City Centre Sustainable Design Housing Competition
The right to Housing is codified as a human right in the universal declaration of human rights (1948).

Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family; including food clothing, housing... {article 25(1)}
# Primary pieces of legislation governing the design and construction of housing

<table>
<thead>
<tr>
<th>Act</th>
<th>Objective of the legislation in regulating the design and construction of homes</th>
</tr>
</thead>
</table>
| National Building Regulations and Building Standards Act of 1977 (Act No. 103 of 1977) | To:  
  a) protect property and the general safety, health and convenience of the public in relation to the erection of homes;  
  b) design and construct homes which are not harmful to the health or well-being of users and occupiers; and  
  c) ensure that certain solutions that are adopted for homes contribute positively to environmental sustainability. |
| Housing Consumers Protection Measure Act of 1998 (Act No. 95 of 1998)   | To:  
  a) provide housing consumers with warranty protection in new homes against major structural defects and roofing leaks; and  
  b) assist housing consumers in the enforcement of agreements concluded with home builders. |
| Occupational Health and Safety Act of 1993 (Act No. 85 of 1993)         | To:  
  a) create a safe working environment for those engaged in the construction of a home; and  
  b) protect persons other than those involved in the construction of a home from the hazards to health and safety arising out of or connected with such construction. |
Building Standards and Regulations promote uniformity in the law relating to the erection of buildings; for the prescribing of building standards; and for matters connected therewith.
Embodied energy is the energy that is consumed in order to build a given usable object. This includes the energy from material extraction, refining, processing, transporting, and fabricating.[2] It is named as such because it is as if this energy is "embodied" within the item itself. Embodied energy also comes along with the idea of embodied carbon, which is the associated CO₂ footprint that is emitted during the object's creation.
USE THE EDGE TOOL

- Compare different scenarios to typical local practices:
  - Embodied energy and carbon
  - Operational energy and carbon
  - Utility cost
  - Water use, and
  - Incremental cost, payback period
When selecting building materials, the embodied energy should be considered with respect to:

1. the durability of building materials
2. how easily materials can be separated
3. use of locally sourced materials
4. use of recycled materials
5. specifying standard sizes of materials
6. avoiding waste
7. selecting materials that are manufactured using renewable energy sources.
What is wrong with current buildings?

- Up to 25% heat loss through the roof
- Up to 35% heat loss through uninsulated walls
- 15%
- 15%
- 10%

25% + 35% + 15% + 15% + 10% = 100%
**Veggie-based insulation:**
Carpets made from corn, paint made from soy and Forrest Stewardship Council-certified lumber and framing materials make up the insulation of the walls, floor, roof and basement.

**Wind power system:**
Wind turbines on the roof provide energy inside the home.

**High-performance thermal windows, doors:** Reduces heat loss, increases daylight and passive solar heating.

**Solar thermal heating system:**
Mounted on the roof, solar collectors heat water used for radiant heating inside the home.

**Solar panels:** Convert sunlight into electricity.

**Low-flow water fixtures:** Reduce hot water usage.

**Home energy manager:**
A control panel inside the home that allows homeowners to manage energy consumption.

**Energy-efficient lighting:**
High-efficiency CFL, LED and OLED lighting throughout the home.

**Gray water recovery:**
Sink, shower and washing machine water is collected and used for toilet flushing and for watering the landscape.

**Demand-response appliances:**
High-efficiency kitchen appliances load from the grid.
IBT ANALYSER

• The essential purpose of this software tool is to effectively and efficiently assist in the selection of appropriate IBT systems, within a specific climate and with the consideration of other quantitative and qualitative criteria.
THE NEW STANDARDS NOW APPLY
The graph illustrates the embodied energy (in GJ) for various materials. **Concrete** has the highest embodied energy, significantly higher than the other materials listed, such as **Ceramics**, **Stone**, **Plaster**, **Fabric**, **Glass**, **Masonry**, **Plastic**, **Timber**, **Copper**, **Aluminium**, **Stainless steel**, and **Steel**. The embodied energy values range from approximately 0 to 250 GJ.
## INNOVATIVE BUILDING SYSTEMS

<table>
<thead>
<tr>
<th>Classification label</th>
<th>Category</th>
<th>Name of building system</th>
</tr>
</thead>
</table>
| A                    | Light building system (LBS) with steel structural frame | Vela building system  
Amsa building system  
Alternative steel building system  
FSM building system  
Space frame building system |
| B                    | Light building system (LBS) with structural steel frame and insulated foundations | Imison 3 building system  
Imison stud building system |
| C                    | Light building system (LBS) with panels and light weight concrete | Goldflex 800 building system  
Goldflex 100 building system  
Goldflex 800 seismic building system |
| D                    | Hybrid building system (HBS) | Automapolyblok building system  
Aruba building system  
Blast building system  
Insulated concrete panel building system  
Rapidwall building system  
Styrox building system |
| E                    | Heavy weight building system (HWBS) with panels and dense concrete | Banbric building system  
Robust building system |
| F                    | Heavy weight building system (HWBS) with building blocks | BESA 2 building system  
Hydroform building system  
Izoblock building system |
| G                    | Masonry construction | Masonry |
ENERGY EFFICIENCY OF IBT

- Energy efficiency overlaps with thermal comfort in that it establishes how much kWh can be saved to reduce costs on electricity but achieve thermal comfort and improved health at the same time. SANS 10400XA is used as a benchmark against the optimization/rational design of energy efficiency of the building envelope –
- There must be an improvement in energy usage of the optimized IBT home compared to the standard SANS 10400XA IBT home at the design stage.

SUSTAINABLE INNOVATIVE SYSTEM

1. WALLING SYSTEMS
2. BUILDING SYSTEM
3. ROOFING SYSTEMS
4. CEILING SYSTEM
5. INSULATION
6. WATERPROOFING AND DAMP PROOFING

7. WALLING SYSTEMS
   CATEGORY A   LIGHT BUILDING SYSTEMS (MONOLITHIC)
   CATEGORY D   HYBRID SYSTEMS
   CATEGORY E   PREFABRICATED PANELS
<table>
<thead>
<tr>
<th>MONOLITHIC SYSTEMS</th>
<th>HYBRID SYSTEMS</th>
<th>PRECAST SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW EMBODIED ENERGY</td>
<td>HIGH EMBODIED ENERGY</td>
<td>HIGH EMBODIED ENERGY</td>
</tr>
<tr>
<td>SUITABLE TO ALL CLIMATIC ZONES</td>
<td>SUITABLE TO ALL CLIMATIC ZONES</td>
<td>NOT SUITABLE TO ALL CLIMATIC ZONES</td>
</tr>
<tr>
<td>HIGH THERMAL PERFORMANCE</td>
<td>HIGH THERMAL PERFORMANCE</td>
<td>LOW THERMAL PERFORMANCE</td>
</tr>
</tbody>
</table>
INNOVATIVE AND SUSTAINABLE TECHNOLOGY

• QUALITY SYSTEMS: TO COMPLY TO ISO 9001
• STRUCTURAL INTEGRITY: TO COMPLY TO SANS 10160 -2 AND SANS 10400 PART K.
• MANAGEMENT SYSTEMS: TO COMPLY TO THE CER
The objective is to provide a safe and secure house for individuals or communities displaced from their homes due to disasters, conflicts, or other crises.

Performance Requirements

Design Life

The performance requirements for emergency housing are as follows:

1) The structural system of the shall have a minimum design working life of 30 years as per SANS 10160-1; and

2) Repairable or replaceable components and materials, such as claddings, roofing materials, exterior trims, windows, and doors, shall have a minimum design working life of 5 years.

Materials

These requirements ensure that the housing units are built to be durable and resilient, capable of withstanding the harsh environmental conditions that are often present in emergencies. As per the latest edition of SANS 10160, the structural system of the emergency housing shall be designed to withstand the free stream velocity pressure that is applicable to the region where the housing will be installed.
Objective
The objective is to ensure that the housing meets the needs and preferences of the occupants and is culturally appropriate and socially acceptable in the community where it is located. This objective recognises that emergency housing is not just a physical structure but also a social environment that affects the mental and emotional well-being of its occupants.

Functional requirements
The functional requirements related to this objective are:

- To assure that the house is delivered within the subsidy amount as determined by the Director General of the National Department of Human Settlements; and

- To create housing that promotes a sense of safety, security, and well-being of the occupants.
SA 3D CONCRETE HOUSE
IBT

Welkom - Everite

WC - Nyanga - Kavango

Jhb - Etwatwa - MIBT

WC - Blue Downs - LEPA, CMA & KNAUF
Walling Systems

This home in Swaziland is constructed with wooden poles. The walls are filled with rocks, which will then be plastered over with mud. (Jon Sojkowski)
CONSTRUCTION PRODUCTS FIT FOR PURPOSE
SYSTEMS TESTED, CERTIFIED AND APPROVED FOR SPECIFIC USE BY MANUFACTURER.
Subject: Robust Building System

Certificate holder: Robust Kits (Pty) Ltd
P O Box 634 BENONI 1500
Telephone: 011 420 1470 Fax: 011 420 1463
E-mail: info@robuststructure.com www.robuststructure.com

Validity
Users of any Agrément certificate should check its status: all currently valid certificates are listed on the website. In addition, check whether the certificate is Active or Inactive.
The certificate holder is in possession of a confirmation certificate attesting to his status.

SANS 10400 – The application of the National Building Regulations

Quick guide
Contents page 3
Preamble page 4
Conditions of certification page 5
Assessment page 7
Compliance with the National Building Regulations page 8
Technical description page 9

Use
The certificate covers the use of the Robust Building System in all areas of South Africa for the erection of single storey buildings for the uses (SANS 10400: Table 1 of Regulation A(20)(1)) set out below:
- places of instruction (A3)
- moderate and low-risk commercial service buildings (B2 and B3)
- moderate and low-risk industrial buildings (D2 and D3)
- small shops (F2)
- offices (G1)
- dormitories (H2)
- semi-detached and row houses (H3)
- dwelling houses and related outbuildings (H4)

This certificate and Agrément South Africa’s assessment apply only to Robust buildings that are designed, manufactured and erected as described and illustrated in this certificate, and where the terms and conditions of certification are complied with.
<table>
<thead>
<tr>
<th>Aspects of performance</th>
<th>Opinion of Agrément South Africa</th>
<th>National Building Regulations satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness-for-purpose of materials used</td>
<td>The materials described in Part 3 meet the requirements of the regulations.</td>
<td>A13(1)(a) Materials</td>
</tr>
<tr>
<td>Behaviour in fire</td>
<td>Walls are classified type FR (non-combustible) with a fire-resistance rating of 60 minutes.</td>
<td>K4 Walls, J1(1)(B), T1(1)(b) and (c) and in so far as the walls are concerned, T1(1)(b) is satisfied. They are also deemed to satisfy the regulation T1(1)(d) in so far as the walls are concerned. Comments made in the section on Supplement to certificates must be taken into account when building plans are scrutinized by local authorities to check compliance with Regulations T1(1)(a), T1(1)(d) with regard to spread of smoke, and T1(1)(e). The following deemed-to-satisfy rules of Section 3 of SANS 10400 have been met: TT5.1(c), TT5.2(c) and with regard to occupancy and tenancy separating elements and party walls between adjoining dwellings units, 90 mm thick Robust walls built up to the underside of roof coverings, TT6, TT8 and TT9.</td>
</tr>
<tr>
<td>Structural performance</td>
<td>Satisfactory, provided the requirements of this certificate are complied with.</td>
<td>K1, K3 &amp; K4 Walls Regulations B1(1) and (2) are deemed to be satisfied: When Robust buildings are built in accordance with the dimensional limitations given in PART 3: Technical Description of this certificate. When these limitations are not complied with, the structural design and erection of each building is the responsibility of a professional engineer or approved competent person and deemed-to-satisfy rule BB4 of SANS 10400 is applicable. Regulations H1(1) and (2), Foundations, are deemed to be satisfied as follows: H1(1) on non-problematic soils; H1(2) in all buildings where foundations are designed by a professional engineer or approved competent person and deemed-to-satisfy rule HH1(1)(a) applies.</td>
</tr>
<tr>
<td>Water penetration and rising damp</td>
<td>Satisfactory. Robust buildings meet Agrément South Africa’s criteria for resistance to water penetration and rising damp throughout South Africa.</td>
<td>K2 Walls J1(4) Floors L1(b) and (c) Roofs</td>
</tr>
</tbody>
</table>