Sustainable Construction – are we closing the loop?

A seminar convened jointly by Green Alliance and the Eden Project

30 January 2006 at the Eden Project, Bodelva, Cornwall

Scoping paper

For good reason, energy considerations have tended to dominate the sustainable construction agenda. Green Alliance’s Closing the Loop project aims to give increased prominence to reducing waste, boosting resource efficiency and achieving more effective cycling of materials in several key sectors, and this seminar is the beginning of this process for the construction industry. We are looking particularly at areas where public procurement can help to deliver best practice.

The review of recent sustainable construction initiatives summarised in the annex to this paper suggests some areas for debate, and below we set these out together with some ideas for moving the agenda forward. Implicit in all of these ideas is the thought that if they are practicable, they might be reinforced by both public procurement practice, and supply chain practice in the private sector.

1. The development of Site Waste Management Plans.

The principles for these are currently being developed by Defra, after pilots carried out by DTI. As currently proposed, at its minimum level, the Code for Sustainable Homes would require that a plan is in place, but makes no stipulation about what should be in it, although there is a possibility that extra points would be available for sorting and recycling of waste on site. We wondered:

- Is there scope to develop the concept of ‘materials exchanges’ to cope with the problems of over- or under-supply of materials?

- Could construction companies set themselves a Waste Neutral\(^1\), Zero Net Waste in Construction\(^2\) or even Cradle to Cradle\(^3\) objective, balancing materials sent off-site with recycled materials brought in?

- Could setting these goals be a condition of planning permission?

2. Improving construction methods and materials used.

The Sustainable Buildings Task Group suggested recycled materials should be 10 per cent of total materials value; the Environmental Audit Committee wanted a higher figure and also suggested that any new materials meet minimum recyclability standards. A genuine ‘cradle to cradle’ approach would mean that all building materials are both recyclable and recycled; if not recycled, they would be easily renewable. They would also meet stringent standards for environmental and health impacts (with problematic materials being phased out), and ideally be produced using renewable energy. Buildings would be designed for easy disassembly and segregation of materials.

- How can we further this more ambitious version of resource efficiency? Are minimum environmental standards for materials the best way forward? Or
would a fiscal instrument such as a materials levy, based on these standards, be a more powerful mechanism than building regulations?

• How could a ‘cradle to cradle’ philosophy for construction methods be taken forwards? What might be the barriers in procurement legislation and practice?

• Could the certification approach used for timber be extended to other construction materials such as metals? If so, what are the lessons to be learned from the timber experience?

We hope that this event at the Eden Project will generate new inspiration and ideas to take this agenda forward.

Julie Hill
January 2006
Annex - How much prominence do current sustainable building initiatives give to waste, resource efficiency and materials?

Sustainable Buildings Task Group 2004

The Task Group was established by Deputy Prime Minister John Prescott, Environment Secretary Margaret Beckett and Trade and Industry Secretary Patricia Hewitt. Its remit was to ‘identify how government and industry can improve the quality and sustainability of new and refurbished buildings’.

The Task Group recommended a single Sustainable Buildings Code, (Code for Sustainable Building) based on BREEAM (BRE Environmental Assessment Method) including Eco-homes which should ‘incorporate clearly specified minimum standards on in key resource efficiency criteria (energy and water efficiency, waste and use of materials). (See the section below, ‘Consultation on a Code for Sustainable Homes’, for more on BREEAM and Eco-homes.)

On waste and materials, the Task Group wanted:

- Site waste management plans, which aim to increase resource efficiency.
- Environmental performance indicators for the construction industry, given the lack of comparable data on site waste management.
- More study of on-site treatment of waste, because of concerns about the impact of hazardous waste regulations.
- A minimum standard for the overall percentage of re-used and recycled materials used in a construction project (suggested as 10 per cent of total materials value), both in the Code and in Buildings Regulations.

The Sustainable and Secure Buildings Act

The Act, passed in 2004, gives new powers for building regulations to address the sustainability of new buildings. These new powers have so far not been used. However, the Act may allow local authorities to require specific features in new developments such as a proportion of renewable energy generation and use of recycled materials. The government is required by the Act to report biennially on progress to making the building regulations sustainable. The first report is due in September 2006. ODPM has commissioned advice from the Sustainable Development Commission, which is due to report soon.

Environment Audit Committee Report: Building a Sustainable Future’ 2005

“There is a serious risk that, as matters stand, the principle beneficiaries of housing growth will be the property development companies, whilst the principle loser will be the environment”.

This was verdict of the EAC after examining current house-building practices. The following paragraph sums up the key environmental impacts:
“Standards and methods of construction of new housing have very significant impacts on the environment. The average carbon emissions associated with building a new home is 9.54 tonnes (tC). The current build rate of 140,000 new homes a year result will result in emissions of 1.41MtC into the atmosphere. Further impacts associated with new housing are related to the sustainability of materials used, such as aggregates and timber, and the amount of waste generated, including contaminated soil, and how it is disposed of. Some 55 per cent of all timber used in the UK goes into housing construction. According to DTI figures the construction and demolition industry produces 70 million tonnes of waste materials and soils. 13 million tonnes of this waste consists of materials that are delivered and never used, which is a staggering 19 per cent of the total annually. 90 per cent of non-energy minerals extracted in the UK are supplied as construction materials and the construction industry produces three times the volume of waste from all households combined. The use of housing during its lifetime also has significant impacts. Currently the housing sector contributes around 30 per cent to UK CO$_2$ emissions and emits 40MtC a year into the atmosphere. In addition, households use 56 per cent of all water supplied and there are parts of the country, the South East particularly, where water supply issues are increasingly of concern.”

The EAC urged the government to join up policy between Defra, ODPM and HMT, and urged greater ambition than that of the Task Group on a number of fronts:

“In our view the proposed Code could and should go further than the Task Force recommended and that BRE’s Eco-Homes standard does, taking advantage of the fact that the new remit of the Building Regulations, under the Secure and Sustainable Buildings Act 2004, would allow much broader ranging requirements to be eventually included within the Building Regulation, such as those set out below:

- that all buildings should be designed to achieve a minimum set lifetime of use, and meet a resilience and durability standard that ensures that damage and repair costs of new homes are affordable throughout their use;
- that any new materials used in construction should meet minimal recyclability standards to encourage their re-use once a building is demolished; and
- that minimum standards of safety and design quality for housing should be incorporated with minimum environmental requirements.

It is vital that when buildings are dismantled as many materials as possible should be re-used and recycled. The National Federation of Demolition Contractors told us that although “average demolition recycling figures are high, between 70 per cent & 85 per cent by weight of structures demolished, the remaining fraction of un-recycled material would appear to be increasing, particularly when the more recently constructed buildings are demolished using modern deconstruction methods”. The Task Force proposed that the Building Regulations should require 10 per cent of materials in the construction of new building to be recycled. We welcome this, although we would prefer to see a higher figure. In addition, we would like to see the Code include a requirement for any new materials used in construction to meet minimum recyclables standards.”
“Sustainable, recycled or recyclable, and - where possible - locally sourced materials should be used in all construction. The Task Force did address this issue though it simply recommended that the feasibility should be examined of introducing an environmental product declaration for sustainable construction products and materials. This is not ambitious enough. BRE already produces a Green Guide to Specification which rates 250 different types of materials according to their environmental impact. There is more than sufficient information already available to allow the Code to include minimal environmental requirements for materials and how they are sourced. A product declaration or labelling scheme would be helpful but not a prerequisite and, in actual fact, including minimum requirements in the Code would in itself generate a strong incentive for such a scheme to be created.”

Securing the Future: delivering UK sustainable development strategy, 2005

The UK government’s 2005 sustainable development strategy Securing the Future places considerable emphasis on sustainable production and consumption and living within environmental limits, as summed up in the heading to chapter three, ‘The One-Planet Economy’. As outlined in that chapter, the government has, ‘set targets within central civil government for more sustainable procurement in areas such as food, construction, and a range of everyday products…’ The strategy also promised that the Code for Sustainable Buildings (as it was then known), ‘will establish new voluntary standards for resource efficiency’. On waste and materials, according to Annex A of the Strategy, the definition and components of sustainable communities includes using ‘sustainable construction materials’. It also notes that sector sustainability strategies have been established in civil engineering, brick, steel, cement and concrete.

Planning Policy Statement 1: Delivering Sustainable Development, 2005

This states that development plan policies should seek to promote the use of waste as a resource wherever possible. The quotes from the statement below illustrate the possibilities:

19. Plan policies and planning decisions should be based on:

• up-to-date information on the environmental characteristics of the area;  
• the potential impacts, positive as well as negative, on the environment of development proposals (whether direct, indirect, cumulative, long-term or short-term); and,  
• recognition of the limits of the environment to accept further development without irreversible damage.

Planning authorities should seek to enhance the environment as part of development proposals. Significant adverse impacts on the environment should be avoided and alternative options which might reduce or eliminate those impacts pursued. Where adverse impacts are unavoidable, planning authorities and developers should consider possible mitigation measures. Where adequate mitigation measures are not possible, compensatory measures may be appropriate. In line with the UK sustainable development strategy,
environmental costs should fall on those who impose them - the “polluter pays” principle.

20. Development plan policies should take account of environmental issues such as:

- mitigation of the effects of, and adaptation to, climate change through the reduction of greenhouse gas emissions and the use of renewable energy; air quality and pollution; land contamination; the protection of groundwater from contamination; and noise and light pollution;
- the protection of the wider countryside and the impact of development on landscape quality; the conservation and enhancement of wildlife species and habitats and the promotion of biodiversity; the need to improve the built and natural environment in and around urban areas and rural settlements, including the provision of good quality open space; the conservation of soil quality; and the preservation and enhancement of built and archaeological heritage;
- the potential impact of the environment on proposed developments by avoiding new development in areas at risk of flooding and sea-level rise, and as far as possible, by accommodating natural hazards and the impacts of climate change; and,
- the management of waste in ways that protect the environment and human health, including producing less waste and using it as a resource wherever possible.

Prudent use of natural resources

21. The prudent use of resources means ensuring that we use them wisely and efficiently, in a way that respects the needs of future generations. This means enabling more sustainable consumption and production and using non-renewable resources in ways that do not endanger the resource or cause serious damage or pollution. The broad aim should be to ensure that outputs are maximised whilst resources used are minimised (for example, by building housing at higher densities on previously developed land, rather than at lower densities on greenfield sites).

22. Development plan policies should seek to minimise the need to consume new resources over the lifetime of the development by making more efficient use or reuse of existing resources, rather than making new demands on the environment; and should seek to promote and encourage, rather than restrict, the use of renewable resources (for example, by the development of renewable energy). Regional planning authorities and local authorities should promote resource and energy efficient buildings; community heating schemes, the use of combined heat and power, small scale renewable and low carbon energy schemes in developments; the sustainable use of water resources; and the use of sustainable drainage systems in the management of run-off. 18

Consultation on a Code for Sustainable Homes, December 2005

The consultation document for the Code for Sustainable Homes19 was issued in December 2005. It narrows the scope of the Code from buildings of all kinds to homes.
The purpose of the Code is to assist those buying newly-built homes to assess their sustainability, through the uptake of the Code on a voluntary basis by house-builders. The Code is to ‘build on’ but also present ‘an alternative’ to regulations. The proposal is that homes would be rated on a star system, depending on a home’s level of compliance with standards set for six ‘essential elements’:

<table>
<thead>
<tr>
<th>Essential element</th>
<th>Minimum standard</th>
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<tbody>
<tr>
<td>Energy efficiency, in both the fabric of the building and in appliances</td>
<td>As building regulations Part L1A 2006</td>
</tr>
<tr>
<td>Water efficiency</td>
<td>No greater than 125 litres per head per day</td>
</tr>
<tr>
<td>Surface water management</td>
<td>Ensure that peak run-off rates and annual volumes of run-off are no worse than the original conditions for the development site</td>
</tr>
<tr>
<td>Site waste management (in construction)</td>
<td>Adopt and implement Site Waste Management Plans (including monitoring of waste)</td>
</tr>
<tr>
<td>Household waste management (in use)</td>
<td>At least 0.8m$^3$ for each home</td>
</tr>
<tr>
<td>Use of materials</td>
<td>An inventory of materials/products used</td>
</tr>
</tbody>
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The consultation document acknowledges that the Code draws heavily on experience with BRE’s Eco-homes initiative, although it is not clear whether it will ultimately supersede Eco-homes. It appears that the Code will only represent an advance on Eco-homes at the 5-star level, since the consultation document proposes making the Eco-homes ‘very good’ standard equivalent to level 3, presumably making ‘excellent’ equivalent to level 4.

Importantly, ODPM proposes that certification of compliance will be in the basis of a post-completion check. Compliance with Eco-homes is assessed at design stage, and post-completion assessment is optional.

Use of the Code by the private sector will be voluntary. However, the Government intends to meet commitments to sustainable procurement by requiring that all homes built using Housing Corporation funding, those built by English Partnerships, those built with direct financial support from ODPM’s housing growth programmes such as the Thames Gateway, and sites developed by the nine Regional Development Agencies, all meet the Code. This could amount to 20,000 homes a year.

**Options for the three ‘Essential Elements’ focussed on waste and resources:**

**1. Site Waste Management Plans**
The Clean Neighbourhoods and Environment Act 2005 has an enabling power for Site Waste Management Plans, although there is not yet a statutory requirement. Defra has been holding a series of workshops on how these might work. The Code’s minimum standard will simply be that a site plan is implemented, and this will attract points, although the numbers have not been allocated yet. Additional points would be available for sorting and recycling of waste on site.
2. Space for household recycling
The code proposal for a minimum of 0.8m$^3$ space for waste storage is the same as the current British Standard. Additional Code points would be available for internal or external dedicated storage provided for recyclable waste.

3. Materials
Initially, the Code proposes a log-book for the home-owner of materials and products used. If the upkeep of the log were a condition of sale in the same way as with a car log-book, this could be a useful mechanism. Additional elements could include evidence from manufacturers or suppliers on life-cycle assessment of their materials; evidence of producer responsibility via certification or declaration; the potential for recycling of materials/products at the end of the building’s life. Additional points would be available for BRE A-rated materials (which are assessed for life cycle environmental impact based on the BRE environmental profiling methodology) and responsible sourcing of timber.

Eco-homes current guidance on Materials

Eco-homes is a rating system developed by BRE within BREEAM$^{20}$. Predictions and assessments are carried out by licensed assessors; assessments are quality assured and certified by BRE. Grades are pass, good, very good, excellent and the certification can be used for promotional purposes. The issues assessed are grouped into the categories of: management, energy use, health and well-being, pollution, transport, land use, ecology, materials (environmental implication including life-cycle impacts) and water. Credits are awarded in each area and a set of environmental weightings enables the credits to be added together to produce a single overall score. Under materials, the criteria are:

- Use of timber from certified sustainable sources
- Provision for recycling domestic waste
- Use of materials with an A rating from BRE.


The Government has been working with the Sustainable Development Commission to develop recommendations for improving the resource efficiency of the existing housing stock.

This is looking at the challenge of the existing housing stock rather than new build, which accounts for only 1 per cent of occupied housing at any one time. The July paper has sections on energy, water and materials. On materials, the basic propositions are:

- Refurbishment of existing stock consumes significantly less materials than new build
- Construction and demolition waste accounts for 33 per cent of all wastes so it should be a major focus
- Recycling of construction wastes has a double benefit, avoiding waste treatment and the impacts of extraction of primary resources
- 10 per cent of UK carbon emissions arise from production and use of building materials
• Housing growth could account for 10 per cent of annual quarried products including demand for infrastructure as well as the buildings themselves. Preference should be given to refurbishing existing stock, building within existing towns and cities, and high density housing.

• Research by WRAP suggests that 10 per cent of a construction project’s materials (by value) can be recycled and can be used at no extra cost.

• The Government’s Environment Direct initiative should standardise materials impacts ratings (perhaps building on BRE’s eco-points). Lack of standardised information on materials choices is the greatest barrier to sustainable choices.

• SBTG recommendation of an Environmental Product Declaration would help standardise information.

The final report is due January 2006.

Investing in Sustainability: Progress and performance among the UK’s listed house-builders – revisited, WWF 2005

This report contains:

• A summary of the key factors that have emerged since the first assessment undertaken in 2003 that are driving house-builders to address sustainability.

• Detailed analysis of the findings of the 2005 benchmarking analysis, highlighting where progress has been made and challenges for the future.

• A series of conclusions and recommendations addressed to both government and developers.

Some quotes and extracts from the report are given below to illustrate the scale of the impact of house-building on the environment and highlight the amount of progress that has been made in particular areas of relevance to this seminar.

Housing’s contribution to the UK’s Ecological Footprint

"WWF’s Living Planet Report 2004 states that we are no longer living within the sustainable limits of our planet. If everyone in the world lived as we do in Europe, it would take three planets to sustain the global population. The environmental impact of the housing sector is already considerable. Household energy and water consumption is placing some of the greatest pressure on the global environment. Our homes account for around 30 per cent of the UK’s carbon emissions, and 56 per cent of all water use. In addition to the lifetime environmental costs of housing, the construction process can place a huge drain on our natural resources: the construction industry produces 70 million tonnes of waste materials per year. A staggering 19 per cent of this total, or 13 million tonnes, consists of materials that are delivered to site and never used. Fifty-five per cent of all timber used in the UK is used in housing construction. It is therefore clear that were houses built according to sustainable principles, we could significantly reduce resource consumption and increase resource efficiency, reducing our ecological footprint.”

“The resource intensity of the construction industry means that there is a significant scope to improve sustainability at an operational level through more efficient resource use. Waste management is one area where greater efficiency can generate demonstrable financial benefits, particularly cost savings. The
construction industry produces over 70 million tonnes of waste each year and the Environment Agency estimates that in 2004 the industry spent over £193 million on landfill tax alone. Increases in the landfill tax, to £18 per tonne, means that many construction companies now view waste minimisation as an important business objective, and those that still don’t should.”

**Procurement and Supply Chain Management**

WWF criteria for house-builders to be meet best practice: “The company states that it has a consistent and detailed process for considering the environmental impacts of materials and specifies the use of recycled/reclaimed materials, materials with low embodied energy, and timber from FSC-certified sources. The company discusses with its suppliers their approach to environmental impacts.”

The verdict on progress by house-builders included: “The house-building sector has considerable purchasing power. Using this power effectively could make a significant contribution to encouraging and expanding the market for, and utilisation of, sustainable building materials in the UK. Very few companies have adopted a strategic approach to supply chain management and procurement enshrined within appropriate policies and procedures. Most companies failed to demonstrate that they had put processes in place to implement consistent procurement standards or used their influence to lower the costs of procuring sustainable materials.”

**One Planet Products**

“One Planet Products is working with partners within the construction and refurbishment industries to drive down the price and increase the supply and quality of sustainable building products and services.

It is a bulk buying initiative specifically focused on environmentally sustainable products and materials. One Planet Products will provide its members (Housing Associations, private developers and contractors) with a mechanism through which they will be able to purchase environmental products, materials and services more cheaply and more easily.

The scheme will also provide a forum for knowledge sharing and information dissemination. One Planet Products is part of the One Planet Living® initiative. One Planet Living is a joint initiative between BioRegional and WWF. [www.oneplanetproducts.com](http://www.oneplanetproducts.com).”

**Domestic Waste**

WWF criteria for house-builders to be meet best practice: “The company integrates communal waste management facilities on all major projects. It can provide examples of projects that have incorporated facilities for storing separated waste into individual dwellings, as well as facilities for storing organic waste.”

**Construction Waste**

WWF criteria for house-builders to be meet best practice: “The company states that it has integrated waste management strategies on all sites and regularly monitors implementation. Performance data and targets are available externally.”

The verdict on progress by house-builders included: “Encouragingly, all the house-builders are beginning to address this issue. Most are looking, to varying degrees, to use modern methods of construction (MMC) to reduce
waste. It is thought that MMC can confer waste savings as materials can be ordered to exact specifications. Westbury states in its 2005 Annual Report and Accounts that “Space4 technology significantly reduces the amount of waste generated by building compared to traditional construction methods”. (It should be noted, however, that there is some disagreement about whether MMC provides the waste savings claimed; research by BRE on MMC homes did not find any significant savings.) It is therefore crucial that companies using off-site construction engage with their suppliers to ensure that waste minimisation practices are being employed during manufacture.”

The carbon benefits of resource efficiency

Waste reduction, reuse and recycling have repeatedly been shown to have carbon benefits compared to the extraction of virgin materials or the other waste management options of incineration and recycling - as well as other obvious environmental benefits. The United States Environmental Protection Agency has conducted an ongoing programme of work since the early 1990s examining the carbon impacts of different waste management options, including source reduction, recycling, incineration and landfill, for a large range of materials in the waste stream. This work has also compared the impact of waste management options to raw material extraction. The following quote succinctly summarises this extensive body of work:

“...waste prevention, recycling collection, and buying/manufacturing products with recycled content—are among the most effective ways to reduce the greenhouse gases traceable to municipal solid waste.

WasteWise partners divert millions of tons of material from disposal each year. They also attain higher levels of efficiency by using only the materials they really need. And as these organizations prevent more waste and recycle more materials, fewer greenhouse gases are emitted into the atmosphere.

Waste prevention, in particular, can greatly reduce the emission of greenhouse gases by conserving raw materials and the energy expended to retrieve, process, and manufacture them into products. In addition, waste prevention keeps materials out of landfills and incinerators. Certain materials generate greenhouse gases as they degrade in landfills or burn in incinerators. Overall, waste prevention provides more climate change benefits than any other waste management option.”


The Nova Scotia’s solid waste management system saves at least $31 million a year - or $33 for every Nova Scotian - compared to the old landfill system. The savings could be as high as $167 million a year, or $178 per person. The study takes into account a full range of benefits and costs, including operating and capital costs for kerbside pickups and landfilling, decreased greenhouse gas and air pollution emissions, new jobs in the recycling industry and time spent sorting waste. The biggest financial advantage of the new system over the old is in the energy saved by using recycled materials instead of
materials extracted from virgin resources. The second largest financial benefit comes from extending the life-span of landfills by diverting nearly half of the province’s solid waste to recycling and composting.

Notes and references

1 'Waste neutral’ as practised, for instance, at the Eden Project
2 'Zero Net Waste in Construction’ - from an unpublished discussion paper by WRAP available from David.moon@wrap.org.uk
3 'Cradle to cradle’ - a more radical approach to resource use, as articulated by William McDonough and Michael Braungart, based on effective rather than efficient use of resources. Cradle-to-cradle principles offer a route to such transformation by stimulating companies to think of their products and services as part of two fundamental cycles – a biological cycle where the ‘nutrients’ of the economy are renewed and recycled through biological processes; and a technical cycle, where non-renewable resources such as metals are kept within the cycle almost indefinitely. Materials that are not suitable for release into the environment for example because of impacts such as toxicity and carcinogenicity are substituted. Adhering to these principles should mean huge reductions in environmental impacts, but it also demands re-thinking the majority of our present products as well as thinking harder about areas where services can replace products. www.braungart.com/vision.htm provides a brief summary of cradle to cradle principals.
4 This document is concerned with both construction processes and life-time impacts.
6 Stock Take: Delivering improvements in existing housing, Sustainable Development Commission, January 2006 (to be published).
8 EAC foreword
9 EAC para. 10
10 EAC paras 142 and 143
11 EAC para 146
13 Securing the Future (STF), page 55
14 STF, page 61
15 STF, page 186
16 STF page 62
18 Planning Policy Statement 1 (PPS1), paragraphs 19-22
20 As well as being used for homes, or Eco-homes as they are called under BREEAM, the approach can be applied to offices, industrial units, retail units and schools. For other building types a bespoke version can be used. For more information see www.breeam.org/
22 Investing In Sustainability page v
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See yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWaste.html for more details of this programme including figures for the carbon emissions associated with waste management options for materials in the municipal waste stream.

yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BWJ6H/$File/wastewise.pdf