

The role of precast concrete in sustainable construction

by Trevor Grounds BSc (Hons), PhD

Driven by climate change, reducing resources and higher cost of staples such as food and energy, the Government has developed a strategy designed to reduce our impacts on the environment while trying to preserve natural resources, improve our living conditions and produce a more inclusive society.

The strategy was outlined in "Securing the Future" ¹, which provides a framework for all aspects of modern living based around four priority areas

- Sustainable production and consumption
- Climate change and energy
- Protecting natural resources and enhancing the environment
- Creating sustainable communities

On 11 June 2008, following wide industry consultations, the Government and the Strategic Forum for Construction published their joint "Strategy for Sustainable Construction" ². This translates the priority areas from Securing the Future into a series of targets, actions and measurable deliverables designed to enable the construction industry to meet the challenge of making both its own operations and the built environment more sustainable.

Even a brief examination of this list confirms that there are some tough challenges ahead for the construction industry but how is precast concrete positioned to be able to play a key role in the improvements required?

Perhaps the first stage for any industry is to ensure that its own manufacturing operations are managed on sound sustainability principles. Although it may come as something of a surprise to those outside of the industry,

Some of the key targets being proposed by the Government:

2012	50% reduction in Construction, Demolition and Excavation waste to landfill compared with 2008 15% reduction in CO ₂ emissions from construction processes and associated transport compared with 2008 levels 20% reduction in water usage in the manufacturing and construction phase compared with 2008 levels. 20% reduction in construction packaging waste 25% of products used in construction projects to be from schemes recognised for responsible sourcing
2016	All new homes to be zero carbon, with Building Regulations locking in improvements in 2010 and 2013
2020	At least 26% reduction in UK CO ₂ emissions based on 1990 levels.
2050	60% reduction in UK CO ₂ emissions based on 1990 levels

the precast concrete sector recognised long ago that many of the principles that underpin sustainable consumption and production also make good business sense and are, therefore, embedded into many of the sector's operations.

Some typical examples are:

- Many companies have based the control of their operations around the environmental management system standard BS EN ISO 14001 and the quality management standard BS EN ISO 9001, more often than not with independent certification.
- Offsite production provides the combined benefits of economy of scale and close control of quality, resulting in cost effective products,

fit for purpose that reduce on-site waste.

- Raw materials are usually supplied from local sources allowing better liaison with suppliers, reduced transport distances and supporting the local economy.
- The use of recycled aggregates and secondary materials (often by-products from other industries such as ground granulated blastfurnace slag and pulverised fuel ash) is common and research continues to develop the use of alternative materials that may otherwise be landfilled.
- Production processes include controls for reducing waste and, where waste does arise, methods for recycling back into the process.

- Key producers of precast concrete have established targets for energy, CO₂, water and waste reduction.

The trade federation, British Precast, has taken a strong lead in developing the guiding principles of sustainable production^{3,4}. In December 2007 it launched the Sustainability Charter to which member companies can sign up and so commit to operate to a wide ranging set of sustainability principles. This is not just posturing as companies will be required to maintain performance data to demonstrate clearly their adherence to those principles.

The next stage in this developing British Precast process is the intention to provide, by the end of 2008 if possible, an independent certification scheme by which manufacturers can show that their products are 'Responsible Sourced', an increasing requirement for projects subject to environmental assessments such as BREAM⁵ and the Code for Sustainable Homes⁶. Having a well defined and often local supply chain, precast concrete is well positioned to be able to demonstrate responsible sourcing throughout the chain against a full range of sustainability criteria, that many, already recognised certification schemes for competing materials would struggle to meet.

With well established procedures and ever improving performance in terms of sustainable production, how does precast concrete fare with regard to sustainable construction?

One of the key principles for sustainable construction has to be good performance over the full life cycle of the building or structure with reusability or recyclability at the end of life. Precast concrete is an inorganic, inert, durable, fire resistant, acoustically insulating, low-maintenance material that with careful design can be deconstructed at the end of building life or at the very least be crushed for use as a recycled aggregate. In short it has excellent credentials for use in sustainable construction.

Providing buildings that are able to both cope with the effects of climate change and reduce the emissions that are considered to be contributing to climate change, is a major challenge. Naturally, the reduction of the energy consumption of buildings is a key target for which insulation of the building fabric is a pre-requisite. Precast concrete can be thermally insulating e.g. Aircrete but perhaps its more important contribution towards the reduction of energy use is its contribution to thermal mass.

Predictions of future temperature cycles in the UK have indicated that care needs to be taken to avoid buildings that overheat in summer. Thermal mass is a complex mechanism but essentially the ability of the mass of concrete to absorb and release heat acts to even out temperature fluctuations on both short and longer term cycles. One of the benefits is likely to be that buildings using thermal mass can be designed more easily to avoid the need for air conditioning in summer⁷ and allow greater use of natural ventilation techniques. This can lead to an overall reduction in the energy required and CO₂ emissions throughout the life of a building when compared to one that does not include thermal mass. Unfortunately, although detailed, the calculations involved in demonstrating that a building has met the requirements of Part L of the building regulations do not currently allow the full benefits of thermal mass to be taken into account. It is hoped that this anomaly can be removed during the work towards the revision of Part L in 2010.

Another manifestation of climate change that has been all too familiar in recent years has been flooding, the effects of which can be prolonged and devastating to all building owners and occupiers. Precast concrete can play an important role in combating these effects through the construction of flood defences, contribution to sustainable urban drainage systems (SUDS) and its resilience to damage when buildings are unfortunate enough to be flooded.



Trevor Grounds has 23 years industrial experience in cement and concrete products. He is sustainability manager with Tarmac Building Products. A member of British Precast and UK Concrete Platform Sustainable Construction Committees, Trevor is also chairman of APA Technical Committee.

In conclusion, even a brief discussion such as this one can clearly highlight the potential for precast concrete to have a major and positive role in the Government's plans to provide a sustainable future for the built environment and the construction industry itself. There are many sources of information on the sustainability of concrete construction but two excellent examples are British Precast at www.britishprecast.org and The Concrete Centre at www.sustainableconcrete.org.uk.

References:

1. "Securing the Future. UK Government Sustainable Development Strategy. March 2005
2. "Strategy for Sustainable Construction HM Government and Strategic Forum for Construction, June 2008. www.berr.gov.uk
3. "Sustainability White Paper May 2007 BPCF
4. "Sustainability Matters BPCF Dec 2005, 2006, Feb 2008.
5. "BRE Environmental Assessment Methods www.breem.org
6. "Code for Sustainable Homes - Setting the standard in sustainability for new homes. CLG April 2008
7. "Thermal mass in housing The Concrete Centre 2006.

Structural Design Of Precast Concrete To Eurocode Standards

Half-Day Introduction to the Eurocodes (EC0, EC1 and EC2)

After releasing 'Precast Eurocode 2: Design Manual' in 2007 British Precast has been running a number of successful half-day courses regarding the structural design of precast concrete to the new Eurocodes, particularly EC2. The half-day course is widely based and will be of interest to a large cross-section of people who work within the construction industry and wish to know what impact Eurocodes will have on the use of structural precast concrete. The content of the course is designed to introduce the Eurocodes, describing the background to them and to also cover the subject of CE marking describing the advantages and limitations of this process. Participation will assist companies in formulating their plans to meet the introduction of the Codes. This course can be held in-house for small groups and individuals can be catered for.

Full-Day EC2 Training Course

The full-day course is an in depth look at Eurocode 2 and uses worked examples from the forthcoming publication 'Precast Eurocode 2: Worked Examples'. The course is aimed at all engineers involved or interested in structural precast design. It is hoped that participants will first have attended the half day introduction course. The course introduces the Basis of Design, EC0 and special aspects of loading in EC1, Accidental Actions and Execution Loads, both of which are relevant to precast construction. The programme contains sections on the types of precast construction commonly used; strut and tie design, braced structures and pre-tensioned prestressed concrete design. A copy of British Precast's new 'Manual for Precast Design to EC2' is provided to each delegate. The lectures and examples are based on the guidance



given in the manual, and the course covers the background to the clauses in the Code to enable the participants to understand the derivation and use of the rules.

As well as the Design Manual participants need copies of EC0, EC2, and their UK National Annexes. The material required from EC1 is handed out in note form.

The lectures are given by Dr. Howard Taylor on behalf of British Precast and take the form of two courses. **For further details please contact EC2Design@britishprecast.org**



THE LITTLE GREEN BOOK OF CONCRETE

The second Little Book from British Precast was published at the British Precast Annual Conference on 13 May 2008 entitled 'The Little Green Book of Concrete'.

At 132 pages, the Little Green Book of Concrete is an indispensable pocket size guide to the benefits of the use of precast concrete when considering the

environmental issues in the selection of construction materials. It will be of great interest to clients, designers, and contractors seeking to understand the applications of precast concrete to meet the needs of sustainable construction.

This informative publication is available at £3.50 per copy, with discounts available for ordering more than 10 copies. For more information or to order your copy today, please visit www.britishprecast.org or email info@britishprecast.org