11. Materials

11.1 Background information on the current situation in Leeds

11.2 The materials used in any development can have an important influence on sustainability. It is important to consider the source of the materials (whether they are from finite or renewable resources) and the energy used in both their manufacture and transportation. Buildings often consume more energy through their materials and construction than they do throughout their lifespan. This is particularly the case with commercial buildings which are generally constructed of high energy materials, such as steel, aluminium and glass, and tend to have a short lifespan before refurbishment. It is important therefore, that maximum use is made of any existing materials on site, recycled materials and of low energy materials - those that are available locally, are naturally occurring and/or a by-product of some other local activity.

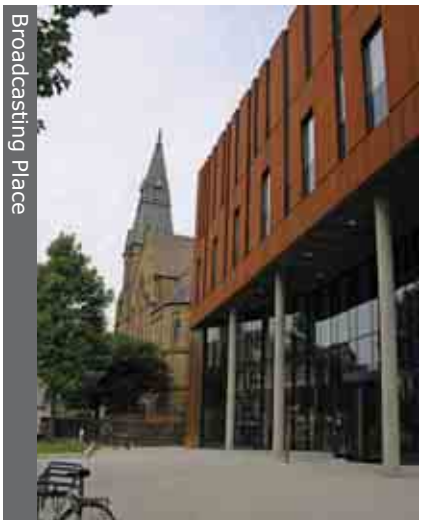
11.3 Within Leeds the major mineral deposits are coal, sandstone, clay, sand and gravel. Despite its modest size there are 14 sites in Leeds where construction materials (minerals) are produced. Total aggregate production is around 750,000 tonnes per year, around one tonne per year for every resident within the district. This is much less than the estimated four tonnes per head accounted for by the consumption of aggregates in Leeds in the construction industry and through DIY. The shortfall is made up of aggregates brought into Leeds by road and rail every day from quarries in neighbouring counties, in particular from the region's national parks.

11.4 Earth is probably the most sustainable building material as it requires no energy in its manufacture and can provide high levels of insulation. In addition, earth sheltered buildings tend to have a reduced impact on the landscape and can provide opportunities for habitat creation. Other natural

Timber sourced from sustainable forests

CASE STUDY: Blackhill Quarry, Bramhope, Leeds

There has been a working quarry on this site since around 1910, producing and supplying certified recycled hardcores for the construction industry and supplying reclaimed walling stone and flags and other landscaping products, to both the trade and public.



Broadcasting Place

The sculpted roof forms and the corten finishing material is meant to reflect the weathered crags of Yorkshire rock formations.

"This connection to the geological forms outside the city was deliberate in order to echo the associations that local sulptors such as Henry Moore and Barbara Hepworth had with the landscape."

Fielden Cleff Bradley

materials, such as straw, cork and hemp can be used to create low impact building and insulation materials. Timber is generally considered to be a low energy material, however care must be taken to ensure that it is sourced as locally as possible and is from well managed, independently certified sources. Timber also has the benefit of locking up atmospheric carbon. The benefits of stone are that it is durable, easy to recycle, low maintenance and has a high thermal capacity. However, consideration should be given to the need for transportation and the impacts of extraction. For the repair of historic buildings and for developments within Conservation Areas, the use of locally-sourced materials is not only a more sustainable option in terms of transport emissions, but it is often more appropriate in terms of the character of the building or area itself. Bricks have a high energy input during production, but are generally durable and can be reused or recycled. Locally produced bricks should be specified to reduce transport costs. Materials such as plastic, steel and aluminium require a high energy input in their manufacture and thus should be used sparingly.

11.5 Materials will be affected by climate change (South East Climate Change Partnership 2005). For example, materials like brick and concrete once warmed up, stay warm for a long time, while light materials such as wood are warmed up quickly, but also cool down quickly. Consequently, walls built with heavy materials retain heat and let it out slowly.

11.6 It is important that the structure should have the optimum thermal mass that helps to maintain a comfortable internal environment and avoids overheating and the unnecessary use of energy intensive cooling systems. For high occupancy uses such as houses and hospitals, this usually means high thermal mass.

11.7 The characteristics of materials may also change with changes in temperature and humidity.

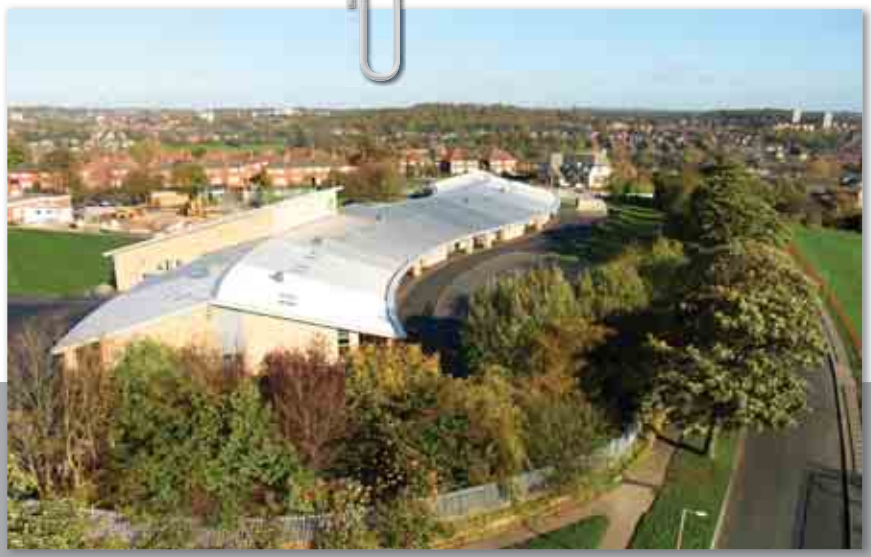
Table 11.1:

Material	Climate change cause and effect
Concrete	Strength affected by curing at higher temperatures
Lime mortar, stone	Affected by increased CO_2 and driving rain
Plastics	Affected by increased UV
Bricks	Strength affected by changes in moisture content
MDF/chipboard	Not to be used in areas where flooding is expected
Roofing felt	Increased UV is likely to accelerate degredation

Skelton Grange eco-centre

11.8 The construction sector uses over 420 million tonnes of material resources each year (Construction Resources and Waste Platform 2004). Annually, the sector generates 90 million tonnes of construction and demolition waste, which equates to 300% of the waste produced by all UK households combined. Only half of the waste is recycled back into the sector. Currently, around 13 million tonnes of construction and demolition waste is material delivered to construction sites but never used.

11.9 Reducing the amount of construction and demolition waste going to landfill has a direct saving in the costs associated with removing it from a site and from lower landfill taxes. Good practice levels of recycled content in construction are cost-neutral or cost saving. WRAP provides a great deal of advice and case studies in this area, which can support cost saving measures.



CASE STUDY: Hollybush School

'intelligent use of well controlled natural ventilation'

Hollybush is the first of a new generation of schools, specifically planned from the very start of the design process to incorporate sustainability into its basic design. The school maximised the use of passive energy, together with improved insulation techniques. A longevity of use was incorporated, aimed at a minimum 60 year life span together with best practice installation and construction use. Timber was selected as a reusable commodity with an acknowledgment to the BRE green guide to construction. Consultation and feedback from staff and pupils from Hollybush School was initiated and carried through.

Designed by ADS of Leeds City Council

Use locally sourced materials and do not over-specify

CASE STUDY: Epicentre - Meanwood Valley Urban Farm

Opened in 1999, the Epicentre provides Meanwood Valley Urban Farm with exhibition space, classrooms and a library, as well as a central focus for the learning and inspiration of the farm's aims. The building is constructed using the Walter Segal concept of modern and adaptable sustainable design.

The building utilises recycled materials, the majority of which is locally grown timber, including the main structure of larch from the Harewood Estate. The green roof minimises the impact of the building from the north and east. Other features include a glazed 'greenspace' to optimise solar gains, compost toilets and a reed bed drainage system.

Designed by Rob Bumby of OSA Architects (now Stack Architects) for Leeds City Council

Managed pine wood

11.10 By locally sourcing materials such as wood or timber, the construction sector will help to reduce the need to transport materials and help maintain local character. Table 11.2 shows the maximum haulage distance it is worth moving a reclaimed material before the environmental advantage is lost.

Table 11.2: Maximum transport distances for reclaimed materials

Material	Distance (miles)
Tiles	100
Slate	300
Bricks	250
Aggregates	150
Timber	1,000
Steel products	2,500
Aluminium products	7,500

Source: BRE Green Guide to specification (BRE 2000)

11.11 The majority of timber used in the UK comes from unmanaged and unsustainable sources world-wide. The effect of a more sustainable construction sector would be significant as it currently uses 60% of all softwood and 44% of all hardwood timber in the UK (Forest Stewardship Council 1996). Materials that will last a long period of time and require little maintenance are also preferable.

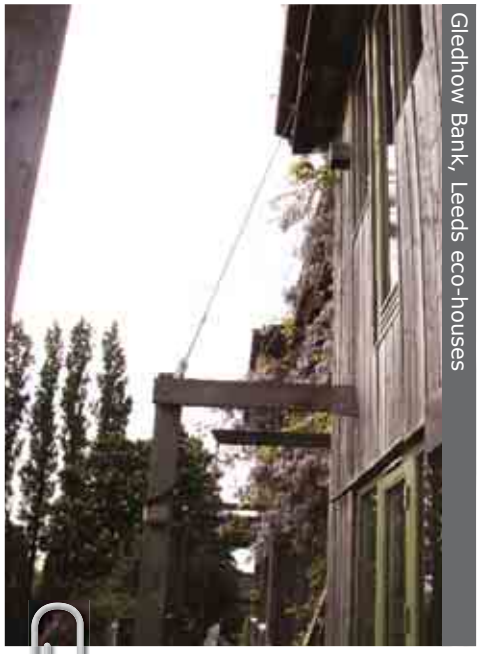
11.12 The analysis of the evidence in the Natural Resources and Waste DPD Resource Flow Analysis (Leeds City Council 2008d) draws the following conclusions:

- Leeds' minerals and aggregates performance compares favourably with other areas and there is evidence of some self-sufficiency, even though Leeds is a net importer of materials;
- The imports into the area do however form a small percentage of overall consumption. In addition, the majority of Leeds' imports come from the surrounding Yorkshire and Humber region, which also has a very low import rate (6%);
- The non-renewable nature of mineral and aggregates and in light of the limited reserves within the Leeds area, reduction, reuse and recycling should always be implemented as opposed to new production;
- The utilisation of construction, demolition and excavation waste should be maximised, in order to ease demand on reserves, reduce the need for the importation of minerals and aggregates and in turn complement the waste reduction targets.

Other Case Studies to refer to:
– Greenhouse p16
– Innovate p13
– Allerton Bywater p33
– Hands On p37

11.13 The CSH includes three issues in this category whose aims are:

Environmental impact of materials	To encourage the use of materials with lower environmental impacts over their lifecycle
Responsible sourcing of materials – basic building elements	To recognise and encourage the specification of responsibly sourced materials for the basic building elements
Responsible sourcing of materials – finishing elements	To recognise and encourage the specification of responsibly sourced materials for the finishing elements



Gledhow Bank, Leeds eco-houses

CASE STUDY: York Eco-Depot

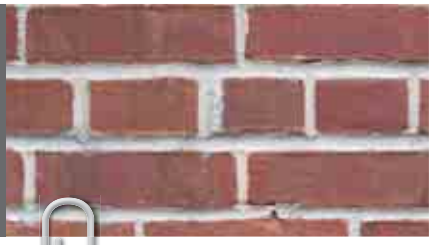
York's new Eco-Depot, finished in 2006, has won multiple awards including a Green Apple Gold Award for its sustainable design and construction and is seen as an excellent example for future developments. One of the reasons why the depot is so energy efficient is the use of locally sourced straw bales and timber as the main construction materials for the walls of the office building. Not only are straw bales highly insulating, they also have low embodied energy because straw, along with timber, absorb carbon dioxide as they grow, unlike more common building materials that release a lot of carbon dioxide during construction. Other features of the building such as underfloor heating combined with heat absorbing concrete floors, well planned building orientation, solar panels and rainwater harvesting, have all contributed to the buildings high level of sustainability. The result of this innovative design is that the current office building is 76% more energy efficient than a traditional building and the Eco-Depot will save approximately 176 tonnes of carbon dioxide every year.

Designed by Carillion for City of York Council

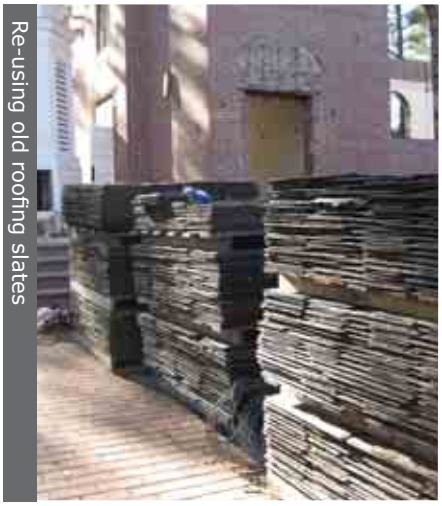
11.14 **Environmental impact of materials / responsible sourcing of materials – basic building and finishing elements**

11.15 Measures that can be taken to encourage the use of materials with lower environmental impacts over their lifecycle and to recognise and encourage the specification of responsibly sourced materials for the basic building (roof, external walls, internal walls, floors, windows) and finishing elements include:

- ☑ Procuring materials that have low whole life environmental impacts, for example, the use of straw bales for wall construction;
- ☑ Procuring materials that have a long life to reduce the need for future demolition;
- ☑ Avoiding over – specification;
- ☑ Reusing existing materials or procure reclaimed and recycled materials;
- ☑ Using recycled materials wherever possible rather than virgin materials. These may result from demolition on site or may be imported from elsewhere;
- ☑ Earthworks undertaken at a development should include a high percentage of recycled organic compost;
- ☑ Products such as cement and lightweight concrete blocks can be made using waste or by-product materials. These should be specified;
- ☑ Avoid specifying materials which cannot easily be separated for reuse / recycling;
- ☑ Natural non-toxic and low VOC (volatile organic compounds) flues, solvents, treatments, paints and coatings should be specified where possible, for example, lime-based renders, mortars and paints;
- ☑ Procure local materials to reduce their transportation impacts;
- ☑ Ensure all timber is legal



Leeds red brick



Re-using old roofing slates

and all timber products come from temperate sources which are independently certified, such as the FSC and PEFC;

- ☑ Innovative schemes using low impact materials will be welcomed;
- ☑ The amount of non-porous hard surfacing should be minimised. Porous surfacing materials should be used to enable surface water infiltration and manage run-off.

- Ensure the materials specified will perform adequately in the climate throughout the lifetime of the development.

CASE STUDY: Town Centre House

This redevelopment of an existing 'tired' office section of a larger city centre shopping centre achieved a BREEAM rating of 'Excellent'. The building has a low energy design and predicted CO_2 emissions are 74% lower than a typical office development of the same scale. This has been achieved through a state of the art cooling and heating system which incorporates a heat recovery stage and natural ventilation. The building achieved a 70% recycling rate for construction waste, used locally sourced York sandstone cladding and incorporated a sedum green roof to improve biodiversity and help attenuate sudden rainfall events.

Designed by BDF Architects and SMC Gower (now known as Archial) for Town Centre Securities plc

11.16 Further information

- 'Green Guide to Specification': www.bre.co.uk
- 'Opportunities to use recycled materials in building', 'Choosing Construction Products: Recycled Content of Mainstream Products', 'Recycled Content Toolkit', are just some of the freely available documents and tools at www.wrap.org.uk
- Recycled content product online construction search tool: http://rcproducts.wrap.org.uk/
- Evaluation tool for recycled content in construction: http://rctoolkit.wrap.org.uk/
- Forest Stewardship Council, UK. www.fsc-uk.org/