

SUSTAINABILITY PRACTICE IN ARCHITECTURE: from Assessment to Design

1st HOLCIM FORUM FOR SUSTAINABLE CONSTRUCTION - SEPTEMBER 2004

Conventional Development Project Cycle

In the context of this poster, 'conventional' refers to the linear approach applied to traditional project developments in the built environment. Simply put, a piece of land is acquired which is intended for development in order to increase wealth. The development team is selected and briefed accordingly. Information flows from the architect to the engineers and the co-ordination process involves minor adjustments to accommodate services requirements. User needs are considered in a general manner where buildings are developed without a specific tenant in mind. Upon completion, the building is handed over to the owner, not necessarily the occupant of the building. In this approach, the project goal is singular and straight-forward: address the economic bottom-line - develop in order to make a monetary profit.

In the documentary 'The Corporation', the flaws of this 'profit-for-profit' viewpoint is systematically argued and the issues surrounding the sustainability debate brought into context. The negative effects of this narrow-minded approach have severe impacts on the future of all life on the planet; social and ecological aspects are being compromised and need to be addressed in order to ensure sustained growth on our finite planet.

Objective of the Poster

The purpose of the poster is to demonstrate regional applications of assessment and design decision-making tools in sustainable construction as solutions to various basic needs in reference to the five key sustainability targets of quantum change, ethics, ecology, economics and context.

Choice of Good Practice Case Studies

In the context of the 'conventional' development project cycle and the subsequent negative impacts thereof, the two case study projects (Lynedoch Eco-Village and the Greenhouse People's Environment Centre) have been chosen as evidence of the systematic applications of sustainability targets towards informed design / construction decision-making through all the project's cycles.

LYNEDOCH ECO-VILLAGE

Sper Wine Estate, Stellenbosch
Western Cape Province, SOUTH AFRICA

BACKGROUND:

Project Description

The eco-village is located on a 5 hectare piece of land to the west of the Sper Wine Estate. The old agricultural shed / dance hall was refurbished and converted to house a combination of existing and new amenities for the community. There were new premises for the existing primary school, a multi-purpose hall, workshops, library, computer centre, not the Sustainability Institute ('Quantum').

A facilities aimed comprising 150 houses forms part of the land return programme, enabling farm workers to become land owners ('Ethical').

Development Team:

- Client: Lynedoch Development (Group) / Owners
- Architect: Environmental Consultants / Architects: ARD Design Architects, Planners, Urban Design
- Consulting Structural Engineers, Mechanical & Electrical Engineers, Agronomists, Environmental Engineers, and Agronomists
- Mechanical and Electrical Engineers, Agronomists, Environmental Engineers, and Agronomists
- Quantity Surveyors: BTM
- Project Manager: P&S
- Plumbers: P&S
- Electrical: P&S
- Structural: P&S
- Interior Design: P&S
- Site Preparation: P&S
- Construction: P&S

DESIGN:

Brief, Concept + Strategies

"Sper's vision is to create a sustainable settlement which caters for heritage and culture, provides wealth for all stakeholders, meets social and economic needs, and provides the infrastructure to encourage new community members to move their lives to the area." (p. 4)

In defining a long-term vision, all stakeholders contributing to the Lynedoch development subscribe to the sustainability values contained in the development framework. The project set specific strategic objectives, which are:

- expansion of agricultural output
- wealth creation, economic development
- social development
- heritage and cultural development
- ecological sustainability

The development team furthermore defined an 'ideal eco-village' - "an environment where people can be in charge of their lives and they (they) reflect and are a positive of 'locally' culture, economic and ecological viability." (p. 4)

"In this development, all stakeholders facilitated the process of preparing sustainability targets to address in the design process. These aims also clarified the challenges and constraints that exist. (p. 4)

- define a vision that inspires people to action
- ensure existing construction processes with sustainability practice
- structure R&D, sustainability issues to ensure integration and implementation viability ('Economics')

As this process and photos illustrate, incorporating sustainability ideals requires an entirely different approach to the 'conventional' development process. Much more time is spent initially on understanding the context of SD requirements.

APPLICATION:

Construction, Operation - the Future

The project team managed to adapt the original building program to respond to the local climate ('Context'). Glazed rooflights allow natural light into the central space of the hall and the natural insulation reflects summer shading and polyester blanket thermal action was introduced into the building through wind-catching ventilation ducts (cool air) in the SW side and 'solar chimney' extraction ducts on the opposite NE side ('Ecological'). The extended greening of the roof on the southeast facing additional shade with deciduous planting allowing summer shade, water warmth and light. Hot/cold air from the rock store pass via ducting under the pre-cast hollow concrete floor in the classrooms. 'Green roofs' - the narrow as seasonal requirements demand. Wherever possible, appropriate and environment-friendly materials were selected. The internal clay (excavated from site) block walls of the classrooms and the concrete blocks used externally were all made on site.

The use of the Sustainability Institute as an educational facility and learning centre for students in ecology, community and sport.

HIGH



Development Team

- determine all the stakeholders (critical) involved in the various phases of the project to ensure a participatory process
- client, developer, sponsor
- building users (occupants / tenants)
- engineers, architects, interior designers
- project manager, contractor and sub-contractors
- specialist consultants (surveyors, film planning, electrical, mechanical, structural)
- facilities / operations manager

Concept

- determine ecological, social + economic design aspects specific to the project through site analysis ('Context')
- develop guidelines on how these goals can be achieved, select appropriate indicators
- Through foregoing briefing + target setting steps, establish a clear picture of relevant SD pursuits
- explore design alternatives to generate multi-faceted solutions for project-specific problems
- address contextual problems to ensure that all priority needs are met
- benchmarking refer 'best practice' scenarios

Design Development

- synthesising design conceptions to targets set earlier to ensure compliance with project-specific goals ('Quantum')
- employ an integrated design process (IDP), consult stakeholders to address all requirements
- consider SD objectives to refine strategies (p. 1)
- ecological (environmental, natural, social + diverse needs)
- economic (employment, wealth, social + diverse needs)
- social (community, health, social + diverse needs)
- determine systems
- trade-offs

Construction

- communicate sustainability targets to construction team and specify same in technical drawings and schedules
- monitor construction activity through Environmental Management Plans (EIA) reform and brief Main Contractor and their construction teams re sustainable site management: e.g. water-efficiency, waste generation, recycling, etc. ('Ecological') refer 'CSR: Construction Monitoring Indicators and Guidelines' (p. 10)

Handover

- educate future users and tenants of the building about 'sustainability devices' employed (e.g. passive cooling + natural ventilation)
- in addition to 'conventional' hand-over documentation, prepare user manuals that relate to 'sustainable' equipment and installations in the building that would facilitate the effective operation of the new building ('Economic')
- tailor-made building brief documents to ensure differences in 'conventional' vs. 'sustainable'
- communicate how user needs were addressed as originally determined in target setting + briefing stages

Operation

- log and report on the performance of the building in operation
- monitor water, energy + waste efficiency
- maintain operating systems to assure effectiveness of applications ('Ecological') + economic
- further to efficiency assessments, assess whether SD decisions made at design stages contributed to an improved built environment
- CSR: Green Buildings for Africa Programme (p. 10) facilitates improvements of the operational performance of existing buildings

De-construction

- assess, refresh or reuse
- determine the life-cycle options of entire building or its various components
- consider 'brave/brave' and 'brave/brave' consequences in the sustainability debate
- reference the operation manuals at the end of a building's useful life for de-construction of components ('Ecological')
- review these final outcomes in lieu of the targets set in the concept phase of the development

Design Decision-Making Tools ('inputs')

In the South African context, where many 'conventional' development practices persist, the question remains how the outputs from assessments can be transformed to provide more effective inputs for application in design processes.

The adjacent tools table (although still in development) by the CSIR (*) indicates the need of modeling tools available to facilitate SD decisions.

Another way of addressing the problem is through the education of mid-career professionals in the construction industry. The CSIR, with the University of Pretoria and the Pretoria Institute for Architecture presented a 'Design for Sustainability' workshop in Aug./Sept. 2003 for architects to facilitate a transition to sustainable practices.

Architects could initially be overwhelmed by the wealth of information and thus struggle to prioritise SD goals.

Assessment Tools ('outputs')

Cole, Howard et al.' note, "... building environmental assessment responds to a tension between the desire for objectively, scientifically rigorous and stringent performance criteria with the desire for practical, transparent, simple to understand criteria that ask industry to respond to manageable step changes in practice."

The outputs of assessment tools applied, communicate which aspects of the project design need to be re-evaluated in order to reach the sustainability targets set at the briefing and concept stages. Although these results present valuable indicators of sustainability priorities, consultants continually face the challenge of juggling **sustainability** and **trade-offs** in order to propose alternatives of viable sustainability solutions to best address the design problem at hand.

Acquisition of these skills is one of the major challenges practicing architects are faced with today.



LOW

Conventional Project Cycle: isolated decision-making process; building cycle runs from Brief to Handover stages only; minimal stakeholder consultation;

Sustainable Building Life - Cycle: 'effect' scale indicating level of sustainability success outcomes at various development stages -

Case Studies: Description and Location

LYNEDOCH ECO-VILLAGE:

The eco-village is a semi-urban settlement situated in the Sper Wine Estate in Stellenbosch, in the Western Cape Province of South Africa. The village consists of a community resource centre, primary school with a residential development (demarcation project erected for monitoring) and construction of further houses for farm laborers to commence start in May 2005. The village also houses the Sustainability Institute.



GREENHOUSE PEOPLE'S ENVIRONMENT CENTRE:

This environment centre is an urban development that is situated in a recycled building (originally the petrol shed of the 100 year old conservancy) in Joubert Park, in the centre of Johannesburg, Gauteng Province, South Africa. The centre consists of the CSIR offices (in operational) and further phases provide the development of a resource centre (SA's first commercial earth building), refurbishment of the conservancy and a recycling centre (all scheduled to start April / May 2005).



GREENHOUSE PROJECT

Joubert Park, Johannesburg
Gauteng Province, SOUTH AFRICA

BACKGROUND: Project Description

The environmental centre is located in the north-west corner of a public park in the CBD of Johannesburg. The 100-year old conservancy forms part of the centre and the original petrol shed was refurbished and converted ('Ecological') to house the CSIR offices.

- The project has 2 main focus areas
- providing a working demonstration of sustainable ways to build ('Quantum')
- supporting community - based organizations working to improve the urban environment ('Economic')
- dissemination of information enabling individuals to sustainably improve the quality of their life ('Ethical')

Development Team:

- Client / Developer: GREENHOUSE PROJECT (Greenhouse Conservancy / SANCOED Greenhouse Conservancy / SANCOED Greenhouse Conservancy / SANCOED Greenhouse Conservancy)
- Architects: Environmental Consultants / Architects: ARD Design Architects, Planners, Urban Design
- Consulting Structural Engineers, Mechanical & Electrical Engineers, Agronomists, Environmental Engineers, and Agronomists
- Mechanical and Electrical Engineers, Agronomists, Environmental Engineers, and Agronomists
- Quantity Surveyors: BTM
- Project Manager: P&S
- Plumbers: P&S
- Electrical: P&S
- Structural: P&S
- Interior Design: P&S
- Site Preparation: P&S
- Construction: P&S

DESIGN: Brief, Concept + Strategies

The aims of the Greenhouse Project is to contribute to transforming Johannesburg into a 'greener' city by empowering the people of Johannesburg to create and maintain the city as ecologically, socially and economically sustainable urban 'GSP Annual Report p. 5"

"GSP gave formal briefs to interested parties, and when the design architects were selected, a workshop was held with 8 'green' specialists to brainstorm the project's SD goals. Thereafter inputs from other stakeholders (NGOs, the community) ('Ethical') were received and also incorporated into the overall master plan. The architect's design concept for the project relate to that of a 'colage': a synthesis of process, participation, renewable growth and integration. [...] We share the project in success" (p. 13). The 3 PROFILES sustainability approach was simple re-generate, re-use, reduce.

A 'green' specification document was prepared for the contractor and outlined measures for sustainability, SD requirements in addition to these environmental awareness workshops were held to educate workers on environmental protection during construction.

The nature of the sustainability interventions selected that the architects were 2003 'inspired' than usual in the construction process. Many lessons have been learnt and the project stands as a proud symbol ('Context') of rising to the challenge of rejecting 'conventional' approaches in favor of sustainability targets set that are in line with the centre's vision.

APPLICATION: Construction, Operation - the Future

In line with the original 'colage' concept of the design, the combination and juxtaposition of different service-related systems add to the specific character of the project ('Context'). The development was influenced by sustainability SD targets, but the 'ecological' priorities consideration was given to the relationships between infrastructure, buildings and plants ('Ecological'). Quite a number of 'green' technologies have been applied:

- hot/cold air store (water-warm in future) to recycle properties
- Extra conservation strategies:
- hot/cold air store
- solar water heater to warm water
- solar conservation strategies (insulation)
- extra conservation (water)
- low flow water system
- grey top in garden
- separate harvesting

Future developments involve the renovation of the historic Victorian conservancy, construction of an internet recycling centre (as yet to follow), new CSIR offices (a true 'earth' building) ('Ecological') where the old offices conducted its resource training centres and last, a 3-storey commercial building is envisaged enjoying high-tech environmental solutions.