heritage lottery fund

Reducing environmental impacts

Good-practice guidance

October 2012

This guidance is available for downloading from **www.hlf.org.uk**. If you require a copy of this guidance in an alternative format (large print, Braille or audio version), or if your first language is not English, we can provide it in the appropriate format or language if you ask us. It is also available in Welsh.

Contents

1 Introduction

This guidance deals with the main environmental impacts that arise on projects that are funded by the Heritage Lottery Fund, providing advice and ideas on dealing with these. It can be used to help develop project proposals and to think about the outcome ‘environmental impacts will be reduced’.

It will be of most relevance to applicants whose project involves building construction – either the refurbishment of existing historic buildings, the addition of new structures to existing buildings, or the construction of completely new buildings. But for projects involving no building construction at all, some sections of the guidance will still be relevant – for example, biodiversity and soil in the case of countryside, wildlife, landscape and parks projects, and transport impacts for any project that encourages more visitors to heritage sites.

Details on what we expect projects to be able to achieve on environmental impact can be found in the application guidance for the programme you are applying under.

This guidance includes sections on each of the following:

- Whole life costing;
- Energy conservation and new buildings;
- Energy efficiency and historic buildings;
- Renewable energy;
- Water;
- Building materials;
- Construction waste;
- Soil, including peat;
- Timber;
- Biodiversity; and
- Visitor transport.

The guidance was produced by Heritage Lottery Fund and Constructing Excellence.

2 Whole life costing

Whole life costing means that decisions are based not just on initial capital cost, but also on the costs of renovation, maintenance and day-to-day operation over the expected lifetime of an asset. In practice, using a period of at least 60 years in decision making is reasonable, when looking at new build options and energy efficiency measures.

Ideally, part of whole life costing (perhaps more properly termed, in this case, ‘whole life value’) should also be to look at impacts that are not fully reflected in financial costs, or which are difficult to measure in financial terms – particularly carbon impacts. This means considering social and environmental costs associated with the design, construction, operation, decommissioning and (sometimes) the re-use of a building or the building materials at the end of its useful life.

Calculating the precise carbon impact of building materials is complex, but there are generic figures available for most commonly-used building materials (see 'More Help'). This will give information that is detailed enough to be able to assess the broad financial implications of choosing different materials and/or construction techniques against their carbon impact.

3 Energy conservation and new buildings

Good practice in historic environment conservation is also good practice in energy conservation, and historic buildings should be conserved for both their cultural value and because it makes environmental sense. Indeed, there is much for architects of future buildings to learn from the energy efficiency of many historic buildings which were, after all, built at a time when energy costs were relatively much higher[1]. Replacing an existing building with a new one involves a considerable cost of 'embodied energy'[2] in materials, transport and construction with research suggesting that embodied energy equates to between eight and 15 years of the energy required to heat and light a building ('operational' energy)[3]. As energy efficiency standards improve, less energy is required to heat and light a building and so the embodied energy of materials used in new construction will become even more important.

Where new buildings are needed, they can now be designed and constructed in ways that take full advantage of solar gain and are so well insulated that they do not need a heating system, and only use natural ventilation instead of an air conditioning system.

However, in the heritage sector, there is a particular challenge for buildings housing important archives, where passive systems of environmental control that can comply with British Standards on the storage and exhibition of archival documents are still being developed. In these cases back-up air conditioning in a building with high thermal mass (i.e. one that absorbs heat and releases it slowly) is likely to be a sensible compromise.

Designing, constructing and operating energy efficient buildings is the first and most important step in the energy hierarchy – only after this should renewable energy be considered.

4 Energy efficiency in historic buildings

Significant improvements to energy efficiency can be made at little or no extra cost within historic buildings. Generally the best ways are to specify energy-efficient lighting and other fittings, improve insulation levels and increase air-tightness – though these last two options tend to be less appropriate for historic buildings, which were frequently built with permeable materials

---

[1] Wallsgrove, J. 2007. Age Energy Research. A study of the energy usage of buildings relative to their age. HMCS Estates. Ministry of Justice

[2] 'Embodied' energy is the term used to describe the amount of energy required to make a building material or product. Materials which have been subjected to little processing are therefore low in embodied energy; materials such as concrete and bricks, which require a great deal of energy to manufacture them are higher in embodied energy. Similarly building materials transported long distances will have higher embodied energy.

[3] Weight, D & Rawlinson S. *Sustainability: Embodied Carbon* in Building Magazine 2007 (issue 41)

and need to ‘breathe’. This is a matter of degree: cutting down on draughts and fitting breathable insulation materials in historic buildings may well be appropriate – sealing the building up will most definitely not be. Over-insulating an old building may simply turn a cold, damp building into a warm, damp one, potentially increasing condensation, timber decay, mould growth and human health problems such as asthma.

Proper consideration must be given to the special characteristics of a historic building when considering energy efficiency measures. Indeed buildings that are listed, in conservation areas or are included in the schedule of monuments are exempt from meeting the requirements of the building regulations on energy efficiency, including the minimum standard for CO_2 emissions, where compliance would unacceptably alter their character or appearance. However, it is also important that opportunities for energy saving are not ruled out for the sole reason that a building is of historic or architectural interest. Energy efficiency should always be improved where the work does not prejudice the cultural significance of the historic building, or increase the risk of long-term deterioration to the fabric or fittings.

Possible ways of improving energy efficiency vary enormously depending on the building, but there are some basic principles:

- It is particularly important in the case of historic buildings to consider the performance of the whole building in terms of its energy efficiency: although an original single-glazed window may have an efficiency rating considerably poorer than modern standards, thick masonry external walls are likely to give the building much better thermal performance overall than the Building Regulations require;

- Simple measures can be very effective in terms of both cost and benefit: draughts of cold air through gaps in the frames of old windows or around doors can cause considerable loss of heat, so draught proofing and weather stripping can help dramatically in improving energy efficiency by improving air-tightness. The partial blocking of chimneys may also be beneficial (for example by using chimney ‘balloons’), although the adequate ventilation of gas appliances must be ensured. This level of work can have as much effect on heat loss as potentially more harmful alterations to a building, such as changing a historic single-glazed window for a double-glazed one (and will be considerably cheaper.) However, it is important to properly consider where heat is being lost; although windows and doors are common problem areas there may be unexpected places where heat is leakage. It might be worth considering a heat-loss test on your building (see ‘more help’ section);

- Well-designed secondary glazing in keeping with the building can offer improved performance, if the existing windows and their setting into the external walls allow sufficient space for it to sit;

- It is often difficult to insulate external walls or floors of historic buildings without causing unacceptable damage. If existing fabric has to be removed – for example, to repair weatherboarding – it may be possible to add insulation in a way that is sensitive to the needs of the historic building fabric;

- It is usually feasible to insulate above the top floor ceiling in traditional pitched roof spaces where these are ‘cold’ roofs ventilated externally, provided the external ventilation is retained. It may be more technically difficult – but still feasible – to insulate at rafter level where there are rooms in the roof-space. In such cases, using insulation materials that breathe and avoid the build-up of moisture is essential;

- Historic flat roofs probably present the greatest technical difficulty in improving thermal performance, and it may not be wise to try to do so; 'improvements' carried out in the past have resulted in moisture being drawn in to the structure, causing decay in the timbers or corrosion of metals;

- Energy conservation ('using less') is not the same as energy efficiency ('doing more with less'). It's easy to forget that changing how a building is used – the temperature of the rooms, and how long they are heated for – can have a big impact on energy use. Generally, steady background heating is better than sharp fluctuations that risk causing condensation and mould in old buildings. Efficient boiler controls certainly make a difference here – as can curtains;

- Insulation materials can be made from natural materials, or at least from materials with low embodied energy and that have low emissions of potentially polluting substances (*see* 'building materials' section). There may be good opportunities for using re-used or recycled materials; and

- Energy-efficient fittings and equipment can now be easily installed, and on larger building renovations it may well be cost-effective and feasible to install a system to recover heat from waste water. In conventional systems, most of the energy used to heat water takes place when raising the temperature of the water in the mains to tepid, even though this is only a third of the total temperature rise that is needed. Waste water systems avoid this expensive cost by using the heat recovered from waste water to pre-heat stored water before it is raised to its final temperature by the main energy source. The system works well for supplying both hot tap water and for water used in heating systems. Systems are now readily available and can result in considerable operational cost savings.

5 Renewable energy

'Renewable' energy covers a wide range of technologies. Energy can be generated either on-site or off-site. Potential on-site technologies for heritage projects include:

- Small-scale hydro-electricity – uses water power to generate electricity;

- Biomass boilers – use wood or other organic matter as fuel;

- Solar panels – use the sun's energy to heat water;

- Photo-voltaics – generate electricity using light;

- Ground source heat pumps – transfers heat energy from the earth or another environmental source; and

- Wind power – using on-site wind turbines.

The use of renewable energy should never be a substitute for making energy savings, but many organisations now wish to generate at least some of their own electricity and heat on site – and in the cases of water or wind power this can even mean reverting to a traditional means of energy generation.

It is often assumed that adopting renewable energy technologies for local generation means that a new building will always cost more. In fact this is not necessarily the case. If a building is designed from the outset to maximise passive light and heat gains, the capital budget can remain comparatively unaffected whilst revenue savings may be substantial.

But it's also essential to consider carefully the contribution that renewable energy systems will actually make to both the financial costs of running a building and carbon dioxide emissions. On smaller capital schemes, it is often possible to reduce environmental impacts far more by increasing insulation and draught-proofing rather than through introducing renewable energy systems. And where renewable energy systems are not installed, it's always possible to use renewable energy by purchasing 'green' energy from companies only supply from renewable sources.

On more complex cases it will be worth undertaking a full cost/benefit analysis of the renewable option. This should be based on costs and benefits over at least a 30 year time horizon. When comparing a renewables option with a fossil-fuel based option, the cost of the fossil-fuel option should include capital cost + operating costs + a cost that reflects the environmental impact of carbon not reflected in market prices. This last cost can be based on the 'carbon price' on trading markets such as the European carbon market.

The potential impact of renewable energy on historic buildings, ancient monuments, conservation areas, and wider landscapes needs to be taken into account, but these issues can be adequately addressed by choosing the right technology. When considering which types of renewable energy systems might be appropriate, some general points to consider are:

- Consider the context. For example, there is little point installing a biomass boiler where there is inadequate storage space for the fuel – this will result in a need for more frequent deliveries by lorry, which would create additional emissions as well as being inconvenient. Similarly, small-scale wind generation may be less effective in urban environments than in rural areas because of overshadowing by buildings, which reduces wind levels. The performance of solar panels and photovoltaics may also be affected by overshadowing buildings or trees;

- The position of solar panels or photo-voltaics needs to be given careful consideration to make sure they are not visually intrusive whilst still being in a good position for efficient operation. It is already possible to incorporate solar systems into new build and historic buildings without detriment to aesthetics or historic fabric. Developments in 'thin film' photovoltaic technology, which uses very small amounts of specialised materials, may well offer further opportunities in the future. The positioning of technologies away from the buildings that they serve may make solar panels or photo-voltaics an option even for the most sensitive sites;

- Heat pumps can be very cost effective. A heat pump is simply a device which moves heat energy from one place to another. The pump removes heat from one area (the source) and discharges it elsewhere (the sink). The source may be water, soil or rock, or even simply fresh air, depending on the type of heat pump used. For heating, the building is the sink – the heat from the source is generally used to heat water which then heats the building. Heat pumps can even be used for both winter heating and summer cooling, by reversing which is the sink and which the source. Installation costs can be reduced if heat pumps are considered at the right point in the project design – for example, adapting the nature of pile foundations slightly may mean that the heat pump installation can be carried out as part of the piling works. Proprietary foundations systems are now available which allow this to happen. Similarly, hard landscaping works can be carried out in a way that allows horizontal coils to be installed at the same time; There are implications here for the timing of building works, so it is essential that the project programme has been developed to allow for this. An air source heat pump needs no ground-works (except for any associated heat distribution pipes/ducts) so it is a much simpler and cheaper option than ground source. The only drawback can be noise and vibration from the fan unit. Any possible impact on archaeology needs to be thought about if you want to install a heat pump;

- In contrast to heat pumps, geothermal systems use heat from rocks deep underground to heat buildings (or hot water) directly. Installation costs are generally higher in the UK than for heat pumps, as it is usually necessary to drill much deeper into the ground to reach the source of the heat. As a result it's unlikely that geothermal energy will be a suitable for any project we fund; and

- Renewable technologies will become cheaper over time, and – for most technologies – they can be fitted at any time. However, one important exception is photovoltaics. This is because the additional cost and disruption of retro-fitting the electrical circuits required can often outweigh the cost-savings in their use. However, installing the appropriate wiring during a new-build or refurbishment project involves negligible additional cost. For this reason, even if current installation is not feasible, it's worth considering the installation of electrical circuits that would enable the later addition of photovoltaic technologies.

6 Water

Water resources, and the wildlife that depends on water, are increasingly under stress from climate change extremes, so it is good practice to ensure that projects use water efficiently and minimise the discharge of waste water. Saving drinking water also saves energy and carbon, since it takes a lot of energy to clean water and put it back into the system. Surface water would have been managed through open ponds and ditches in the past and reed beds would have provided a waste treatment resource. Such sustainable urban drainage systems (SUDS) are being used increasingly today.

The first aim should be to reduce the demand for water. Within buildings, significant benefits can be achieved by specifying low water-consumption fittings, with minimal extra cost. In parks and gardens, there needs to be careful planning of irrigation systems and water features; adaptation to climate change must also be considered in the selection of appropriate plant species.

Some best practice tips are:

- Install flow-reducing valves to pipe-work below taps that are not used for high volumes of water. Flow-reducing valves can be easily and cheaply fitted to pipe-work below taps;

- Install aerated taps for hand washing. These introduce air into the water stream. They can be installed by replacing the standard tap insert – meaning easy installation with no need to change the tap itself – at very low cost. They can reduce water consumption by up to 80%, according to the Environment Agency. There are now some versions that can operate as at low flows, but bypass the spray system to act as a normal tap if they are deliberately turned on high (to fill a sink quickly, for example). Other ideas you may want to consider include flow regulators, low-flow shower heads, waterless urinals and low-volume flush WCs using 2-4 litre or 4.5 litre cisterns;

- Sustainable urban drainage systems (SUDS) offer a range of benefits. This will reduce the rate at which water runs off hard surfaces, thus reducing the potential for flooding during extreme rainfall; they can also provide additional habitats and contribute to the visual appearance of a project. There is a wide range of options, from the very simple case of using porous paving to creating temporary water storage areas called 'swales' which allow water to soak slowly into the ground rather than flowing into hard drains.

Consider the range of options and local ground conditions before deciding which is appropriate. Impact on archaeology is another important consideration;

- Rainwater harvesting can work if the water is to be used for garden purposes. It is worth considering simple storage and purification measures to avoid nuisance as a result of stagnant water or biting insects. Filter the rainwater before it enters the storage tank, to ensure that biodegradable material is kept to a minimum, and use tightly fitting lids so that biting insects such as midges or mosquitoes cannot get into the tanks to lay their eggs. It is also worth considering a layer of charcoal at the base to keep the water reasonably pure. This is particularly applicable for smaller storage tanks, but sometimes also for commercial systems in larger tanks where the rainwater may be stored for some time;

- The lower rainfall and hotter conditions expected in future years due to climate change should be considered when choosing plant species for projects. Many plant species are available which cope well in dry conditions, and their use should be considered;

- Sprinklers should only be used for very specific purposes such as soaking unplanted areas of ground before planting takes place, since watering an exposed soil surface leads to greater evaporation of moisture. If irrigation systems are to be installed they should apply water at the base of plant stems, below the leaf canopy; drip or trickle systems are more efficient (see more help); and

- It is possible to collect rainwater and use it for flushing WCs and in washing machines. However, for these uses a complex system needs to be installed, with the requirement that it must not be possible for the water to enter the drinking water system. The same situation applies to ‘grey water’ – that is, water that has been used for comparatively light purposes and is collected, for example, from hand basins. Although this cuts down on water use, it requires a completely separate pipe system. Grey water must even be treated before it is re-used for flushing WCs. This means grey water recycling is particularly expensive to install when retrofitting as part of refurbishment works, although it is now more commonly installed in new developments.

7 Building materials

The production, use and disposal of building materials have a major environmental impact. In 1995 for example, 10 per cent of UK CO_2 emissions were related to the manufacture and transport of building materials[4].

In addition to being the right materials for your heritage, the things to consider in selecting building materials encompass their ‘whole life’ environmental impact. This includes embodied energy, waste involved in production, other environmental impacts during manufacture, the environmental impacts of the material whilst in use, and whether the material can subsequently be re-used or recycled.

The only effective way to take all of these into account is through a full ‘Life Cycle’ Analysis. However, that’s a very complex process to carry out. Below is some basic guidance that, if followed, is likely to minimise environmental impacts whilst at the same time respecting heritage

[4] Building Research Establishment (BRE), Environment Agency’s ’Sustainable Materials’ factsheet, produced as part of its SITEWise II campaign.

value. For the most part these guidance points complement each other – though some conflicts do inevitably arise (see 'potential conflicts'):

- Use traditional building materials. They are usually the most appropriate type of material for use in heritage projects because of their physical and aesthetic compatibility with the historic building. Also, using traditionally-produced new materials supports the maintenance of industries and businesses that are important for conservation;

- Use materials that are low in embodied energy. Products that would be chosen on this criterion include timber, lime mortar (lower embodied energy than cement), slate, stone, and a variety of unfired earth materials such as cob and rammed earth;

- Source locally to reduce the impact of transporting materials for long distances. Local products will on the whole tend to be lower in embodied energy and are likely to be the right choice on heritage grounds – for example lime mortar and slate;

- Use paints, varnishes and other finishes that are natural-oil or water-based. That is, they should not be petro-chemical or solvent-based products, which tend to have a far greater environmental impact and may also cause irritation to asthma and allergy sufferers. Natural oils and paints also allow buildings to 'breathe'. These paints and varnishes are likely to contain ingredients such as wood resins, plant oils (linseed oil, for example) and earth pigments. Natural flooring products such as natural lino, sisal, coir or timber can also help reduce such health impacts by contributing to better indoor air quality;

- Re-use materials from existing buildings. Re-using materials avoids all the environmental impacts of new manufacture and is a basic principle of efficient resource use. However, buying in re-used historic materials from elsewhere is to be avoided as it is rarely possible to conclusively establish exactly where the materials have come from. There is a very real risk that sourcing second-hand heritage building materials will damage important historic buildings;

- Incorporate materials with high recycled content. This not only reduces the amount of new material, energy and pollution in production, it also reduces the need for landfills, and possible pollution from incineration. Many materials and components are now available that have recycled content. Try to go for recycled products made from renewable resources. These include concrete that uses fly ash aggregate (PFA), carpets made from recycled plastic bottles, insulation made from recycled paper and paints that contain post-consumer returns. The Government's Sustainable Procurement Task Force found that 10% of the materials value of any construction project could easily derive from recycled content at no extra cost[5]. If you need to use non-renewable metals such as copper, lead, zinc, tin, steel and aluminium, you should be able to source products with a high recycled content. These resources should only be used if there are no substitutes and if they will contribute to the overall longevity of the building; and

- In new-build projects it is worth exploring the use of pre-fabricated or pre-assembled materials or modules; these may allow tighter on-site assembly tolerances and better air leakage performance, as well as greatly reducing waste from production or assembly. In particularly large-scale projects, inviting key suppliers to take part in design and sustainability workshops can bring substantial benefits.

Potential conflicts

[5] Department of the Environment, Food and Rural Affairs (DEFRA), 2006. *Procuring the Future*

- Embodied energy and energy efficiency. Using building materials with high thermal mass (materials that retain heat and release it slowly over time) is a good way of achieving energy efficiency. Clay block, cob, rammed earth and air-dried brick all have high thermal mass and low embodied energy. However, these materials are not always the most suitable for the local environment, in which case architects may want to use bricks or concrete in a design that achieves energy efficiency but does not perform as well on embodied energy. This is fine – but only if the building is expected to have a relatively long life (over 30 years), and is designed in such a way that the materials can easily be re-used. This implies the use of lime-based cements for brick and block-work, to enable easy dismantling and brick re-use. Using high embodied energy materials which cannot be re-used in a scheme which has a short life is not an efficient use of resources;

- The use of natural oil and water-based paints and finishes and heritage conservation. There may be cost and technical issues here, for example drying times for water based paints, and durable finishes in high-use public areas. Lead paint is a specific issue since it has unrivalled durability on timber. Lead paints that contain no lead carbonate or lead sulphate pigments can be used without any legal restrictions. Paint containing lead carbonate (white lead) can be used on Grade 1 and II* buildings (Grade A and B in Scotland), subject to a declaration to English Heritage, Cadw or Historic Scotland; and

- Slate amount of wastage in production means that it is sometimes argued that UK-sourced slate is not only more expensive than imported slate, but also has a higher embodied energy. There are also issues about the landscape and nature conservation impacts of some slate quarrying. Our preference is still for UK-sourced slate[6]. Slate quarried in the UK is a traditional material to be favoured on heritage grounds.

8 Construction waste

The construction industry creates 36 million tonnes of landfill waste a year – more than one third of the UK's total. Addressing waste management and minimisation during the construction phase offers lots of opportunity for both environmental and financial improvement. Improved resource use, reduction in greenhouse gases (methane, a main component of landfill gas, being particularly important), and less traffic impact are just some of the environmental benefits that are easily achievable. In terms of financial savings, the average savings made through effective waste management have been shown to be around 3% of build costs[7]. There is also a social benefit: there is a strong correlation between effective waste and materials management and a low accident record.

Adopting a site waste management plan means that a systematic appraisal has been carried out of the types and quantities of waste that are likely to be produced during construction. Measures can then be taken to minimise waste, and to manage the waste that cannot be avoided. It also helps ensure compliance with all statutory requirements associated with the management of waste. The voluntary Code of Practice for Site Waste Management Plans issued by the DTI in July 2004 provides guidance on how to do this – see the 'More Help' section. On construction projects with costs of more than £300,000 site waste management plans are now mandatory.

9 Soil

Soils store vast quantities of carbon and buffer chemicals that might otherwise pollute water or air. The way soil is handled and managed can significantly reduce the carbon footprint of

[6] National Green specification, 2007. http://www.greenspec.co.uk/html/materials/pitchedroofs.html
[7] Figures produced by WRAP and Envirowise

development and mismanagement of soil resource can lead to excessive runoff and pollution of water courses.

Transport of topsoil is one of the main methods of spreading a number of particularly invasive alien plants, whilst the redistribution of archaeological material is another problem of relocating topsoil. It is important that soils are effectively managed to prevent loss of biodiversity; avoiding the mixing of top and sub-soils is one example of good practice that can be easily implemented.

Careless storage of topsoil results in loss of or changes to its characteristics such as micro-fauna, seed content and pH – if, for example, it is stored in large heaps then the micro-fauna and seeds in the middle are likely to be destroyed, and the outside of the heap may be colonised by less desirable and more aggressive species. Proper management of soil is essential to avoid this, generally by storing it in shallow piles to avoid heat build-up and damage to its structure.

If the soil on the site is of poor quality, it may be feasible to compost green waste and mix it with subsoil from the site to produce reasonable quality topsoil. However, beware of enriching soil where wild flowers are intended to grow, particularly if existing species are intended to be re-introduced following completion of a building project. Many valuable wild flower species need poor soils to thrive, and will be shaded out by competing plants if the soil is enriched. This is another area where a good ecologist can provide invaluable advice and information – even more the case if you are restoring habitats or land-use and need to ensure the right soil conditions (physical, chemical and biological) are in place. Where additional topsoil is required on a site, excavated subsoil should be mixed with composted material and then re-used, in preference to importing topsoil. This is particularly the case where the compost can be made on site. As much as anything, this creates fewer lorry movements and less noise, disturbance and emissions.

Peat was first formed towards the end of the last Ice Age, and grows extremely slowly, so can't be replaced at the same rate at which it is currently being used. The destruction of peat habitat also accelerates the release of CO2 and methane, a powerful greenhouse gas. As peat can preserve organic remains, peat bogs are also vitally important for conservation of historical and archaeological resources.

10 Timber

There are many advantages to using timber: managed woodlands help to maintain the natural environment, store carbon as well as providing social benefits. Worldwide, the maintenance of well-managed forests is of vital importance if we are to deal with issues such as climate change, biodiversity loss and poverty reduction.

There is now a great deal of advice and information available from government and others on the ways that sustainable timber can be obtained, including details of the types of documentation that can provide confidence that timber has come from a well-managed source. This recent work means that it is becoming easier to obtain timber products which do not damage the environment.

UK-grown hardwoods and softwoods are preferable to imported timber, and all UK woodlands with woodland management plans approved by the Forestry Commission are deemed to provide sustainable timber. Durable UK softwoods you could use instead of imports include larch, western red cedar and Douglas fir.

Government policy on public procurement is now that all timber must be obtained from verifiable legal and sustainable sources. The best guidance on this issue is provided by the UK government's 'Central Point of Expertise on Timber' (CPET). On heritage projects, the basic principles of good practice are:

- The replacement of original timber in historic buildings should be minimised by regular maintenance and good conservation practice. Where timber has decayed, the objective should be to undertake the least amount of intervention that is possible;

- No timber or timber products should be derived from tree species that are protected under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) unless it can be shown by official documentation that the CITES requirements for trading in that species have been complied with;

- Procurement procedures need to clearly indicate that timber must be supplied from a source that is legal and sustainable. The only methods for demonstrating and verifying that timber has been sourced legally and sustainably are those that have been approved by the government's Central Point of Expertise on Timber (CPET). These methods include certification schemes such as FSC and PEFC, but there are others – including local suppliers where the level of documentation required is much simpler; and

- Finding sustainable sources of tropical hardwoods that are frequently desired for marine and maritime projects can be difficult – but here too there are increasing supplies of from certified forests. It's also worth investigating alternative types of timber to traditional products such as teak and greenheart.

11 Biodiversity

All construction sites have some wildlife issues, whether they are in an urban or rural setting. The very nature of construction means that there is great potential for negative impacts like direct species loss, fragmentation of habitats, and disturbance during feeding and nesting periods. However, an informed and positive approach to working with wildlife can lead to significant benefits. On all construction projects it is always worth contacting the relevant authority for general biodiversity and natural heritage advice.

The first priority for all projects is to know your site: what wildlife is there now, and what are the likely or potential impacts of your construction project on this wildlife. It's also important to know whether there are any designations. These may be national (Site of Special Scientific Interest, Special Protection Area, Special Conservation Area) or local (Local Nature Reserves, Local Wildlife Sites) covering your site. Your local authority will be able to give you details of any designations affecting your site. You will need to consider both the species present and the habitats on which they depend to survive. Depending on the scale of your project, you may need to commission expert advice and surveys to establish what species are present; you will certainly need expert help if there are protected species such as bats, great-crested newts, red squirrels or badgers on or perhaps even near your site, and it is likely that you will need a licence to carry out work. As well as plants and birds, surveys should also cover mammals, invertebrates, reptiles, amphibians and – in some cases – lower plants. These should be undertaken by trained surveyors at the right time of year (for example, botanical surveys in winter will not be effective).

There may be significant constraints if such species are present, including where and when you can carry out building or landscaping work. You are not allowed, for example, to cut back or remove hedges or trees where there might be nesting birds during the nesting season (the spring and summer months). Bat roosting sites must be maintained at all times and building activity is prohibited when they are in use.

As far as you possible, protect what is there already. This is, of course, a legal requirement if there are statutory designations or protected species on your site. If it is not possible to protect existing habitats and species, plan how to reduce impacts on biodiversity both during the building works and afterwards. This could include mitigation measures designed to alleviate the immediate impact or enhancement measures, designed to improve conditions elsewhere or in other ways.

Improving the overall biodiversity of a site can be done by providing new habitats, either as part of a building design or through landscaping and planting. Green roofs, for example, offer some benefits for wildlife particularly in urban environments (as well as other advantages such as insulation and reducing the rate of water run-off). A very wide range of other measures can be introduced at little or no additional cost to encourage a greater variety of wildlife.

12 Visitor transport

Visitor travel is a difficult issue for many heritage sites, especially ones based in more rural or isolated areas and that depend on visitor income. But providing ways for the public to reach a site without using a car is an increasingly high priority. Many ideas are now being tried out that establish a 'people-friendly' rather than 'car-friendly' environment at heritage sites, such as links provided to public transport and cycle-ways, and ticketing systems that reward visits made in more environmentally-friendly ways.. Monitoring how visitors arrive and proportion of visitors, staff, volunteers and contractors that come by public transport, walking or by bicycle is a pre-requisite to encouraging change in these choices.

If car parks have to be provided, materials for surfacing should be of natural materials such as stone or recycled aggregates that are in keeping with the local environment. Sustainable Urban Drainage (SUDS) techniques should be incorporated (see section on ‘Water’).

Appendix 1: Sources of further help

Whole life costing

- Office for Government Commerce; and
- University of Bath – produces the Inventory of Carbon & Energy (ICE) on life cycle carbon impacts.

Energy efficiency / renewable energy

- English Heritage / Historic Scotland / Cadw;
- Energy Saving Trust;
- Carbon Trust;
- Combined Heat and Power Association;
- National Energy Foundation;
- The Green Energy Helpline;
- National Energy Foundation; and
- Renewable Energy Association.

Water

- Waterwise;
- The Royal Horticultural Society and
- Environment Agency.

Building Materials

- Building Research Establishment – produces the Green Guide to Specification;
- GreenSpec;
- Sustainable Building Association;
- Association for Environmentally Conscious Building; and
- Wolseley Sustainable Building Centre.

Construction Waste

- Waste Resources Action Programme (WRAP);
- National Industrial Symbiosis Programme (NISP); and
- Envirowise.

Soil

- Soil Association;
- National Soil Resource Institute;
- Soil Management; and
- British Society of Soil Science.

Timber

- Forestry Stewardship Council (FSC);
- Programme for the Endorsement of Forest Certification (PEFC);
- ProForest; and
- Forests Forever.

Biodiversity

- Natural England / Scottish Natural Heritage / Countryside Council for Wales; and
- Landscape Institute.

Visitor Transport

- Sustrans;
- Campaign for Better Transport; and
- Environmental Transport Association.

General

- Constructing Excellence;
- Sustainable Build;
- Sustainable Energy Action;
- Sustainable Construction; and
- Construction Industry Research and Information Association (CIRIA).