# The Green Building Handbook South Africa

## The Essential Guide

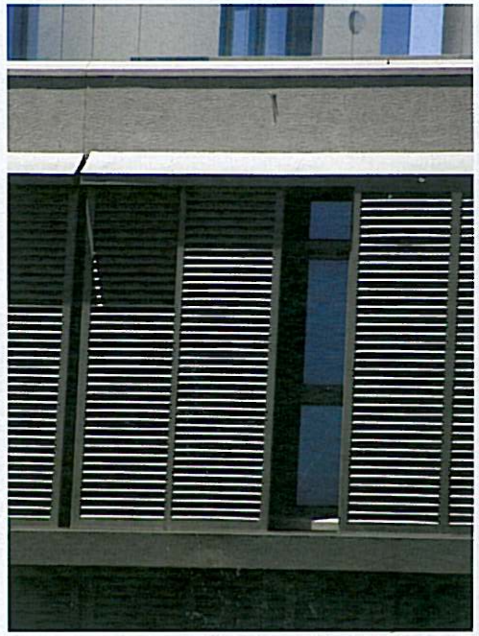
### Volume 2

9780620452403

www.greenbuilding.co.za

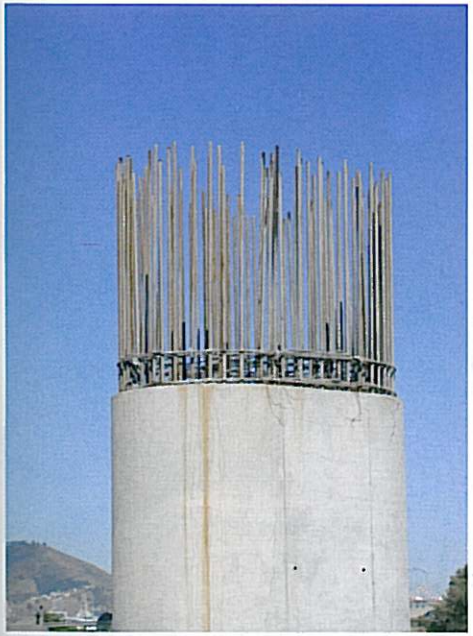
# Contents





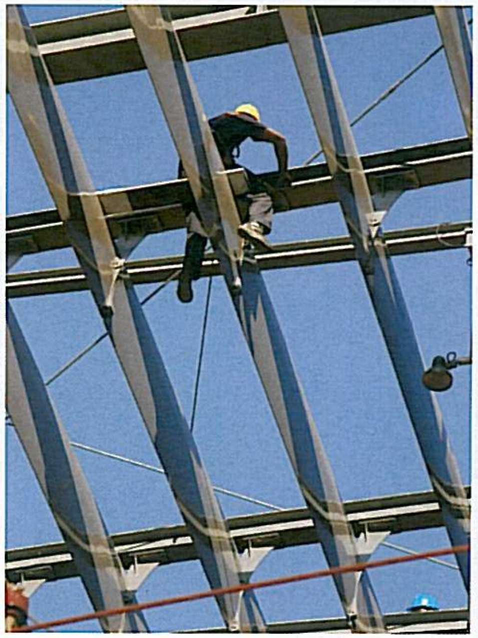
# Contents



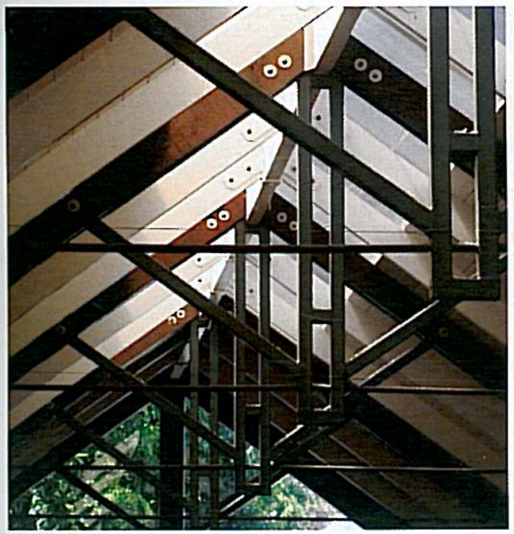
# Contents





# Contents









# ADVANCED WALLING SYSTEMS

Dr Andre de Villiers
CSIR
Built Environment

## INTRODUCTION

Traditionally walls and roofs provided shelter from the outdoor environment, while maintaining an indoor environment conducive to life support and limited comfort. Shelters were designed within and against the local environment – climate, rain, wind and safety, using available materials for protection. With the gradual settlement of nomadic populations, traditional settlement building developed with experience and continued exposure to the environment giving rise to appropriate vernacular architectures. These earned the admiration and respect of a modern and contemporary world for their simplicity, appropriateness, comfort and beauty within their environment. Following the industrial revolution and the growth in dependence on fossil fuels and industrial activity rendering carbon emissions, the tables are turned towards a dependence on the environment and nature for protection against the ills of modern society's industrial processes and built creations. The external wall is once again the interface but not merely for protection against the environment. Now, it is to harness and utilise the forces of nature, wind, rain, heat and cold, plants and trees to clean and cool polluted air and provide power, water and moderate temperatures for people to live and work in comfort.

The external facade is an integral skin to the fully functioning body of the building. It provides both views and privacy to its people, contains and conditions the internal environment. It is the most openly experienced element of the building: a building is largely judged by its facade. It is punctured by services to and from the building and is sometimes the carrier of services and fittings for use in the building. It has a distinctive functional role but, for this article, an eco-environmental role that has distinctive sustainability implications as well. The external skin is a critical subsystem of the complex building system of components, connections and people working together as a potentially self sustaining machine. All work together for the improvement, growth and development of the system as a whole – a long term healthy life cycle is being planned, within which each component considered as to its suitability and role in this cycle.

The question addressed by this article is: How should advanced walling systems, as defined and discussed above, be planned, designed, built, refurbished, and end their useful lives, to classify as smart, sustainable, green or eco-building environments?

The objective is to achieve external walling that:

| | |
|---|---|
| creates comfortable buildings | less dependant on municipal services |
| performs better | renders minimal or no building waste |
| is durable | easily extendable |
| quick to build | demountable |
| readily alterable | re-usable |

To answer the question and move towards achieving the objective, we consider the commonly misused concept "sustainable" but in this article referred to as "smart sustainable eco-building". It emerges from the practical application of the 9 general principles of sustainability set out in ISO 15392:2008, for all phases of a project as proposed by Chevalier & Lebert (2009) in a CIB working group project. Their report is titled: The Final Vision (sic. for sustainable smart eco-building). It suggests the integration of two frameworks of thought:

1. the decision-making phases of a project in terms of its full life-cycle; and
2. smart sustainable eco-applications as embodied in the nine general principles of sustainability, applied to each stage.

The life cycle stages of building projects are:

- planning, design, construction, operation, renovation, and end of life.

For each of these stages the 9 general principles applied are:

- continual improvement, equity, global thinking and local action, holistic approach, involvement of interested parties, long term consideration, precaution and risk, responsibility and transparency.

Chevalier and Lebert (2009) follow this framework of thinking to determine their final vision statement for Smart Sustainable Eco-Buildings. From their 10 key considerations, only the first one what is it… is considered in this article since it involves the overall planning stage (underlined above) and is considered in terms of all 9 ISO sustainability principles. Of the 9, only global thinking, local action, holistic approach and long term consideration, are considered here as being relevant to walling systems. One can reasonably argue that the full life cycle stages of a project (in this case the walling system), considered in terms of the 9 ISO general principles would lead to sustainable eco-smart advanced walling systems that must satisfy social, environmental and economic concerns.

Long term consideration, seen as the life cycle concept from cradle to grave of materials, considering the total embodied energy of materials, components and finishes to bring them into being and use them in building, is crucial to our thinking of materials and their use. Preference should be given to low energy materials or, when higher energy materials such as aluminium are used, then the potential for re-use of the material for similar or other applications and repeated re-use, must be considered. In general, the lighter or stronger the material, the better. Materials must also be chosen for their





optimum utilisation. Under utilisation is wastage. Other considerations such as off-gassing, toxicity and the additional energy required for re-forming the material for re-use, are factors that must be taken into account.

Planning is the phase during which the general direction of the project in terms of sustainable thinking as in ISO 15392:2008 is established. External walling in particular requires a Holistic approach. The nature and extent of a project is determined in the context of its environment; furthermore, community and client needs are determined at this stage. The site and its immediate surrounds are surveyed; traffic and pedestrian movement is studied; points of access to the site and building are established; etc. The building, as a conceptual entity in itself, begins to take shape as growing out of this holistic consideration of its context so that it fits into the environment, as though it were an integral part of it. The walling itself is the building's external skin to this environment. It incorporates openings for entrance and exit; windows for views; and gardens in the facade, acknowledging nature, cleaning the air and cooling the building and its external spaces or balconies with fresh air for relaxation and view. The nature of the project in its environment is being set and the architectural language of the building comprising its content and external face to its environment is taking shape in the minds of the designers.

The external walling not only looks outward but is integrally part of the building as subsystem to the building system as a whole. General sustainability-related planning considerations would be:

- Integration with relevant local buildings, town planning or environmental planning schemes and infrastructure. The facade is often the dominant design language of the building. It needs to indicate integration and openness to the community environment.
- Consideration of SANS 204-1, 2 and 3 of 2008 concerning energy efficiency in buildings for general requirements, natural environmental control requirements and artificial ventilation and air conditioning requirements respectively. In part 1 clauses 4.2, 4.7, 4.8 and 4.9, refer to walling and the external building envelope. In parts 2 and 3, Clauses 4.5.2 and 4.6.1, 2, and 3 concern walling or envelope of a building.
- Sufficient insulation to maintain indoor environment comfort levels.
- The nature of fixing and fitting of the walling system to the building in a sustainable manner that is deconstructable for end-of-life re-use of components.
- Material selections that are low energy and fit for their purpose such as fixing, fittings and finishes
- Materials to be selected for lasting the full life cycle of the building and for potential re-use afterwards or for reconditioning or replacing as part of planned renovation in its life cycle.
- External finishes that require no maintenance, low maintenance or are self cleaning.
- Occupant needs in terms of natural light openings in the wall and visual contact with the outside.
- The need for integration with mechanical indoor air handling systems, e.g. for outside air intake, preferably from or through a planted wall or provision for a planted garden in the facade for oxygenated and naturally pre-cooled air intake. This could be at ground level or from balconies





in the facade or at garden recesses in the building facade such as the sky courts of Yeang in his Menera Mesiniaga building, Kuala Lumpur, and Menara UMNO, Penang (Steele, 2005).

- Consideration of passive energy design in preference to energy-intensive artificially-controlled environments. Where such are needed, energy demand should be reduced by natural means and passive strategies should be integrated into the system.
- Whether passive or artificial, a sealed airtight building is recommended to reduce unnecessary burden on heating and cooling and hence to save on cost. This applies to wall openings and fittings, such as windows and doors. It also relates to the interfaces or connections of wall systems with other building sub-systems or components such as floors and roofs.
- Renewable energy use in preference to non- renewable energy.
- Solar panels for water heating.
- Photovoltaic panels or wind turbines or mills for electricity generation.

Such considerations as part of the facades of best practice buildings are becoming common practice by many of the world's leading architects. Creativity and ingenuity are needed to utilise the forces of nature to sustain the building and its immediate environment, rather than merely protecting and sheltering people from the elements. Tall buildings, with their exposure to the sun, wind and rain offer potential for receiving, storing and using water to reduce urban run-off and municipal handling problems. Exposure to the sun presents an opportunity for solar panels as window shading, screens and facing material to the building. Wind exposure on tall buildings is generally a problem to the stability of the building. Perforation or careful planning of the skin to the prevailing wind directions could channel wind through the structure or deflect or capture the wind, while using turbines to harness its power for electricity.

Walling systems should be designed to take advantage of the site, its exposure or protection from wind, solar gain or and wind direction. Each wall, north, south, east and west has a different function to perform in terms of sun, wind, rain, corrosive exposure etc. North sun and light is generally best served by horizontal shields while the low angle east and west sun is better shielded by vertical elements or shades.

Such wall design to passively deal with particular comfort, light and sound conditions to which it is exposed brings meaning (semiology) to the building as an intervention in nature that works with nature to naturally bring functional advantage, comfort and value to the building in its specific environment.

## CONCLUSION

Construction and building developments need not negatively impact the environment, as is currently the case. Comprehensive, holistically-planned walling systems on the other hand, can positively impact the environment if planned, in a smart, sustainable eco manner as part of the local community environment. A structured way of thinking, as described in this article, has considerable advantage in aiding planners to comprehensively engage with their environment in developing a smart sustainable eco-building and environment as integral part of their environment. These concepts and considerations apply to new building and the renovation or remodelling of existing developments.

**REFERENCES**


Chevalier J. and Lebert A., 2009. The Final Vision CIB News Article of the Smart-ECO, Sustainable Smart and Eco-Buildings in the EU Work Group. November 2009. CIB.

SANS204-1:2008 South African National Standard. Energy efficiency in buildings Part 1: General requirements. Pretoria: SABS

SANS204-2:2008 South African National Standard. Energy efficiency in buildings Part 2: The application of the energy efficiency requirements for buildings with natural environmental control. Pretoria: SABS

SANS204-3:2008 South African National Standard. Energy efficiency in buildings Part 3: The application of the energy efficiency requirements for buildings with artificial ventilation or air conditioning. Pretoria: SABS

Steel, J., 2005. Ecological Architecture, A critical history. London: Thames and Hudson

(CIB News Article. Group: Smart-ECO, Sustainable Smart, Eco-Buildings in the EU. Sicth Framework Progamme, Priority 6.1.3.1.2 Eco-Buildings, Nov 2009. by Jean-Luc Chevalier and Alexandra Lebert