Code for Sustainable Homes – how to win credits

How the BRE's Code for Sustainable Homes enables structural engineers to make a positive impact on the reduction of a building's ecological footprint

Background

In 1997 the UK committed to reduce its carbon emissions by signing the Kyoto Protocol. Various assessment methods have since been introduced to assist design teams in reducing the impact of the built environment from concept to demolition.

The building of domestic properties constitutes a major portion of UK construction sector activity, and as such was seen as a main target area for improvement. The Building Research Establishment (BRE) Ecohomes environmental assessment methodology was introduced accordingly. More recently the BRE has investigated the environmental impacts in homes and schools by building an innovation park at BRE Watford (Fig 1). More information on the research is discussed in the BRE Information Papers IP 9/08 Parts 1 to 42.

Ecohomes methodology was superseded by the Code for Sustainable Homes (CSH)[1] for new domestic properties in October 2007. However, Ecohomes continues to be used to assess existing homes. Assessments are carried out by a CSH assessor who has been trained to monitor the environmental performance of the buildings.

The CSH is a design guide, which was produced with the aim of helping UK housing developments to achieve zero carbon emission levels by 2016. In terms of energy performance, a 'Level 1' home corresponds to basic UK Building Regulations Part L compliance, 'Level 4' is a Passivhaus[3] standard and 'Level 6' represents a zero carbon development.

Currently, use of the CSH is compulsory in the design of social housing, which must achieve a minimum of code Level 3 or 4 by 2010, Level 5 by 2013 and Level 6 / zero carbon by 2016. The CSH is divided up into nine categories:

- Energy and CO_2 emissions
- Water
- Materials
- Surface Water run-off
- Waste
- Pollution
- Health and Wellbeing
- Management
- Ecology.

1 Kingspan Offsite Lighthouse built to the Code for Sustainable Homes at the BRE Innovation Park (*Photo courtesy BRE*)

The following tables, from the Technical Guidance[4] to the Code, summarise some of the code requirements.

Code Level	Minimum percentage reduction in dwelling emission rate over target emission rate
Level 1 (*)	10
Level 2 (**)	18
Level 3 (***)	25
Level 4 (****)	44
Level 5 (*****)	100
Level 6 (******)	'Zero Carbon Home'

Table 1.3 Code Levels for Mandatory Maximum Standards in Indoor Water Consumption

Code Level	Maximum indoor water consumption (litres per person per day)
Level 1 (*)	120
Level 2 (**)	120
Level 3 (***)	105
Level 4 (****)	105
Level 5 (*****)	80
Level 6 (******)	80

Table 1.2 Code Levels for Mandatory Minimum Standards in CO_2 Emissions

Structural engineers can readily make a beneficial impact in four of these categories, namely: Energy and CO_2 emissions, Materials, Surface Water run-off, and Waste, discussed in more depth below.

Energy and carbon dioxide (CO_2) emissions

Energy and CO_2 performance is weighted heavily in the assessment, and credits rely partly on the performance and thermal properties of the building fabric to reduce carbon emissions. This is demonstrated by the percentage improvement of the Dwelling Emissions Rate (DER) over the Target Emissions Rate (TER).

The calculation is known as a Standard Assessment Procedure (SAP) which focuses on insulation and heating system performance. The SAP calculation needs an insulation value for the building fabric (U Value), which is determined by the material used in the structure and construction as a whole*. There are alternative, more rigorous methods, which involve further building physics and dynamic modelling. These can lead to a better assessment of overall energy performance.

*** Consider the *Green Guide for Specification*[5], which rates the construction thermally and ecologically, at structural design concept stage**

Easy credit wins:

– Use insulating materials which have a low U value. Logically, this should increase the percentage of improvement of the DER, therefore improving energy performance.
– The more efficient the thermal envelope and airtight the construction, the more the operational energy demand is reduced.
– Integrated design between the structural engineer, architect and building service engineer to create a building fabric which moderates the internal environment and reduces energy demand.
– These factors all improve the efficiency of the overall building performance, which is recorded on the building's Energy Performance Certificate (EPC). This forms a critical piece of information in the building's Home Information Pack (HIP).

Materials

'Reduce, Re-use, Recycle' – the structural engineer's prerogative! Credits can be gained through the re-use of building materials, retention of building façades and the refurbishment of existing building structures, rather than their demolition and replacement with new.

However, the question must be asked 'how do we do this responsibly?' Material specification should consider embodied energy content, which is the energy used in sourcing the construction materials, processing them, delivering them to site and incorporating them in the construction. Environmental impact ratings of various typical construction build-ups are provided in the BRE's Green Guide for Specification[5] in which materials and constructions are rated from A* to E on their environmental impacts.

Easy credit wins:

– Source 80% of materials responsibly. If timber construction is adopted it must be 100% responsibly sourced – FSC, PEFC registered.
– Specify where possible A-rated constructions for the roof, external walls, internal walls, upper and ground floors and windows.
– Structural design specifications should be reviewed and optimised for incorporation of the use of materials such as recycled aggregates.
– Design for demolition: recycling of materials at the end of the building's life cycle should also be considered.

For further guidance on the relative environmental performance of different typical constructions, look at the *Green Guide for Specification*[5] and work closely with the project's CSH assessor to use the material calculators to maximise the credits awarded.

All these points need consideration, the thought process recorded, and made auditable for credits to be awarded. Your CSH assessor should be able to advise you appropriately.

Water and surface water run-off

Water is a natural resource, fundamental for all life, which when altered unsympathetically can result in flash floods, disease and damage, therefore financial cost. This section is mandatory and awards credits for the reduction of a household's water consumption and for the reduction of surface water run off. It is also a section that requires engineering to meet the targets, which for domestic water consumption are:

– Level 5 and Level 6: 80 litres/person/day.
– Level 3 and level 4: 90 litres/person/day
– Level 1 and Level 2: 120 litres/person/day.

Easy credit wins:

– Specification of water saving devices; taps, low flush toilets rainwater harvesting and/or greywater recycling.
– Storage and treatment plant to facilitate the above may have some impact on the building layout and structure.

It is important to minimise surface water run-off as this can help reduce flood risk, but it also reduces the amount of water discharged into surface water drainage systems, thus helping to minimise infrastructure costs. For sites in areas designated as high flood risk, credits can only be awarded if 100% of surface water flows are discharged through an attenuated system. Refer to the CIRIA Interim Codes of Practice[6] for Sustainable Drainage and Planning Policy Statement 25 – *Development and Flood Risk* (PPS 25) for further guidance.

Easy credit wins:

– Sustainable Urban Drainage Systems (SUDS)
– 'Green' roofs
– Attenuation of surface water.

Evidence is required for credits to be awarded, including calculations for retention and attenuation systems, flood risk assessments, drawings and correspondence confirming that appropriate authorities have been consulted.

Waste

The UK construction industry uses 400M/t of materials every year. Currently only 90M/t are recycled, of which 45M/t become recycled aggregates. It is the UK Government's objective by 2012 to have reduced the waste from construction, demolition and excavation that goes to landfill by 50%. Landfill taxes continue to rise and will be £48/t by 2010.

Through responsible specification and careful design, structural engineers can minimise the disposal of waste to landfill, and thus demonstrate that through their involvement, project costs can be reduced.

What CSH doesn't cover, but where you can have a significant impact…

'It is essential that we build the potential for adaption into design and construction methods – whether this is a new development, refurbishment or regeneration'[7]

Structural engineers can play a significant role in reducing the impact of climate change and depletion of natural resources, not only through compliance with the Code for Sustainable Homes, but also through doing what we do best – minimising costs by using resources efficiently, solving problems interactively within design teams, having the knowledge and skills to assess and adapt existing buildings, and through bringing an open-minded and innovative approach to design.

Further information

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References

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See UK government website: (http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/)