Measuring the environmental performance of construction materials:


BREEAM Materials, BRE Global

February 2009
Overview

• Sustainability context and buildings

• LCA and Environmental Profiles Methodology

• The Green Guide to Specification

• Use of the Green Guide – BREEAM and The Code

• Impacts of external cladding and facades
Sustainability – Why are we here?
Construction industry and buildings

- Large impacts
  - Construction and demolition waste alone represents **32% of total UK waste** (DEFRA)
  - the energy used in constructing, occupying and operating buildings represents approximately **50% of greenhouse gas emissions in the UK.** (Environment Agency 2007)
  - Passenger transport vehicles account for a further **15% of CO₂ emissions.** (EST)
Sustainability: How does this apply to buildings?

- Sustainability is a complex & political agenda
- Generally no agreed consensus
- Likely to always change depending upon context
- Lots of Greenwash
- No single tool for measuring sustainability
- Industry using many tools/methods/systems;
  - Life Cycle Assessment (LCA)
  - BREEAM
  - Code for Sustainable Homes (CSH)
  - Carbon Labelling & Footprinting
  - Whole Life Costing (WLC)
  - Environmental Product Declarations (EPD’s)
  - Many others…
Looking at the product level…

How do we measure environmental performance?

Life Cycle Assessment (LCA)
Life Cycle Assessment (LCA)

Extraction

Environmental impacts

Creation

Maintenance

Disposal

Protecting People, Property and the Planet
How can LCA be used in the Industry?

• To measure existing performance and monitor improvements

• To assess benefits of innovative processes

• To compare materials which offer the similar functions, eg external wall constructions

• To compare building designs over their expected lifetimes

• Used in the BRE Environmental Profiles Methodology

• Applied in tools like The Green Guide to Specification
What is an Environmental Profile?

Measurement of the environmental performance of a material, product or system over a set time period.

- Extraction of raw materials & transport (“cradle to gate”)
- Production (“gate to gate”)
- Transport, installation and end of life (“gate to grave”)

Achieved using Life Cycle Assessment (LCA)

Used in BRE 2007 Environmental Profiles Methodology
  - Level playing field for assessing construction products

Outcome is a Type III Environmental Product Declaration (EPD) compliant with ISO 14025 (externally audited by UKAS)
## Environmental Profiles 2008 Impact categories

<table>
<thead>
<tr>
<th>Environmental Issue</th>
<th>Weighting (%)</th>
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<tbody>
<tr>
<td>Climate Change</td>
<td>21.6</td>
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<tr>
<td>Water extraction</td>
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<td>Mineral resource depletion</td>
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<td>Stratospheric ozone depletion</td>
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<td>Human toxicity</td>
<td>8.6</td>
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<td>Ecotoxicity to water</td>
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<td>Nuclear waste</td>
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<td>Ecotoxicity to land</td>
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<td>Fossil fuel depletion</td>
<td>3.3</td>
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<td>Eutrophication</td>
<td>3.0</td>
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<tr>
<td>Photochemical ozone creation</td>
<td>0.20</td>
</tr>
<tr>
<td>Acidification</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Derivation of Ecopoints

Issues → Measurement → Weighting

Protecting People, Property, and the Planet
The Environmental Profile – An independent product declaration

### Approved Environmental Profile

**Environmental Impact:**

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Impact Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change</td>
<td>20 kg CO2 eq</td>
</tr>
<tr>
<td>Acid Deposition</td>
<td>0.3 kg SO2 eq</td>
</tr>
<tr>
<td>Human Toxicity</td>
<td>0.02 kg</td>
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</table>

### Environmental Productivity:

<table>
<thead>
<tr>
<th>Productivity Category</th>
<th>Productivity Value</th>
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<tbody>
<tr>
<td>Carbon footprint</td>
<td>12,000 kg CO2 eq</td>
</tr>
<tr>
<td>Acid Deposition</td>
<td>0.03 kg SO2 eq</td>
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### Environmental Risk:

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<tr>
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<td>0.05 kg</td>
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<tr>
<td>Air Pollution</td>
<td>0.005 kg SO2 eq</td>
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<tr>
<td>Water Runoff</td>
<td>0.005 kg</td>
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</table>

### Environmental Sustainability:

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<thead>
<tr>
<th>Sustainability Category</th>
<th>Sustainability Value</th>
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<tr>
<td>Carbon footprint</td>
<td>12,000 kg CO2 eq</td>
</tr>
<tr>
<td>Water Runoff</td>
<td>0.005 kg</td>
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</tbody>
</table>

### Environmental Certification:

<table>
<thead>
<tr>
<th>Certification Category</th>
<th>Certification Value</th>
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</thead>
<tbody>
<tr>
<td>BRE Environmental Profiles</td>
<td>100% BRE Global</td>
</tr>
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</table>

### Environmental Impact by Sector:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Impact Value</th>
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</thead>
<tbody>
<tr>
<td>Primary</td>
<td>0.1 CO2 eq</td>
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</tbody>
</table>

**Environmental Profile Summary:**

- **Environmental footprint:** 12,000 kg CO2 eq
- **Human Toxicity:** 0.02 kg
- **Carbon footprint:** 12,000 kg CO2 eq

**Environmental Impact:**

- **Climate Change:** 20 kg CO2 eq
- **Acid Deposition:** 0.3 kg SO2 eq
- **Human Toxicity:** 0.02 kg

**Environmental Productivity:**

- **Carbon footprint:** 12,000 kg CO2 eq
- **Acid Deposition:** 0.03 kg SO2 eq

**Environmental Risk:**

- **Human Toxicity:** 0.05 kg
- **Air Pollution:** 0.005 kg SO2 eq

**Environmental Sustainability:**

- **Carbon footprint:** 12,000 kg CO2 eq
- **Water Runoff:** 0.005 kg

**Environmental Certification:**

- **BRE Environmental Profiles:** 100% BRE Global

**Environmental Impact by Sector:**

- **Primary:** 0.1 CO2 eq
BRE Global: Certified Environmental Profiles

- Sister company to BRE (previously BRE Certification)
- Data verification process – evidence
- Supports external claims
- Environmental Profiles valid 3 years
- An independent environmental product declaration

- Whole process revolves around:
  - Product manufacture data
  - Data verification (Factory site audit)
  - Data modelling – LCA methodology
What do you do with an Environmental Profile? Comparison at a building element level

Bricks vs bricks

Blocks vs blocks

Wall specifications
The Green Guide to Specification

- Ecopoints for building materials placed into specifications
- Environmental impacts of building elements
- Based on LCA
- A+ to E rating

www.thegreenguide.org.uk
The Ecopoint and A+ to E ratings

- **Ecopoints per m²**
- **Years**
- **Maximum Ecopoint rating**
- **Minimum Ecopoint rating**

- **High relative environmental impact**
- **Low relative environmental impact**

**Protecting People, Property and the Planet**
The Green Guide to Specification

- Green Guide update
  - Online & Paper publication

www.thegreenguide.org.uk
  - 1500+ generic specifications each with summary Ratings
  - Ratings A+ to E
  - 13 impact category ratings
  - Six building types

- FREE access
- Ongoing development

Protecting People, Property and the Planet
Welcome to The Green Guide to Specification Online

Green Guide online provides designers and specifiers with easy-to-use guidance on how to make the best environmental choices when selecting construction materials and components.

In the Green Guide online, building materials and components are assessed in terms of their environmental impact across their entire life cycle - from 'cradle to grave'. This accessible and reliable information will be of great assistance to all those involved in the design, construction and management of buildings as they work to reduce the environmental burden of their properties.

The specifications shown throughout the Green Guide should not, however, be used as a basis for on-site construction. They are of generic nature only and are used to illustrate a range of typical materials. Although every effort has been made to ensure that the information given here is accurate, our knowledge and understanding continues to evolve. The Green Guide ratings shown here represent our best efforts to provide objective, helpful guidance to enable the specifier to make more informed choices based on the data and methodologies available at this present time.

The Green Guide online has been developed alongside the printed version which will be published later this year. The Green Guide online offers a flexible and adaptable medium and will be updated on a regular basis.
Building Type?

Green Guide 2008 ratings

The Green Guide 2008 ratings can be accessed by following a series of steps to allow you to select the most appropriate range of ratings, starting with the type of building in which the element will sit.

Some ratings apply to more than one building type and this will be stated at element selection stage.

The ratings can be viewed on screen or printed.

Note that ratings are copyright BRE and should not be reproduced in any publicly accessible format without the express permission of BRE. Please email the Green Guide Helpdesk.

Please select a building type

- Domestic
- Health
- Industrial
- Commercial
- Retail
- Education
Element?
**Element details**

**Green Guide 2008 ratings**

Building type > Domestic

Category > External Wall Construction

**External Walls**

External wall ratings are the same for the following building types:
Domestic, Health, Commercial, Retail, Industrial, Education

**Functional unit for External Walls:**
1m² of external wall construction, to satisfy current building regulations, and a U value of 0.3 W/m²K. Where relevant, the specification will also include an internal wall finish.

**Variation for retail/industrial**
1m² of external wall construction, to satisfy current building regulations, and a U value of 0.3 W/m²K.

Perhaps more than any decision facing the designer, the choice of the external wall specification is subject to the widest range of practical, economic and visual considerations, some of which may be beyond the control of the design team.

External walls can have a significant contribution to the impacts of...
**Sub-Section of Elements**

Please select the element type of *External Wall*.

**Construction ratings you wish to review:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Sub-Section</th>
</tr>
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<tbody>
<tr>
<td>Blockwork Cavity Wall</td>
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<tr>
<td>Rendered or Fairfaced Blockwork Cavity Wall</td>
<td></td>
</tr>
<tr>
<td>Rendered or Fairfaced Blockwork</td>
<td></td>
</tr>
<tr>
<td>Cladding on Framed Construction</td>
<td></td>
</tr>
<tr>
<td>Rainscreen Cladding</td>
<td></td>
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<tr>
<td>Insulated Cladding</td>
<td></td>
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<tr>
<td>Insulated Render Systems</td>
<td></td>
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<tr>
<td>Curtainwalling</td>
<td></td>
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<tr>
<td>Loadbearing Precast Concrete</td>
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## Specification ratings

### Green Guide 2008 ratings

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<tr>
<th>Element number</th>
<th>Summary rating</th>
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<tr>
<td>805230675</td>
<td>C</td>
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<td>806230688</td>
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<td>806260690</td>
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## Green Guide 2008 ratings

<table>
<thead>
<tr>
<th>Building type</th>
<th>Domestic</th>
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<tr>
<td>Category</td>
<td>External Wall Construction</td>
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<tr>
<td>Sub-category</td>
<td>Loadbearing Precast Concrete</td>
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<tr>
<td>Element Type</td>
<td>Loadbearing Precast Concrete Systems</td>
</tr>
<tr>
<td>Element</td>
<td>Brick faced precast concrete cladding panel, insulation, medium dense solid blockwork, plasterboard, paint</td>
</tr>
<tr>
<td>Element Number</td>
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<tr>
<td>Summary Rating</td>
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<tr>
<td>Climate Change</td>
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<tr>
<td>Water Extraction</td>
<td>B</td>
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<tr>
<td>Mineral Resource Extraction</td>
<td>A</td>
</tr>
<tr>
<td>Stratospheric Ozone Depletion</td>
<td>D</td>
</tr>
<tr>
<td>Human Toxicity</td>
<td>A</td>
</tr>
<tr>
<td>Ecotoxicity to Freshwater</td>
<td>A+</td>
</tr>
<tr>
<td>Nuclear Waste (higher level)</td>
<td>A</td>
</tr>
<tr>
<td>Ecotoxicity to Land</td>
<td>D</td>
</tr>
<tr>
<td>Waste Disposal</td>
<td>D</td>
</tr>
<tr>
<td>Fossil Fuel Depletion</td>
<td>D</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>D</td>
</tr>
<tr>
<td>Photochemical Ozone Creation</td>
<td>B</td>
</tr>
<tr>
<td>Acidification</td>
<td>C</td>
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</table>
The Use of the Green Guide to Specification

- **Architects and building specifiers**

- **Part of BRE’s Environmental Assessment Methods for buildings**
  - BREEAM & EcoHomes (BRE)
  - Code for Sustainable Homes (BRE & DCLG)
  - Materials specification credits
  - [www.breeam.org](http://www.breeam.org)
What is BREEAM?

- **BRE - Environmental Assessment Method**
- Voluntary Certification scheme for Buildings (but often specified as part of planning)
- Provides an environmental label for buildings
  - Pass, Good, Very Good, Excellent, Outstanding
- Independent & credible
- Holistic and Issue based – broad range of environmental concerns
- Ensures best environmental practice above regulatory minimum
- Large scope – many different types of buildings assessed
- Used mainly in UK but also growing Internationally
The Code for Sustainable Homes

• The Sustainable Buildings Task Group (SBTG)
• Set up by DEFRA, DTI, DCLG, EA, EP and others

• Launched April 2007, revised May 2008
• A single national standard for England
• Based on BREEAM - EcoHomes
  - (replaces EcoHomes in England)

• Mandatory rating for all new homes in England (May 08) and now for Wales too!
Materials Specification

- One of the many issues assessed in BREEAM and The Code
- Credits available - variable
- Whole life environmental impact
- Key building elements assessed
- Green Guide to Specification
  - Ratings A+ to E
  - [www.thegreenguide.org.uk](http://www.thegreenguide.org.uk)
- Higher scores for better rated elements
- Code – Minimum D rated specifications
- Based on LCA and Environmental Profiles Methodology
- Bespoke ratings – Certified Environmental Profiles
How are Cladding & Facades assessed within BREEAM and The Code?

- Points available within the materials specification credit
  - **External walls**

<table>
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<tr>
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</tbody>
</table>
Green Guide performance for external cladding finishes

- Cladding on framed construction
  - Steel or timber framed performs well (A and A+)
  - Claddings include
    - Copper
    - Canadian cedar
    - Clay tiles
    - Concrete tiles
    - Polymeric render
    - Pre-treated softwood
    - PVC weatherboarding
    - UK Natural slate
    - Glass reinforced Plastic (GRP)
  - Sheathing material is important
    - Plywood sheathing has a higher impact than OSB
Green Guide performance for external cladding finishes

- Cladding on loadbearing masonry
  - Autoclaved fibre cement, Fibre cement sheet, Concrete tiles, Cement rendered blockwork
  - Canadian Western Red cedar, treated softwood
  - Clay tiles, Terracotta
  - Coated steel composite profiled panels / single sheet, copper sheet
  - Imported granite / marble, limestone, sandstone, natural UK slate
  - PVC weatherboarding

- Timber and PVC weatherboarding specifications perform well (A+)
- Coated steel composite panels perform well (A)
- Imported stones and sandstone specifications perform less well (B)
- Slate rainscreen cladding performs poorly (E)
  - High mineral resource extraction & ozone depletion
Green Guide performance for external cladding finishes

- **Rainscreen claddings**
  - On various different frames & infills
    - *Precast concrete panels with stone facing specifications performs poorly*
      - High climate change impacts
    - *Autoclaved fibre cement sheet and coated aluminium / steel profiled sheet perform well*
      - Low climate change & mineral resource extraction
    - *Treated softwood performs very well*
      - Low climate change & water extraction
    - *Coated steel / aluminium composite profiled insulated panels mostly all get A’s*

- **Curtain walling systems (aluminium, timber or precast concrete)**
  - Poor ratings with range from B - E
Conclusions

• Sustainability becoming increasingly important for the construction industry

• LCA and Environmental Profiles are tools for assessing environmental performance

• The Green Guide to Specification is a useful tool for architects and specifiers

• Green Guide increasingly being used in the UK due to BREEAM and The Code for Sustainable Homes
Any Questions?

Thank you

Tel: 01923 664462  
breeam@bre.co.uk

www.thegreenguide.org.uk  
www.breeam.org