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TECHNICAL NOTE #5

Sustainability

In Context of Clay Brick Masonry Walling

Prepared by:
Howard Harris
Structatherm Projects

www.claybrick.org.za

Title

A review of the current themes of sustainability in terms of masonry walling.

Status

This Technical Note is provided as an information sheet for appending to the ClayBrick.org website, and serves as a summary of other significant works that contribute towards the case of masonry walling in the advance of Sustainability in Buildings.

Scope

A review of articles published in 'Sustainability Conferences' and developed for the Clay Brick Association.

Methodology

The seminal publications and events around the principles of Sustainable Development are reviewed. Articles published during the proceedings of SB10 and SB11, and earlier writings by the CBA on the topic of Sustainability and Life Cycle Assessments were reviewed for items of relevance to the Clay Brick Association of South Africa. The potential for new standards that contribute toward achieving greater sustainability in buildings in the RSA is examined.

Outline

- Sustainability Principles
- Three Pillars of Sustainability
- Measurement of Sustainability
- International Systems and Standards
- European and National Standards
- Indices of Sustainability in Buildings
- Conclusions

Sustainability Principles

The Brundtland Report issued by the World Commission on Environment & Development of 1983 (named after the Chairman Gro Harlem Brundtland) set out the following fundamental definition of Sustainability:

'Sustainable Development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs.'

Conflict between the various competing goals involves the simultaneous pursuit of economic prosperity, environmental quality and social equity, which today is known as the three dimensions of sustainability, or 'the triple bottom line.

The 'destination' of sustainability is a set of wishful characteristics of a future system.

The Agenda 21 item of the World Conference of Nations in Rio de Janeiro of 1992:

- Clearly identified information, integration and participation as key building blocks to help countries achieve broader public participation in decision-making, as a fundamental prerequisite for achieving sustainable development.

- Forms the basis of the Principles to be followed by the process of the annual Conference of the Parties (COP), of which COP17 was held in Durban in 2011. Key international agreements, such as the Kyoto Protocol that binds certain countries to reduce their Greenhouse Gas emissions are the product of this process.

Environmental Sustainability

Environmental sustainability is the process of making sure current processes of interaction with the environment are pursued with the idea of keeping the environment as pristine as naturally possible, based on an ideal-seeking behaviour.

An "unsustainable situation" occurs when natural capital (the sum total of nature's resources) is used up faster than it can be replenished. Sustainability requires that human activity only use nature's resources at a rate at which they can be replenished naturally. Inherently the concept of sustainable development is intertwined with the concept of carrying capacity, as the long-term result of environmental degradation is an inability to sustain human life.

Economic Sustainability

From the above it is clear why Economists view the economy and the environment as a single interlinked system. A unified valuation methodology is in the process of being defined, but no single index or measurement yet provides a simple measure of progress.

Intergenerational equity can be incorporated into this approach, as for the economic valuations of climate change economics. This rules out discrimination against future generations and allows for the possibility of renewable alternatives to petro-chemicals and other non-renewable resources.

Social Sustainability

Efficient policies are compatible with increasing human welfare, eventually reaching a golden-rule steady state. Poverty eradication, synonymously with job creation, has in many under-developed countries been seen as a superior ideal, however the eight Millennium Development Goals of the United Nations Development Programme includes Goal 7: Ensure environmental sustainability.

Measurement of Sustainability

Broadly defined, the sustainable development agenda enjoins current generations to take a systems approach to growth and development, and to manage natural, produced, and social capital for the welfare of their own and future generations.

The measurement and monitoring of this multifaceted agenda is problematic. Different organisations have tried to measure and monitor the proximity to what they consider sustainability by implementing what has been called; sustainability metrics and indices. Even at Project level there is a lack of uniformity of measurement.

In 2007, a report for the U.S. Environmental Protection Agency stated, “While much discussion and effort has gone into sustainability indicators, none of the resulting systems clearly tells us whether our society is sustainable. At best, they can tell us that we are heading in the wrong direction, or that our current activities are not sustainable. More often, they simply draw our attention to the existence of problems, doing little to tell us the origin of those problems and nothing to tell us how to solve them.”

Nevertheless, a majority of authors assume that a set of well-defined and harmonised indicators is the only way to make sustainability tangible. Those indicators are expected to be identified and adjusted through empirical observations and trial and error. Commonly used terms, measures and reporting systems are Carbon Footprint (CO_2), Global Warming Potential (GWP), Ozone Depletion Potential (ODP), Material Input per unit of Service (MIPS, Green Building Ratings Systems, and the Global Reporting Initiative - all contribute to achieving some comparability.

Measurement of Sustainability, cont'd

The most common critiques of such measurements are related to issues like data quality, assumptions, comparability, objective function and the necessary resources. The monetisation (dollarisation) of carbon and pollution impacts in terms of an integral, long-term cost-benefit measure and monitoring tool for the sustainability of every project, activity or enterprise would seem to be one solution, which might meet the objective.

The achievement of the above measurement objective with International or even nationally relevant measures is surely attainable if globally relevant assumptions can be agreed upon. Pollution by way of CO_2 emissions is, for example, a global phenomenon caused by regional or even local problems. This concept aims to be a practical guideline towards sustainable development following the principle of conservation and increment of value, rather than restricting the consumption of resources.

International Standards of Sustainability

The tenets of sustainable development outlined above are the inter-linkages, inter-generational equity, and dynamic efficiency. These requisites are established by *ISO 15392: Sustainability in Building Construction – General Principles:*

1. Continual improvement
2. Equity
3. Global thinking and local action
4. Holistic approach
5. Responsibility
6. Involvement of interested parties
7. Long-term consideration
8. Precaution and risk
9. Transparency

ISO 15392: Sustainability in Building Construction – General Principles

ISO 15392 is based on the concept of sustainable development, as it applies to buildings and other construction works, from "cradle to grave". Over their life cycle, construction works absorb considerable resources and contribute to the transformation of the environment. As a result, they can have considerable economic consequences and impacts on both the environment and human health.

International Standards of Sustainability, cont'd

Other Standards serving the measurement of Sustainability are:

ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
ISO/TS 21931-1:2006	Sustainability in building construction - Framework for methods of assessment for environmental performance of construction works - Part 1: Buildings
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
ISO/TS 21929-1:2006	Sustainability in building construction - Sustainability indicators - Part1: Framework for development of indicators for buildings

European and National Systems

In Japan, the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) is in place, although it is presently voluntary.

In Europe, the EU Directive on Energy Performance in Building (Dir.2007/91/EC), and the EU Strategy for Sustainable development (EU-SSD) have given rise to a suite of horisontal standards being prepared by CEN/TC 350.

These standards are being developed to assess the effects on sustainability of different design and specification solutions, in terms of environmental, social and economic performance. They will be able to be used as part of a reiterative design process to achieve the optimum sustainable solution.

Standards are being prepared within the framework of Table 8.1 as below:

European and National Systems, cont'd

Table 8.1: Framework for Standards being developed

Framework level	**prEN 15643-1 Sustainability Assessment of Buildings - General Framework** *(TG)*				
	prEN 15643-2 Framework for Environmental Performance *(TG)*	**prEN 15643-3 Framework for Social Performance** *(WG5)*	**prEN 15643-4 Framework for Economic Performance** *(WG4)*	*Technical Characteristics*	*Functionality*
	Framework for Methods of Assessment of Environmental Performance (ISO/FDIS 21931-1)			***Service Life Planning – General Principles (ISO 15686-1)***	
Building level	**prEN 15978 Assess. of Environ. Performance** *(WG1)*	**WI 015 Assessment of Social Performance** *(WG5)*	**Assessment of Economic Performance** *(WG4)*	***CEN Standards on Energy Performance of Buildings Directive (EPBD)***	
	WI 003 Use of EPDs *(WG1)*		***Life Cycle Costing (ISO 15686-5)***		
Product level	**prEN 15804 Environmental Product Declarations** *(WG3)*	***(see Note below)***	***(see Note below)***	***Service Life Prediction (ISO 15686-2), Feedback from Practice (ISO 15686-7), Reference Service Life (ISO 15686-8)***	
	EPD of Build. Products (ISO 21930)	***Note***: At present, technical information related to some aspects of social and economic performance are included under the provisions of prEN 15804 to form part of EPD			
	prEN 15942 Comm. Form. B-to-B *(WG3)*				
	prCEN/TR 15941				

Standards produced by CEN (European) TC 350

CEN TC350 standards for the environmental, social and economic assessment of buildings (in general 'works' define the aspects and impact indicators for the quantification of a building's sustainability.

Standards produced by CEN (European) TC 350, cont'd

Sustainability of Construction Works

Title :		Date of Availability
EN15643-1	Assessment of Buildings - Part 1: General Framework	2010-10-30
EN15643-2	Assessment of Buildings - Part 2: Framework for the Assessment of Environmental Performance	2010-10-30
EN15978	Assessment of the environmental performance of buildings - Calculation Method	2011-05-15
-	Assessment of the environmental performance of buildings - Use of environmental information from environmental product declarations (EPD)	?
EN15804	Environmental product declarations - Core Product Category Rules	2010-01-31
EN15942	Environmental product declarations - Communication Format: Business to Business	2011-01-20
-	Environmental product declarations - Communication Format: Business to Consumer	?
TR15941	Assessment of Buildings - Methodology for selection and use of generic data	2009-08-28
EN15643-3	Assessment of Buildings - Part 3: Framework for the assessment of social performance	2011-06-30
EN15643-4	Assessment of Buildings - Part 4: Framework for the assessment of economic performance	2011-06-30

Standards produced by CEN (European) TC 350, cont'd

Modular Information Supply

Key information will routinely be made available by suppliers on an Environmental Performance Declaration (EPD)

1. A building assessment requires data on products, materials, processes and services, as well as specifications of scenarios (exposure, use, lifetime, maintenance, repair, replacements and end-of-life). In the chain of supply of information pertaining to the building, the environmental, social and economic data is based on the inputs and outputs of resources, energy and emissions.

2. The information flow (from the level of the product to the building level) in CEN TC350 is structured and schematised in corresponding information modules. Each information module contains information on aspects, indicators, scenarios and, where relevant, other technical information necessary for assessing the three dimensions of sustainability.

3. At the building level, each information module in the building's life cycle stages and its sub-stages requires information supplied from products, processes, scenarios and other relevant technical information

4. The assessment of the social and economic performance of a building is parallel to the environmental assessment, and follows the same life cycle stages within the corresponding boundaries.

   Note: For the assessment of the economic performance of buildings (acc prEN15643-4) the life cycle stage "planning" is added to the "physical material flow" based assessments of the environmental and social performance.

5. All aspects and impacts are captured where they occur in the building's life cycle stages and sub-stages. For example, waste from the brick production process is allocated to 'production, waste generated during transport of the bricks to 'transport', brick-waste generated in the bricklaying stage is allocated to 'construction', etc.

Relevance to the Brick Industry and Masonry Construction

As European building assessments will require data on products, materials, processes and services, as well as specification of scenarios (exposure, use, lifetime, maintenance, repair, replacements and end-of-life), this information will be required to be provided by suppliers in terms of supply contracts and purchase agreements. This is to be provided as an Environmental Performance Declaration (EPD), which will report on Indices, the definition of which will be established in the EN standards.

In the chain of supply of information pertaining to the building, the environmental, social and economic information is to be based on the input and output of resources, energy and emissions. By Industry Agreement this data may be standardised in terms of assumptions around quarry conditions, brick manufacturing methods, firing fuel sources, distances from point of supply, type of masonry construction, etc.

The information flow (from the level of the product to the building level) in CEN TC350 is structured and schematised in corresponding information modules. Each information module contains information on aspects, indicators, scenarios and where relevant, other technical information necessary for assessing the three dimensions of sustainability. This is effectively a further development in the Material Safety and Specification Sheets.

At the building level, each information module in the building's life cycle stages and its sub-stages requires information supplied from products, processes, scenarios and other relevant technical information. Thus, the brick industry will need to provide data which shows the performance of masonry walling, i.e. the bricks in combination with mortar as built into the construction.

The above European requirements are already employed by Green Building Practitioners for the undertaking of Green Building Council assessments. If we can assume that the ISO document development will follow the CEN developments (or the corresponding Japanese developments), then ultimately this type of practice will come to South African building industry.

Conclusion

Brick and Masonry construction methods have been shown by Life Cycle Assessment projects in Australia and Europe to be very competitive in comparison with other construction materials and methods. It is highly likely that the same situation will prevail in South Africa. Thus, in February 2013, the Clay Brick Association of South Africa entered into an agreement with the University of Pretoria's, Department of Architecture to proceed the undertaking of a Clay Brick Life Cycle Assessment for Masonry Walling, on its behalf.

The competitive advantage of sustainability, as shown by bricks in the RSA can then be carried to the marketplace through rapid introduction systems, such as that envisaged in the CEN system, as described above.

The Clay Brick Association will however, continue to take the lead on behalf of the Brick Industry in South Africa, by means of promoting the introduction of Sustainability measures and Standards into buildings.