully considered.



Light Tubes
Reflective tubing can be used to bring light to interior spaces during the day. The tubes transport light from the roof to the desired spaces. Light tubes can serve as an effective strategy for lighting in bathrooms, closets, and other typically dark spaces.


Light Shelves
Horizontal "shelves" can be used to reflect daylight onto the ceiling and deeper into a space. Light shelves should be built above eye level on the north side of the building. They double as shading devices and should be placed accordingly.



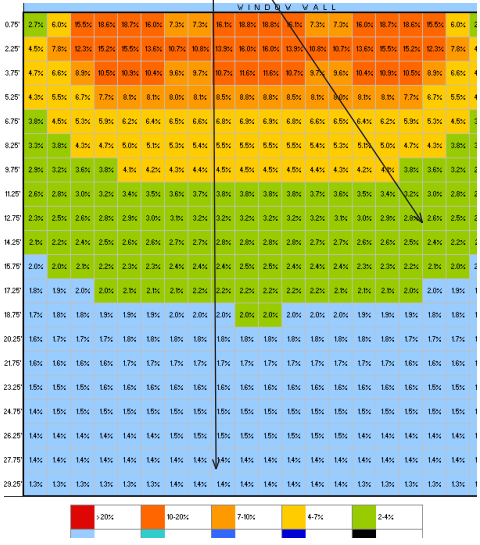



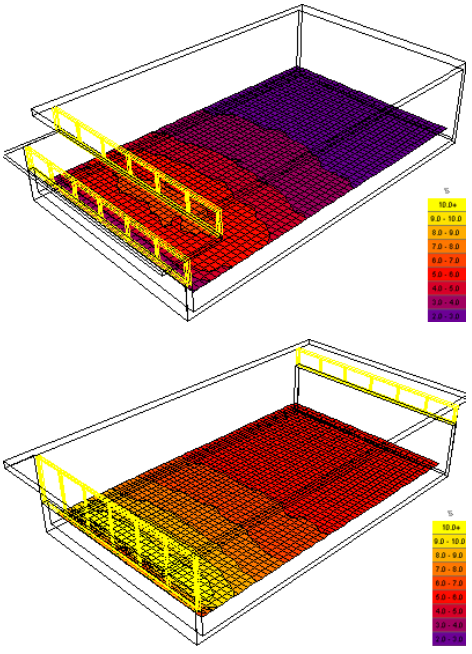
LIGHT BALANCE

- Light must be balanced from more than one side of a room.
- Classrooms tend to be large, so balance is an absolute necessity to prevent large contrasts between one side of the room and the other.
- Balance large windows (used for winter solar gain and view) with smaller windows on the opposite side.
- **Avoid fenestration on only one side of a deep classroom.**
- Aim to achieve a daylight factor between 2 and 3% everywhere in the room.

EXAMPLE
POSSIBLE POSITION OF BLACKBOARD TO AVOID GLARE

EXAMPLE
A BLACKBOARD HERE WILL RESULT IN CONTRAST GLARE





PLAN VIEW OF SIMULATION GRID (MSBG)

Daylight factor simulation of a room with fenestration on the north side using diffuse light only. Shaded boxes indicate variation in daylight factor across the room. Almost 50% of the proposed room receives a daylight factor of less than 2% so additional lighting is required. This additional light requirement can be met with the addition of another natural light source on the south wall or electrical lighting.

SURFACE COLORS

Light colors reflect more light than dark colors. The ceiling has the greatest impact on light reflection, followed by walls and then floors. Colors should be chosen carefully to maximize light reflection. Lighter wall colors should be utilized around the windows. Conservative reflection values for interior surfaces are indicated in the table below.

CEILINGS	70-80%
WALLS	50-60%
FLOORS	20-30%

- Vary colors between rooms, or at least from one age group to another
- Choose colors from warm side of the palette
- Use soft, cuddly colors for infants
- Rich, stimulating hues are appropriate for toddlers
- Bright, energetic hues are suitable for preschoolers

GLARE

Too much light entering the crèche can result in glare. Glare is associated with both natural and synthetic light. Avoid glare from smooth concrete finishes and other reflective surfaces, such as chalkboards, etc. A blackboard placed on a wall adjacent to a fenestrated wall may result in contrast glare. Thus, a blackboard should be placed opposite the main windows.

THERMAL COMFORT

Daylighting plays a vital role in the thermal comfort of the school. The effects of solar radiation are discussed in more detail in the section on thermal comfort.

SHADING

Summer sun in Cosmo City can be harsh, thus shading in the summer months becomes a crucial strategy. Shading helps to control levels of light and thermal energy permitted into the building's interior space. Shading strategies are discussed in more depth in the thermal comfort section.

Notes to consider:

- Shading blocks not only the sun, but also diffuse light and view of the sky. Daylight levels are reduced by extensive shading.
- Too little shading can result in overheating while too much shading may result in poor natural lighting.

4.2 ORIENTATION

Orientation of the crèche and elements within the building play crucial roles in the passive design of the crèche. Orientation helps to maximize passive solar heating in cool temperatures, avoid solar gain during hotter months, provide natural ventilation, and supply year-round daylighting.

In the southern hemisphere the sun travels across the northern sky. The sun rises in the East and sets in the West. During the summer in South Africa, the sun will pass almost directly overhead at noon. In the winter, its path will lie farther north in the sky. These simple facts must serve as the basis for solar-passive design.

DESIGN STRATEGIES

BUILDING ORIENTATION

Orient the building facing north to capitalize on solar gains for passive heating.

Orient about 15° east of due north to capture morning sun.

Orient the longer side of the crèche along an east-west axis to provide maximum daylight by exposing the broader side of the building to the northern sun.

Long facades should be turned towards the direction of prevailing breezes to enhance building cooling in warmer months.

WINDOW ORIENTATION

Place the largest windows on the northern façade.

Include windows on south side for light balance

Minimize east-west windows

SITE ORIENTATION

Shield windows and ventilation openings from harsh winter winds to prevent unwanted draughts and excess heat loss in the winter.

Locate exterior obstructions such as landscaping and fencing such that full sun is available on northern windows between 9 a.m. and 3 p.m. for maximum winter solar gain.

Deciduous trees and other low vegetation can be implemented for north facing shading as they will lose their leaves in the winter.

Pedestrian paths and parking lots should be located on the less sunny east and south sides of the building.

Our most exciting view is on the WEST of the conservation area. How do we compromise?

INTERIOR SPACES

Frequently used rooms such as classrooms and play spaces should be situated on the northern side of the crèche, where they are heated most effectively.

Less frequently used rooms such as closets should be located in the southern reaches of the building.

Kitchens tend to produce excess heat and thus should be placed on the south side of the building.

The bathrooms and kitchen should be located in close proximity, separated by a single wall.

People tend to prefer colder temperatures for sleeping, so locate napping areas on the southern side of the building.

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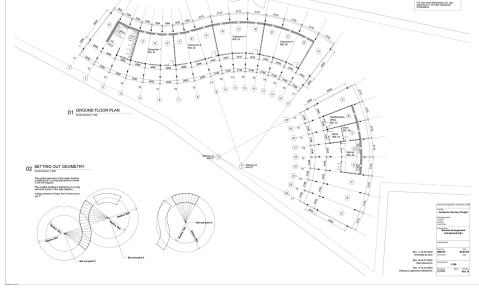
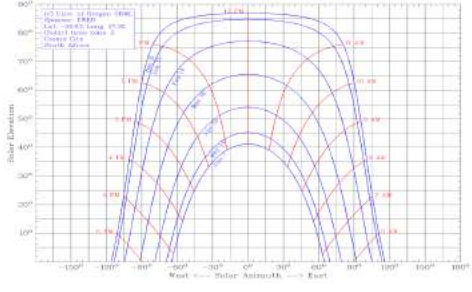




4.3 SHADING

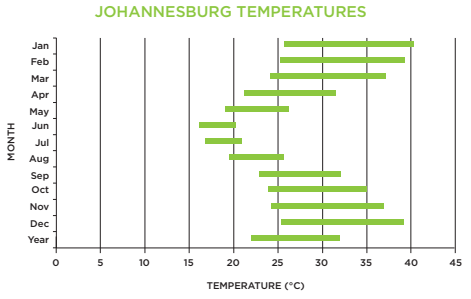
Shading is essential in regulating both light levels and solar gain that penetrate into the building's interior. There are many different strategies for shading; some of the main concepts are covered here.

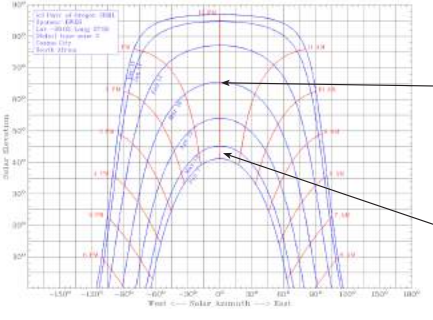
NOTE:
The position of the sun in the sky varies depending on the time of year and the time of day. The sun's position over the period of a year for Johannesburg is represented in a sunpath diagram, as seen in Figure 1. The sun hits its highest point during December and its lowest point during June. It is important that the crèche receive sufficient sunlight during the winter months to maintain an appropriate temperature, and minimal solar gain during the summer months to prevent overheating.

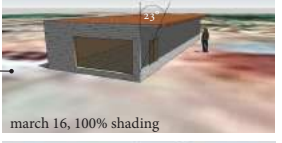
NOTE:
Average temperatures for the city of Johannesburg can be seen in Figure 2. From about April to August, shading should allow sunlight into the space to heat the crèche. In the other months, shading should aim to minimize solar gain. The angles required to shade openings can be calculated using the sunpath diagrams provided, which are accurate to our site location.

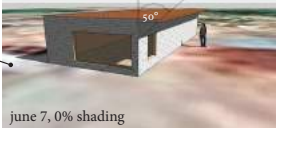
DESIGN STRATEGIES:

1) Overhangs are most likely the cheapest alternative and are highly effective They can serve as **sun protection** and **rain protection**.
2) Overhangs must be sized using the shadow angles for the area to allow sun between 9am and 3pm.
3) Vertical shading elements need to be used east and west openings and must be designed appropriately
4) Vegetation can be used as an effective shading strategy.
5) Provide either colored Venetian shades or light-colored translucent shades on all windows in occupied areas, even those with exterior shading.
6) Adjustable shades help with glare and daylight control.
7) Internal shades do not reduce cooling loads since solar gain has already been admitted into space.
8) Insulating drapes or shutters should be included to prevent heat loss through fenestration during the winter.









4.4 THERMAL MASS

Thermal mass describes how the mass of a building provides a sort of inertia against temperature fluctuations. This is commonly referred to as the thermal flywheel effect. High mass materials can absorb the sun's heat throughout the day and re-radiate this heat at night. In the summer, the thermal mass can give off it's built up heat at night and serve to cool a room during the day. This serves to flatten out the diurnal heat fluctuations. The radiative heating or cooling associated with thermal mass has a large impact on the thermal comfort of occupants.

MATERIALS

- Adobe brick
- Earth, mud, and sod
- Rammed earth
- Natural rocks and stones
- Insulating concrete forms
- Earth-bag wall systems
- Concrete

RECOMMENDATIONS

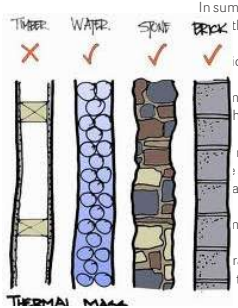
- Earth-bag wall system, brick, or concrete masonry units for thermal mass wall
- Build north and east exterior walls with thermal mass material
- Insulated concrete slab foundation with exposed concrete floor

IMPLEMENTATION

Thermal mass can include a concrete floor or masonry floor tiles, walls, or other elements incorpo-rated into the room

During winter, thermal mass should receive direct sunlight, especially in the morning, so it can absorb radiation.

In summer, the thermal mass should be shaded or insulated so it draws warmth the surrounding room and cools the air in the interior space.



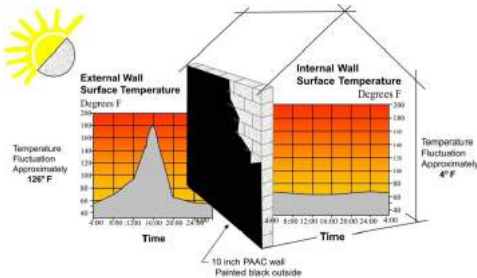
ior walls should be protected from the weather.

nal mass should be exposed on the interior face to allow heat exchange he room air and interaction with building occupants.

mass effectively in the room. Ensure that mass is either directly heated sun or that it is present in thin layers in areas that receive a large amount ar collection.

nal mass is best applied over large areas rather than in large volumes.

ral rules of thumb say that the area of thermal mass should be about six the area of accompanying glazing.



4.5 VENTILATION

There is a direct correlation between ventilation and solar comfort in a building. It is essential to supply sufficient indoor air quality to promote comfort, health, and concentration. Fresh air eliminates odors and provides oxygen for students and teachers. The high occupation density of a crèche (upwards of eighty people) means high fresh air requirements to achieve these comfort levels.

Design ventilation systems to avoid unwanted heat gain in the summer and excessive heat losses in the winter. During periods of weather extremes, occupants tend to close windows, leading to stuffy rooms. We want to minimize the duration with which this might occur.

WIND DRIVEN VENTILATION:

Wind driven ventilation should be the first strategy considered since only mild breezes are required. Wind causes positive pressure on the windward side of the building and negative pressure on the leeward side. To maximize wind induced ventilation in the crèches, ventilation openings should be located to take advantage of summer breezes.

STACK EFFECT:

If air in a space remains still, a temperature gradient develops in the height of the space. A large enough temperature gradient results in a driving force. The stack effect is completely dependent on temperature and humidity. Warm air is less dense than cool air at the same humidity while humid air is less dense than dry air at the same temperature.

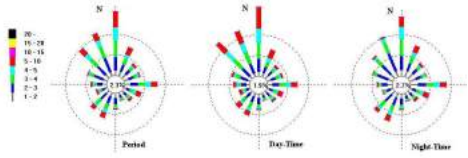
In the crèche, stale, humid air should rise and escape through openings in the ceiling. This air is replaced by cooler air from a lower location.

The stack effect is most effective in the winter when the indoor and outdoor temperature is greatest.

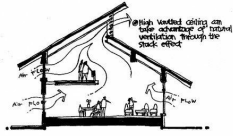
During the hot summers in Cosmo City, it will be difficult to achieve the required flow with the stack effect since the temperature differences will be much lower.

RECOMMENDATIONS:

1. Locate ventilation openings on the north and south walls of the crèche. Air will enter from the south wall and exhaust through the north wall.
2. Provide high ceilings with controllable windows near the ceiling for stack ventilation.
3. Provide ridge vents (openings at the highest point in the roof). These vents enable both stack and wind driven ventilation to exhaust effectively.
4. Provide at least two inlets and exhaust openings per room. Locate exhaust openings higher than inlets to maximize stack effect.
5. Avoid placing inlet and outlet windows directly across from each other. This offset encourages more air mixing and improves effectiveness. One should not be able to see through the building.
6. All windows and other ventilation openings must be fully operable
7. Allow adequate internal ventilation. Open doorways and louver walls allow airflow through the building interior. High louvers can be used if privacy is needed.
8. Limit building depth to a maximum of 15 meters. Naturally ventilated buildings should be relatively narrow to encourage cross ventilation. Deeper rooms (relative to ceiling height) provide less effective ventilation.
9. Minimize exterior wind obstructions in the summer.



NOTE:
Prevailing winds tend to blow north to northwest, with some easterly winds during the winter. This is compatible with a north oriented building since the broad side will be exposed for ventilation openings.



AIR REQUIREMENTS (SANS 0040)

OCCUPANCY	MINIMUM AIR REQUIREMENT, L/S	REMARKS
CLASSROOMS	7.5	AIR SUPPLY REQUIRED PER PERSON
LIBRARIES	6.5	AIR SUPPLY REQUIRED PER PERSON
CAFETERIAS AND DINING ROOMS	5	AIR SUPPLY REQUIRED PER PERSON
KITCHENS	17.5	AIR SUPPLY REQUIRED PER PERSON
PLAYING AREA (GYMNASIUMS, ETC)	10	AIR SUPPLY REQUIRED PER PERSON
ROOMS CONTAINING BATHS, SHOWERS, WC PANS OR URINALS	25	AIR SUPPLY REQUIRED PER BATH, SHOWER, WC PAN, URINAL STALL OR 600 MM OF URINAL SPACE

4.6 FOUNDATION AND FLOOR

FOUNDATION

The foundation is a structure that transfers the load from the building to the ground. When designing the foundation, the mechanical properties of the soil must be taken into account, including the effect of the underlying earth freezing and thawing and other climactic factors. Our site in Cosmo is a flat plot of compacted soil stays above freezing temperature, allowing for a simple shallow foundation design.

SLAB-ON-GRADE FOUNDATION

Past universities working with Education Africa chose to use slab-on-grade foundations because of their low cost and simplicity. In most cases, ready -mix concrete was donated by a local company and poured over rebar. Particles such as metal oxides can be mixed into the concrete to add color. Polishing the surface eliminates the need for additional floor support and covering.

Slab-on-grade has several structural and functional disadvantages due to the large surface area and relatively thin thickness. Over time, the ground will settle leading to uneven loading and cracking in the concrete. However, proper soil compaction will largely reduce this effect. The large surface area also allows for significant heat loss during the winter if insulation is not installed under the concrete. The concrete slab can challenge servicing the underlying utilities such as plumbing. These problems can be mitigated with proper planning and good construction practices.

Materials: ready-mix concrete, rebar,

SHALLOW FOOTING FOUNDATION AND SUBFLOOR

The load is distributed over many footers anchored into the soil. Beams are secured above the footers and the subfloor system (strengthens floor) is constructed upon the beams. Additional floor joists run between these beams to distribute load on the subfloor. The subfloor underneath interior space should be well insulated to prevent heat loss.

By adjusting the height of footers, the floor can be built at different heights. The subfloor system also allows for a crawl space under the floor which makes maintenance and servicing the plumbing and electrical system easier.

Materials: concrete , steel rebar, steel or concrete beams

FLOOR COVERING

A surface material can be laid on top of the foundation or subfloor. Sealed concrete floors do not need additional floor covering. Some crèches use carpet mats to soften the noise impact of falling toys and provide thermal insulation in the winter. For foundations that require a subfloor, a floor covering should be installed. Wood was commonly used in previous Education Africa projects, but is prone to warping. A variety of flooring materials are available at nearby hardware stores, which enables differentiation between materials. The flooring in the bathroom must be watertight (in accordance with building codes) and all flooring must be easy to clean and maintain.

Materials: sealed natural and engineered wood, carpet, linoleum, cork, vinyl, ceramic tiles,

UPPER LEFT:
WOODEN FLOOR AND SUBFLOOR SUPPORTED BY CONCRETE FOOTER FOUNDATION SURROUNDED BY GRAVEL IN OLIFANTSVELEI CRECHE.

ABOVE:
PLYWOOD FLOORING OVER WOOD SUBFLOOR AND FOOTERS IN CRECHE AT WEILER'S FARM.

FAR LEFT:
SLAB ON GRADE FOUNDATION USED BY EMANUEL CRECHE.

NEAR LEFT:
REBAR AND SHUTTERING IN PLACE BEFORE POURING CONCRETE FOR SLAB-ON-GRADE FOUNDATION USED IN THE JOUBERTON CRECHE.

4.7 MASONRY

CONSTRUCTION TECHNIQUES

CONCRETE AND CLAY MASONRY

- Masonry can be used to form cladding structures with wooden framing. After wooden framing is placed, brick-ties anchor brick walls to the framing. Masonry units will be stacked and mortared. Roof overhang can prevent water from penetrating the brick, thus increasing its durability.
- Bricks can be stacked, mortared, and bound with concrete to produce a load bearing structure. An overhanging roof is usually attached to provide shade and maintain a cool temperature.

DRYSTACKING/INTERLOCKING MASONRY:

- Obtain machine, test soil water
- Mix soil and cement in desired ratio by hand or with mixer
- Load the soil-cement mix into Hydraform block making machine
- Cure blocks by covering them with plastic immediately
- Blocks are watered for a week
- Plaster or cement can be coated over interlocking blocks for protective or decorative purposes

DESCRIPTION OF USE

Masonry can be used for loadbearing or cladding purposes. Bricks can be laid in interesting patterns for decorative ventilation, and sunlight purposes. Bricks can be used as cladding with other wall materials such as earth bag or rammed earth.

TYPES

CONCRETE:

Materials needed: supplied by manufacturer

Affordability: Concrete blocks are readily available by manufacturer. They are cheaper than clay bricks.

Advantages: Concrete blocks have high thermal and acoustic insulation, and are durable. Concrete is compatible with concrete. (The foundation, lintels etc. which will also most likely be concrete). Does not crack as easily as clay bricks. Additive mixtures can be used for waterproofing. Different colors can be used.

Limitations: Overall energy of the production of cement in concrete is high. The carbon and environmental footprint of this process is fairly large. Skilled labor needed.

Sustainability: Energy efficient since thermal mass slows passage of heat and absorbs it. Heat is absorbed during the day, keeping the building cool during the summer. Heat is released during nightfall or winter to sustain a warm building. Less energy needed to cool/heat the building. Concrete bricks are reusable and recyclable.

Dimensions: Length Width Height nominal dimensions of typical concrete masonry units (mm)

1 90 x90 x 90
2 90 x90 x 90
3 90 x 90 x 90
3 90 x1 90 x1 90

HYDROFORM:

Materials needed: hydraform block making machines, soil to be compressed Composition: sand, soil , silt clay content should be 10-45%; Water content should be 8-12%; 1:20 cement to soil ratio is preferred to strengthen the blocks

Affordability: Transportation costs are reduced because soil is found on site.

Advantages: Process of construction is very simple, quick, and can be easily to unskilled laborers. Building this wall can be a community unifying event. Building requires little mortar. Water absorption is at an acceptable level. Hydraform bricks have good thermal capacity. Transportation costs are reduced because soil is found on site.

Limitations: If left natural, interlocking masonry can soften from contact with a large amount of moisture. Plastering provides good protection.

Dimensions: 225-235mm usually in length, machine dictates width.

	Two Typical dimensions:
H F 220	Conduit H F 150
Use External Walls / Boundary wall	Interior/ Partition Walls
Width 220mm (9 inc)	150mm (6/4.5 ins)
Height 115 mm	115 mm
Length 100- 240 mm	100- 240 mm
Weight 9-11kg approx.	4.5 -6 Kg approx

Sustainability: Minimization of transportation costs because materials used are excavated on site (no firing involved). Made of natural materials - carbon footprint is very minimal.

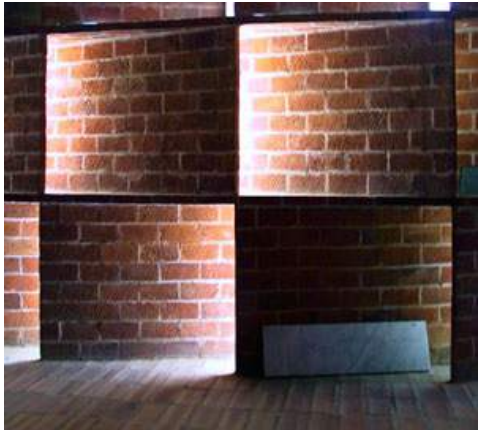
DESIGN IDEAS

Pillars can support a shaded roof to lighten load on the brick walls. Hydra form interlocking bricks can be used and eliminate the need for mortar. Different shaped bricks can be compressed and molded using hydra form machine.

Rammed earth and masonry can are compatible.

Decorative concrete blocks can be used.

Different sizes and shapes of interlocking bricks create a variety of patterns.



METAL FRAMED ROOF WITH LOADBEARING BRICK WALL SYSTEM. BRICK PILLARS HELP CARRY THE LOAD OF THE ROOF.

4.8 EARTHBAG CONSTRUCTION

CONSTRUCTION TECHNIQUES

- To use earth bags, a rubble trench is dug and filled with gravel and concrete.
- Enough room should be left so that the first and second rows of earth bags are below grade. Large bags of compacted granular material placed horizontally.
- The earth-bag should be filled as they are placed on the wall to minimize required effort. Barbed wire is placed between each row or course of the earth bags for added strength and to prevent sliding between bags. Four point is recommended and two strands are used for dome shaped buildings and one strand for vertical buildings.
- Earth bag construction is primarily loadbearing. For vertical walls, add bond beam to increase strength. Doorways should be arched for earth-bag construction.
- Roof structures can be framed with wood and attached before completed. Wooden braces can be used for the interior structure to support shape
- Wooden structures sometimes fortify openings within a building. Lintels is used above openings (i.e. windows etc.)
- Other wooden walls can be adjoined to existing earth bag constructed walls

DESCRIPTION

Composition: Usually composition of clay in the earth bag mixture should be around 5-25% because too much or too little clay causes stability problems. The mixture should not be too watery
Affordability: Good material choice because of its low cost and readability on the excavated site.
Materials: Requires a polyethylene bag (recommended) or burlap, four point barbed wire, soil clay mixture, concrete and earth, lime, or cement-based plaster.
Dimensions: Each bag is 457 mm wide and 762 mm long or 18"X30". This size of bag is referred to as the "50 Pound Bag" and is most commonly used.
Advantages: construction does not require skilled labor, thus the building can be a unifying community effort. Material is fire resistant and does not decay. Earth bag is an excellent thermal mass.
Limitations: Structure may require periodic finishing and some maintenance. UV rays can destroy the polyethylene bag so it must be protected during construction.

DESIGN IDEAS

Two types of earth bag walls are usually used: dome and vertical.

DOME WALLS

- Dome walls should be circular instead of elliptical to ensure stability. Another alternative is to make wood frame arches resulting in an arch shaped building.
- Dome roofs need more protection than a hangover, roof lime plaster is used (stronger than earth plaster)
- horizontal stacking of earth bags required

VERTICAL WALLS

- For vertical (rectangular structures) wood framing can be used and earth bags can be used as infill.
- Plaster should be applied to the earth bag wall's interior and exterior. The plaster strengthens the wall system, prevents degradation of earth bags, and provides aesthetic opportunities. Earth plaster is recommended. Plaster can be painted. Different types of plaster produce different textures. Brick cladding can be used on the outside.

OTHER DESIGNS

- Earthbags can be combined with strawbales for mega insulation

4.9 RAMMED EARTH

CONSTRUCTION TECHNIQUES

- Rammed earth should not be below grade because moisture from the ground can penetrate rammed earth and reduce compression strength. If it is below grade it must be reinforced on both sides with another material.
- Foundation for rammed earth can be reinforced concrete in a pier and beam form. Posts would have a flared bottom to distribute the weight of the wall. A continuous beam of concrete connects the posts. Earth is rammed on top of the beam.
- Another option for rammed earth is a "spread footing" method and build a foundation with concrete and steel below grade.
- Formwork is to create a desired shape for a section of the wall and can be constructed from plywood and lumber and connected to the foundation.
- Clay, sand, and gravel are mixed with a gasoline powered plaster mixer. When delivering soil to the formwork, it must be compacted by hand or with a hydraulic loader. An overhanging cap of steel can be added to walls to keep rain water away.
- Framing is needed for all openings. Wood is preferred over metal because moisture from the soil mixture will corrode metal frames. Doors are attached onto the wooden frames. Wood pieces are embedded in certain openings when ramming the wall.
- Concrete ring beams attach to tops of walls to reinforce wall panels and fortify the structure during seismic disturbances. Roof systems connect to these beams.

DESIGN IDEAS

For the interior and exterior of walls, rammed earth can be left bare or covered with stucco plaster. Brick veneer is another option. After pouring the mixture into formwork, rammed earth can be pattered for aesthetic purposes.

FORMWORK CONSTRUCTION

CONCRETE BEAM TO
REINFORCE RAMMED WALLS

SANDBLASTING

DESCRIPTION OF USE

Materials needed: plaster mixer, earth, concrete wood pieces. Best composition: thirty percent clay and seventy percent sand, gravel. Portland cement, lime, or different mixtures of clay can be added to the soil to strengthen rammed earth.

Affordability: Costs for compaction machinery must be considered. The hydraulic loader saves time but could be expensive.

Sustainability: It is environmentally friendly because it uses soil on site. Even if soil is delivered from other locations its CO2 emissions are much less than that of cement. If Portland cement is used, its percent composition in the rammed earth mixture will be small.

Advantages: Rammed earth is water resistant, strong, durable, and fire resistant. Rammed earth is a good thermal mass, so energy costs of heating and cooling will be minimized in the long run.

Dimensions: Thickness of wall is around 250 mm

Limitations:

Rammed earth can be a load bearing or a non-loadbearing wall system depending on wall-thickness. Skilled labor is needed. Finding a good soil composition on site may be difficult, but about 6% cement can make most soils suitable instead of the optimal composition mentioned above. Pouring soil into the formwork is a demanding task because rammed earth is not a liquid like concrete and can be time consuming.

DIFFERENT TYPES OF SOIL
PRODUCE DIFFERENT SHADES AND VARIATIONS

STONE FOUNDATION WITH MUD
BRICKS, RAMMED EARTH WALLS CAN HOLD WELL IN PLACE ON ITS OWN WEIGHT, THE MUD BRICKS ARE THERE FOR DECORATION AND ARE OPTIONAL.

EARTH CAN BE RAMMED INTO A LOG
TYPE PATTERN , NATURAL SHADE OF COLOR IS PRESENT IN THIS IMAGE

RAMMED EARTH ATTATCHED TO A
MUDBRICK WALL , GRANITE LINTEL IS USED ABOVE AN OPENING

MANUALLY RAMMING EARTH

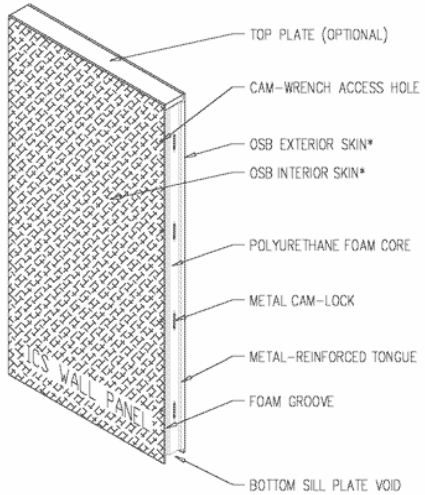
4.10 SIPS

CONSTRUCTION TECHNIQUES

- General standard foundation (i.e. concrete) is needed
- SIPS are manufactured and shipped to the building site
- Panels are placed on foundation and lifted into desired position with a crane or a forklift
- They are joined with expanding foam, sealing tape, sealing mastic and hardware (such as screws, nails, etc)
- Timber framing with sips as insulating walls can also be built

DESCRIPTION OF USE

- **Affordability:** Sips are not too expensive. The materials used to make sips are cheap and available.
- **Advantages:** The goal for building a SIP house is to make it as airtight as possible, thus insulation is very effective. Thermal capacity is high with no gaps for heat to escape and cooling and heating costs are reduced. Load is distributed evenly over all the panels rather than just a frame. Little labor is needed, and assembly does not take a long time. Sips are compatible with many other building systems. Sips can be used with truss roofs, or stick walls with a sip roof. They are also compatible with timber framing.
- **Sustainability:** The OSB outer skins of the SIPS come from fast-growing softwood trees. SIPS are recyclable. Good Insulation and thermal capacity requires less energy.
- **Limitations:** Fire resistant for only 15 minutes. It requires a separate ventilation system. Mechanical ventilation is needed. Because sips are energy efficient, a relatively small unit can be installed. The ventilation system will control air flow and bring fresh air inside while expelling stale air. The ventilation filters incoming air to keep out humidity and of allergens. HRVS are also used to recover the heat which is released from the building. HRVS utilize heat exhausted from the building to heat incoming air.
- **Dimensions:** Walls are typically between four to twelve inches thick.



4.11 STRAW BALE

CONSTRUCTION TECHNIQUES

FOR LOADBEARING: MONOLITHIC PLASTER AND BALE SYSTEM

- A concrete foundation is needed with a waterproof material between the foundation and straw bales to prevent moisture from seeping.
- Lay flat straw bales on top of one another, on top of the foundation.
- Straw bales need to settle before adding stucco or plaster.
- If straw bales are firm then the settling won't happen spontaneously. The bales need to be compressed. Walls can be mechanically or manually compressed.
- While assembling the wall system, wooden or bamboo stakes which penetrate a few bales stabilize the bales. These stakes remain while plastering and are embedded permanently into the structure.
- Bales are held firmly onto foundation with high tensile fencing wire attached to a top plate (made out of wood or steel sheet).
- Straw bales are coated with plaster. Straw bonded to plaster prevents the plaster from buckling.
- It serves as a lateral reinforcement while plaster carries the load. Different mixes of plasters can be applied. See materials: earth bag.

NON-LOADBEARING: POST AND BEAM SYSTEM

- Timber framing is constructed and straw bale is used as infill. Window and door frames and headers are made from wood.
- Roof framing, set onto a wood plate or concrete beam, is placed on top of the wall. A threaded bar can penetrate through the top bales and fasten to the roof to add stability
- Poultry netting can be mounted on both sides of the walls for plastering.
- Stucco plaster is used to fortify areas around windows, doors, and corners. It is held against bales using U Shaped pins or wires.

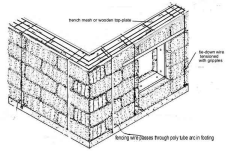
DESCRIPTION OF USE

Straw bale can be used to build load bearing and non-loadbearing wall structures.

- **Materials needed:**
  - Loadbearing: U shaped pins, wooden stakes, straw bale, plaster, and compressing device, concrete, fencing wire, top plate, gripper (device that tightens wire)
  - Nonloadbearing: timber, plaster, straw bale, concrete
- **Affordability:** Straw bale loadbearing and nonloadbearing walls are relatively cheap. Loadbearing is cheaper because it does not require additional wood framing.
- **Advantages:** Straw bale is sustainable and earth friendly, as straw is made from dead stalk material. Straw bale is a good insulator. The advantage of the bale-and-plaster loadbearing system is a simpler design which is easier to achieve than the non loadbearing technique. Straw bale is generally considered a strong and durable wall system material. If coated with plaster, fire resistance is high. Construction does not require much skilled labor. The low tech process allows community to get involved.
- **Limitations:** If straw is left unplastered, fire resistance is low. If exposed to too much moisture, rotting may occur. This should be taken into account when designing roof overhangs. It has high seismic resistance.
- **Dimensions:** Depending on the desired insulation straw bales of different sizes can be used. For super insulation the thickness of a straw bale wall is about two feet.

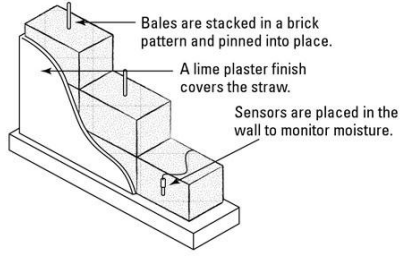
DESIGN IDEAS

- Straw and bale with wood framing and then plaster is one design.
- Straw bale (loadbearing) with stucco plaster.



Straw-bale construction offers high insulation value but can cost more and be difficult to work with.

PLASTER CAN BE PAINTED. BRICK CLADDING CAN ALSO BE USED.



4.12 WINDOWS AND OPENINGS

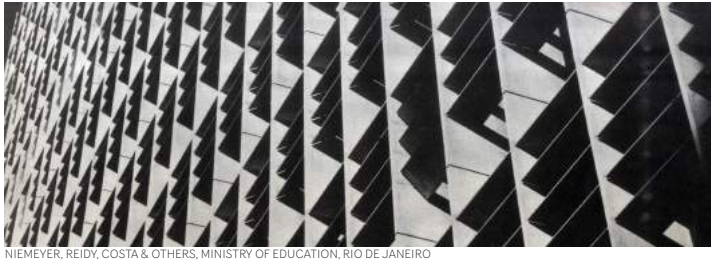
DESIGN IDEAS

Fenestration and shading devices are crucial to the design of the façade, for both natural illumination and interstitial spaces. These sorts of devices are influenced by the sun's direction and shading changes throughout the year.

A series of precedents from Brazilian and American architecture are shown. Even though climate varies between these regions, the most important element to the design of shading devices and openings is the awareness of the Sun's position throughout the day. For example, Oscar Niemeyer's Boavista Bank in Rio de Janeiro, Brazil, changes its fenestration design according to the direction the Sun at different times of day. This is even more important in a school, as light entering classrooms or presentation spacescan provide natural illumination or cause glares if directed towards blackboards/glossy presentation boards.

The examples shown are mostly based on the design of a repeated module, which create rhythmic shadows along the façade or the exterior vicinity. These shading devices can create spaces not defined as either interior or exterior. Manipulation of shading devices and fenestrations can significantly affect the design of interior spaces. A very innovative project, designed by Ernst Giselbrecht + Partner presents the Kiefer Technic Showroom in Austria. The project is mainly an office building, whose façade completely reconfigures according to different climate circumstances throughout the day. Changes in the façade completely alters how light filters into the building.

KIEFER TECHNIC SHOWROOM, AUSTRIA

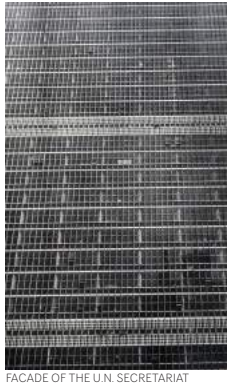


NIEMEYER, REIDY, COSTA & OTHERS, MINISTRY OF EDUCATION, RIO DE JANEIRO

P.A. RIBEIRO, BAHIA

M.M.M. ROBERTO, RIO DE JANEIRO

M. BREUER, BRONXVILLE, NY



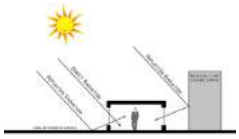
FACADE OF THE U.N. SECRETARIAT

A. RAYMOND, PONDICHERRY

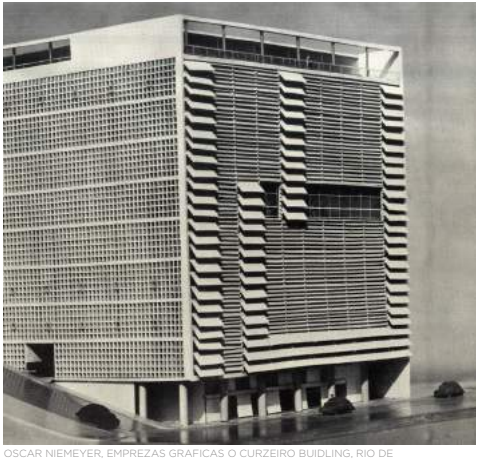
OSCAR NIEMEYER, BOAVISTA BANK, RIO DE JANEIRO, BRAZIL

SHADING DEVICES

Outdoor shading devices are often incorporated into buildings. When designing shading devices, several implications must be considered regarding operations, maintenance and safety. The designer must be aware of circumstances that affect occupants' safety or comfort, such as leakage, air control, cooling loads, sun angles, material durability, location latitudes, nesting birds, etc.



EXAMPLE OF HOW SOLAR RADIATION ENTERS AN ENCLOSED SPACE



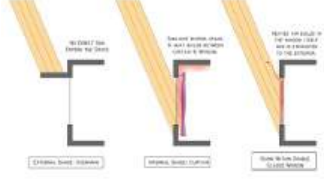
OSCAR NIEMEYER, EMPREZAS GRAFICAS O CURZEIRO BUIDLING, RIO DE

HORIZONTAL SHADING

Horizontal shading devices are usually the simplest and most maintenance-free. They are most effective on the south side of a structure, but are commonly used for southwest, southeast, and north facades. Horizontal shading, or, overhangs, must be very deep to be effective on east or west facing walls. It is recommended to leave a gap between the shade and the building to allow airflow. Overhangs should be designed so their position allows low winter sun through the entire window while completely shading the window from summer sun.

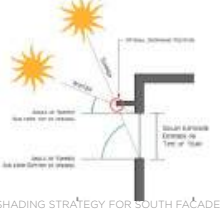
Material Suggestions:

It is common to see horizontal shading made out of concrete, treated wood or aluminum.

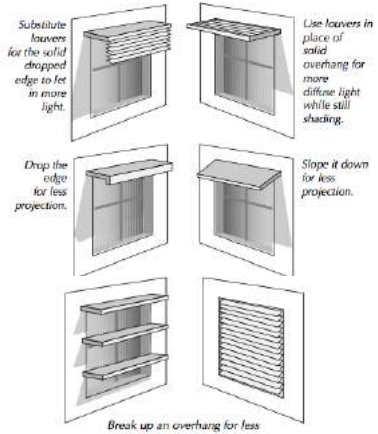


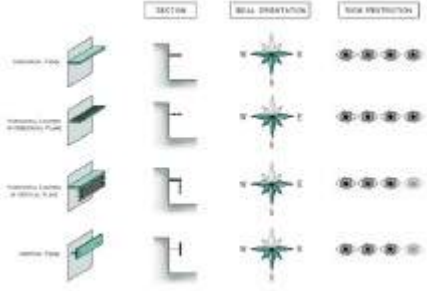
EXTERIOR SHADING, IF DONE PROPERLY, EMLIMINATES THE NEED FOR INTERIOR SHADING DEVICES, SINCE IT BLOCKS BOTH LIGHT AND THERMAL ENERGY

SHADING STRATEGY FOR SOUTH FACADE



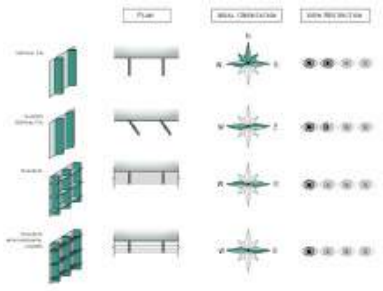
SHADING STRATEGY FOR SOUTH FACADE





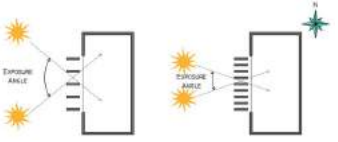
VERTICAL SHADING DEVICES (SIDE FINS)

Vertical Shading devices, or side fins, are usually the most appropriate for east and west facing fenestrations. These facades receive the sun at low angles. They can be found at southeast and southwest openings. Side fins are very effective as windbreakers and are helpful for insulation during winter. Fins placed perpendicular to the wall create horizontal shadows. Fins that are obliquely angled to the wall result in asymmetrical shading. Adjustable vertical fins create a variety of shadows that can be recofigued day by day, but are usually costly and coomplex.

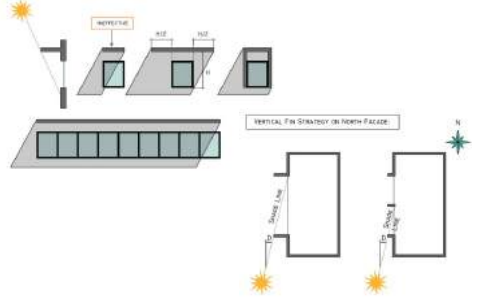


MATERIAL SUGGESTIONS

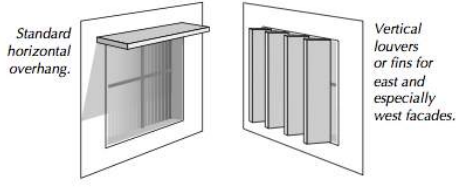
As with horizontal shading, concrete and treated wood side fins are common on buildings. Innovative projects, such as the one below, incorporate different materials (bamboo) to create the outer facade and side fins. Projects like these can be very time consuming, especially if not prefabricated.



BY MAKING THE FINS "DEEPER" OR CLOSER TOGETHER, THE SUN PENETRATION IS LESS.



THE "SHADE ANGLE" OR "D" DETERMINES THE DEPTH AND SPACING OF VERTICAL SHADES.

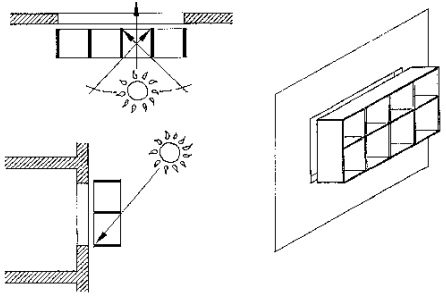


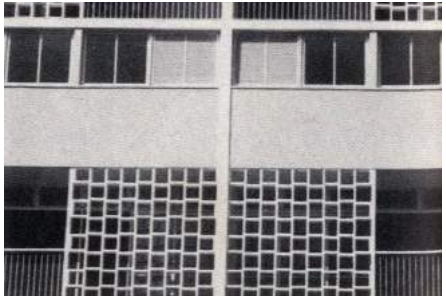
EGG CRATE SHADES

A combination of both horizontal and vertical shading results in the "egg-crate" solar shading device. These are usually seen in very hot climate because of their high shading ef˜ficiency. They usually work well with walls and control ground glare from reflected solar rays.

MATERIAL SUGGESTIONS

The most common material used for egg crate shades is concrete, as wood warps due to climate changes and candistort the grid.

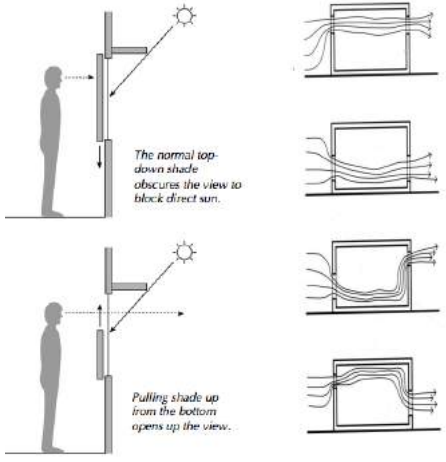




A. REIDY, RIO DE JANEIRO

INTERIOR SHADING DEVICES

Includes movable shading devices, shutters, interior blinds, etc. These devices should be limited since they can be expensive. Even though they will help with glare and visual comfort, they will not reduce cooling loads.

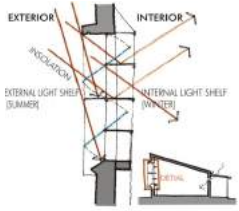


LIGHT SHELVES

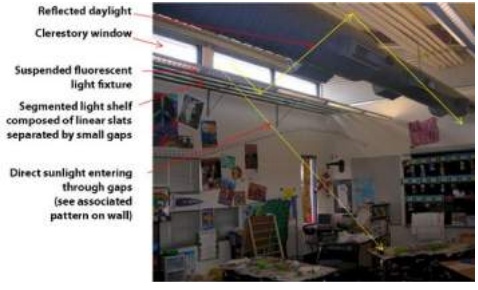
Light shelves are considered a variation of horizontal shading. It is based on the same concept of roof overhang, yet are usually designed deeper so that shading covers glazed windows at heights greater than 2.2 meters.

Light shelves are generally placed above eye level on the equatorial side (the north side in the case of Cosmo City) of a building where maximum sunlight hits and shelves are most effective. They allow daylight to penetrate into a space up to about 2.5 times the distance between the floor and the top of the window.

They are usually directed towards the interior so incoming light bounces off the light shelf and is reflected towards the ceiling. The light is then distributed over the ceiling and into working areas of the space. This method effectively by reduces glare problems and provides another alternative to natural illumination.



LIGHT SHELF DETAIL



4.13 INSULATION

Insulation is to be applied on walls and roof. This will keep the school cool during day and warm during night, increasing energy efficiency.

Each type of insulation has an R value which represents its efficiency. Higher R values equal better insulation ability. For example, a sheet of fiberglass insulation that is 1.5 inches thick has an R value of 3.5 while a spray-on cellulose insulation that is 1.5 inch thick which has an R value of 4, would show that cellulose insulation is more efficient.

I. CELLULOSE

EXPECTANCY

This type of insulation helps buildings stay warm in winter and cool in summer by effectively controlling all three methods of heat transfer: convective, conductive, and radiant. Buildings with cellulose insulation are more comfortable and less expensive to operate and maintain. Research at universities and national laboratories has proven that cellulose insulation offers up to 50% better performance than fiberglass.

It can prevent up to 89% of heat generated in the home from escaping through the ceiling.

Cellulose is known to be slightly more expensive than fiberglass insulation. It is sustainable, but combustible and water permeable. R – value = 3.70 per inch

METHOD OF INSTALLATION AND COMPONENTS

Made mostly from shredded recycled newspaper (about 85%) and mixed with a variety of chemicals that make it permanently flame resistant.

It can be sprayed on by machine which requires specialized workers.

CONSIDERATIONS

When installed properly and under normal conditions of use, these additives are nontoxic to humans, will not adversely affect other building components, and actually help create an environment that is inhospitable to insects and rodents. Bags of cellulose can be found locally in Gauteng. This insulation is SABS approved. It is not hazardous to Children - non-allergenic and non-toxic. Cellulose insulation also prevents the release CO2 and methane which are released when newspaper decomposes in landfills.

SUPPLIER

ThermGuard - Phone 082 5529 762 Website http://www.ceiling-insulation.co.za/contact.htm

Fire Resistant - tested & fire rated B/B1/2

II. FIBERGLASS

EXPECTANCY

Most products available typically consist of a 50mm layer of glass fiber insulation with a reflective foil sheeting cover on one side. However the thicker the insulation the better (100-150mm is not much more expensive but it is twice or three times as effective). Fiberglass insulation is easy to install and relatively inexpensive. It can also be used to wrap geysers (or water tanks) to increase energy efficiency.

Fiberglass offers exceptional acoustic properties & enhances indoor environmental quality through noise absorption.

Fiberglass is odorless, inert and fully compatible with all standard building materials and components. It will not accelerate corrosion of steel, copper or aluminum. It will not sustain vermin and will not breed or promote fungi, mold or bacteria. R – value = 3.14 per inch

METHOD OF INSTALLATION AND COMPONENTS

Easy install; anyone can install. There are also number of suppliers and installers who specialize in geyser blankets.

Made by jetting molten glass through tiny heated holes in a high-speed stream. These fibers are then wrapped by reflective foil sheeting. This is also non-combustible.

CONSIDERATIONS

Fiberglass insulation can cause irritation when in contact with skin.

4.14 ROOF COVER

GENERAL DESCRIPTION

There are hundreds of possibilities when we want to cover a building, from typical tile disposition to traditional thatch covers. Based on the constraints of easy and quick installation, good properties, and cheap material, we will focus on **corrugated sheets**.

The wide range of materials gives us variety of properties and prices, but in general these materials are often used in developing countries because they are inexpensive and widely available.

There are three main subgroups:

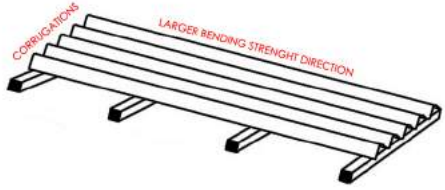
- **Metal sheets** (galvanized iron, aluminum-zinc alloys, stainless steel, etc)
- **Fiber cement sheets**
- **Polycarbonate sheets**

SIZE

Typical commercial dimensions are between 610 and 762 millimeters width; 3,600 and 6,600 millimeters length.

STRUCTURE PERFORMANCE

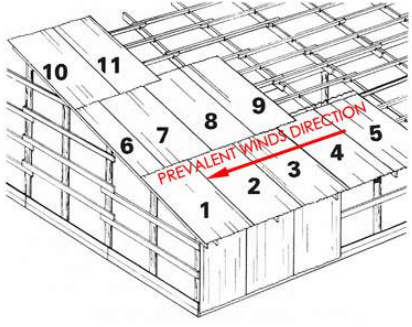
The bending strength of the sheets is greater in the direction perpendicular to the corrugations. Thus, sheets are longer in their stronger direction. This allows coverage of an entire roof with only one layer. Although this eliminates joints perpendicular to the corrugation, constructability may be more difficult with large sheets.



Roof sheeting requires a substructure to support the material. The essence of this substructure is to provide enough number of purlins (small beams) perpendicular to the corrugations in order to accomplish maximum span requirements.
The distance between them depends on sheet properties and roof slope, but, maximum space between purlins is less than 1 meter.

CONSTRUCTION

- Lay sheets beginning on the lower edge opposite prevalent winds.
- Start the second row with half of a sheet in order to achieve an alternate pattern.
- Special attention must be paid to upper, lower and overlap purlins, the rest of them will be between those. Ridge covering must overlap at least 125 mm, to prevent leaks and shear.
- Screws must be placed in the crown of ridges and sealed.
- To accommodate thermal movement, holes should be at least 5 mm. larger in diameter than screws.



ROOF SUBSTRUCTURE
BEAMS AND PURLINS

SCREWS POSITION
SCREWS MUST BE PLACED IN THE CROWN OF RIDGES

METALLIC SHEETS

CONTEXT

There are different metallic materials with slightly different properties. This translates into various prices and maintenance requirements, but design and construction considerations remain essentially the same.

PERFORMANCE

AFFORDABILITY: They are relatively cheap, as an order of magnitude we can find sheets between $4 and $20 per square meter. They are easy to install and transport.

SUSTAINABILITY: Different types of metals are recyclable, and some sheets are made from post-consumer materials.

CONSTRUCTABILITY: Easy to transport and manage because of light weight. It does not require complex skills to place.

ADAPTABILITY: Depends on material:

- Galvanized iron is not a long-term durable material due to water and oxygen corrosion. Despite its gallvanization (which inhibits corrosion), rusting is inevitable in places with acid rain.
- Aluminum-zinc alloy sheets or plain aluminum sheets are more expensive and not as strong as corrugated galvanized iron, but are more durable (up to 50 years) due to resistance against corrosion. They are lightweight and have positive climatic properties.
- Stainless steel: It is expensive but has good strength and corrosion resistant properties.

RESILIENCE FACTOR AND MAINTENANCE REQUIREMENTS

- Low maintenance for aluminum and stainless steel sheets.
- More maintenance is required for galvanized iron, because it gets damaged via corrosion.
- Easily replaceable and easy to construct.
- A layer of paint will increase durability.
- The steel and zinc will be exposed if there is a scratch or cut. To avoid this, take care to clear debris.
- If sheets rust around fixings, covering them with a sheet that protrudes about 100 mm below the lap joint can extend the life of the covering.
- Metal panels respond to temperature change by expanding and contracting, causing the fastener hole size to increase which will result in leaks.

POTENTIAL DESIGN AND CONSTRUCTION STRATEGIES

- Shallow-pitched roofs are possible with this material, but care must be taken to avoid possible ponds on the surface. Any kind of roof penetrations (e.g. vents, flues, skylights) must be sited to avoid restricting water run-off.
- Ventilation/insulation should be adequate to prevent condensation on soffits (underside of roof elements).
- Avoid contact with moisture-retaining materials (e.g. rain exposed timber, wet mortar, etc.).
- Take into account incompatabilities between different types of metal compositions.
- A double roof system is suggested to dampen acoustics from inside (echo) or outside (rainfall) the building.
- A double roof system would also aid climatic performance (heat absorption). Another option to avoid heat absorption is to paint it with light colors or a reflective coating (cool roof).
- Typical shapes are corrugated and inverted box-rib (square-fluted). The first type is often cheaper and the second is often chosen for aesthetic reasons.

PONDS ON THE SURFACE

CORRUGATED SHEETS

IBR SHEETS

FIBER CEMENT SHEETS

CONTEXT

Fiber cement is a material composed of portland cement and fibers, used in the manufacture of rigid and light plates. Fiber cement boards are waterproof and easy to both cut and drill, and therefore a suitable material for roofs.

PERFORMANCE

AFFORDABILITY: Widely used in low-income houses in Cosmo City. It is inexpensive and widely available.

SUSTAINABILITY: Require less energy to construct and are potentially recyclable, but at present there are no programs that reincorporate fiber cement into production.

CONSTRUCTABILITY: Require little skill and easy to install.

RESILIENCE FACTOR AND MAINTENANCE REQUIREMENTS

- Requires little maintenance once installed and painted.
- Good impact resistance when thick enough and resistant against large temperature changes.
- Fireproof.
- Can last up to 60 years.

POTENTIAL DESIGN AND CONSTRUCTION STRATEGIES

- The recommended pitch ranges between 5° and 35°
- Thermal resistance and sound transmission vary greatly between fiber cement products. Fiber cement sheet products rate poorly in thermal resistance and sound transmission, thus wall insulation is highly recommended. In general, the thicker and denser the product, the better resistance to temperature and sound transmission.

FIBER CEMENT SHEETS
LOW INCOME HOUSEING
COSMO CITY

POLYCARBONATE SHEETS

CONTEXT
Metal sheets have better properties and are cheaper than PVC sheets; therefore PVC must be used only in order to provide natural lighting and/or color effects.

PERFORMANCE
AFFORDABILITY: The prices of PVC is relatively cheap, similar to metal sheeting

SUSTAINABILITY: It is recyclable and some of the sheets are comprised of post-consumer recycled plastic.

CONSTRUCTABILITY: Lightweight, and thus easy to transport and manage. Does not require complex skills to install.

ADAPTABILITY: Avoid use in extreme hot climates, and double roof systems cause inadequate ventilation. It has light transmission up to 90%.

RESILIENCE FACTOR AND MAINTENANCE REQUIREMENTS
- It is less durable than aluminum or stainless steel.
- If used as roofing or light transitivity surface, it requires cleaning.

POTENTIAL DESIGN AND CONSTRUCTION STRATEGIES
- The same as metal sheets, but without any corrosion problems.
- They cause a greenhouse effect, and therefore should not be used in interiors where overheating may be a problem.
- They can be used as translucent windows, for example in a restroom.

MAINTENANCE ISSUES

TRANSLUCENT WINDOWS

CLADDING MATERIAL

USES AS WALLS

RECOMMENDATIONS

GALVANIZED IRON
- It is the cheapest way to cover a roof, but maintenance requirements are high, and the rusted appearance is not appealing.
- If there is possible contact with children, this option must be discarded because of rust.

ALUMINUM-ZINC ALLOYS
- It is expensive, but the appearance and low maintenance may be worth it.
- Some brands offer an epoxy coated surface that increases durability

STAINLESS STEEL
- The same as aluminum but more expensive

FIBER CEMENT
- If used as a simple roof cover it may remind occupants of low-income housing and neglect our aim to improve upon the status quo.
- It has poorer climatic performance abilities than metal sheets.

POLYCARBONATE
- Collect heating, possible overheating problems by greenhouse effect.
- It is only recommended to lighting purposes.

Corrugated sheets can also be employed as other building components such as walls, lighting, or cladding materials.

4.15 ROOF SYSTEMS

GENERAL DESCRIPTION

A roof is not just a building cover, nor is it a simple skin to protect a building from rain. A building must act as a whole, all building systems interconnected. The roof is one of the most decisive parameters of the structure.

When designing a roof system, several factors must be taken into account:

- CONSTRUCTABILITY: Different systems require complex skills and lengthy installation processes.
- NATURAL LIGHTING AND VENTILATION: The roof plays an important role in climatic performance. It will determine the shape of the building, air currents, and shade.
- SUSTAINABILITY of materials and methods.
- DURABILITY and maintenance requirements: The roof is entirely exposed to weather changes and thus is vulnerable. Some materials perform better than others depending on climate.
- AFFORDABILITY: Roof systems and materials are linked to a wide variety of construction and maintenance requirements; the cheapest materials may be the most expensive to maintain in several years.
- OTHER BUILDING SYSTEMS: The roof system will have decisive influence on the substructure below (walls, columns, etc). Therefore, neither walls or roof system can be chosen regardless of the other.
- RAIN WATER HARVESTING: If it is decided to install this system, the roof will play an important role.

CONSTRUCTION TECHNIQUES

If we focus on materials, we have two main options: wood or steel.

- Wood can be used as sawed timber or as "poles" in its natural circular form. The strength of poles is larger because of not disturbance, and the waste of material is smaller, but connections can be more difficult than using timber.
- Steel is stronger than wood which enables larger spans and free-form plans with small diameter members.

With these materials we can develop two different roof systems:

- Frames: Are large forms made from jointed individual members which link the roof directly to the ground.
- Trusses: Are elements made from independent members placed above independent columns or walls.

There are two ways to work with timber or steel systems: On-site Assembly or prefabrication.

- Prefabrication has some advantages because trusses and frames are supplied to the site already assembled. It is only necessary to place each piece on site. Installation does not require special tools or skills and saves significant construction time.
- Prefabrication affords a choice of size and quantity, with logistic and constructability limitations. Typical sizes are as long as the required span.

Depending on shape and weight, installation may require a crane. Frames or trusses are lifted and held in place, then linked together with purlins by welding or bolts. Therefore, frame set up does not require skilled labor.

When combining roof structure, roof cover, and ceiling, there are three different options:

- **SHEETS – TRUSS – CEILING**: Large space between roof and ceiling, allows wind to cross through and avoid rain noise.
- **SHEETS – PURLINS – CEILING (OR WITHOUT CEILING):** The frame supports both roofing sheets and ceiling; insulation is placed in between.
- **INDEPENDENT ROOF**: Both building and roof are completely independent, which eliminates load-bearing limitations but requires a double structure, without any common element. It makes large shaded spaces possible, potentially through the use of a super-structure.

RECOMMENDATIONS

- Repetitive frames may be preferred over trusses because they are faster to install and do not require a substructure for support.
- High ceilings eliminate overheating and allow additional cross ventilation and lighting.
- Roof cover – ceiling space may be enough insulation. Care must be taken to avoid inhabitation by birds or other pests.
- Projections and high roofs offer significant shaded space.
- Totally independent roof – rooms require a double structure without connections: more expensive, but will afford freedom of form to both roof and rooms.
- Water harvesting must be taken into account; this may be difficult if with complex joinery or connections.
- Steel is environmentally less friendly than wood.

TIMBER AND POLES FRAME

A frame made of timber or poles is one of the most traditional ways to build a small structure. Roof sheets are supported by the building structure. The idea is to have wood beams and columns interconnected, creating a frame that is later linked with other frames by purlins.

- Repetitive prefabricated frames, quick set up
- Shape and openings provide ventilation and day lighting
- Bolt connections do not require skilled labor or special tools

- Wood poles (i.e.: bamboo, gum poles) tied or jointed using metallic plates
- It is not prefabricated, which increases assembly time
- This is a cheap and quite strong solution but requires skilled labor
- Affords a large shaded area

- The roof is independent of the rooms; the two structures are not connected in any way
- Repetitive prefabricated frames, quick set up
- Easy water harvesting because of mono-slope

TIMBER AND POLE TRUSS

There is a wide variety of timber trusses that may be used, and all have large spans and need to be fastened walls or columns. Less assembly can be prefabricated, and thus more work is required. It is necessary to construct load bearing walls before placing the roof.

- It is not prefabricated, requires skilled labor
- Connections between poles are more difficult than between sawed timber
- High ceiling
- Arch configuration is difficult to construct.

- Planar prefabricated timber truss
- Canvas in one side to protect from birds incursion
- Some services (i.e.: light cables) are placed through the truss
- Some rooms have a ceiling under the roof

- Mixed structure: wood poles (bamboo, gum poles) and steel
- Ceiling is placed between roof cover and beams
- High ceiling and light appearance

- Same idea as framing, but trusses allow larger spans than beams
- Allows prefabricated trusses that are fastened to columns or walls on site

STEEL FRAME

For a typical steel structure, frames are prefabricated and then fastened on site while beams and columns are assembled on-site. This allows a free form plan, but requires skilled labor.

- Steel structure with metallic sheets independent of the rooms
- Seamless roof-to-wall construction
- Water harvesting can be difficult

- Lightweight steel structure + plastic film cover
- Several independent rooms under each roof
- No water harvesting
- Large shaded area

- Steel structure with no prefabrication, just independent columns and beams assembled on site.
- Ceiling is placed under the roof sheets with space only for insulation

- Same idea as prefabricated timber frames but made by small diameter steel members in triangulated shapes
- Every frame is prefabricated and jointed on site.
- Light weight structure.

STEEL TRUSS

In this case, the idea is the same as timber trusses. The difference is that steel truss members are thinner, which results in lighter structures.

- Light weight steel frame over clay ceiling
- Supported by walls and columns
- Requires welding
- Clay ceiling with arch shape. Bricks work under compression

- Planar steel trusses.
- Sloped inwards, central canopy allows water harvesting.
- Central canopy shades the patio; gutters are fastened to columns

4.16 PLUMBING SYSTEM OVERVIEW

FIXTURES
- 5 bathroom sinks (lavatories)
- 1 kitchen sink
- 6 toilets (2 adult, 6 children)
- solar water heater

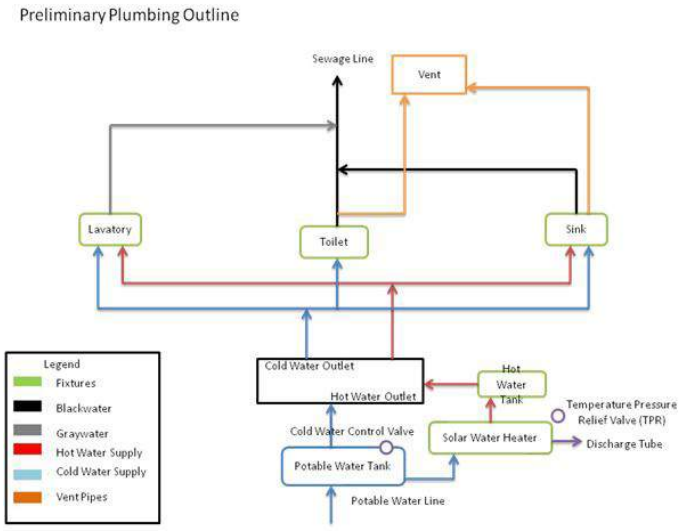
PIPE LINES
- potable water (hot and cold)
- sewage line (graywater and blackwater)
- vent line

VALVES
- water control valve (cold)
- greywater valve (for potential recycling)

DRAIN-WASTE-VENT
- vent stacks
- traps

OUTLETS
- water (hot and cold)

MISCELLANEA
- Filters
- Clean Out
- Insulation



4.17 WATER SYSTEMS

BLACKWATER AND GREYWATER

- **BLACKWATER** is the wastewater from the toilet, kitchen sinks and dishwashers
- **GRAYWATER** is the wastewater from laundry, bathroom sinks (lavatories) and bathing

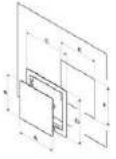
The former cannot be recycled due to the presence of human waste, while the latter is recyclable. Both, however, will be sent to the public sewer line. However, due to the fear of much maintenance, the graywater will not be recycled; so therefore both types of water will be sent to the sewer line. The lines are still separately colored for the possibility of the implementation of recycling technology.

VALVES

- Stop valves, gate valves, sill cock valves, compression valves and ball valves
- Typically, the shutoff/control valve is for the cold water. It allows the flow to be turned off, such as when the water heater, or other appliance, is not in use or needs repair.

PLUMBING ACCESS

- Framing square around the hole that is left in the wall and trace the perimeter
- Hole in the drywall; horizontal support block behind the wall board if hole is not near studs in the walls; otherwise just secure support blocks to the studs before installing the door and frame
- Water shut-off valve and electrical wiring



TYPICAL PIPING MATERIALS

PIPING MATERIALS	WHY?	WHERE?	COMPATIBILITY WITH CHILDREN
COPPER	easy to handle and solder moldable metal easier to shape/bend safer to use for potable water (corrosion, weather and bacteria resistant) recyclable	(if use copper, it will be buried deep, to prevent robbery ~)	Safe
PE (POLYETHYLENE)	flexible (fittings not necessary) low-cost easy to transport resists corrosion does not require maintenance	Cold water only; outdoor piping; buried	No contact
PEX (CROSS-LINKED POLYETHYLENE)	cheaper than metal most flexible piping (easier to install) flexibility allows for increased expansion capacity (pipes more burst resistant) have shut-off valve at each supply line (easier to repair) resists corrosion does not require maintenance more aesthetically pleasing then PE pipes due to color availability	Connections to fixtures (no UV exposure, prone to biofilm growth), difficult to break down and reinstall), hot water	Do not leave the pipes within reach of children; they can try to climb or pull out the pipes
PVC (POLYVINYL CHLORIDE)	rigid hard to damage is long lasting more resistant to bacteria (good for drain/waste system) corrosive resistant	DWV (unsafe for potable water due to production of carcinogenic byproducts), sewer and drain pipe; cold-water, buried	No contact

COMPARISON OF PIPING MATERIALS

	PVC (POLYVINYL CHLORIDE)	PEX (CROSS LINKED POLY-ETHYLENE)	PE (POLYETHYLENE)	COPPER
DURABILITY	~ 30 years	~ 50 years	~ 30 years	> 50 years
Weight	Light	Light	Light	Heavy
Tensile Strength	Moderate	High	High	Very High
TEMPERATURE	Smallest temp range	Wider range than PVC	Cold only	Much wider range than PEX
TRANSPORT	Harder (provided in tubes)	Easy (provided in reels)	Easy (provided in reels)	Harder (provided in tubes)
INSTALLATION	Solvent welding (rigid with high chemical resistance; requires skilled labor)	Crimp ring (or WIRSBO® Quick & Easy®, which uses rubber seals)	Clamped couplings (requires skilled labor)	Solder (or compression fittings)
COST	$1.5 to 6 /m + fittings	$2 to 3.6 /m + fittings	$0.5 /m + fittings	$3 /m + fittings
PRODUCT DIMENSIONS L = LENGTH D = DIAMETER	L: 3 – 5 m D (toilet/general outflow): 90-110 mm D (sink/shower outflow): 32-50 mm	L: 50 or 100 m D: 20 – 25 mm	L: 50 or 100 m D: 20 – 25 mm	N/A
SAFETY	Releases poisonous gasses if burned, dioxins in manufacturing and leeched into water	Releases poisonous gasses if burned, but has FAR fewer toxins than PVC, especially in manufacturing	Immune to corrosion, releases harmful chemicals if burned.	Safe (modern ones are corrosion-resistant)
MAINTENANCE	No maintenance required. Fails are usually due to bad installation practices and are easy to solve.	No maintenance required. Fails are only due to bad installation practices.	No maintenance required. Fails are only due to bad installation practices.	No maintenance required

POLYETHYLENE (HDPE & LDPE)

- HIGH DENSITY POLYETHYLENE (HDPE) – (0.941 ≤ density < 0.965) has strong intermolecular forces, high tensile strength, is harder than LDPE, is good for drainage pipes
- LOW DENSITY POLYETHYLENE (LDPE) – (0.910 ≤ density < 0.925) weaker intermolecular forces, higher resilience, is good for small-diameter water distribution pipes.

POTENTIAL DESIGN / CONSTRUCTION

- A common 20 – 25 mm PE pipe system is used to connect the local water supply with the interior of the building, because its flexibility and strength give a good outdoor and underground behavior.
- Fitting can be avoided because of flexibility, but when they are necessary a mechanical pressure fitting may be used.
- The backfilled is not as critical as in PVC pipes, because PE is less rigid and more resistant.
- It is recommended to check the fittings with water pressure larger than the common before cover them.
- Care must be taken about suppliers: all the products must comply with SABS requirements.

DETAILED COST (FROM CASHBUILD)

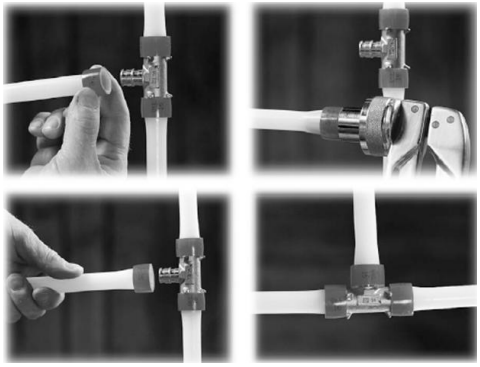
HDPE: 20mm x 100 m. 350 ZAR = $50 -> $0.5/m

LDPE: 20mm x 50 m. 125 ZAR = $18 -> $0.36/m
25mm x 50 m. 168 ZAR = $24 -> $0.5/m

SUPPLIERS

STEWARTS & LLOYDS TRADING BOOYSENS 118 4TH STREET, BOOYSENS RESERVE 118 4TH STREET, BOOYSENS RESERVE, JOHANNESBURG, GAUTENG 2016 P: 011 496 3000 F: 011 496 3012 HTTP://WWW.STEWARTSANDLLOYDS.CO.ZA HDPE: 25 MM. FROM 0.7 (PN 6.3) TO 1.2 (PN 16) $/M	JACOBS PYPE PLOT 295, KROKODILDRIFT-EAST, BRITS 0250, BRITS P: 012 2620161; 012 2502860 HTTP://WWW.JACOBSPYPE.ORG LDPE: 20MM 0.22 $/M 25MM 0.32 $/M HDPE: 20MM 0.32 $/M 25MM 0.5 $/M ELBOWS AND COUPLINGS: FROM 2 TO 3 $/UNIT TEES: 3 TO 5 $/UNIT
PRAYSA 1199 1 LOG ROAD EXT 14 WADEVILLE EXT 14, UNIT A1, P: 014 763 1742 F: 011 383 9910 HTTP://WWW.PRAYSA1199.CO.ZA	RamPiping Systems 178 Immelman Road Wadeville Germiston, Johannesburg, Gauteng 1428 p: 011 827 3700/1 f: 011 827 3702
MASTERBATCH SA 13 spanner road spartan, kempton park, gauteng p: 011 975 6252 f: 082 466 0468 http://www.masterbatch.co.za	JCL ENTERPRISES Gate 7, Kent road, Anderbolt, Boksburg, Gauteng 1446 p: (07) 9333 8351 f: (08) 6673 9018 http://www.jcl.co.za
SMART PIPING SUPPLY 13 Spartan Road, Kempton Park, p: +27119746760 f: +27119746764 http://www.smartpipingsupply.co.za	SPIRAL HDPE PIPE (PTY) LTD Unit E3-4, Old Mutual Industrial Park, Moot Street, Hermanstad, Pretoria, Gauteng 0002 p: 012 377 1670 f: 012 379 2603
ZEBULA ENGINEERING AND STEEL SUPPLIES CC ROVER ROAD RUSTIVIA GERMISTON, GERMISTON, GAUTENG 1401 P: 011 822 2441 F: (08) 6656 6840	AFRIPEX (PTY) LTD Unit 1, APD Industrial Park, Elsecar Road Kya Sands, Johannesburg, South Africa Telephone +27 (0) 11 708-6807 Fax +27 (0) 11 708-6808 Email: info@afripex.com www.afripex.com

CROSS-LINKED POLYETHYLENE (PEX)



POTENTIAL DESIGN / CONSTRUCTION

- For this kind of building a traditional "tee system" installation method is recommended, due to low water demand. This is a main pipe where all the points are connected.
- Additional installation procedures and tips are widely explained in Afripex web page: (Tech Data Sheet: Basic Tapwater Manual (3.3 MB))
- It is recommended to check the fittings with water pressure larger than the common before cover them.
- Care must be taken about suppliers: all the products must comply with SABS requirements.

DETAILED COST (UPONOR®, CASHBUILD)

Plastic elbow 16 mm = $3
Metallic elbow 16 mm = $4
PEX 15mm x 5.5m 75 ZAR = $11 -> $2/m
22mm x 5.5m 140 ZAR = $20 -> $3.6 /m

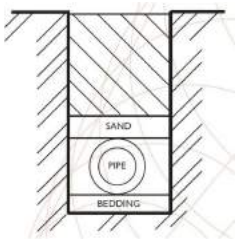
SUPPLIERS

Smart Piping Supply 13 Spartan Road, Kempton Park, p: +27119746760 f: +27119746764 http://www.smartpipingsupply.co.za	Afripex (Pty) Ltd Unit 1, APD Industrial Park, Elsecar Road Kya Sands, Johannesburg, South Africa Telephone +27 (0) 11 708-6807 Fax +27 (0) 11 708-6808 Email: info@afripex.com www.afripex.com

(POLYVINYL CHLORIDE) PVC

DETAILED COST

PVC 50mm x 6 m
68 zar = $9.7 -> $1.6/m
SVpipe 110mm x 6 m
245 zar = $35 -> $6/m
Underground pipe 110 x 6 m 140 zar = $20 -> $3/m
Fittings: SV bend plain 94 / 110
33 zar = $5



POTENTIAL DESIGN & CONSTRUCTION

- A common waste pipe installation requires a 90 or 110 mm. PVC pipe that connects all the toilets, and 32, 40 or 50 mm PVC pipes that link sinks, showers, baths, etc. with the larger pipes.
- When possible, elbows must be avoided and care must be taken about the minimum slopes: 2% when the diameter is smaller than 50 mm. and 1% in the largest ones.
- Joints between pipes or pipes-accessories are done using glue or a rubber, depending on the model.
- The wall thickness is standard and thicker pipes are more expensive. Therefore the possible external loads as vertical soil pressure, possible superimposed live loads (vehicles) must be taken into account. They can crush or bend the pipes.
- The backfilled is also critical, direct contact with stones must be avoided. It is recommended spill a sand bed, install the waste pipes, and then cover them with a layer of tamped sand before add excavated material. As larger is the depth of trench greater the soil loads but smaller the superimposed load effects. In private land is recommended a cover of 0.3 meters from ground surface to top of the pipe, or 0.6 meters if vehicles are allowed.
- Flexible PVC pipes are useful as easy to install small diameter waste pipes to sinks or showers, but they must be connected with a rigid one.
- Care must be taken about suppliers: all the products must comply with SABS requirements

SUPPLIERS

RAMPIPING SYSTEMS 178 IMMELMAN ROAD WADEVILLE GERMISTON, JOHANNESBURG, GAUTENG 1428 P: 011 827 3700/1 F: 011 827 3702	MASTERBATCH SA 13 SPANNER ROAD SPARTAN, KEMPTON PARK, GAUTENG P: 011 975 6252 F: 082 466 0468 HTTP://WWW.MASTERBATCH.CO.ZA
JCL ENTERPRISES GATE 7, KENT ROAD, ANDERBOLT, BOKSBURG, GAUTENG 1446 P: (07) 9333 8351 F: (08) 6673 9018 HTTP://WWW.JCL.CO.ZA	Smart Piping Supply 13 Spartan Road, Kempton Park, p: +27119746760 f: +27119746764 http://www.smartpipingsupply.co.za
PVC Pipeline Services Hammets Crossing Off Pk Blc 807/2 Selbourne Rd, Johannesburg, Gauteng 2153 p: 114620231	Selectrical Material Wholesalers Shop 17 Roraima Centre Hawk Str. Elspark Germiston, Boksburg, Gauteng 1418 p: 0119130952 / 0825613014 f: (08) 6689 2937 http://www.smwholesalers.co.za
ZEBULA ENGINEERING AND STEEL SUPPLIES CC Rover Road Rustivia Germiston, Germiston, Gauteng 1401 p: 011 822 2441 f: (08) 6656 6840	

POTABLE WATER DEMAND (FOR DRINKING PURPOSES)

From p 71/113 (http://www.nal.usda.gov/fnic/DRI//DRI_Water/73-185.pdf):
Children 1-3 years need 1.3 L/day of total water (0.9 L/day of total beverages, including drinking water) Around 4 cups.

4-8 years need 1.7 L/day of total water
(1.2 L/day of total beverages, including drinking water) Around 5 cups.

Assume: Preschooler age range of 2-5, total volume of beverages needed taken as average of 0.9 and 1.2 = 1.05 L/day. Assumed that children would not drink their daily fill at school, total volume of beverages then taken as half of total = 0.525 L/day.

(80 children) (0.525 L/ child per day) = 42 L
of total beverage intake for total children

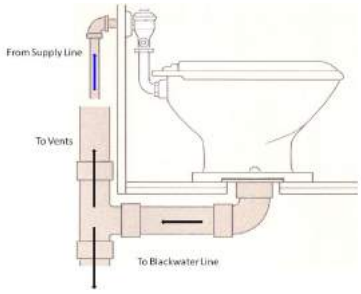
From p 73/113
Adult Men 19-50 years need 3.7 L/day of total water
(3 L of total beverages, including drinking water)

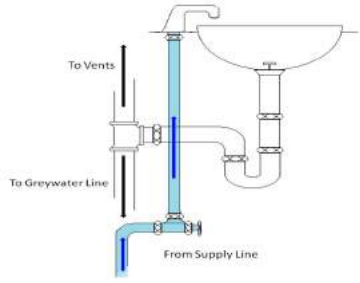
From p 75/113
Adult Women 19-50 years need 2.7 L/day of total water
(2 L of total beverages, including drinking water)

Assume: Presence of several adults, the total volume of beverages needed taken as average of 3.7 and 2.7 = 3.2 L/day. Assumed that adults would not drink their daily fill at school, total volume of beverages then taken as half of total = 1.6 L/day.

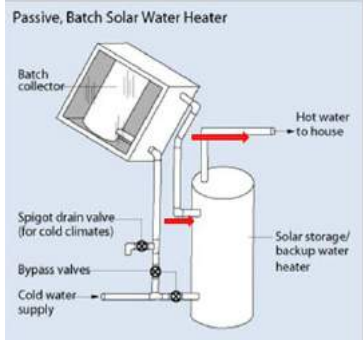
(X adults) (1.6 L/ adult per day) = 1.6X L
of total beverage intake for total adults

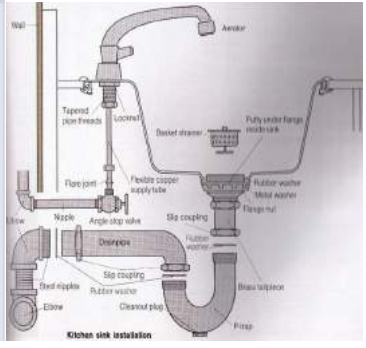
FIXTURES





SINKS : 5 LAVATORIES, 1 KITCHEN
DIFFERENCE : DIFFERENT DRAINS, DIFFERENT SIZES





SOLAR WATER HEATER : 1 UNIT

TOILETS : 6 CHILDREN, 2 ADULT

4.18 WASTE AND VENTING SYSTEM

DRAIN-WASTE-VENT (DWV)

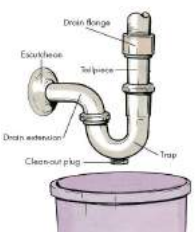
Drain-Waste-Vent system removes the wastewater (blackwater and graywater) from the house and also vents the gases produced by the waste Made of traps, vents, soil vent pipes, and then through the public sewer line

Waste will go from the fixtures, through a trap, to the waste lines, before leaving via the public sewer line as well as the soil vent pipe (which may be on the roof). Every fixture must contain traps and every fixture must be vented; if not, a problem with just one fixture may affect the others in the system.

The vents will also provide a means for the pressure to equalize on either side of the traps, which will allow the trap to hold a little water. This water will render the trap more efficient by preventing the sewer gas from travelling back to the fixture.

CLEAN OUT

- Component that allows the pipes to be manually cleared of any kind of blockage of accumulated debris
- A clean out is usually placed at the most likely place for debris to gather; this is usually at where a vent stack (vertical) meets the sewage line (horizontal), or where the pipe changes direction 90°.
- For regulations on venting and waste, see Appendix.
- Access to certain points of the waste system is achieved in the rodding eye, which allows the clearage of blockage



4.19 ENERGY SYSTEM: SOLAR WATER HEATER

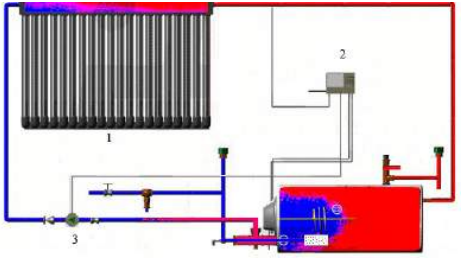
INTERFACE

Collectors are placed on the roof. While the domestic hot water tank can be placed anywhere, traditionally it is placed inside the roof.

We can expect around 2 MWh of electricity savings in a given year. Because the school is located in a highly insolated area, we can expect a payback period of around 8 years.

MECHANISM

A heat transfer fluid (HTF) is exposed to the sun during day whereby it is heated. HTF could be water or nontoxic antifreeze. Evacuated tubing and insulation prevents the heat gained from being lost. Heat is then transferred to a hot water tank via a pump. If the whole system is on the roof, the evacuated tubes are slanted upwards, with the hot water tank on the top. Heated fluid in the evacuated tubes rises to the top into the tank. Depending on the choice of heat transfer fluid, hot water can be directly pumped into the tank, or the water in the tank is heated by a heat exchanger, a coil of pipe with HTF running through it.



ACTIVE SOLAR WATER HEATER
1. EVACUATED TUBES
2. CONTROLLER
3. PUMP
4. WATER TANK

Possible Extensions?

- Solar panels: Both pump and controller system can be powered by solar panels. Solar panels are also appropriate for these systems since the system should only be used when there is sun.

- Flat panel collectors can be used instead of evacuated tubes. Typically flat panel collects have higher efficiency but they would cost more (around R 4,000).

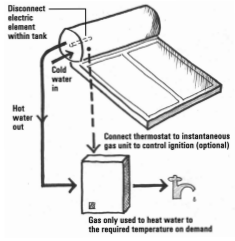
COMPONENTS

- **COLLECTOR** consists of three parts: heat pipes, evacuated tubes, and a manifold. Water is pumped through the heat pipes. These pipes are inside evacuated glass tubes. The manifold holds together 16 or 20 of these evacuated glass tubes.
- **DOMESTIC HOT WATER (DHW) TANK**: Stores the water being used. This could be bought separately depending if the building have an existing water tank.
- **HEAT EXCHANGER**: If the system uses anti-freeze as an HTF, a coil of piping is installed inside the hot water tank to transfer heat to the used water.
- **PUMP AND CONTROLLER SYSTEM**: The pump keeps the HTF running through the system. A controller system can turn off the pump when the water temperature is high enough. During night, when the solar collector cannot supply heat, the controller system can also activate an auxiliary heating from electricity.
- **INSULATION:** The tank itself may have its own insulation. If not, then a sheet of insulation (usually fiberglass insulation), will be wrapped around it. If the water tank is placed on roof, insulation may not be needed.

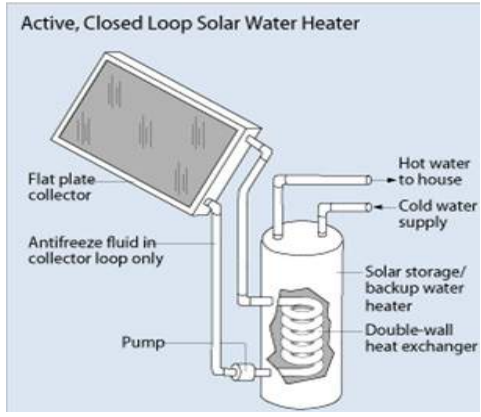
CONSIDERATIONS

- A passive solar water heater system is very simple. It consists of no electrical components. Manuals are usually given to instruct assembly, angling, positioning. A typical system weighs around 140 kg.
- One passive solar water heater assembly, used for residential purposes, is intended for up to two people. More would be needed for greater demand of hot water.
- Since water usage is greatest in the bathrooms and kitchens, it is best that the collector system is placed as close to these rooms as possible.
- Compared to a passive solar water heater, the cost of the active solar water heater components are certainly be greater. Including installation the cost would range from R 12,000- 20,000 around R 3,000 greater than passive systems.
- In the active system, the domestic hot water tank does not have to be on the roof, allowing for a more aesthetically pleasant appearance. However, space would have to be put aside elsewhere. Typical active systems place the tank inside the roof to minimize the distance between collector and tank.
- Given the complexity of the system, it could become a hassle for maintenance and installation.

PASSIVE SOLAR WATER SYSTEM



ACTIVE SOLAR WATER SYSTEM



PASSIVE SOLAR WATER SYSTEM

4.20 ENERGY SYSTEM: PHOTOVOLTAIC CELL

INTERFACE

Solar panels can power the school enough to be off the grid. It has the potential to exceed the needed amount of electricity and give back to the grid.

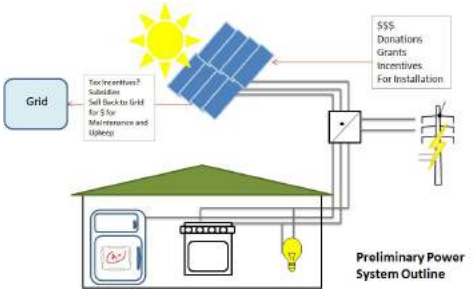
EXPECTANCY

Each solar panel cell power can deliver at peak around 3.5 Watt-hours of energy. This can be more in summer and in certain areas. Assuming there is 10 hours of sunlight a day, one solar panel cell can generate around 35Wp (peak-Watt) a day. If a solar panel has 50 cells in series, it can generate 175Wp/hr or 1.75 kWatt-hours a day.

The energy requirements are determined by the power that each appliance (light, TV set, radio, refrigerator, etc.) uses and the number of hours per day each appliance is on. If more energy is used than is produced in a given time, the energy store (battery or batteries) will run out.

COMPARISON

- To supply a family of 4, i.e. 600kWh/month (20 kWh/day), one would need either 12 - 175 Wp of solar panels or 9 - 220 Wp of solar panels (~15 sq. meter).
- In Eskom or municipals, this would equal to an R450 bill at a typical 75c per kW-hr. A energy system to cater for this would cost about R400000.
- Average radiation basis is 5.5kwh/sqm/day. This is more radiation than any solar panel can capture.



FIXTURES (POTENTIAL)

- Fluorescent light (4 outside, 8 inside)
- Stove (1)
- Solar Water Heater
- Refrigerator (1)

COMPONENTS

- **SOLAR PANELS** - capture radiation and convert it to useable electricity
- **BATTERIES** - store the solar energy when no electricity is being used
- **CONTROLLERS** - Computer device which directs and controls the solar energy
- **INVERTERS-** (stand alone or grid connect) - Using an off-grid inverter can significantly improve the efficiency of your PV system even under highly inductive or capacitive loads. The inverter provides an economical way to get instant AC power anywhere and at all times, just as long as a battery is handy. It converts a DC power source (solar panels) to 230 VAC power.

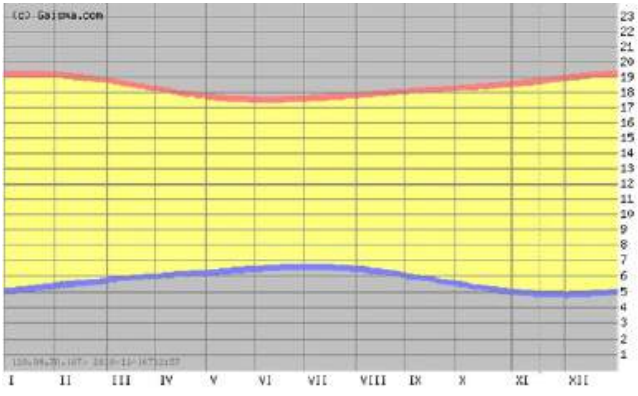
BRANDS

- **Kyocera –** Provides 50w, 70w, 95w, 135w, 135w, 185 w, 205 w, and 210w panels
- **Lorentz –** Provides 50w, 75w, 120w, and 175w panels
- **Sharp –** Provides 148-175Wp and 200-220Wp panels

SUPPLIERS

PO Box 1159
Randpark Ridge 2156
Johannesburg, South Africa
e-mail contact: info@kgelectric.co.za

INSOLATION OF JOHANNESBURG



Darkness Sunshine Dusk

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Insolation, kWh/m²/day	6.70	6.10	5.46	4.77	4.21	3.80	4.08	4.78	5.69	5.98	6.29	6.62
Clearness, 0 - 1	0.57	0.55	0.56	0.59	0.64	0.65	0.66	0.65	0.64	0.58	0.55	0.56
Temperature, °C	22.23	22.11	21.07	18.66	15.25	11.61	11.46	14.61	18.50	20.20	20.85	21.36
Wind speed, m/s	3.62	3.50	3.37	3.54	3.74	4.04	4.18	4.74	4.95	4.73	4.31	3.77
Precipitation, mm	134	93	92	56	15	8	4	8	28	76	112	113
Wet days, d	14.4	10.4	11.0	7.7	2.5	1.5	0.8	1.9	3.4	8.9	13.1	13.6

These data were obtained from the NASA Langley Research Center Atmospheric Science Data Center; New et al. 2002

4.21 RECOMMENDED SERVICES

RAINWATER COLLECTION

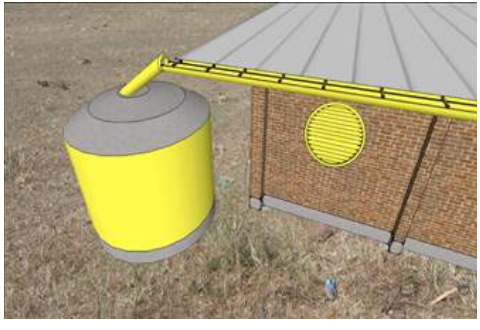
By collecting rainwater, the crèche will be able to reduce municipal water use for irrigation during the dry seasons. This is an economic advantage, reducing the dependency on city water. This is also a strong sustainability factor, as it will conserve water, and prevent excess runoff and the need for drainage from the roof.

EXPECTANCY

Maximum monthly rainfall: 130mm.

(Surface Area of roof in m2) x (~.075m rain) x (1000 liters/m3) = ~Size cistern needed in liters for one month's worth water.

Usage
Watering garden. (*most recommended)
Groundwater recharge (*probably not necessary, up to discretion of landscape architects).
Grey water, i.e. toilet (*may pose challenge when connecting to municipality line, and will require energy to pump indoors; not recommended).



FROM THE YELLOW SUBMARINE (TONGO, SEGAU, MALI). WATER FLOWS OFF SLANTED ROOF LEADS TO FILTERED GUTTERS. SLANTED ROOFS LEAD TO CISTERN.

COMPONENTS

- **Sloped roof.** Corrugated iron is most efficient, but all waterproof materials are compatible.
- **Rain gutters** along the edges of the roof, all downward sloping to one (PVC) pipe leading to cistern. Must have mesh/filter to remove roof debris.
- **Cistern**, gravity-fed. Above ground, size dependent on amount that can be used. Must be sturdy plastic, and NOT clear (algae will form).
- **Piping.** Need 4" PVC pipe, same supplier as for plumbing. Anticipate needing at least 5 meters, but this will need to be determined based on cistern's location relative to the crèche.

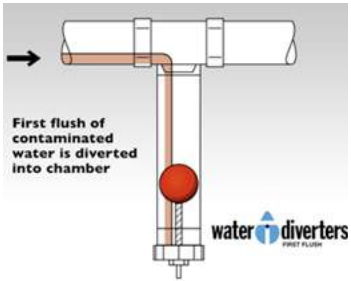
GUTTER WITH MESH FILTER
TO COLLECT ROOF DEBRIS.

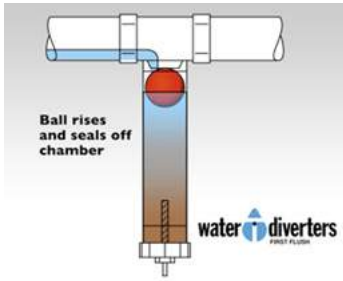
SUPPLIERS

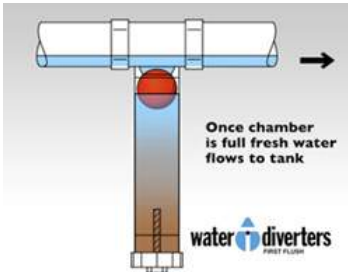
Gutters		
Gutters Galore, Gauteng	021 982 0895	http://www.guttersgalore.co.za/
SuperSpan Gutters, Gauteng	033 342 9412	http://www.superspan.co.za/index.php
Cistern		
Water Rhapsody		http://www.waterrhapsody.co.za/tag/water-tanks-johannesburg/
Urban Rain Systems	+27 11 817 3534	www.urbanrainsystems.co.za
Filters		
First Flush (American)		http://www.rainharvest.com/shop/shopexd.asp?id=269 Product Code (WDDS98, $34.95)

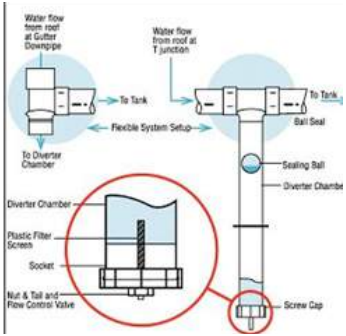
CISTERN, URBAN RAIN SYSTEMS

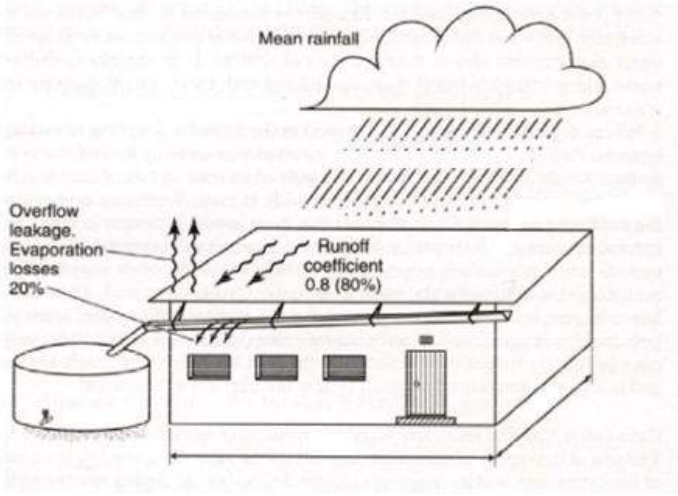
	2000 Litre Raincell™ Tank	3000 Litre RainCell™ Tank
Length	2,1m	2,5m
Height	1,9m	2.1m
Width	0.8m	0.88m
Capacity	2000 Litres	3000 Litres











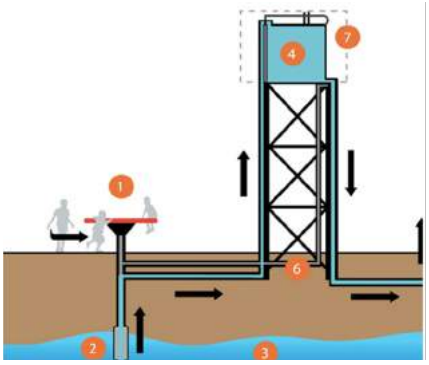
4.22 ALTERNATIVE FIXTURES: PLAYPUMP

Due to cost (in the case of the playpump) or efficiency (for the biogas), or even just the existence of a less troublesome alternative (for hydroponics), these potential fixtures are not feasible at this point of time and with the current budget.

I. PLAYPUMP

A PlayPump is, to the children, a merry-go-round designed for collaboration, and group playtime. However, to the crèche, it is a highly sustainable water pump, utilizing energy that the children exert during playtime. It has the potential to conserve energy, and teach children about how mechanical processes become sustainable.

Children playing on the PlayPump provides a gradient energy that enable the ground water to be pumped upwards.



EXPECTANCY

A PlayPump is able to pump 1,400 liters of water per hour at 16 rpm from a depth of 40 meters (maximum depth of 100 meters). It should be located in the "Playground" area of the site, integrated into other play equipment.

DESIGN CHALLENGES

- Is it ethical?
- What will we use the PlayPump to pump, since there is no groundwater? Potential in connecting to rainwater collection, but the rainwater collection can be designed gravitationally, and thus would not require a pump.
- Is it effective? Will energy produced outweigh product cost?

COMPONENTS

- A merry-go-round, for the children to spin on.
- A large tank to store water; can also act as an advertisement board.

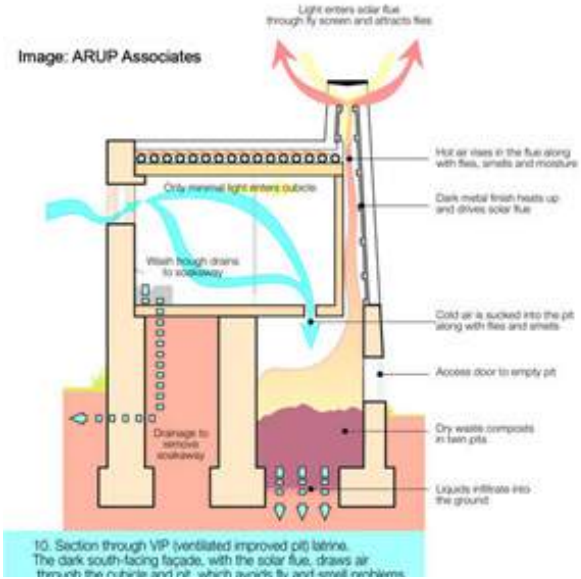
SUPPLIERS

Water for People (http://www.waterforpeople.org/)
about $14,000 (USD).

4.23 ALTERNATIVE FIXTURES: VIP TOILETS

II. VIP TOILETS

Dry toilets can help lessen the amount of water required to run the school. It is of the outdoor 'outhouse' type structure.
It can also collect methane in pit to be used as biogas. In this case, the methane can be recovered through the ventilation popes, converted for use, and then used to power a stove, lights, heater, etc



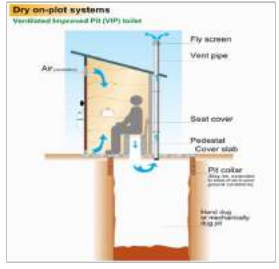
10. Section through VIP (ventilated improved pit) latrine.
The dark south-facing façade, with the solar flue, draws air

COMPONENTS

- Two (or more) pits are dug into the ground or built raised above the ground.
- Slab (for each pit) are places for the users to finish their business. A dry pit does not require any water for flushing.
- Superstructure made of wood, iron sheets, bricks, cement or nylon rice sacks (depends on local availability and level of skilled labor).

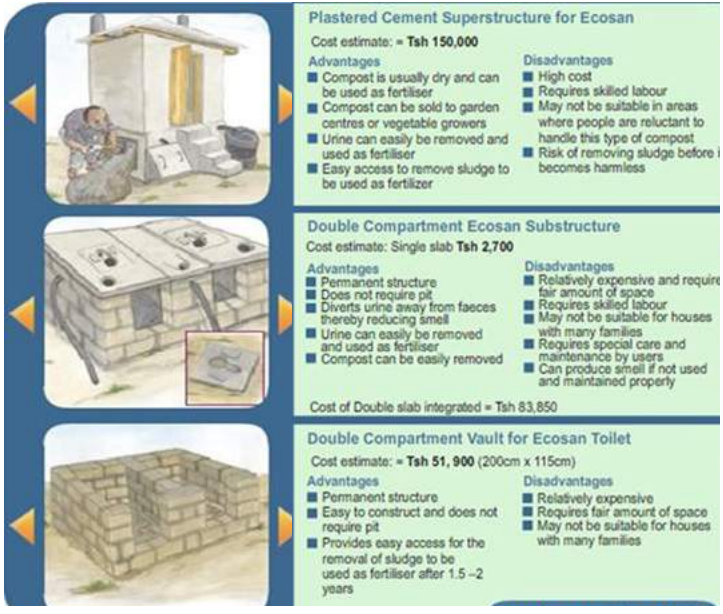
LIMITATIONS

A composting toilet requires a significant commitment from its users.
A timeline must be followed that determines how long one pit may be used before it needs to be sealed for composting. Once a pit is sealed, it must be left to compost for a specific period of time. After composting, someone must excavate the pit, and implement a use for the soil produced. Community members must be a part of the decision, design, and installation process. In our case, it might make community members feel like they are reverting back to less innovative times. VIP's are theoretically a good option, but are not practical or desired, and thus not recommended in our project.



VIP SYSTEM

- Less expensive. Can accommodate more people since underground space is less limited
- more difficult to empty after composting is complete



Plastered Cement Superstructure for Ecosan

Cost estimate: = **Tsh 150,000**

Advantages
- Compost is usually dry and can be used as fertiliser
- Compost can be sold to garden centres or vegetable growers
- Urine can easily be removed and used as fertiliser
- Easy access to remove sludge to be used as fertilizer

Disadvantages
- High cost
- Requires skilled labour
- May not be suitable in areas where people are reluctant to handle this type of compost
- Risk of removing sludge before it becomes harmless

Double Compartment Ecosan Substructure

Cost estimate: Single slab **Tsh 2,700**

Advantages
- Permanent structure
- Does not require pit
- Diverts urine away from faeces thereby reducing smell
- Urine can easily be removed and used as fertiliser
- Compost can be easily removed

Disadvantages
- Relatively expensive and require fair amount of space
- Requires skilled labour
- May not be suitable for houses with many families
- Requires special care and maintenance by users
- Can produce smell if not used and maintained properly

Cost of Double slab integrated = Tsh 83,850

Double Compartment Vault for Ecosan Toilet

Cost estimate: = **Tsh 51, 900** (200cm x 115cm)

Advantages
- Permanent structure
- Easy to construct and does not require pit
- Provides easy access for the removal of sludge to be used as fertiliser after 1.5 –2 years

Disadvantages
- Relatively expensive
- Requires fair amount of space
- May not be suitable for houses with many families

ECOLOGICAL SANITATION (ECOSAN)

- Composting latrine that produces a rich, organic fertilizer
- Built above ground, No pit needs to be dug. More expensive Less conductive to many users

Plastered Cement Block Superstructure with Vent Pipe

Cost estimate: = **Tsh 68,700** and Tsh 103,400 (with roofing sheets)

Advantages
- Lasts for a very long time
- Permanent structure
- Easy to paint with any colour
- Can reduce smell and heat

Disadvantages
- Very expensive

Integrated Sanplat (Sungura)

Cost estimate: = **Tsh 22,000** (150cm x 150cm)

Advantages
- Easy to clean and maintain
- Long lasting
- Can be installed on its own without wooden platform

Disadvantages
- High cost
- Requires skilled labour for fabrication
- May be slippery especially where toilet is also used for bathing
  Very heavy to transport and better made near the toilet

Pit lined with Sand-Cement Rings(6 rings = 1.5m x 2.8m pit)

Cost estimate: **Tsh 39,000**

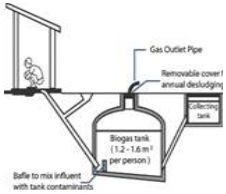
Advantages
- It is permanent and prevents soil from collapsing
- Safer option for lining in soft and sandy soil
- Possible to empty full pit and reuse it many times

Disadvantages
- Relatively expensive
- Rings can break during transportati and installation
- Emptying could be costly and there may be a problem with space to dispose of the sludge
- Another toilet needed for 2 years u sludge is safe to handle

4.24 ALTERNATIVE FIXTURES: DIGESTER

III. DIGESTER (BIOREACTOR)

Biogas is the gas produced by the anaerobic breakdown of organic compounds. About 0.020 ~0.028 m3 methane is produced per kg human solid waste. The resulting methane can then be used as a biogas to offset some of the cooking fuel costs, while nitrogen-rich slurry can be used as fertilizer/compost for garden.



MECHANISM

Greywater from the sin run-off (recyclable) will be redirected into the toilet cistern (now blackwater). The resulting mixture, when flushed, will enter the septic tank for treatment by the bacteria in the biodigester.

Basic setup of the biodigester consists of two components: a digester (or fermentation tank) and a gas holder. The digester is a cube-shaped or cylindrical waterproof container with an inlet into which the fermentable mixture is introduced in the form of a liquid slurry. The gas holder is normally an airproof steel container that, by floating like a ball on the fermentation mix, cuts off air to the digester (anaerobiosis) and collects the gas generated. In one of the most widely used designs, the gas holder is equipped with a gas outlet, while the digester is provided with an overflow pipe to lead the sludge out into a drainage pit.

CONSIDERATIONS

- Unfortunately, human waste isn't as effective as that of livestock. The resulting slurry would need some priming, which is of a higher carbon-nitrogen ratio (such as with animal waste, straw, or sawdust), in order to better the efficiency of methane production.
- Nitrogen-rich slurry can be used as fertilizer for garden.
- Human waste contains dangerous pathogens, minimize contact with system by implementing pumps. Also, to assure hygienic quality, especially due to the mixing of human wastes, a long retention time (>60 days) shall be used.
- Satisfactory gas production at 15-20 degrees Celsius, best at 35 degrees.

FEASIBILITY

From Table 4 (http://journeytoforever.org/biofuel_library/MethaneDigesters/MD4.html):

1 Human adult output: % volatile means 'digestible by bacteria'
2.2 lbs urine/day (75% volatile) = 1.65 lbs urine/day digestible
0.5 lbs fAeces/day (95% volatile) -> 0.475 lbs feces/day digestible
Assume: A preschooler will only output ¼ the same amount as an adult in a day --> 0.11875 lbs feces in a day

From Table 2 (http://www.fao.org/sd/egdirect/egre0022.htm) : 0.020 - 0.028

$$(0.11875\ lbs\ feces)\left(\frac{0.45359237\ kg}{lb}\right)\left(0.02\frac{m^3\ biogas}{kg\ human\ dung}\right) = 0.0010772819\ \frac{m^3 biogas}{day}$$

From Table 1: 50%-70% of biogas is composed of methane →

$$(0.5)(\ 0.0010772819\ (m^3\ biogas/day\ ) = 5.3864095E-4\ m^3\frac{methane}{child\ in\ one\ day}$$

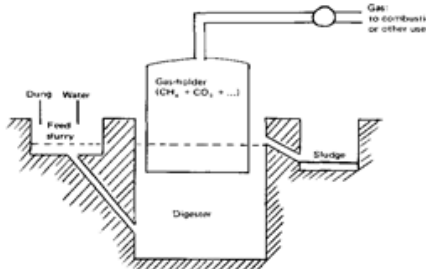
Energy content of methane: $\frac{39\ MJ}{m^3\ metane}$

$$(5.3864095E-4\ \frac{m^3 methane}{day})(\frac{39\ MJ}{m^3\ metane})$$

$$= 0.0210069971\ \text{MJ/day} \sim 21000\text{J/day for 1 preschooler} \quad \rightarrow \text{for 120 kids, 252000 J/day}$$

$$(X\ \frac{kg\ dung}{person\ in\ one\ day})(0.02\ \frac{m^3\ biogas}{kg\ human\ dung})\ (0.5\ methane\ in\ biofuel)(\frac{39\ MJ}{m^3\ metane})(\frac{10^6\ J}{1\ MJ})$$

= 390000X = Energy produced by methane [J] per person in one day



CASE STUDIES

Background 1 : In India, human and livestock waste is a huge environmental hazard.
The government plans to help by subsidizing several of these units.

Size: 1 m^3

Cost: $425

Where: Gujarat, India

Feedstock: human waste (night soil),
kitchen scraps,
Organic waste in general

-can convert the waste generated by a four-person family into enough gas to cook all its meals and provide sludge for fertilizer.

-primed with cow dung for optimal bacteria growth

Background 2 : The children now currently collect kitchen wastes from seven restaurants to feed the digesters, then sell organic vegetables back to the restaurants at 20% over the non-organic price.``

Size: 30m^3

Cost: N/A

Where: Kathmandu, Nepal

Feedstock: wastewater from the orphanage
-enough to run two stoves for 6-8 hours per day, saving about $130 per month in LPG costs

-used by 40 children

-Greenhouse project associated with the digester, to teach the children how to take care of plants and use biogas. The goal is to achieve a financially self-sufficient orphanage by the year 2020, with the addition of 2 more digesters.

Background 3 : The children now currently collect kitchen wastes from seven restaurants to feed the digesters, then sell organic vegetables back to the restaurants at 20% over the non-organic price.

Size: n/a

Cost: 1.75 lakhs = $3937.5

Where: Jebapur, Tal Sakri

Feedstock: Night soil, food waste

-50 m^3 methane produced in a day, by 400 students

-saves about 25% of total fuel require

4.25 ALTERNATIVE FIXTURES: PIPING SYTEMS AND HYDROPONICS

IV. AESTHETIC DESIGN OF PIPING SYSTEMS

- Color coded piping for maintenance. For example, a different color for: black water pipes, grey water pipes, and municipal water pipes. Or, color code by materials, if more than one material are used. Or, color code by installation practices so that if a pipe must be fixed, it is easy to tell how this must be done.
- Clear PVC piping can be used for all exposed pipes carrying grey or municipal water. Children will find it interesting to see water flowing through them. However, these are not to be used outdoors, and are unnecessary if hidden. Pipes must also be kept out of reach of children if there is a chance they could be pulled apart.
- Lead one pipe outdoors and attach to a spigot and/or drinking fountain so that children can drink/wash hands while playing outdoors and after eating outdoors. Put basin beneath spigot to collect water if a drain cannot be installed. Water collected can be used on the garden.
- Unusual, interesting structures

POMPIDOU CENTRE

V. HYDROPONICS

Hydroponics is a mean of growing plants, using a medium other then soil (such as rice husks water, or gravel). Less water is needed for a hydroponics system in comparison to a regular soil garden; the productivity of the hydroponics is also much greater. However, systems that were considered were of the traditional hydroponics systems, as well as two soil techniques that can potentially lessen runoff.

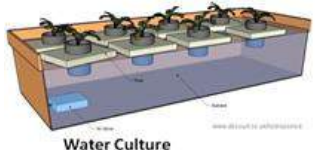
RECOVERY DRIP

TYPES

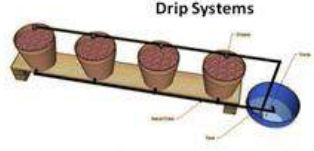
- **RECOVERY DRIP SYSTEMS** – excess nutrient solution run off is caught and used via a pan or a small container. The run off can either be automatically or manually recollected
- **WATER CULTURE** – mentioned for the sake of comparison, an active hydroponics (requires a pump), the plants are held up by floating Styrofoam squares while an air pump bubbles nutrient and oxygen from the bottom of the tank.
- **WICK SYSTEM** – simplest type of passive hydroponics; plants are in individual pots with a wick protruding from the bottom to allow a path for nutrient to be drawn by the plants. Weak point is that large plants may require liquid at a faster rate than the wick could supply.

DESIGN CHALLENGES

Higher maintenance than a conventional soil garden



Water Culture
DRIP SYSTEMS



CASE STUDY 1: JESUSALEN, COLOMBIA (LATIN AMERICA)

Location: Jerusalen, Colombia (Latin America)
Support: Food and Agriculture Organization of the United Nations
www.fao.org/
History/Brief Description: Urban poor, 130 participants (women)
Local materials: Recycled/Salvaged plastic containers/tubs/buckets/bamboo tubes/pots
Plastic bags and sheeting used to waterproof discarded wood pallets/lumber bed growers
Nutrient/Fertilizer: Bat guano and worm casting
Design Assessment: Hydroponic bed growers, consisting of small containers and discarded wood pallets, were placed on rooftops, balconies, stairs, and any available space in the sun. Rice bran was used as the growing media (local mill, low weight per growing area). Growing substrates also included sand, peat moss, volcanic materials. Two types of nutrients used: organic and inorganic nutrients. Inorganic nutrients were supplied by a funding agency. Excess nutrient is recycled into the growers so as to shrink the nutrient runoff into the environment. All water used in hydroponic culture was applied to the bed grower and then excess is gathered below and recycled to growers the next day. Environmental control was provided by shade cloth or hand built shelter. The women then sold their produce to a supermarket as per a contract, every week.
Conditions of Site: Enough sun and decent weather to be conducive to hydroponic growth
Economic Assessment: Simplified grower with 1 m^2 of growing space required less then $5.00 to build.
Average water use for growers was from 2 to 4 liters a day per m^2 for 0.11 to 0.23 kg produced, (0.5 to 1 gallon per 0.25 to 0.5 pounds). There was a reduction in water use from 5 to 10% of that required for soil. Hydroponic nutrients were supplied by the funding agency at a cost of about $9.00 per year. The women earned as much as three times more than their husbands earned in semi-skilled jobs after just 60 days of the experiment. Approximately $30.00 per month on 10 m^2.
Labor: Hydroponic nutrient is hand poured over plants once in the morning (about an hour). 90% of the 130 women were housewives or homemakers.
Size: N/A (consisted of individual plants and several 10 m^2 growers)
Performance: Exceedingly well. Pest control was maintained by observation, physical barriers, and hot pepper and garlic sprays.
Potential Design/Construction Strategies/Pointers:
"Even though hydroponic culture is easy to learn, the people are often timid to make decisions and need support when the first problems appear to them that are of easy solution."

"In the technical part the most frequent problem is the distribution of the inorganic

CASE STUDY 2: ST. WERBURGHS (SOUTH-CENTRAL AFRICA)

Location: St. Werburghs, near Mutare, Zimbabwe (South-Central Africa)
Support: Plan International
http://plan-international.org/
Carbon Quest International
www.carbon.org/
History/Brief Description: 1991, two year drought; the Shona people were first sent desert-survival publications to find water resources
Water obtained from a stream (limited) – most of the work was agriculture-based
First began with small Tupperware systems (water in, water out)
Local materials: Recycled Tupperware systems (at the beginning)
Worm castings were used as a substitute for inorganic nutrient
Design Assessment: Small portable hydroponic technique used at the beginning; water poured in, allowed to slowly drain, water poured back in. Required an hour of time.
The investment was in a primary school (997 children from grades 1 to 7) , which was also the only free public education offered to children there. The hydroponic system of the school was a plastic tub, which served as a small hydroponic grower. A hole was cut in the tub and was where a drainpipe was placed, to allow the overflow water to collect i a container below. The tub was filled with propagation grade perlite.
Conditions of Site: Dry, drought, agriculture based work force
Economic Assessment: Was a great aid to the people as the water could be reused.
Labor: Hydroponic nutrient is hand poured over plants once in the morning (about an hour).
Villagers and teachers were educated on the benefits of hydroponics as well as how to use the hydroponic.
Size: N/A (size of a tub...)
Performance: Exceedingly well. Children planted herbs, vegetables, tea plants and coffee plants.
Goal of the teachers was for every child to produce their own daily nutritional needs by the time their free education ends in 7th grade.
Potential Design/Construction Strategies/Pointers:
The method of teaching that was employed to educate the villagers and the teachers was through the usage of kits and hands-on experiments. Several of the village elders were illiterate, so therefore pictures and videos were helpful

4.26 ALTERNATIVE FIXTURES: SOLAR CHIMNEY

SOLAR CHIMNEY

A natural form of "air conditioning" is utilized in that solar convection is used to enhance the stack effect and thereby more efficiently pump hot air out of a building.
A single solar chimney with a suitably large glazed roof area and a high chimney can generate 100-200 MW/day.

MECHANISM

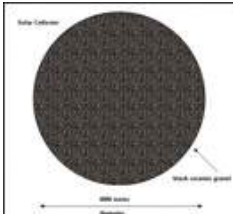
Solar energy heats the air within the chimney during the daytime and therefore creates an updraft inside it. The updraft evacuates hot water from the chimney, and replacement cold air is drawn in from the cool side of the house due to the suction at the bottom of the chimney due to the updraft displacing hot air outside. A turbine attached to a generator can be joined to the top of the chimney to generate mechanical energy. At night, or in the winter when cooling is no longer needed, the vent connecting the house to the chimney can be closed.

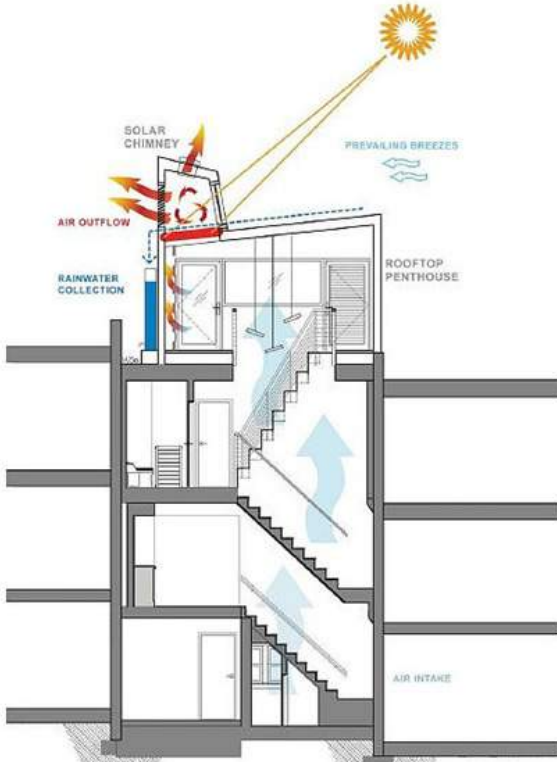
COMPONENTS

- An absorber is used to retain solar energy for best effects; two intersecting sides of the chimney absorb heat. The absorber sides face the southern direction, to maximize the amount of radiation.
- The chimney should be located at the side of the house with the most sun exposure, usually the south.
- The solar chimney is made of a minimum of three basic stacks

POSSIBLE MATERIALS

- Glass - A good heat absorbing material for building the solar collector area of the solar chimney, which is usually situated on top of the chimney or sometimes even the entire shaft. (3 to 5 vertical shafts are needed for the process.)
- Black ceramic gravel - The best material to use as solar collector for a solar chimney.





POSSIBLE MATERIALS (CON'T)

- Stainless steel - Also a good heat absorber; particularly good for enhancing the airflow inside a building because of low friction properties, so enhances stack effect. For the round exhaust stack (of the 3 stacks) made of stainless steel.
- Concrete - The body of the chimney is made of reinforced concrete, which also is a good heat absorber. In fact, the chimney itself acts as a thermal engine. Due to its favorable surface to volume ratio, the chimney acts like a pressure tube with low friction loss.

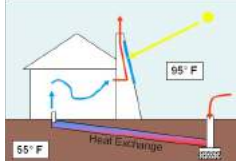
CONSIDERATIONS

- Works best with high temperature difference between indoors and outdoors, to create a greater pressure gradient
- Chimney is placed at the part of the house most exposed to the sun, to maximize convection
- Wind turbines may be installed with generators to convert the wind power from the updraft into mechanical energy
- Can create interesting design forms for the building structure
- This could be unnecessary because is only overglorified cross-ventilation. Hot air is going to leave the house, regardless of whether or not there is a chimney.

ATTACHMENT OF TURBINE TO GENERATE MECHANICAL ENERGY (TO OCCUR ON TOP OF THE CHIMNEY)

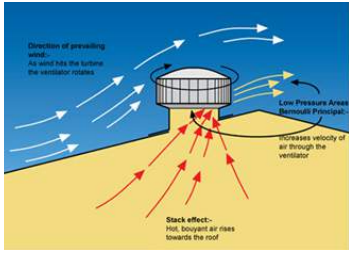
POSSIBLE EXTENSION OF SOLAR CHIMNEY SYSTEM:

To maximize the effect, new air can be directed in underground pipes before entering the building. Johannesburg has a low average wind speed, therefore convection would not be as infective; therefore it would be a good idea to maximize cooling. Ground temperature is relatively stable all year, and will cool the air before it goes inside the hotter house.



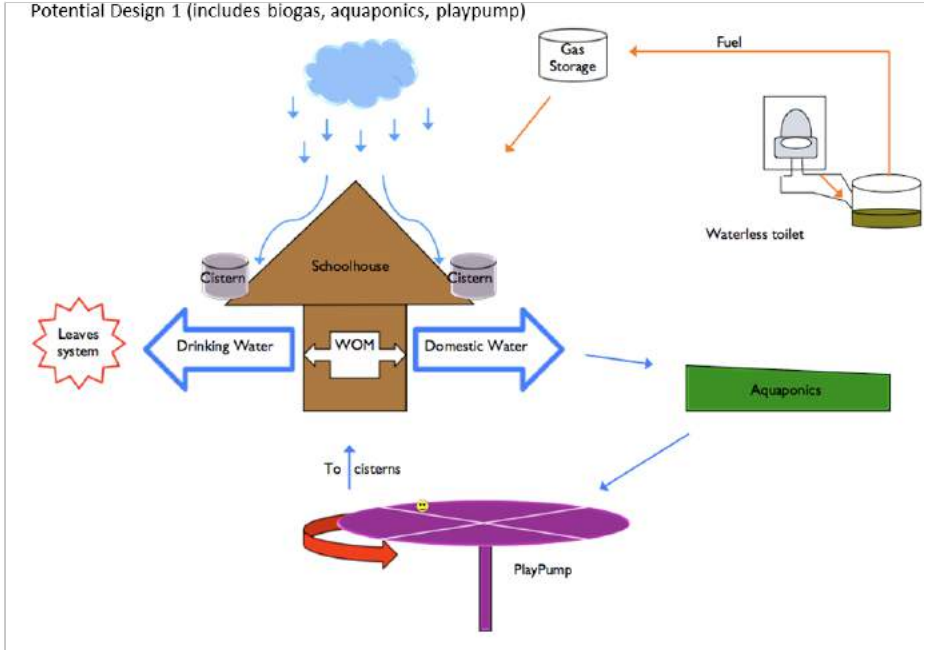
EXTRA COMPONENTS:

- A long, wide corrugated pipe is laid in a trench about 5-10 ft. below grade. Drainage holes are drilled into the bottom of the pipe, which is laid upon a gravel bed.
- A 90 degree elbow as well as sludge filter or wire mesh is laid over the opening from the ground to protect against damage from rain or stray animals



4.27 ALTERNATIVE FIXTURES: SUMMARY

REFER TO PREVIOUS SECTIONS OF ALTERNATIVE DESIGN CHAPTERS FOR IMAGES OF BIOGAS, HYDROPONICS, AND PLAYPUMP.



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4.29 MATERIAL CATALOG

FOUNDATION

- Concrete
- Waste Tires

WALL SYSTEMS

Load Bearing:

- Stone Cladding
- Earth Bag Construction
- Clay + Straw
- Clay Bricks
- Hydraform Bricks
- Waste Tyres Construction
- Sandcrete

Framing + Cladding

- Wood Cladding
- Metal Cladding
- Plastic (vinyl) Cladding
- Stucco/Stone Masonry Cladding
- Brick Cladding

STRUCTURE

Steel:

- Circular
- Square
- "L"
- "I" Beam

Wood

- Gumpole
- Standard Wood
- Tension Fabric

Reinforced Concrete

FLOORS

- Wood Deck
- Rammed Earth
- Concrete

CEILING

- Double Roof System
- Reed Ceiling
- Plywood
- MDF
- Cork
- Drywall

ROOF

- Corrugated Galvanized Iron Sheets
- IBR Sheets
- Fiber Cement
- Polycarbonate Sheets
- Gumpole Beams
- Wood Truss Roof
- Steel Roof (Truss)

INSULATION

- Cellulose
- Thatch (under roof)
- Mineral Fiber
- Loose Fibered (treated cellulose & glass wool)

FENESTRATIONS

- Glass Block
- Skylights
- Screens
- Casing/ Baseboards
- uPVC

DOORS

- Standard Hinge
- Sliding Door
- Patio Door

WATER SYSTEM

- PE Pipes
- PEX Pipes
- PVC Pipes

ENERGY

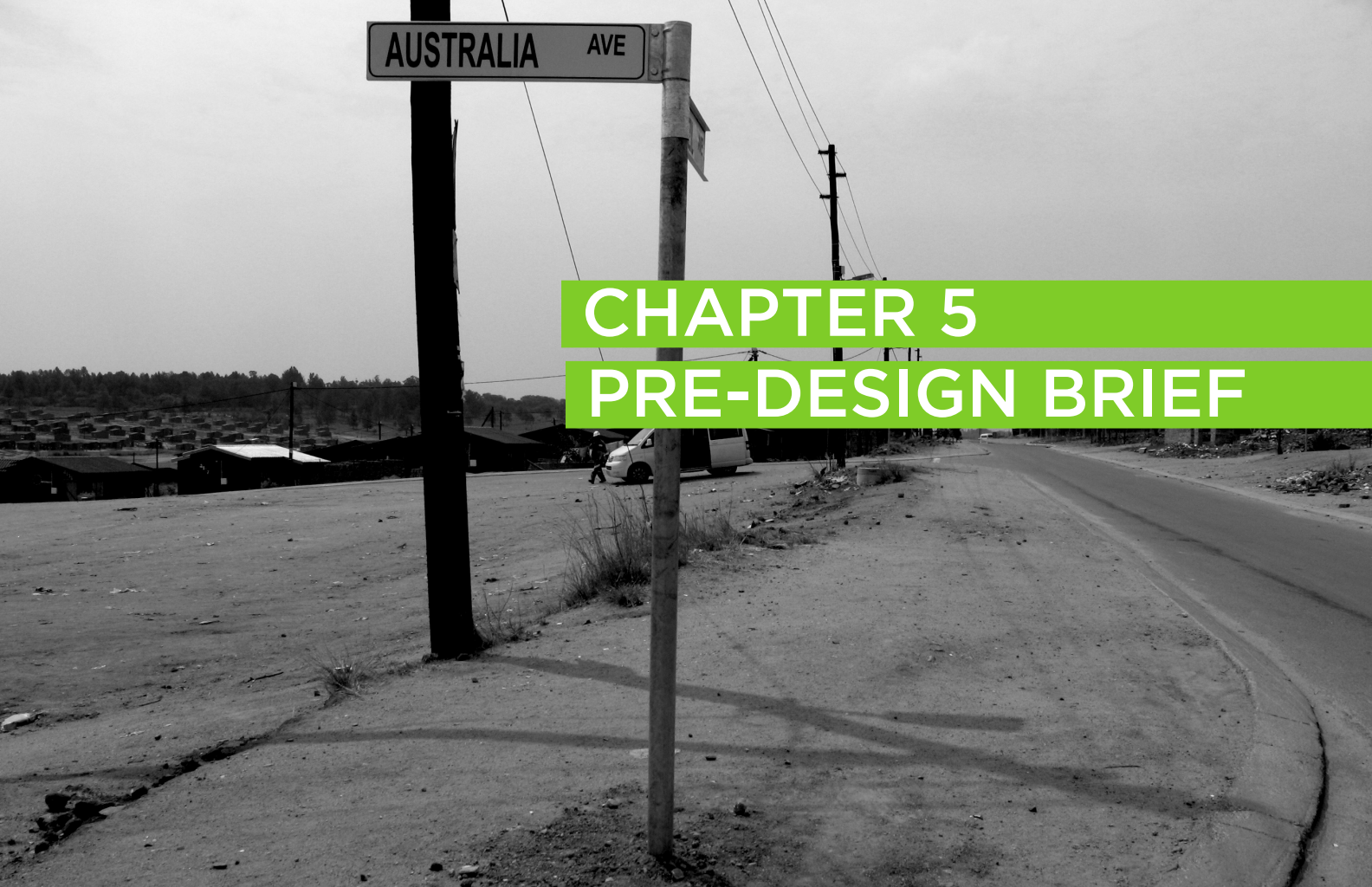
- Solar Water Heater
- Solar Battery Pack
- PV Panels
- Water Heat System
- Windmill Pump

FINISHINGS

- Washers
- Bolts
- Nuts
- Nails
- Exterior Paint
- Interior Paint
- Primers
- Chalkboard Paint
- Water Retention Layer / Vapor Barrier (typically a plastic/foil sheet)
- Chaulk / Filler

GARDENING/FOOD

- Composting Bin
- Bag-a-Farm



CHAPTER 5
PRE-DESIGN BRIEF

5.1 PROJECT BACKGROUND

COSMO CITY IN SATELITE VIEW

COSMO CITY MASTERPLAN IN BASIL READ'S OFFICE

INFORMAL CRECHE IN COSMO CITY

Cornell students will design and build the first official crèche in the low-income sections of Cosmo City. Currently, day care centers in the poorer areas of Cosmo City are "informal," hosted in houses that are too hot in summer, too cold in winter, crowded and barely stimulating for children.

Our project will be the first Early Childhood Development (ECD) engagement between Education Africa and the Cosmo City community. This pioneering initiative is a collaboration between Basil Read, the City of Jo-burg, Education Africa, and Play with a Purpose. They will be CUSD's main clients for this project.

Play-with-a-Purpose is the ECD organization responsible for training the teachers and staff who will work in subsequent Cosmo City ECD centers. Our facility will be used solely as a pre-school/crèche and Play-with-a-Purpose curriculum training facility.

CURRENT CONDITIONS

During a site visit, four CUSD members had the opportunity to visit several informal crèches in Cosmo City. Currently, the Reconstruction and Development Program (RDP) [see 3.1] units in Extensions 2 and 4 do not have an adequate number of proper day-care centers. In most informal crèches, there are over 60 young children in a single unit that measures only 6m by 6m (approximately 20ft by 20ft).

Given these conditions, children often spend most of the day watching cartoons instead of learning, and rarely receive time to play outside. When they do, they are exposed to rust-covered playground equipment and construction scrap materials.

The first few years of a child's education are the most formative and are proven to have the greatest impact on children's ability to learn and develop into active citizens. At present, teachers are faced with the daunting challenge of teaching children with barely adequate supplies and overcrowded facilities.

It is our mission to change the status quo of early childhood education in Cosmo City through the construction of a stimulating and engaging learning environment. Our crèche is the first purpose-built crèche in Cosmo City and will set the standard for future ECD centers to come.

5.2 CLIENTS AND STAKEHOLDERS

DIRECT CLIENTS

EDUCATION AFRICA

Education Africa is a non-profit organization based in Johannesburg, South Africa. Under their Social Architecture program, Education Africa has collaborated with international universities to design and build pre-schools, day-care centers, and skills training centers for the poor. In recent years, Education Africa has committed to building only Early Childhood Development centers because of the great need.

RELATIONSHIP:
They will be our direct contact regarding the project.

CONTACTS:
James Urdang
Linda Gould
Daniel Fisher (USA)

BASIL READ

Basil Read (Pty) Ltd. Is one of the largest construction, mining, and development company in South Africa. They have partnered the City of Johannesburg, as a joint company CODEVCO, to develop and manage Cosmo City.

RELATIONSHIP:
Basil Read is providing CUSD with the necessary professional assistance, such as plot surveys, geotechnical data, demographic data, etc. They will the site, enforce security during construction, and assist with the construction itself with labor and equipment. They will stamp our drawings, provide both the structural engineer and architect of record, and facilitate the building plan approval with the City of Johannesburg.

CONTACT:
*Robin Siebert, Developments
*Brian Mulherron, General Manager, Cosmo City Codevco
Russell Zama, Development Director, Cosmo City
Des Hughes, Managing Director, Basil Read (Pty) Ltd
Mike, Surveyor, Basil Read
Lynette, Townplanner
Christelle Myburgh

PLAY-WITH-A-PURPOSE

Play-with-a-Purpose is an Early Childhood Development consultant based in Muldersdrift, Johannesburg, South Africa. They train staff members of early childhood development centers and have partnered with other non-profit organizations. Currently, they are the main partner for ECD training in Cosmo City along with Education Africa, City of Johannesburg and Basil Read.

RELATIONSHIP:
Robin Wynand, CEO, will be our design client as she is well informed about the requirements and specifications of ECD centers. Our document and design will inform subsequent crèche productions, as it will be a partnership between designers and ECD experts.

CONTACT:
Robin Wienand

CITY OF JOHANNESBURG

The City of Johannesburg is the developer of Cosmo City and has jurisdiction over the land. They are allocating the land for the school. As part of a national and regional initiative, the city is supporting the implementation and development of Early Childhood Development centers.

RELATIONSHIP:
They will be assessing the building approvals and also the recipient of our research document and pre-school facility.

a world class African city

CONTACT:
*The city officials will be contacted via Education Africa and Basil Read.

Our clients and stakeholders.


The site visit with Basil Read and Cosmo City Development Forum

Managing Director, Des Hughes was explaining Cosmo City and future developments in the area such as Malabongwe Ridge, which is an improved version of Cosmo City.

STAKEHOLDERS

CUSD will only have direct contact with Direct Clients (see p. 3). Other stakeholders directly or indirectly involved with the project need to be taken into account. These stake holders will affect the success of the project after it is constructed. Therefore, it is important that they are engaged or at least considered in the design and planning process. The other stakeholders are listed below:

OTHER STAKEHOLDERS

1. FUTURE STUDENTS
2. FUTURE TEACHERS AND STAFF
3. TRAINED TEACHERS AND STAFF
4. COSMO CITY EXT 4 RESIDENTS
5. RESIDENT COMMITTEE IN EXT. 4
6. BLOCK COMMITTEE
7. SURROUNDING NEIGHBORS
8. FUTURE BUSINESS AREA TENANTS
9. PRIMARY AND SECONDARY SCHOOLS

The site is surrounded by various programs and there are immediate residential neighbors that will be affected by the project.

South of our site will be a business area and farther south are the primary schools. It is important to understand the interface between our site and its surroundings in regards to the social ramifications towards potential users of those spaces and the owners of future businesses.

NEIGHBORS

5.3 PROGRAM CHECKLIST

USERS

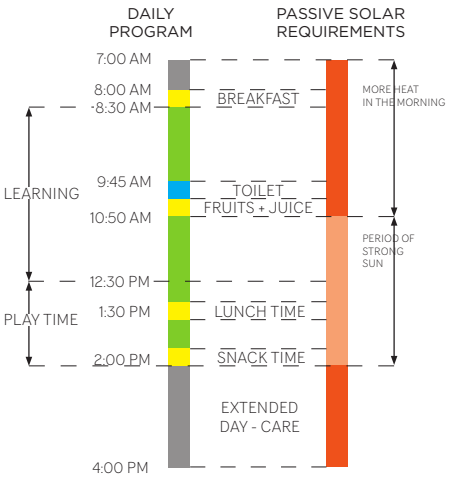
80
CHILDREN

- 20 INFANTS
- 20 2 - 3 YEARS
- 20 4 - 5 YEARS
- 20 6 - 7 YEARS

7+
STAFF MEMBERS (ADULTS)

- 1 HEADMASTER
- 3 TEACHERS (max)
- 1 COOK
- 1 GARDENER
- 1 SECURITY

TYPICAL DAILY SCHEDULE



- This is a typical daily program of créches in South Africa.
- Classtime is usually concentrated during the morning while the afternoon is reserved for play time and outdoor activities.
- Solar requirements are important to consider. The heating of the rooms is critical in the morning, especially in the winter. Daylighting is most critical when activities are indoors (i.e. in the morning).
- Do not underestimate the strong African sun or the winter period in the climatic performance of the building.

GENERAL SPACE REQUIREMENTS

INDOOR SPACE: 1.5 M^2 / CHILD

OUTDOOR SPACE: 2 M^2 / CHILD

20 STUDENTS / CLASSROOM

*All rooms must have adequate cross ventilation (operable windows)
*Avoid stairs/multi-story structures: safety issue for children
*All students use toilets at specified time with supervision by teachers

SPACE PROJECTIONS

CATEGORY	QTY	UNITS	NOTES
Total Site Area	~1700	sqm	approximate land area
Building Footprint	> 450	sqm	sum of breakdown below
Classroom (babies)	> 40	sqm	1.5sqm / child ++
Classroom (2-3)	> 40	sqm	1.5sqm / child ++
Classroom (4-5)	> 40	sqm	1.5sqm / child ++
Classroom (5-6)	> 40	sqm	1.5sqm / child ++
Office + Sick Bay + Training Room	> 60	sqm	estimated
Storage	> 10	sqm	estimated
Kitchen	> 20	sqm	estimated
Ablutions / Toilets	> 20	sqm	estimated
Semi-Outdoor Area	> 170	sqm	2 sqm / child

These space projections are calculations derived from building codes, best practices and the expected resources.

CLASSROOMS

1 FOR INFANTS

The infancy room must accomodate very young children with limited mobility. Soft surfaces and large floor mats are common. Their toys range from bouncy balls to cardboard tubes. In addition, it must contain the following:

- 1 slightly secluded training toilet
- 1 sink or basin large enough to bathe a small child or infant
- 1 changing table with storage for diapers
- a napping area with space to keep sleeping mats while not in use

1 FOR AGES 2-3

1 FOR AGES 4-5

1 FOR AGES 6-7

GENERAL PROGRAMS

Each classroom requires a secluded spot for a disruptive child to have a "time out"

Each classroom must have a "Teacher's Station" with a desk and shelves (desk must face wall).

Each classroom must have hooks for each child to hang their backpack, coat, and washcloth.

ABOUT THE CLASSROOM

Each classroom has "theme spaces" where children learn specific skills. Throughout the day, students rotate between the "stations" in groups. The sections do not require physical demarcation, but the environment should creatively accommodate the unique activities at each station.

The themes are as follows:

Make-Believe (dress-up, playing house, cooking, etc)

Blocks and Construction (various types of blocks and building toys)

Arts and Crafts (space to get messy and store art supplies)

Reading Nook (storage for books with comfy spot and a small table)

Discovery and Nature (science-themed corner with found objects, plants, and animals)

Activity Corner (changes weekly depending on the skill they are focused on at the time)

GENERAL REQUIREMENTS

All classrooms require built-in shelves to store the following:

- games and toys
- papers and files (in cereal boxes)
- old student work
- activity files

All classrooms need room for five small plastic tables (four chairs at each table)

ADMINISTRATION

1 OFFICE

Everybody entering the school should pass the office for security.

The office should have a lockable computer desk with space for a printer and filing materials.

SUB-PROGRAMS

TEACHER TRAINING

The office can also function as a training room for new teachers:
4 large tables for 2 trainees each

SICK BAY

1 child-sized bed
storage for medical supplies

LIBRARY AND MEDIA ROOM

The library and media room will contain storage and shelf spaces for books, videos and other materials. Potentially also used for training purposes.

SERVICES

1 KITCHEN

1 SERVING WINDOW
for children to retrieve lunch

UTILITY KITCHEN SINKS
deep enough for large pots

ELECTRIC STOVE

TOILET/ABLUTIONS

4 FAUCETS

6 CHILDREN'S TOILETS

1 ADULT TOILET (SEPARATE)

1 SHOWER
for staff, gardener, or cook

WASHCLOTH HANGER
Area for children to hang their personal washcloths

GENERAL REQUIREMENTS

- Floor and walls should be waterproof
- Separation of boys and girls is optional

STORAGE AREA

1 FOR FOOD

must be accessible to kitchen for easy access and lockable.

1 FOR GENERAL

for gardener's tools, cleaning agents, etc. Should be accessible from outside so that adults do not disrupt classrooms.

GENERAL REQUIREMENTS

- There must be adequate storage for both
- Storage must be secured with locks to prevent theft
- Storage does not need to be in a location where passive heating is needed. In fact, a cool, dark location would allow food to last longer.

OUTDOOR

SHADED MULTI-PURPOSE SPACE

1 SANDBOX
must be built under shade

Ample semi-outdoor spaces should be created to take advantage of the relatively mild weather in South Africa. Shaded spaces can help to shade against the strong African sun while allowing children to remain active.

WATERPLAY AREA (OPTIONAL)

This must also be shaded. The waterplay area can be part of the outdoor activity as well as the handwashing period for lunch and snack periods. Use this to promote washing and proper hygiene through play!

ABLUTIONS / TOILET



IN-CLASS STORAGE




ADMINISTRATION

GENERAL STORAGE


SICK BAY


FOOD + KITCHEN





CLASSROOM SPACES AND ACTIVITIES

The collage of images below show the different activities that go on in classrooms and indoor spaces. They provide visual directions on the types of objects that are used and the physical space requirements

INDOOR ACTIVITIES

SINGING
DANCING
NAPPING
EATING AND SNACKING
DRAWING AND COLORING
POSTERING
READING
HANGING BACKPACK
PUTTING ON SHOES
SITTING AROUND
FORMING GROUPS
TEACHER INSTRUCTION
SITTING AROUND TABLES

CHILDREN RISKS

When designing for children, safety risks are important. Removing as many dangerous factors as possible creates a better environment for learning and development. Material and spatial design considerations are needed to create a balance between an interactive and safe place. Although the space should allow movement, it should prevent children from injury.

SHARP EDGES

FRAYED MATERIALS

INACCESSIBLE CORNERS

TRASH AND HAZARDOUS OBJECTS

FRAGILE GLASS WINDOWS AND DOORS

TALL SPACES AND PLAY STRUCTURES

TALL STEPS

SECURITY

Security cannot be taken for granted in Cosmo City, particularly at an early childhood center. Security measures such as the examples below should be integrated within the design from the start to minimize harsh or unfriendly experience

SECURITY POST

The school will have a security post. Most posts are ad-hoc shacks that double up as a home for the security guard. It is usually located within the compound (see technical site recommendations for more in-depth analysis)

FENCE AND GATE

Fences and gates around the perimeter are a must. Careful design strategies need to be considered because the perimeter boundary is the first interface between the community and the school.

SECURITY DOORS

Designs for doors must ensure that classrooms cannot be broken into. Some doors have metal grilles while other schools installed safety bars after construction. There is an opportunity to design security into the door.

WINDOW GRILLES

Security in windows must also be considered. Window grilles or safety precautions can prevent trespassers from breaking in.

5.4 INTRODUCING THE SITE AND SITE RECOMMENDATIONS

KEY MAP

1 HOUSING
The site is a part of Cosmo City Extension 4, a low-income residential sector that is linked to the Reconstruction and Development Program. Houses are in the give-away category.

2 PARCEL NUMBERS
Each plot of land is assigned a parcel number. Each parcel's number starts with the number of the Cosmo City extension it is in. (i.e. parcels around the site will be 4XXX because they are in extension 4)

3 TRAFFIC
Vehicular traffic is experienced most on the road immediately South of the site. The least amount of vehicular traffic occurs on the road immediately North of the site.

4 PROPERTY LINE
This line delineates the property boundary. In drafted drawings, this line appears as a dot-dashed line. All building done by CUSD must occur within this area. CUSD can propose uses for the space outside of this line, but it must be approved and constructed by the developer.

5 SITE GRADE
The site slopes toward the West and slightly toward the South. There is a steep drop off at the West end of the site that is adjacent to the conservation area.

6 SOIL COMPACTION
The soil on the site is compacted, meaning that the site will sheet water, instead of absorbing it. The condition of the soil is crucial for planting. Rainwater can be an incredible resource, if soil conditions and site grade are used correctly

7 DROP-OFF
The drop of at the West end of the site is approximately 3 meters high. To prevent the drop-off from eroding, avoid directing runoff toward it. If directing runoff toward the drop-off is unavoidable, plant the slope or make it gentler.

8 CONSERVATION AREA
The conservation area lies outside of the property line. It essentially serves the purpose of a vegetated drainage ditch/flood zone safety.

SITE SURVEY


SEE SHEET 5
4139
4138
4137
4136
4135
AB12
AB11
J3
J4
4022
N2037
N2038
SEE SHE
4245
4246
4238
SEE SHEET 7
AC5
AC6
4247
4237
4248
4236
AC8
4249
4250
4251
4252
4253
RM1
X +80 (

VIEW FROM EAST TO THE SITE

VIEW FROM SITE TO THE EAST

VIEW FROM SITE TO THE NORTH

VIEW FROM THE SITE TO THE NORTHWEST

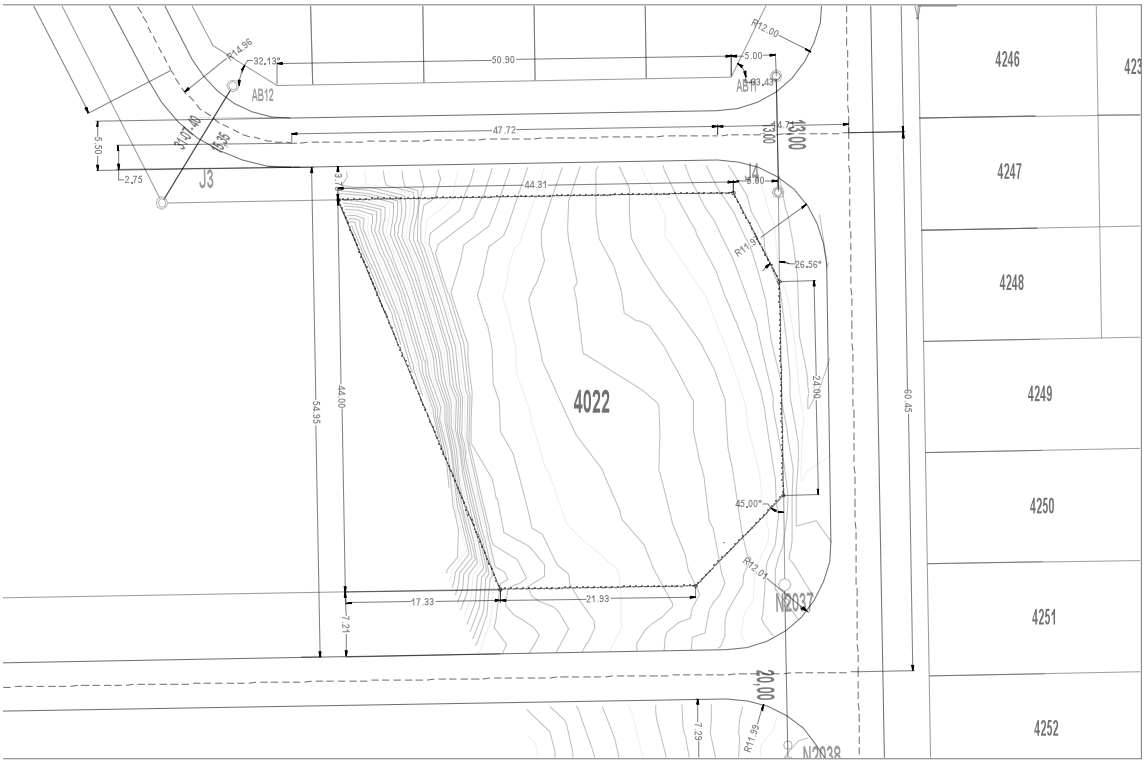
VIEW FROM THE SOUTH WEST INTO THE SITE

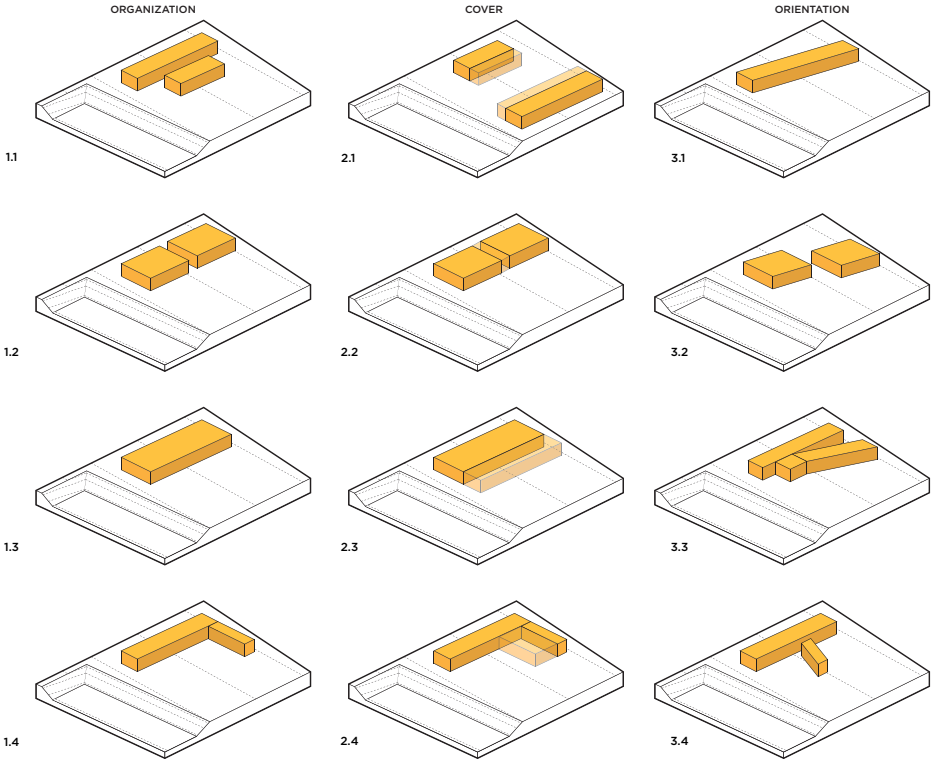
VIEW FROM THE SITE OUT TO THE SOUTH

VIEW OF THE BACK OF THE SITE

VIEW FROM THE SITE OUT TO THE WEST

SITE DIMENSIONS





POSSIBLE BUILDING CONFIGURATION

1. ORGANIZATION

Organization of the structure or structures.

- 1.1 • **Two structures aligned North-South.** Consider the space between the structures as instrumental in the programming of the building and the programming of the site.
- 1.2 • **Two structures aligned East-West.** Consider the space between the structures as instrumental in the programming of the building and the programming of the site. Circulation on the site could benefit greatly from this configuration.
- 1.3 • **One structure facing North.** Can be extremely useful in terms of passive heating and cooling. This configuration, however, might create a disconnect between the programming of the site and the structure.
- 1.4 • **One structure facing North with wing attached.** A wing attached to the main structure can generate an engaging site design. It can also improve the public's image of the school as it can face more heavily traveled roads. This configuration, however, can also enclose the site in an undesireable way.

2. COVER

Cover refers to partially-enclosed parts of the structure or site. They are in many cases less expensive than a fully enclosed space of the same footprint. They can also create more roof surface area, which would increase the amount of harvestable water

- 2.1 • **Two structures, separated, each with a semi-enclosed space.** This configuration can create a smoother transition from inside to outside, as well as generate a powerful site design.
- 2.2 • **Two structures, connected by a semi-enclosed space.** Covering this space would effectively make a contiguous footprint. Might improve air circulation in classrooms. Also creates microclimate between structures, which can be ideal for certain plants
- 2.3 • **One structure with an attached semi-enclosed space.** Creates a large footprint of shaded area, ideal for a South African climate.
- 2.4 • **One structure with wing attached and semi-enclosed space.** Depending on the configuration of the building and wing, this semi-enclosed area could be a powerful generator for the program of the building and more importantly, the programming of the site.

3. ORIENTATION

The orientation of the structure or structures can have a great affect on the ways the building systems operate.

- 3.1 • **One structure, facing Northeast.** This configuration would affect most the entrance to the school, particularly the layout of the parking area.
- 3.2 • **Two structures, rotated.**
- 3.3 • **Two structures, connected, forked.** A configuration such as this, if executed properly, could engage the site fully.
- 3.4 • **One structure with a wing attached.** This configuration can accommodate parts of the building program that do not require it to face North.

PARKING LOT / PROVISION

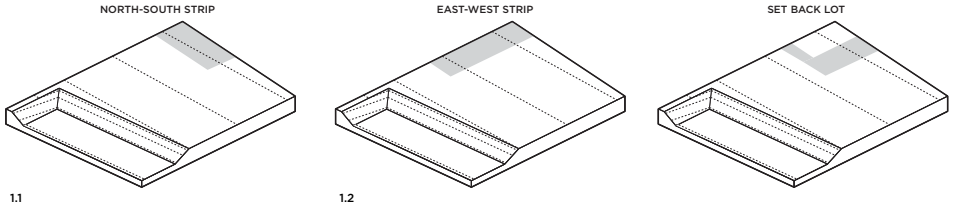
LOT SHOULD PROVIDE UP TO 3 CARS. They are most likely visitors, the ECD trainer or a place where taxis can park and wait for the children or teachers.

CONFIGURATIONS

1.1 • **North-South strip.** Advantages are a less concentraded flow of runoff than East-West strip, the guard post can be centrally located on East edge and still touch lot, and buffers a portion of site from busy street.

1.2 • **East-West strip.** Advantages are that lot is located along less-traveled North edge and aligns with the long edge of the school. Disadvantages are concentrated amount of runoff flowing close to conservation area.

1.3 • **Set-back lot.** Advantage are cars located away from main entrance of site and the division of the site allows for convenient placement of trash/dumpster. Disadvantages are the increased amount of impervious surface.



1.1 1.2

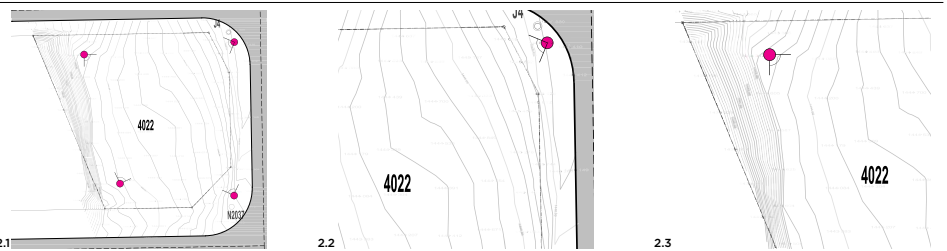
SITE TOPOGRAPHY

CONDITIONS AND RECOMMENDATIONS

2.1 • The site slopes gently to the east and slightly to the south. The dropoff is a height of about 3m, and it slopes steeply to the southeast. The conservation area can be treated as a drainage area for the site, however, large amounts of runoff can erode the drop-off considerably.

2.2 • Existing grading that lies outside the property line shall remain that way unless otherwise stated by the developer. If placed, sidewalks should drain away from the site into existing concrete drains on the street.

2.3 • The drop-off has potential to erode from runoff and general use. The steepness of the slope can be decreased to allow for better use of the slope (i.e. vegetative stabilization). Run-off from the site into the conservation area may need to be mitigated or collected



2.1 2.2 2.3

CONSERVATION AREA

CONDITIONS AND RECOMMENDATIONS

3.1 . The conservation area is a separate parcel from the creche site and is therefore out of the architect's jurisdiction. It is, however, within reason to propose a use for the conservation area. Pay attention to runoff that might drain into the conservation area. It is important that the minimal runoff gets put into this area.

3.2 . The drop-off at the back of the site is steep, with about a 3 meter change in elevation. The slope of the drop-off can change, but keep in mind that only the higher edge can be changed, not the lower edge. This would reduce the amount of space on the site for programming.

3.3 . One way to keep runoff from penetrating the slope (which would erode) and the conservation area is to plant the edge nearest the drop-off. Vegetation would absorb the water. The slope, though now too steep to plant, could be made gentler and then planted to prevent erosion.

ENTRY/ACCESS RECOMMENDATION

Access to the site must be located on or touching the north edge of the site. This is the least-traveled road and therefore provides the safest access to the site.

SINGLE ENTRANCE

1.1 Single entrace. One lane wide. This does not provide adequate access for large vehicles entering the site.

1.2 Single entrance. Two lanes wide. This provides an adequate two-way entrance and exit to the site. It does not, however, distinguish between vehicular and pedestrian traffic, which would be unsafe for children.

1.3 Single entrance. Three lanes wide. This provides an adequate two-way entrance and exit to the site. Types of paving can designate what is to be used for pedestrians and vehicles.

DOUBLE ENTRANCE

2.1 Double entrance One lane wide. This does not provide adequate access to the site. Large vehicles will be entering the site.

2.2 Double entrance. One one-lane, one two-lane. This distinguishes between pedestrian and vehicular traffic. (OPTIMAL)

+2 ENTRANCES

3.1 Triple entrance. Two one lane wide, one two lanes wide. This a security post distinguish between where people are entering and exiting the site.

3.2 Triple entrance. One one lane wide, two two lanes wide. This has distinct access for pedestrian and vehicular traffic, as well as an auxilary entrance for a large vehicle like a garbage truck, which could pick up garbarge easily were the dumpster situated near the acess. However, this may bring about control issues.

SECURITY POST

SITUATION

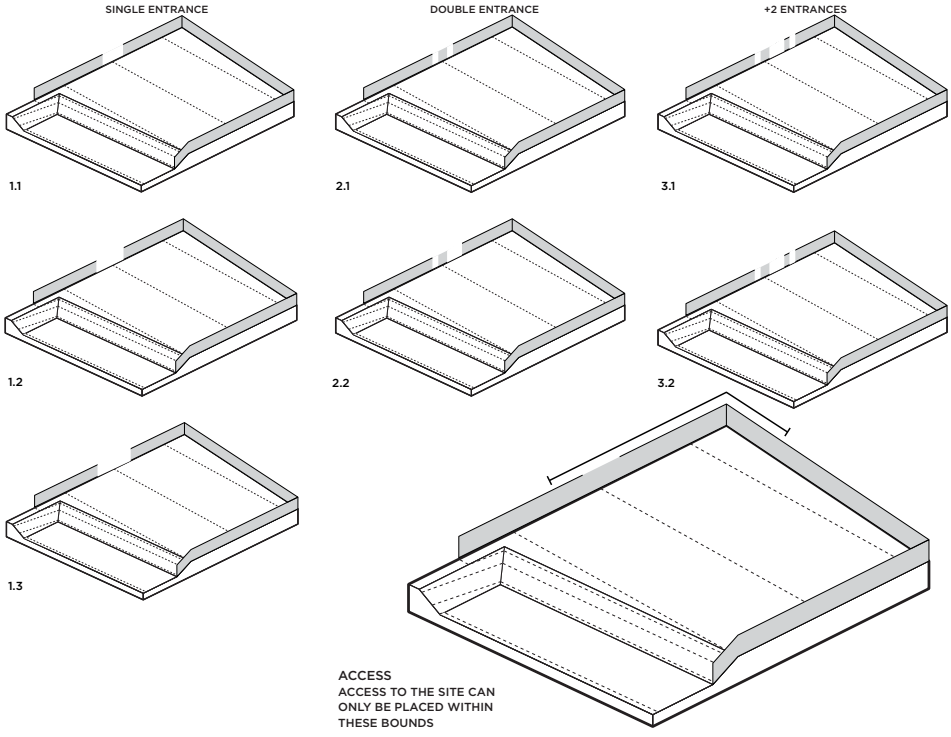
Guard station can be inside the fence, within the compound or it can be integrated into the fence.

SIGHT LINES

The guard station's field of vision should be able to cover most of the site perimeter.

SIZE

The size of the security post will be adequate for 1 person.



5.5 SITE COMPONENTS AND COVER TYPES

OUTDOOR AREA









SEMI - OUTDOORS



OUTDOORS

OUTDOOR PLAYTIME
RUNNING
HIDE + SEEK
SWINGS
SEE-SAW
PLAYGROUND STRUCTURES
GARDENING (OPTIONAL)

SEMI-OUTDOORS

SANDBOX
EATING AREA
OUTDOOR CLASS TIME
PLACE FOR GATHERING
SITTING AND RESTING

LOCAL FENCING TRENDS

1. CHAIN-LINK FENCES

CHAIN-LINK FENCES ARE THE MOST COMMON FENCING TYPE SEEN.

2. BARBED WIRE

BARBED WIRE IS A VERY COMMON ADDITION TO CHAIN-LINK FENCES (DESPITE THE SCHOOLS BEING DESIGNED FOR CHILDREN).

3. PUBLIC BORDERS

SOMETIMES, BARBED WIRE IS USED ON BORDERS THAT FACE PUBLIC AREAS. THIS INDICATES A HIGHER NEED FOR SECURITY ON SIDES FACING PUBLIC AREAS.

4. RESIDENTIAL BORDERS

WHEN BARBED WIRE IS NOT USED ON THE ENTIRE FENCE, SIDES FACING RESIDENTIAL AREAS DO NOT HAVE BARBED WIRE. THIS INDICATES A LOWER NEED FOR SECURITY ON THESE SIDES.

5. FENCE POST REINFORCEMENTS

FENCE POSTS LOCATED IN CORNERS ARE REINFORCED WITH THICKER POSTS AND ANGLED, METAL BUTTRESSES. THIS INDICATES A NEED FOR IMPROVED STRUCTURAL STRENGTH ON DEFAULT FENCES.

6. FENCE HEIGHT

FENCES AND WALLS ARE ALL AT LEAST 1.8M (6 FT) TALL.

SECURITY: FENCES, GATES AND GUARD STATIONS

Several trends are commonly found in Cosmo City's crèches' fencing, gates, and guard stations. By observing photos taken during the site survey, several of these trends in crèche perimeter security were analyzed to provide a context for the design of our schoolhouse's perimeter. This analysis provides information about security conditions and local practices, and design recommendations that are based on this information.

FENCE RECOMMENDATIONS

1. The fence or perimeter wall height should be greater than 1.8m (6 ft). This is common to all the creches.
2. The fence is the first interface between the school building and vthe community. Its design should find a balance of security and respect for community. It cannot be overtly hostile to trespassers and provide visibility for the school, which will be a symbol for the community. A form of "passive defence" can create a successful compromise.
3. The fence should include extra security, such as a sloped wall or natural boundaries (see Plant Schedule) create by trees and prickly plants. Most creches in the region use aggressive defences such as barbed wire and spiked picket fences. This is the level of security deemed fit by the community, and our fence should try to achieve high security as well, while keeping in mind the compromises and considerations from point 2.
4. Priority for extra security and noise reduction should go to the South side (facing the future business district). This is based on the placement of extra security on specific sides of the fence that faced public areas.
5. Chain-link fences do not look secure, are easily tempered with, and are not aesthetically pleasing. Should CoDevco provide a chain-link fence, reinforcements to its structure will be required. Creative use of the chain-link fence should be considered to resolve aesthetic issues.
6. Bright colours should be used on the fences and walls to enhance the child-like atmosphere of the creche. This will also help differentiate the creche from the surrounding buildings.

THERE IS A CAR PARKED INSIDE THE SCHOOLYARD. THERE IS A CHAIN-LINK FENCE PERIMETER AROUND THE SITE, AND SO THERE MUST HAVE BEEN A LARGE ENOUGH DOOR FOR THE CAR TO ENTER.

IN THE BACKGROUND, THERE IS A GATE LARGE ENOUGH FOR CARS TO ENTER THROUGH.

THE REFLECTION IN THE WINDOWS SHOWS A CAR PARKED INSIDE THE SCHOOLYARD. AGAIN, THERE MUST'VE BEEN A GATE LARGE ENOUGH FOR THE CAR TO ENTER THE SCHOOLYARD.

SOMETIMES THERE IS MORE THAN JUST ONE GATE FOR CARS. THE METAL DOOR ON THE LEFT SIDE OF THIS PICTURE IS AN ENTRANCE DESIGNED FOR PEOPLE.

GATE RECOMMENDATIONS

1. Provide one gate large enough for car traffic in both directions. It is expected that automobiles will be entering the site as well.
2. Provide a separate or integrated gate entrance for people. Fewer gates will be more secure, although an integrated gate would be inconvenient.
3. Having more than two fences is highly discouraged. It would be excessive, and would only increase security risks.

GUARD STATION RECOMMENDATIONS

1. Preferable placement of guard station in order of priority:
    a. Inside the schoolyard (maximum asecurity if perimeter boundary does not prevent entry, and maximizes guard's field of vision)
    b. Outside the schoolyard (maximizes effectiveness of perimeter boundary, limits guard's field of vision and effectiveness should the perimeter boundary fail)
    c. Incorporate into fence (compromise)
2. The guard stations field of vision would preferably cover all the sides of the fence. However, if this is not possible, here is a recommended priority list of which sides to cover first:
    i. The side with gates.
    ii. The side with the business district.
    iii. The sides facing roads.
    iv. The side with a slope
3. The guard station should be designed for one person to live in 24/7. This is common practice in Cosmo City, and is a necessary security measure.

TEDDY BEAR

THERE IS A 7 FEET WALL AROUND THE PERIMETER OF TEDDY BEAR. A CLOSEUP OF THE WALL MATERIAL IS ALSO SHOWN.

TEDDY BEAR

BEHIND THE TREE, THERE IS THE 7 FEET WALL. BEHIND THE WALL, THERE IS ANOTHER, SEPARATE BRICK WALL THAT IS ABOUT 14 FT TALL

WHEELER

THIS IS THE 6 FEET PICKET FENCE. IT IS MADE OF METAL THAT HAS BEEN PAINTED GREEN. AT THE APEX OF EACH PICKET, THERE ARE 3 SHARP POINTS.

NOTABLE EXCEPTIONS TO LOCAL CRECHE TRENDS

These exceptions are presented to provide other perspectives of fencing and gate designs in Cosmo City creches.

TEDDY BEAR

The perimeter of Teddy is surrounded by 7 ft cement/concrete walls, about 1 foot thick, with posts in intervals of 2 ft. This completely shuts off visibility of the schoolyard from the outside. In addtion, one side of Teddy's perimeter has an additional 14 ft brick wall outside the 7 ft wall. The gates are made of copper or iron, with an open grille on the top half, and are less than 0.5 ft thick.

WHEELER

Wheeler is built on mildly uneven terrain. It uses a 6ft tall metal picket fence, and the intervals between the pickets are 5 inches wide (smaller than an adult foot's width). Each picket has spiked tips.

These exceptions are presented to provide other perspectives of fencing and gate designs in Cosmo City creches.

CLOSING REMARKS AND FOCUS

There are 3 main considerations for the design of our fence, gates, and guard stations:

SECURITY - Based on the local practices of using barbed wire and spiked pickets for children's schools, security is a serious concern in Cosmo City.

INNOVATION AND SUSTAINABILITY - Our creche is symbolic to the community, and one of its publicized features is the sustainable and innovative design of the school. The residents want something fresh and new. However, whatever creative ideas are implemented should not sacrifice security and function.

APPEARANCE AND AESTHETIC APPEAL - This is particularly important for the perimeter boundary because it will make up the majority of the school's public facade. The majority of the community's visual impression may be based on the perimeter appearance, because a relatively small percent of the population will be going beyond the schoolhouse perimeter.

RAISED BEDS

Raised beds are a safe way to provide food to the school children. They are rectangular in shape without a top or a bottom. The bed is placed on the ground and the void is filled with healthy topsoil. This topsoil can be ammended by adding organic matter to it.

Raised beds should be accessible to children, as they can be valuable teaching aides. Irrigation of the raised bed can vary, depending on the plant and the available resources. Depending on the available materials, raised beds can even be made out of salvaged materials, such as tires and old wood.

Raised beds can be invaluable in generating a design for the site. Consider placement, shape, continuity, educational value, species, and the proximity to and interface with the school.

GROUND COVER

The soil on site has been heavily compacted. This makes it extremely difficult for roots and water to penetrate the soil. It is therefore unsustainable to propose large areas of grass lawn without considerable site preparation and/or importing new top soil.

Grass requires maintenance and water, does not have good penetrating root structures, and competes for resources against other more valuable plant species, such as shade trees or fruiting shrubs. However, it is a good semi-durable play surface for children.

Paths around the site should be maintained as compacted soil. They can be delineated with a mulched or planted edge.

VEGETABLE GARDENS








CRITERIAS FOR VEGETABLE GARDEN

The vegetable garden is a great source of food and income for the community. It lowers the maintenance cost of the school while providing ecological additions to the site. It helps to employ the gardener. Given such a large site, we have the opportunity to create a much more effective urban agriculture system for the productive garden.

- **The garden can become an important teaching tool and should be integrated in the playscape**
- **Garden should have boundaries to prevent children or invaders to destroy the plants**
- **Because of the soil on our site, we may need to acquire more top soil and use raised beds**

VEGETABLE TYPES

SPINACH
LETTUCE
MULBERRY
OLIVE TREES

BEETROOTS
BEANS
SWEETCORN
CHILI
MINT
CORIANDER
BASIL
TOMATO
NASTURTIUM
PEAS
CHIVES
PARSLEY
MARIGOLD

These are common vegetables that are planted on previous schools. They respond to local culture and nutritional needs.

REEL GARDENING

REEL GARDENING

Reel Gardening is a simple and cost-effective way of growing vegetables. It is made of a strip of paper with seeds. The paper can be unrolled and put into strips on the soil. With water, nutrients and the sun, the plants will grow.


STEP 1: OPEN PACKAGING


STEP 2: LINE THE REELS


STEP 3: GROW THE PLANTS

BAG GARDENING





RECOMMENDATIONS

Bag gardening is a method of conserving space by planting in bags of soil, the plant will grow out of the holes in the bag. This is especially useful for areas where there may be soil contamination or places where there may not be enough space. This is also a method to limit water runoff. Can grow kale, spinach, capsaicin, and onions, for example.

KEYHOLE GARDENING



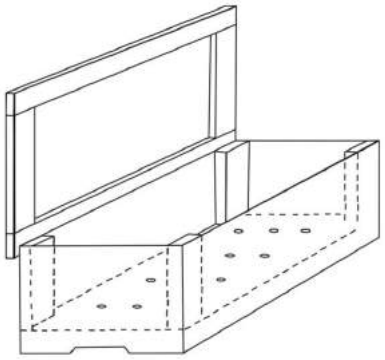


RECOMMENDATIONS

Keyhole gardening is a method of stacking a garden; the middle of the area is dug deeper than the rest, providing a direction for the water runoff to gather.

The garden can be constructed to have different levels with different plants; the lower leveled gardens can have more child-friendly flora, where the vegetables for food could be on upper levels for adults to tend.

COMPOSTING BINS



DESCRIPTION

Description: An outdoor composting bin will allow for the decomposition of organic waste produced on site. Waste can include: food scraps, kitchen scraps, gardening scraps, and paper products. After decomposition, a rich fertilizer will be left, ready for use the garden.

WORMS

In this process, called Vermicomposting, red worms (Eisenia Foetida) will be added to the bin to speed up the decomposition process, and reduce the required maintenance.

SIZE

The bin needs to be no more than 30cm deep because the worms live and feed near the surface, and will need .3 cubic meters for every pound of waste. A suitable size would be 30cm x 150cm x 75cm.

COMPONENTS

- Wood (plywood for external, hard and non treated for internal)
- Nails/Hinges
- Construction materials (hammer, saw)
- Worms

MECHANISM

Does not require turning like most, non-worm composting bins. Soil is ready within 2-3 months, in which case it will need to be removed. To do this, the lid can be left open for a short while so the worms burrow toward the lower layers, away from the light. Then, the top layer can be removed and used. The bin is expected to last 4-5, but if the first is proven successful, a new bin can easily be constructed.

5.6 PLANT SCHEDULE

ORGANIZATION OF PLANT SCHEDULE

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Aptosimum decumbens	(None Found)	Aesthetic Appeal	0.1	- crawls along ground up to 1m - small purple flowers	7
Sphenostylis angustifolia	Wild Sweet Pea	Aesthetic Appeal Erosion Prevention	0.1	- Deep, woody root system - Pink flowers - Requires some tending to (such as frequent watering, protection from frost, and replanting)	3
Parinari capensis	Sand Apple	Aesthetic Appeal Erosion Prevention Medicinal Herb	0.1 to 0.2	- Deep root system - Large elliptical leaves - Antimalarial properties	7

The 17 noteworthy plants are highlighted in the Plant Schedule

The entire plant matrix is organized from smallest plant height to largest plant height

The sources of information are represented by a number. The corresponding source and link can be found at the end of the plant schedule

LEGENDS FOR SYMBOLS OF PLANT USES

Aesthetic Appeal | Construction Material | Erosion Prevention | Grazing | Medicinal Herb | Natural Boundary | Shade

AESTHETIC APPEAL - The plant is visually pleasing or unique

CONSTRUCTION MATERIAL - The plant's components are used to fabricate products such as brooms or timber

EROSION PREVENTION - The plant is suited to preventing soil erosion, and stabilizing soil

GRAZING - The plant is commonly used for grazing

MEDICINAL HERB - The plant is traditionally used by locals for medicinal purposes

NATURAL BOUNDARY - The plant can be used to discourage/ prevent passage, for example, with thorns

SHADE - This plant can provide a significant amount of shade for people or buildings

INCORPORATING PLANTLIFE INTO DESIGN

Here you will find a list of 41 indigenous plants of South Africa. Each of the plants have properties useful for the design of a sustainable schoolhouse, and there are 17 in particular that we believe have the best properties for our schoolhouse's purposes. The plants are categorized into 7 main uses: Aesthetic Appeal, Construction Material, Erosion Prevention, Grazing, Medicinal Herb, Natural Boundary, and Shade. All of the plants are endemic to Coscmo City, and most of them require no extra watering or attention to survive and grow, making them a very sustainable choice of plants for the school site. Using the information from the plant schedule, specific plants can be chosen to be incorporated into our school and plot to create a functional and sustainable solution.

The schedule is organized by median height, from smallest to largest. The **scientific name, common name, uses, height in meters,** and **other information** about the plant are listed in the table. The 17 highlighted plants have additional commentaries and pictures provided on the sides of the page to provide a clearer vision of how these recommended plants may fit into the layout of the schoolyard.

Although we have already identified 17 plants that we believe are most likely to be incorporated into the schoolhouse, the other plants may be very useful as well. Do not hesitate to look into non-highlighted plants to see if their properties better serve the functions you require, and remember that the highlighted plants are only a recommendation.

At the end of the plant schedule, there are further details on how to use the information in the plant schedule, in addition to the source links where the plant information was found. Should you require more information about specific plants, you can follow the number from the sources column to see where we obtained our information, or you can use any of the other sources to search for plant information, as they are mostly all databases of plant properties.

SYMBOLS FOR PLANT USE

In addition to photographs of the recommended plants and further commentary, symbols of the plants' uses are located immediately below the plant's scientific name. These symbols are provided to allow a quick glance of the plants' potential usefulness. A legend and explanation of each category of plant use is provided to the right.

SPHENOSTYLIS ANGUSTIFOLIA

COMMON NAME:
Wild Sweet Pea

COMMENTARY:
This plant would require tending (not fully "sustainable"), but children could also take part in caring for these plants.

PARINARI CAPENSIS

COMMON NAME:
Sand Apple

COMMENTARY:
This plant is more compact than other erosion prevention plants, and its large leaves may come in useful for cooling roofs. In addition, its anti-malarial properties are very applicable to the community of Coscmo City.

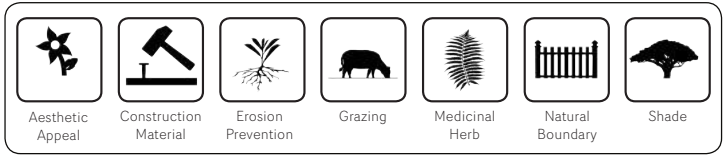
RHYNCHELYTRUM NERVIGLUME

COMMON NAME:
Ruby Grass

COMMENTARY:
This plant is very aesthetically pleasing, and would require very little maintenance. It would be an ideal garden flower.

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Aptosimum decumbens	(None Found)	Aesthetic Appeal	0.1	- crawls along ground up to 1m - small purple flowers	7
Sphenostylis angustifolia	Wild Sweet Pea	Aesthetic Appeal Erosion Prevention	0.1	- Deep, woody root system - Pink flowers - Requires some tending to (such as frequent watering, protection from frost, and replanting)	3
Parinari capensis	Sand Apple	Aesthetic Appeal Erosion Prevention Medicinal Herb	0.1 to 0.2	- Deep root system - Large elliptical leaves - Antimalarial properties	7
Senecio coronatus	Chipapari	Erosion Prevention	0.1 to 0.2	- Large rootstocks - Elliptical leaves - Small, yellow flowers	7
Rhynchelytrum nerviglume	Ruby Grass	Aesthetic Appeal	0.1 to 0.3	- Evergreen - Pink flowers - Tolerant to dryness and cold - Requires little maintenance	6
Anthephora pubescens	Wool Grass	Grazing	0.1 to 0.5	- High quality hay	5
Conmmelina africana	Yellow Commelina	Medicinal Herb Grazing	0.1 to 0.5	- Hard, woody, deep rootstock - Common in Southern Africa - Used to treat veneral diseases or fertility disfunctions	3

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Eragrostis obtusa	Dew Grass	Grazing	0.1 to 0.5	- Weak grazing grass, only useful in young stages	1
Pentanisia prunelloides	Wild Verbana	Aesthetic Appeal Medicinal Herb	0.1 to 0.6	- Easily grown from cuttings - Widespread in South Africa - Grows best with other grasses - Resistant to fire and drought - Herbal/medicinal properties for various ailments	3
Heteropogon contortus	Black Spear Grass	Grazing Construction Material (Thatching)	0.1 to 0.75	- Weakly drought resistant - Able to grow in poor soils	1
Eragrostis racemosa	Narrow Heart Love Grass	Erosion Prevention	0.1 to 0.8	- Low leaf production - Grows at a slow/moderate rate - Used in shallow soil and heavily grazed areas	1
Cynodon dactylon	Bahama Grass	Erosion Prevention Medicinal Herb	0.1 to 0.9	- Highly invasive rhizomes - Very adaptable to different environments and climates	6
Hyparrhenia hirta	Common Thatching Grass	Construction Material (Thatching)	0.1 to 0.9	- Mostly year-round growth - Tolerant to many soil types	5



PENTANISIA PRUNELLOIDES

COMMON NAME:
Wild Verbana

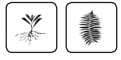
COMMENTARY:
This plant would be suitable as a supplement to the main schoolyard grass. Its medicinal value may come in useful as well.

ERAGROSTIS RACEMOSA

COMMON NAME:
Narrow Heart Love Grass

COMMENTARY:
This plant could serve as a supplementary addition to whatever other erosion prevention methods are being used.

CYNODON DACTYLON



COMMON NAME:
Bahama Grass

COMMENTARY:
This plant's invasive rhizomes make effective for erosion prevention, but also make it hard to control this plant's growth.

ERAGROSTIS SUPERBA


COMMON NAME:
Sawtooth Love Grass

COMMENTARY:
This plant is extremely hardy and commonly used for erosion prevention. However, its high seeding make it difficult to control this plant's growth.

TRAGUS KOELERIOIDES

COMMON NAME:
Creeping Carrotseed Grass

COMMENTARY:
This plant's erosion prevention ability is rather mild; it would serve best as a supplement.

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Eragrostis superba	Sawtooth Love Grass	Erosion Prevention Grazing	0.1 to 1.0	- Fast growing - Always green - High seeding - Drought resistant	1
Digitaria tricholaenoides	Purple Finger Grass	Grazing	0.4 (0.2 to 0.55)	- Strong and durable grass	1
Digitaria argyrograpta	Silver Finger Grass	Grazing	0.4 (0.2 to 0.6)	- 4 to 20cm long leaves - Good leaf production - Grows in dry conditions	1
Panicum coloratum	Small Panicum	Grazing Construction Material (Hay)	0.5 (0.1 to 1.0)	- Requires well prepared seed bed	1
Tragus koelerioides	Creeping Carrotseed Grass	Erosion Prevention	0.5 (0.12 to 0.95)	- Weed - Prevents topsoil loss - Very aggressive growth	1
Tristachya leucothrix	Hairy Trident Grass	Grazing	0.5 (0.15 to 0.90)	- Sheep particularly like this grass	1
Brachiaria serrata	Red Top Grass	Grazing	0.5 (0.3 to 0.75)	- Low leaf production	1
Monocymbium ceresiiforme	Wild Oatgrass	Grazing Aesthetic Appeal	0.6	- Nimble and cute - Grows in acidic soil - Useless after maturity	1


Aesthetic Appeal


Construction Material


Erosion Prevention

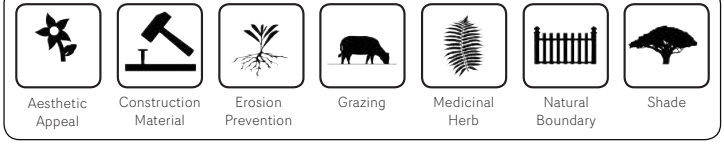

Grazing


Medicinal Herb


Natural Boundary


Shade

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Scabiosa columbaria	Butterfly Blue	Aesthetic Appeal	0.6	- 90 cm wide - Prefers mildly alkaline soil - Attract bees and butterflies	2
Eragrostis chloromelas	Boer Love Grass	Grazing	0.6 (0.3 to 0.9)	- Very drought resistant - Spreads by natural seeding	1
Panicum natalense	Natal Buffalo Grass	Erosion Prevention	0.65 (0.5 to 0.8)	- Used in mountain grasslands	1
Eragrostis lehmanniana	Lehmann Love Grass	Grazing	0.7 (0.5 to 0.9)	- Drought resistant - High pH tolerance (7.0 to 8.5)	1
Vernonia natalensis	Silver Vernonia	Aesthetic Appeal Medicinal Herb	0.8 (0.1 to 1.5)	- Anti-fever/malaria uses - Purple flowers - Silver hairs on leaves and stems	3
Pogonarthria squarrosa	Herring-bone Grass	Erosion Prevention Construction Material (Broom-making)	0.85 (0.27 to 1.40)	- Grows easily in tough areas - Grows in colonies	1
Trachypogon spicatus	Giant Spear Grass	Erosion Prevention	0.9 (0.3 to 1.5)	- Long, broad leaves - Slow/moderate growth - High leaf density that protects against rainfall	1



SCABIOSA COLUMBARIA

COMMON NAME:
Butterfly Blue

COMMENTARY:
This plant is very visually pleasing, and it could potentially bring butterflies and bees into the children's everyday life.

VERNONIA NATALENSIS

COMMON NAME:
Silver Vernonia

COMMENTARY:
This plant is very visually pleasing, and has been used traditionally as a medicine against malaria, fevers, and other general illnesses. However, this plant has also been used to ensure healthy births, or to induce abortions. If the loacls are unaware of these properties, they should be warned.

TRACYPHOGON SPICATUS

COMMON NAME:
Giant Spear Grass

COMMENTARY:
This plant's moderate growth rate makes it a better erosion prevention plant than some others, because its growth can be more easily controlled.

XEROPHYTA RETINERVIS

COMMON NAME:
Black Stick Lily

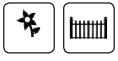
COMMENTARY:
This plant has a very unique appearance, and is culturally significant to South Africa as well. Its erosion prevention properties are mild. However, this would still be an excellent addition to gardens or the schoolyard.

CASSINOPSIS ILICIFOLIA

COMMON NAME:
Lemon Thorn

COMMENTARY:
This plant's spines would make a very good secondary fence; it can grow up over time and take over the visual presence of a fence giving a more aesthetic and natural boundary to the grounds. Its non-extensive root system will be far less likely to ruin pavement.

BUDDLEJA SALVIIFOLIA

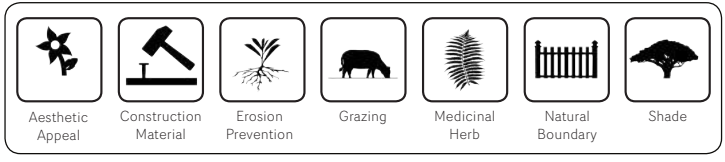


COMMON NAME:
Sagewood

COMMENTARY:
This plant is less well suited to be a protective boundary plant than the Lemon Thorn (above), but would still make a good hedge that is far more aesthetically pleasing due to its lilac flowers.

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Loudetia simplex	Common Russet Grass	Construction Material (Thatching)	0.95 (0.4 to 1.5)	- Hardy - Grows in poor soil	1
Cymbopogon excavatus	Common Turpentine Grass	Construction Material (Thatching)	1.0 (0.1 to 2.0)	- Slow-growing	1
Themeda triandra	Red Oat Grass	Aesthetic Appeal	1.1 (0.45 to 1.8)	-Traditional food plant	1
Xerophyta retinervis	Black Stick Lily	Aesthetic Appeal Construction Material Erosion Prevention Medicinal Herb	1.8	- Pink flowers in summer - Sparse, and dense root system - Smoked to treat asthma and nosebleeds	3
Cassinopsis ilicifolia	Lemon Thorn	Natural Boundary	3.0 (1.0 to 6.0)	- Sharp spines and leaves - Non-extensive root system, - Attracts many birds	3
Buddleja salviifolia	Sagewood	Aesthetic Appeal Natural Boundary	4.5 (1.0 to 8.0)	- Readily growing shrub - Very decorative - Can form trimmable hedge - Leaves can be used for tea	3
Leucosidea sericea	Oldwood (Tree)	Shade Natural Boundary Construction Material (Timber)	4.5 (2.0 to 7.0)	- 5m wide vergreen - Thick branches and leaves - Grows easily with cuttings	3

SCIENTIFIC NAME	COMMON NAME	USES	HEIGHT (METERS)	OTHER INFORMATION	SOURCES
Protea caffra	Sugarbush	Aesthetic Appeal Shade	5.5 (3.0 to 8.0)	- Difficult to cultivate	3
Halleria lucida	Tree Fuchsia	Aesthetic Appeal Shade	6.0 (0.3 to 12.0)	- Grows non-ripe edible fruit - Evergreen - Forms tree or shrub - Resistant drought and frost	3
Kiggelaria africana	Wild Peach (Tree)	Natural Boundary Shade Construction Material (Timber)	8.5 (0.1 to 17.0)	- Evergreen - Thick branches and leaves - Non-invasive root system - Birds and caterpillars are attracted to its fruits/leaves	3
Acacia caffra	Common Hook-thorn (Tree)	Aesthetic Appeal Natural Boundary Shade	10.5 (3.0 to 18.0)	- Symbol of luck - Extensive root system - Resistant to drought, fire, frost, and pH change	3
Acacia erioloba	Camel Thorn (Tree)	Natural Boundary Shade	11.5 (5.0 to 18.0)	- Deep taproot (up to 60m) - Thorny stems - Currently a "protected" tree	4
Celtis africana	White Stinkwood (Tree)	Aesthetic Appeal Shade	16.0 (2.0 to 30.0)	- Grows easily in varied environments - Grows small berries that attract birds - Already widely used in South African parks	3



HALLERIA LUCIDA

COMMON NAME:
Tree Fuchsia

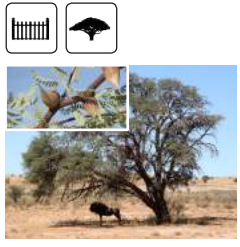
COMMENTARY:
This tree is very decorative and will provide consistent shade year-round. It only reaches large sizes if it is well watered, so it will most likely be at a height between 5 – 7 meters. It attracts many species of birds.

ACACIA CAFFRA

COMMON NAME:
Common Hook-Thorn

COMMENTARY:
This tree's flowers and foliage are very decorative, but its spines and stems may be harmful to children unless the tree is pruned. It has the potential to hurt the foundation or break up pavement because of its aggressive root system so it should not be planted near buildings or the road.

ACACIA ERIOLOBA



COMMON NAME:
Camel Thorn

COMMENTARY:
This tree has very long thorns, which would make it a good barrier plant. It has a very broad and elevated canopy which can provide great shade.

OVERALL RECOMMENDATIONS

PROBABLE PLACEMENT OF PLANTS

The probable placement of each plant on the site is suggested by its uses. Although all the plants may be useful placed anywhere on the site, the following list provides the primary locations that each plant would be placed, based on their use:

- *Aesthetic Appeal* - In gardens or anywhere on the site • *Construction Material* - No specific recommendations
- *Erosion Prevention* - On the sloped side of the site
- *Grazing* - No specific recommendations
- *Medicinal Herb* - In gardens or anywhere on the site
- *Natural Boundary* - On the site border
- *Shade* - Over roofs, parking lots, play areas, on the site border

OTHER VISIONS

Natural Boundary plants are so categorized based on physical characteristics such as thorns or thick branching. They can be used as a defence on the perimeter. In addition, the trees could also be used to prevent access to the site as well as reduce visibility into the site, also adding to a secure perimenter.

Medicinal Herb plants can be incorporated into the gardens and site as a reserve of medicinally valuable plants that can also be sold to suplemment the school income. Some of the suggested plants have been traditionally used to cure diseases such as malaria, which is prominent in Africa. If the school includes an amount of these plants, it could become a public reserve of traditional medicines, whether children become mildly sick or Cosmo City inhabitants fall ill.

Entangled Bank – A sustainable city development for Dallas
An example of incorporating plants as part of buildings

CLOSING REMARKS ON PLANT SUSTAINABILITY

Plants have a very distinct role in sustainability and integration with nature. Unlike the majority of building materials used in construction, the incorporation of plants into the design of a building is the incorporation of a building component that remains alive after construction. Not only are plants sustainable, but they represent a paradigm shift in construction methodology: making buildings become a part of nature, rather than a lump of organized, dead material sitting on top of nature. Remember to not only think of the plants as objects to be placed in a garden; it is very possible to use some of these plants to create functional parts of the building. For example, using trees and prickly plants to form a fence, or using plants with large and dense leaf surface area to cover and help cool the school roof.

The schoolhouse is a symbol of sustainability (amongst other things), and there should be a **very deliberate** attempt to apply plants as a building material, rather than a mere object.

SOURCES AND LINK

FAO Grassland Database
http://www.fao.org/ag/AGP/AGPC/doc/gbase/latinsearch.htm
Floridata
http://www.floridata.com/ref/s/scab_col.cfm
PlantZAfrica
http://www.plantzafrica.com/plants/plantsmain.htm
Sun Gardens
http://www.sungardens.co.za/items/index
Tropical Forages
http://www.tropicalforages.info/key/Forages/Media/Html/Anthephora_pubescens.htm
University of California Agriculture and Natural Resources
http://ucce.ucdavis.edu/datastore/datastoreview/showpage.cfm?usernumber=58&surveynumber=451
Zimbabwe Flora
http://www.zimbabweflora.co.zw/speciesdata/index.php

5.7 DESIGN FOR PLAY

Playing is a child's way of learning. In order to maximize the children's experiences, we, as designers, must understand and treat these children as our clients. We must understand their emotional, intellectual, and motor development to inform the material and design strategies we will use to create a multi-sensory, small-scale world in which they can learn, explore, and have fun.

TARGET AGES OF THE CRÈCHE:

PRECONCEPTUAL PHASE : 18 MONTHS - 4 YEARS

- Ability to create symbols, to imitate others, and to learn languages
- Attention is no longer limited to the immediate environment. Through the use of symbols and "make-believe", children begin to develop their imagination.
- A more developed imagination facilitates creativity and innovation.
- Interested in primarily independent play, or parallel play; not yet intested in socialization or collaboration.

INTUITIVE PHASE : 4 - 7 YEARS

- Ability to conceptualize ideas and assess functionality, purpose, "good vs. bad", etc.
- Develops a strong curiousity and begins to ask questions
- Ability to understand authority and adhere to rules
- Ability to imitate actions and socialize with adults and peers

SENSORY EXPLORATION

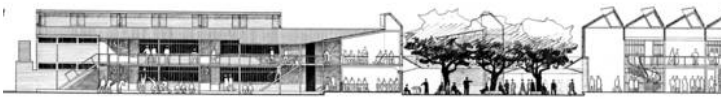
Multisensory experiences engage the whole body in the learning process and are fundamental to the knowledge-building process and formation of creativity and personality.

SIGHT: lighting and shadow teach humans how to understand space, volume, color, and texture. Incorporating different colors, emphasizing light differences (inside/outside, natural/artificial lighting, etc.), and placing mirrors will improve the child's understanding of the environment.

SMELL / TASTE: smell is a powerful sense in terms of understanding materiality, food, nature, etc. Nothing triggers memory stronger than smell. Stategies for maximizing the nasal experience include the exposure of natural materials, including an herb garden, and having a centrally located cafeteria space.

SOUND: important for sense of space: "sounds evoke strong physiological and psychiological reactions, they thicken the sensory stew of our lives and we depend on them to help us interpret, communicate with and express the world around us" (Ackerman, 1990, p. 175). Silence can be oppresive to children, while loud noises can be a large source of stress. A balance should be met by reducing some noises (rain on roof, wind, etc.) and encouraging others (steady hum of playing, flowing water from exposed plumbing, etc.)

FEEL: since the skin is the body's largest organ, feeling is one of the most extensive opportunities for learning. Tactile experience is the most intimate form of learning and maximum textural resources should be included in the design.



Good example of the incorporation of nature: Usasazo Secondary School

OSMOSIS

Osmosis with the world outside, in terms of nature and socity. The creche should blur what is inside / what is outside. This consequently will blend what is learning / what is play.

A school should not be a counter-world for children, but rather a distillation of society. The school becomes an interface between childhood and contemporary reality.

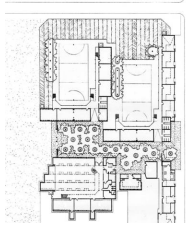
COMMUNITY

This creche has the opportunity to become very symbolic, culturally, through community involvement during the construction phase and continually in the future. A school is a collective effort between children, parents, and the community and can instill collective values, collegiality, and a source of pride.

CONSTRUCTIVENESS

A creche should be an active laboratory. The environment should stimulate experimentation, creativity, and constructivism.

Simple moves, like including a platform, to serve as a stage for dramatic activities, and including display space, to showcase student artwork, will instill confidence and initiative in the arts.



LARGE MUSCLE DEVELOPMENT

Between the ages of 0 and 7, the children's size will more than triple. This growth, along with muscle development , and coordination, must be challenged in the creche. Climbing devices, swinging devices, crawling devices, and game space (ball game area, tag area, etc.) must be included.

NARRATION

Education is not a destination, but a process. The space should emphasize this notion by narrating the children's development through drawings, writings, materials, objects, colors, etc. Even when children are not occupying the space, there should be ample evidence of their existence.

RICH NORMALITY

The space should be a harmonious and balanced environment, comprised of interactions between different materials, objects, situations, and iconography. No one object should overpower another. Hierarchy between objects should be minimized so that everything is approachable to the child; like how sunlight is the sum of all colors of the specrum.

OVERALL "SOFTNESS"

The creche should establish it's own ecosystem that is diversified, stimulating, welcoming, and is fully accomodating. The space should be dynamic and group oriented, but also sympathetic towards privacy and introverted work. Colors, light, and openness provide for a serence, amiable place.

Source: Caring Spaces, Learning Places. Pages 87-88

FLEXIBILITY

Epigenesis, or the ability to adapt and develop one's own evolutionary process, should be applied to the creche.

PROGRAMATIC FLEXIBILITY

- Movable wall partitions could allow for one large space to be broken in to more intimate spaces
- A creche operates mostly during the day. Could something else operate out of the building at night?

USER FLEXIBILITY

- Space should accomodate for all ages (0-7 and adult supervisors.)

  Height of tables, chairs, toilets, sinks, knobs, handles, etc. must all be taken in to consideration

SEASONAL FLEXIBILITY

- How will the space change based on the season?

  In extreme weather (heat, rain, cold, etc.) the windows will be closed and everyone will remain indoors. In enjoyable weather, the building's wall will become more of an interface between inside and outside since more children will want to play outdoors.

NOTE:
ALTHOUGH COLORS ARE IMPORTANT FOR INSPIRING CREATIVITY AND A DYNAMIC ENVIRONEMT, NO MORE THAN SIX COLORS SHOULD BE USED IN ORDER TO PREVENT DISTRACTION AND STRAIN ON COGNITIVE ABILITIES.

GOOD EXAMPLE: OLIFANTSVLEI PRESCHOOL

COLOR

Different colors can be implemented in the creche, corresponding to the programatic environment:

- **RESTFUL / RELAXFUL** (for sleeping / quiet time area) = turquoise, lavender, soft tones

- **THOUGHTFUL** (for classroom) = green, blue, violet, earthtones

- **PLAYFUL** (for outside areas) = red, red-orange, yellow, lime

- **CLEANLINESS** (for bathrooms / kitchen) = white, blue

THE "ABC"S OF MATERIALS FOR PLAY

A Aluminum Foil, Acorns
B Bamboo, Baskets, Beads, Bark, Bottles, Bottle Caps, Boxes, Bolts, Bricks, Bubble Wrap, Buttons, Beans (dry), Bubbles
C Cedar, Copper, Carpet Tiles, Caps, CD Discs, Clothes Pins, Crayon Bits, Coffee Cans, Coffee Filters, Corks, Ceramic Tiles
D Driftwood, Dirt, Duct Tape
E Earth Clay, Egg Cartons
F Feathers, Flowers, Funnels, Fabric, Film Canisters, Fur
G Gears, Grasses, Grain, Gadgets (recycled)
H Hardware, Hats, Hay
I Ice, Ice Cubes
J Jewelry, Juice Lids, Jars
K Keys & Locks, Keyboards
L Logs, Lids, Leather, Leaves
M Metals, Mud, Magnets, Mirror, Marbles, Milk Caps, Milk Cartons, Milk Jugs, Mirrors
N Nature
O Organic plants
P Paper, Paper Plates, Paper Rolls, Paint Stirrers, Plastic, Pine Cone, Popsicle Sticks, Paint
Q
R Rocks, Rain Gutters
S Shampoo Bottles, Shoe Boxes, Socks, Soda Bottles, Spray Bottles, Shells, Sticks, Spoons, Soap
T Tape, Tiles, Tin Cans, Toothpicks, Tubes, Twine, Tree Branch
U Unit Blocks
V Vinyl Gutter
W Water, Wallpaper, Wire, Wood, Water Bottles
X X-ray Film
Y Yarn, Yogurt Containers
Z Ziploc Bags

REGGIO EMILIA MODEL

It is important to note that there is no cookie cutter method for creating such a school, since such a program should reflect and mirror the routines of the community. That being said, Reggio Emilia also believes that children's way of learning do not drastically change and there are underlying goals of a Reggio Emilia program that can be discussed and infused into design.

"Children [are] protagonists to their own learning, not some 'container to be filled.'"

The schools use real world objects, not mass manufactured objects, to allow the children to create and invent.

"The environment is seen too as educating the child, in fact, it is considered as the third educator,"

"The spaces are not tailored necessarily for safety and or built to child size, but are built as they are in real life."

Designing for children requires a new set of skills and way of thinking, which this section tries to explain. Luckily, the future educators of our school, the NGO Play With a Purpose, have given us some direction in the form of the Reggio Emilia model of early childhood education. This method, which has been recognized as one of the best for early childhood education, is truly an inspiring model and places great importance on spatial design for education, going so far as to name the physical space as the "third educator" after the two teachers in the classroom.

At the end of WWII, a group of parents and a visionary educator, Loris Malaguzzi, decided to build their own schools, separate from church and state, to educate their children. What emerged from this community in Reggio Emilia, Italy, is a collection of locally run schools, and a method for educating young children that has become the gold standard. There is no cookie cutter method for creating such a school. The Reggio Emilia schools in Italy, in America, and in South Africa should all be different, since such a program should reflect and mirror the routines of the community. That being said, Reggio Emilia also believes that children's way of learning do not drastically change among cultures and there are underlying goals of a Reggio Emilia program that can be discussed and infused into design.

The first most important aspect thought behind Reggio Emilia is the role of the child and allowing the child to: "organize for their control" (Neugebauer 68). Students do many long-term projects, and their work and progress is displayed throughout the school. Children are asked to create their own curriculum based on what interests them. The physical environment has an important role in this process. "The environment is seen too, as educating the child, in fact, it is considered as the third educator," (Gandini 1993 145).

Spaces and objects are seen as catalysts to inspire the students' curriculum. Rooms and furniture are not tailored necessarily for safety or built for child size, but imitate the community. In the Italian schools children use porcelain ware for mealtime, have access to computers, projectors, scissors and other potentially dangerous or breakable objects. Although accidents may occur, students are thought to learn through experience. Students are given real world objects to play with, such as corks, because they allow children to invent and create their own activities, instead of following the prescribed activities of 'children's toys'. A variety of materials, such as glass and mirrors, are built into the environment for similar reasons.

Reggio Emilia schools teach also have some different spaces, not found in most schools. There is a stage for puppet shows and other performances, always plenty of nooks and spaces for storing and hanging student's work, and social spaces. Most interesting is the introduction of a new room, "the atelier, the schools studio and laboratory," (Gandini 1996 56). This room, separate from the classroom, is open and meant for painting and general exploration. Attention is also paid to open space and natural light.

Much of the beauty of Reggio Emilia schools only occur once the students, teachers, and family have become part of the school, but the initial designs are still important in this process for "space [to be] seen as having educational content," (Gandini 137). It is difficult to understand the local South African life and infuse it in our design. Scattered in this booklet is our attempt to understand this culture. In our discovery, a few issues stand out as essential for designing a school – the importance of gardens and the need for simple and inexpensive upkeep. Many children come from extremely poor households and only at school will the children get a real meal. It is important to include nutritious food in the school garden to feed these children. The school itself needs to be designed so that upkeep is relatively simple and cheap.

For more resources on designing Reggio Emilia spaces see:
"Caring Spaces, Learning Places.' By Jim Greenman
"Child Care Design Guide." Anita Olds

CASE STUDY: EL PORVENIR SOCIAL KINDERGARDEN

Architect: Giancarlo Mazzanti
Location: Bogota, Columbia
Project Area: 2,100 sq. meters
Project Year: 2007 - 2009

DESCRIPTION

Built in a desolate neighborhood and surrounded by informal settlements, this elementary school was built to instill confidence and pride in local children.

The elementary school's entire design is based off the oval interface. Inside the oval are rotated modules, or classrooms, in chain construction, that provide for either linked social spaces or introverted sub-spaces. The angles of the classrooms and large glass facades create a unique view, yard, and relationship with the outside environment. The oval is permeable, but still symbolizes intimacy and protection from the outside world.

If the inside, sub-spaces are viewed as the private, intimate spaces, the outside must act as public spaces. The kitchen, administrative offices, etc. is located outside the oval interface and is directed toward the local city.

The oval accomplishes many dualities, intrinsic to the elementary school: inside/outside, private/publuc, child/adult, sheltered/exposed, etc. It's statified composition also introduces intresting light and shadows in to the yard space.

The architect, Giancarlo Mazzanti, stressed the educational opportunities of nature. The "outdoor yards" are used as outdoor classrooms, so the notion of having fun is blurred with learning. On weekends, these spaces become public and are used for community meetings, further enforcing the symbolic importance of the space.

CASE STUDY: NDLOVU PRESCHOOL OVC

Location: Wapadrand, Pretoria
Creator: Dr Hugo Templeton
Number of children: 120 (Averaged)

DESCRIPTION

Started in 1994, under the Ndlovu Medical Centre, this crèche was created under the Reggio Emilia model, specifically for children who had lost their parents or who had parents that were very ill. The crèche is a "nutritional unit" for the children, where adults supervise and ensure that children are being fed healthy, regular meals. The crèche also functions as a civic node, where the community can come to get water, grow vegetables in the vegetable garden, and offer guidance and supervision to the children.

Although the Reggio Emilia stressed a strong teacher-parent-student relationship, this creche is unique in that a lot of the children's parents are not present. This is resolved through community involvement, where members volunteer their time supervising the children. These supervisors act as teachers, mentors, and even adoptive parents in some cases.

Each day, the children complete a verbal sensory checklist. They have discussions on the things they saw, noises they heard, smells they encountered, new tastes they liked, etc. Not only is this fun for the children, but it increases their awareness of the surrounding environment. Introducing healthy competition surrounding something like "who heard the most unusual noise" becomes a win-win situation since all the children's senses automatically become heightened.

5.8 DESIGN PARADIGMS



PARTICIPATORY SPATIAL PLANNING, MERCY CORPS

In 2008, MercyCorps Urban Program Indonesia conducted a Participatory Spatial Planning (PSP) project for the community of Rawa Bebek, one of the largest and most resilient slums in North Jakarta. The goal was to help develop a proposal for a productive community space under the elevated toll-road that cuts through the city. The PSP project went through a comprehensive community building process that included a spatial planning charrette, training of trainers and guided proposal development. The community based organization that partnered the NGO, KMPKT, have been empowered to develop their own proposals and community programs that continue to inspire grassroots movement for the urban poor in Jakarta.

MAGAGULA COMMUNITY CENTER, buildCollective

BuildCollective was founded by Marlene Wagner who was one of Education Africa's first partners. The Magalula Community Center is an ongoing ambitious project that attempts to integrate sustainable construction processes along with community engagement and local capacity building. Development of new innovative construction techniques were aimed at amplifying current skills of local laborers as well as developing markets and design outlets for local materials and processes.

CARIN SMUTS ARCHITECTS

Carin Smuts is the founder and principal of CS Studio Architects, who focuses on low-cost public structures in South Africa.

POST-CONSTRUCTION COMMUNITY ENGAGEMENT AND EMPOWERMENT. The structures designed continue to inspire community building and identity beyond the pre-design process and construction process. For example, walls were regarded as blank canvases of which the community can fill with their inspirations and sense of belonging.

Mural painting that became part of community events were common in her structures. As such, the community continues to have an attachment to the structures constructed due to constant dialogue and physical enagement with the building as part of their culture and daily interactions.

PARADIGM 0: EMPOWERMENT + ENGAGEMENT

Community empowerment and engagement can be divided into three different categories:

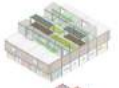
PRE-DESIGN PARTICIPATION Community input is used to inform design decisions and at the same time, participation of community members in the beginning of the process results in a sense of ownership for the project which is key to create a sustainable and long-lasting impact.

CONSTRUCTION AND CO-CREATION The community or target individuals are involved in the construction process such that there is skills-transfer thus creating a project that can impact future employment and economic opportunities of the community involved.

POST-OCCUPANCY PERFORMANCE The project has an impact even after the architect or builders have left. The building itself can engage the community in a meaningful, integrated positively into their daily interactions.

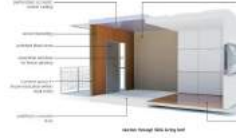
APPLICATION:

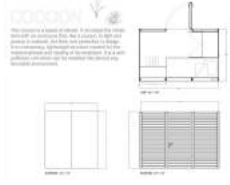
- **Although pre-design participation is not possible we will be able to engage the community during construction** We will be working with local unskilled laborers that will be trained in the process of our construction. Community engagement workshops can also be conducted when the team is in South Africa
- **Post-occupancy performance will result in a socially significant project for the community** as they will remain attached to the building after the students have completed the project. The community will also contribute to the upkeep of the building.



FRAME AND INFILL

DSGN AGNC have developed a proposal through community participation and facilitation for a housing project servicing 50 families of La Union in Facatativa, Colombia. The project was part of a research on low-cost and low-tech building delivery mechanisms in the city. Their project embodied the idea of "frame and infill" which is a combination of empowerment through ownership and mass customization. The building was designed as steel and reinforced concrete frames that have integrated sustainable features such as proper day-lighting and ventilation, rainwater collection and potential zones for urban agriculture. The main idea is for that the community is able to customize their own dwelling units. They are creating a "fill" in the frame by participating in the construction of the walls, fenestrations and additional features that they wish.





CORE UNITS

The housing in Cosmo City was designed as core units that anticipate further extensions as the community experiences upward mobility. The lot sizes provided are about 250m2 while the core unit housing sizes are as small as 36m2. The large lot and core unit suggests future additions to be made – more rooms and materials.

Core housing units are also strategies that are developed for quick and efficient disaster relief architectural responses. Core units that are modular, pre-fabricated and quick to implement can provide the necessary basic shelter and services such as water, sanitation and electricity. As conditions stabilize, additions can be easily made to the core unit construction to expand the space required for the surviving or relocated families.

PARADIGM 1: ANTICIPATORY DESIGN

The design should anticipate the upward mobility and growth of the community such that when resources free up and become available, they have the ability to include some of the sustainable strategies that have been developed. For example, rainwater collection tanks and roof gardens may not be something that is feasible for now. However, the design should anticipate for such initiatives to be explored further.

APPLICATION:

- **Anticipate opportunities for further developments in space, material and technology.** Some of the technologies and strategies that we have compiled may not be applicable during the time of our construction. However, these catalogues will be information that can be used when resources become available to the community.

ADSPECS

The Adspecs is an excellent example of resilience put into practice. The glasses are made of plastic membranes that are injected with water. The amount of water injected via a syringe corresponds to the optical degree required. The Adspecs technology was able to be made cheap and easily replicable providing clear vision to the poor.

JOHN OSCHENDORF / BRICK TILE VAULTING

John Oschendorf leads the Masonry Group at MIT. His researches traditional Guastavino vaults and brick tile vaulting with locally found materials. His buildings use such traditional, cost-effective and simple techniques to reduce the embodied energy of the buildings by almost 90% compared to conventional modern building technologies.

PAPER TUBE STRUCTURES

International renown architect, Shigeru Ban, embarked on the innovative paper tube structure experiments. One of the first projects was to implement the recyclable and efficient structure for emergency shelters for the UNCHR. Subsequent variations of the project includes paper church, pavillions, museums and libraries.

The paper tube structures can be described as resilient as it was employed not only as a new sustainable material innovation, the joints and detailing of the construction are also designed to be as low tech as possible, such as metal tapes and fabric as in the case of the 2000 Japan Pavillion for the EXPO in Hannover.

building for the poor does not mean a poor building

1.7 billion people are in absolute poverty and where 98% of the world are not able to afford formal design services

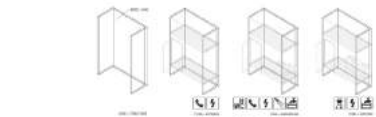
PARADIGM 2: RESILIENCE

RESILIENCE is vital to the scaling up of new sustainable technologies. Different communities have varying capacities and not everyone understands the latest gadgets and control systems. As a result, issues such as maintenance, life expectancy, upfront costs of installation and capacity to work with new building systems and technologies greatly affect the efficacy of design. In academia or in the high-end market, designers are trained to think with almost infinite or large amount of resources. Resilience takes into account the lifetime of the product or design. It is a user-centered approach to sustainable strategies of design and technology that integrates low maintenance, low dependency and long-term impacts. Moreover, it responds to conditions where there is a possibility of no resources at all.

LOW COST AND LOW TECH does not mean low creativity and function. It is important to note that building for the poor does not mean a poor building. Low cost and low tech innovation is an increasingly fecund field for explorations because of the impact it can create given current conditions of the world where 1.7 billion people are in absolute poverty and where 98% of the world are not able to afford formal design services. The low cost and low tech approach maximizes the potential of given resources. In design, it is about making the most out of cheap and affordable materials through creativity and innovation

APPLICATION:

- **The community we are working with have very limited resources and there is almost no maintenance capacity** because no janitors or facility coordinators will be available. The staff members consist of teachers, security, cook and gardeners. They usually volunteer their time to maintain the facility in addition to their main occupation, which can become strenuous.
- **The life-cycle of the product should be long lasting or easily replaceable** to reduce time, cost and labor for subsequent maintenance cycles.



TSUNAMI SAFE(R) HOUSE

The Tsunami Safe(r) House project was initiated by MIT School of Architecture along with other Engineers. The goal was to provide quick and easily constructed homes for the Tsunami refugees. The house was to be created out of robust concrete core structures that can be transformed into various permutations - kitchen, toilet, storage, etc. It is a C-shaped structure that acts as boath laod bearing and shear wall. Apart from it's structural integrity, its form can create malleable spaces as the user chooses.

PROJECT JOUBERTON

Project Jouberton by Nottingham University employed a bolted timber frame structure with lateral frames. The framed structure can easily shift in height according to the undulation of the roof, thus creating a complex wave like roof form with a single structural framing system.

HOUSE FOR NEW ORLEANS

The house in New Orleans by MIT was exhibited in MoMA, New York City in the exhibition "Home Delivery". It showcases cheap and efficient prefabircated paneling system that fits like puzzles, not requiring glue, bolts or extra detailing connections. The idea was to develop a paneling system that is highly modifiable can give customizable forms with a single type of material.

MASS CUSTOMIZED STRUCTURAL SYSTEM has similar production method and process but each iteration responds differently to a certain spatial configuration as well as specific structural demand.

PARADIGM 3: MASS CUSTOMIZATION + EFFECIENT CONSTRUCTION

CONSTRUCTION LOGISTICS AND SIMPLICITY greatly affect how one designs. Designing with construction in mind can empower the designers to develop more creative solutions and actually control their final design product. The knowledge of construction and implementation process of architecture has been increasingly ignored with specialization in the industry and academia. A renowned master-builder is the recent Pritzker Prize winner, Peter Zumthor who understands the quality of materials, tactile construction techniques as well as the socio-psychological effects of spaces. Simplicity in construction is an important aspect of this project. **Simplicity does not mean simple**. Simplicity in construction means that the design should eliminate unnecessary steps that will complicate construction logistics.

MASS CUSTOMIZATION is a growing field in almost all industries ranging from customizing your own birthday cakes to car chassis to building structures. There is a growing exploration in mass customization in both product design and architecture delivery. Mass customization allows for repetitive elements that have similar production methods and processes but leave room for infinite variations to produce unique customized products rapidly. With architecture, mass customization can be applied to structural systems, wall systems and even fenestrations and openings such as windows and doors.

APPLICATION:

- **Repetitive elements and efficient construction techniques** can enable the completion of the project in 6 weeks.
- **Students and unskilled laborers will mostly be working on the project.** Simplicity in construction techniques and logistics will be crucial for the success.

ESPAÑA LIBRARY

Giancarlo Mazzanti was commissioned by the mayor to design Espana Library, one of the many library-park projects in Medellin, Colombia. In his design, he combined modernist aesthetics with local stones. The library is situated in the middle of Medellin's many barrios becoming a symbol for hope and community identity.

MAPANGUBWE INTERPRATIVE CENTER

Apart from a structural engineering feat and experiment, the Mapangubwe Interpretive Center attempts to use local materials, traditional architecture and symbolism to create a new formal language. The project was made possible by extensive structural engineering modelling with the brick tile vaulting system that created remarkable spaces throughout.

PARADIGM 4: CULTURAL RELEVANCE

Cultural significance can be important in reifying community and national identity in South Africa and Cosmo City. The building has to embody the community and its ideals. There should also be a respect towards tradition and context of local architectures.

However, there should be a balance of function, aesthetics and conscoius use of symbolism. Reductive archtiectural productions during the post-modern era proliferated symbolic architectures that are neither inspiring nor functional. In the case of our project, it is important to not create a "mud-hut" as most would think of traditional architure. The exposed straw-bale structure of Tebogo Home has been criticized by the users and community as a non-permanent structure. Some of the teachers asked when they would be able to get the real building.

Culture can also be found from within where culture of the locale (Cosmo City or even Extension 4) will vary from the region (Johannesburg or South Africa).

APPLICATION:

- **Do not design a "mud-hut"** as a symbol of tradition. South Africa is an emerging economy and Cosmo City is made up of a community that is struggling out of poverty towards a better future. The last thing to do is create a design language that suggests a condition that is inappropriate.

- **Develop a synthesis of form, fuction and culture.**

TSOGA ENVIRONMENTAL CENTER

The new environmental center won the Holcim Sustainable Design Award due to its innovative use of materials. The building employed local gum-poles as their roof structures and in situ reclaimed bricks reducing its grey energy.

EKO PRAWOTO - ARCHITECT

Eko Prawoto is an Indonesian artist and architect who uses local materials and traditional building techniques to develop new forms. He is well known for his creative use of bamboo to create pavillions and homes. His recent project includes a bamboo temple in South Korea.

RURAL STUDIO PROJECTS

Rural Studio was founded by Samuel Mockbee, an architect and educator, working in the black belt of Alabama. Due to limited resources, the projects made use of waste materials creatively in their design. Some material examples are used car windshields as curtain wall system and used tyres with plaster as walls for a chapel.

PARADIGM 5: MATERIAL RESOURCE NETWORKS

"Max Bond once made a powerful observation regarding the social content of design: that the techniques of construction specified by architects affect who builds buildings.(7) This observation speaks volumes. Materials and techniques of construction impact the local building and fabrication industry, economically."
– Yaw Dankwa Osseo Asare

When designing the building, architects should be conscious of the material ecology and resource networks that are connected to the design. From the availability of raw materials, procurement process, production and to construction. The understanding of such flows will allow the architects to make wiser decisions on design and have control over its external implications other than the final product – the architectural object. How can it use the locally available yet limited materials to the fullest potential? How do the process of building, construction and use of materials inform future building productions in the region and help to improve sustainable practices? These are questions that we should be looking at as we design the building.

LOCAL MATERIALS AND TECHNIQUES Cameron Sinclair, the foudner of Architecture for Humanity argued for the case of local materials and techniques as he believes that "unproven concepts can be inappropriate and a distraction to the task at hand." Local materials ensure that local resources remain within the locale thus, reduces the embodied energy of the structure. By using local techniques, local employment can be maximized using existing time-proven skills ad construction techniques.

MATERIAL REUSE AND RECYCLE Reusing materials and using materials that are durable but can be recycled can greatly reduce waste. It also extends and maximizes the lifetime of the material.

APPLICATION:

- **Creative applications of waste and reused materials.**
- **Local materials and techniques should be used as much as possible to close he resource loop**

5.9 SUMMARY OF REQUIREMENTS AND RECOMMENDATIONS

GENERAL BUILDING REQUIREMENTS

ORIENTATION FOR OPTIMAL SOLAR GAIN

- Orient créche 15° off north
- Rectangular shape with long side in the east-west direction
- Allow sun exposure between 8am to 3pm
- Largest windows on the North side
- Windows on the south side for ventilation and light
- Minimize windows on east and west side
- Locate classrooms and offices on the North side as these are programs that have hgihest human occupancy and requires greatest comfort during the day
- Locate bathrooms, kitchen and napping area in the South. Bathrooms do not need to be heated, kitchen is usually hot and needs to be cool and napping area requires a cooler temperature for optimal comfort.

SHADING

- Horizontal shading on the north to control varying solar gain in winter and summer
- Allow more sunlight between april and august (winter period in South Africa)
- Vegetation such as trees around the bilding can also be used for shading
- Ensure controllable interior shading devices

VENTILATION

- High ceilings with vents or clerestory windows above to allow for natural ventilation in hotter days
- Locate lateral ventilation openings on North and South for efficient airflow
- Locate higher exhaust opening on North side. For example, slope roof with higher pitch on the North side
- Do not locate windows directly acroos (i.e. stagger or alternate openings) to encourage air mixing between spaces
- Ensure fully operable windows for passive control of building environment
- Limit Building Depth to a maximum of 15 meters
- Ensure adequate internal ventilation between rooms

DAYLIGHTING

- Locate large, high windows on the North side for ample and ambient daylighting
- Locate smaller windows on North side
- Use light tubes for bathrooms and storage
- Use light color for ceilings, mild to light color for walls and darker floors (concrete will be adequate)
- Locate Blackboard on the South wall to avoid glare
- Do not have windows on only one side of the room to prevent glare
- Use light shelves to increase light penetration into the room

THERMAL MASS

- Locate thermal mass wall on the North side
- Allow direct sunlight in the winter and shade in the summer
- Materials such as earthbag, concrete and bricks are recommended

GENERAL LIGHTING

- Indoor lighting should be located in every room. However, its usage should be minimized.
- Outdoor lighting will be required during night-time for security and also to keep the structure well-lit for the community to enjoy.

DESIGN RECOMMENDATIONS

DESIGN PARADIGMS

0. COMMUNITY EMPOWERMENT AND ENGAGEMENT
1. ANTICIAPTORY DESIGN
2. RESILIENCE
3. MASS CUSTOMIZATION AND EFFECIENT CONSTRUCTION
4. CULTURAL RELEVANCE
5. MATERIAL RESOURCE NETWORKS

DESIGNING FOR PLAY

- SENSORY EXPLORATION
- LARGE MUSCLE DEVELOPMENT
- OSMOSIS
- COMMUNITY
- CONSTRUCTIVENESS
- NARRATION
- OVERALL "SOFTNESS"

CHAPTER 6
APPENDIX

6.1 BUILDING AND CONSTRUCTION CODES OF SOUTH AFRICA – SANS10400

The following content provides a guide to find exact codes and emphasizes specific building codes that pertain to a school structure. The SANS10400 have been reviewed to select individual sections that may have a high potential relationship to the design of the school. However, if more detailed information on a particular specification is required, it is suggested that the SANS10400 is consulted directly.

Structural Design - Part B (pg. 77)
- Design requirements
- Structural material

Dimension – Part C (pg. 79)
- Room requirements
  - o All habitable rooms other than kitchen, scullery or laundry rooms must be 6 m^2 with no linear dimension of less than 2 m.
- Plan dimensions
- Ceiling height

Public Safety – Part D (pg. 83)
- Pedestrian entrances
- Ramps
- Balcony
  - o The edge of any balcony, bridge, flat roof or similar place more than 1 m above the adjacent ground or floor level shall be provided with a balustrade or parapet wall not less than 1 m in height, unless unauthorized access of persons thereto has been excluded by a physical barrier properly erected and maintained.

Site Operations – Part F (pg. 89)
- Protection of public
- Damage to local Authority's property
- Unstable soil conditions
- Preparation of site
- Soil poisoning
- Control of Dust and Noise
- Waste material on site
- Cleaning of site
- Builder's sheds
- Sanitary Facilities

Excavations – Part G (pg. 93)
- General stability requirements
  - o Any excavation more than 3 m deep shall be designed by a professional engineer or other approved competent person
  - o Except where the foundation for any external masonry wall is placed on solid rock, the bottom of the excavation for such a foundation shall not be less than 300 mm below the level of the adjoining finished ground.

Foundations – Part H (pg. 95)
- General Rules
  - o Any such foundation shall be constructed in concrete having a compressive strength of not less than 10 MPa at 28 days, or be mixed In proportions by volume of 1 part of cement , 4 parts of sand and 5 parts of coarse aggregate.
  - o Any continuous strip foundation shall have a thickness of not less than 200mm: Provided that where the foundations laid on solid rock such thickness shall not apply.

Floors – Part J (pg. 97)
- Materials
  - o Any floor supported on ground or on filling shall be constructed of -
    Impervious floor units not less than 40 mm thick and consisting of slate, bricks, natural stone or other approved material; or
    A concrete slab which shall have a compressive strength of not less than 10MPa at 28 days, or be mixed in the proportions by volume of 1 part cement, 4 parts sand and 5 parts coarse aggregate, and the thickness of such slab shall be not less than 75 mm.
  - o Filling material should be applied in well compacted layers not more than 150 mm in thickness
  - o The underside of any floor boards other than those laid on a concrete slab shall be not less than 550 mm above the surface of the ground immediately below such floor boards.
- Fire requirements
- Water requirements
- Under Floor Membrane
  - o Any under-floor membrane shall be not less than 0,25 mm thick and shall be laid on a surface which shall not contain any sharp object which may perforate such membrane.

Walls – Part K (pg. 99)
- Strength and Stability
- Water penetration
- Roof fixing
- Fire requirements
- Height requirements - The span between supporting walls of a timber or metal roof truss, roof rafter or roof beam shall be not more than 10 m and the span between supporting walls of any first floor or roof slab shall be not more than 6 m.
- Load requirements - The dead load of the roof covering material shall be not more than 800 N/m^2 of slope area for roofs other than concrete slabs.
- Structural vs. Non Structural Walls
- Types of Material
- Dimensions
- Framing & columns and piers in walls
- Cavity walls
- Foundation walls - The height of any foundation wall not acting as a retaining wall shall be not more than 1,5m
- Free-standing walls

- Retaining walls of Masonry
- Roof Anchoring
- Water/Rain Penetration
- Damp-Proof Course

Roofs – Part L (pg. 113)
- Fire resistance and combustibility
- Dimension requirements
- The center-to-center spacing of trusses relevant to the roof covering to be applied shall not exceed:
  (a) Sheets, either metal or fiber cement - 1 400 mm
  (b) Concrete tiles, clay tiles or tiles of similar material - 760 mm
  (c) Metal tiles, 1 050 mm
- Any trussed roof shall be provided with approved bracing to prevent buckling of rafters, tie-beams and long web members and to keep trusses upright.
- No member of any truss shall have a length greater than sixty times its least dimension.
- Waterproofing
- Flat roofs requirements

Stairways - Part M (pg. 119)
- Spiral stairways are not permitted for schools
- Dimension requirements
  - o The rise of any step shall not exceed 200mm
  - o Any landing serving two flights in the same straight line shall
    (I) have a length of not less than 900 mm; and
    (II) have a width of not less than that of such flights
  - o No flight of stairs shall have a vertical rise greater than 3 m between landings.
  - o No door shall open onto a stairway unless such door opens onto a landing and the width of such landing shall be not less than that of such door.
- Prevention against Falling
- Fire requirements

Glazing – Part N (pg. 123)

Lighting and Ventilation – Part O (pg. 129)
- Requirements
  - o Any habitable room, bathroom, shower-room and room containing a wc pan or urinal, or any room which is a parking garage shall be provided with: means of lighting and ventilation which will enable such room to be used, without detriment, and, health or safety or causing any nuisance, for the purpose for which It Is designed.
- Approval of artificial ventilation
- Natural lighting
  - o Zones of space
- Natural ventilation

Drainage - Part P (pg. 143)
- Design of drainage installations
- Materials, pipes, fittings, and joints
- Be able to withstand an internal water pressure of 50 kPa and an external water pressure of 30 kPa without leaking.
- Sanitary fixtures
  - o Any sanitary fixture shall be made of impermeable, non-corrosive material, shall have a smooth and readily cleanable surface and shall be so constructed and fitted as to discharge through a trap, into a soil pipe or waste pipe, as the case may be.
  - o The water supply outlet to any waste fixture shall be situated not less than 20mm above the flood-level rim of such fixture: Provided that this requirement shall not apply to any bidet.
  - o The following table provides the number of fixtures for a school
- Standards for WC pans/ Urinals
- Discharges from Washing Areas
  - o Size of discharge pipes
- Drainage systems
  - o Size of drains
  - o Access to drainage systems
- Provision of Traps

For a population of up to —	Number of sanitary fixtures to be installed relative to the population given in Column				
	Males			Females	
	WC pans	Urinals	Washbasins	WC pans	Washbasins
15	1	1	1	2	1
30	1	2	2	3	2
60	2	3	3	5	3
90	3	5	4	7	4
120	3	6	5	9	5
	For a population in excess of 120 add 1 WC pan, 1 urinal and 1 washbasin for every 100 persons			For a population in excess of 120 add 1 WC pan for every 50 persons	For a populatio in excess of 12 add a washbasi for every 100 persons

Non –Water Borne Means of Sanitary Disposal – Part Q (pg. 175)

Stormwater Disposal – Part R (pg. 177)
- Valleys and Gutters
- Access to storm water drains

Facilities for Disabled People – Part S (pg. 179)
- Ramp
- Lifts
- Doors
- Toilet Facilities
-

Fire Protection - Part T (pg. 185)
- Safety distances
- Roof assemblies and coverings
- School requirements
  - o Exit doors - population of any room is not more than 25 persons the width of any exit door shall be not less than 800mm
  - o Any classroom, lecture room or boardroom that has a population of more than 50 persons or any other room that has a population of more than 25 persons shall have not less than two exit doors, and such doors –
    (I) shall open in the direction of travel along the escape route; and

(II) shall have an aggregate width of not less than the required width for an escape route for such population, as contemplated in rule TT21:

- o Provided that where such population is more than 240 persons three or more exit doors, as may be required, shall be installed. Also the school should have an exit door that shall open in the direction of travel along the escape route: Provided that in any occupancy classified A3 where the population of the room is less than 50 persons, such door may open into such room.
- o Any feeder route in any basement or school buildings with more than 50 people shall be provided with emergency lighting as contemplated in subrule
- o Portable extinguishers – 1 per 200 m2

The type of fire extinguisher shall have a capacity or mass rating as the following:
(i) Water type 9 £
(ii) Foam type 9 £
(iii) Carbon dioxide type 4,5 kg
(iv) Dry chemical type 4,5 kg
(v) Halogenated hydrocarbon type 2,5 kg

- Ventilation of stairways in an emergency route
- Openings in floors
- External stairways and passages
- Air Conditioning and Ventilation Systems
- Seating Arrangements in Auditoria or Halls and on Grandstands
- Non-combustible building materials

Space Heating – Part V (pg. 241)
- Chimneys
- Flue Pipes

Fire Installation – Part W (pg. 245)
- Communication pipe
- Water meter
- Isolating valves
- Fire Installations

Energy consumption - SANS 204
- Maximum energy demand and maximum energy consumption per building classification
- 12hrs per day /5days per week
- Maximum energy consumption for its climatic zone - 400 kWh/(m2•a)b
- Light power

Depending upon occupancy and activity, the minimum lighting levels shall be determined in accordance with the requirements of SANS 10114-1.
10 Power W/m² - 25 Energy kWh/(m²•a) - 100 Lux

- Minimum Space Occupancy Allowed in a School - 1 person/5 m²

Fire Stability - SANS 204
- Structural components
  - o Minutes of stability – 30mins for single story building, 30mins for double story building, 90 mins for 3-10 story building
  - o The use of unprotected steel in the structural system of all single story and certain double story buildings is permitted in spite of the fact that in many cases such structural members would not comply with the requirements of Table 5.
  - o The practice is regarded as safe for all practical cases that are likely to occur in single story construction but the possible consequences of early distortion or collapse should be considered in the design of two story buildings in order to be certain that escape routes will be able to serve the purpose for the required period.
  - o Particular care needs to be exercised where thin sections are used or in "space-frame" type structures.