1 BACKGROUND

The purpose of this 4th edition of *The Green Guide to Specification* is to provide designers and specifiers with easy-to-use guidance on how to make the best environmental choices when selecting construction materials and components. It is more comprehensive than its predecessors and contains more than 1200 specifications used in various types of buildings.

Developing the content has involved the widest possible consultation with industrial partners, manufacturers and trade associations, academics and researchers, and reference to a wide range of other reliable sources of environmental data and information.

The whole process has also been the subject of more rigorous peer review procedures than its predecessors and, as a result, both the methodologies used and the findings made are as robust and dependable as they can be at the present time in the field of environmental impact assessment and life cycle assessment of construction products.

1.1 ENVIRONMENTAL CONSERVATION

Many in the property sector are becoming more aware of the need to reduce exposure to 'environmental risk'. While the most common construction and development-related risks have been associated with polluting activities or the failure of specialists to deal with specific environmental hazards, the future scope of environmental liability may have far-reaching implications for the construction industry. The impact of the construction process and the associated impact from materials extraction and manufacture in terms of energy and resource use or levels of emissions on global conditions could be identified as a major 'indirect' environmental hazard. As such, it is possible that these issues will become potential legal liability flashpoints and that designers, specifiers and materials manufacturers will be obliged to take this into account in the design and construction process.

Environmental impacts come in many different forms. It is widely accepted that there is mounting evidence to suggest that the concentrations of carbon dioxide (CO_2) and other 'greenhouse' gases (such as methane) in the atmosphere are increasing. This, it is argued, is leading to global warming and climate change. As the main source of these greenhouse gases is the burning of fossil fuels for energy, a reduction in the energy levels required in the manufacture of building materials represents an opportunity for producers of materials to minimise the environmental impact of their products. The release of chemicals into the atmosphere from manufacturing processes has been linked to damage to the ozone layer and to other effects that are harmful to the environment and human health. Volatile organic compound (VOC) emissions may be irritant or toxic. Nitrogen dioxide and nitrogen oxide (NOx), released in combustion processes, are both contributors to acid rain and react with VOCs in sunlight to produce photochemical smog. This smog is implicated in an increased incidence in asthma and respiratory illness. Sulfur dioxide (SO_2), also released from the combustion of oil and coal products, is a main contributor to acid rain. All these impacts are relevant and present in building product manufacture. Suppliers and producers have a responsibility to understand the relative impacts of manufacture and to work towards impact mitigation. Designers and specifiers can assist in this process through making more environmentally responsible choices.

Similar responsibilities are evident in other parts of the construction value chain. Property investors and funding institutions, under pressure from shareholders and insurers, are also seeking a 'greener' and more 'socially responsible' approach to the design and procurement of buildings, and many property-owning organisations are signing up to Corporate Social Responsibility (CSR) initiatives. A more carefully considered, environmentally aware approach to the specification of materials is important in being able to demonstrate that projects are well managed and are protecting shareholders' interests through minimising the risks associated with environmental impact. Across all these issues, *The Green Guide* is designed to provide robust information to assist in decision-making processes.

1.2 THE PURPOSE OF THE GREEN GUIDE

Before the publication of the first edition of *The Green Guide* in 1996[1], there was little accessible, reliable or methodologically robust guidance available for specifiers seeking to minimise the environmental impacts of building materials. Much of the relevant research and information at that time offered either generalised guidance, usually unsupported by quantitative data, or, alternatively, complex numerical assessments that proved difficult for designers and clients to interpret. The first edition of this publication therefore aimed to

provide a simple 'green guide' to the environmental impacts of building materials which was both easy for busy professionals to use and soundly based on numerical data. This ethos was maintained through the publication of subsequent *Green Guides*, and has remained as an aim and purpose for developing this 4th edition.

The Green Guide is intended for use with whole building assessment tools such as BREEAM, The Code for Sustainable Homes and EcoHomes rather than as a stand alone tool. Material choice and specification has an impact on the overall environmental, social and economic impact of a building which *The Green Guide* cannot take into account. For this reason, BRE Global does not recommend that targets based on *The Green Guide* ratings are set independently, for example by Planning Authorities.

1.3 THE DEVELOPMENT OF THE GREEN GUIDE

The success of the Environmental Profiling system used in *The Green Guide* is demonstrated by the continuing demand for successive, updated editions. The 2nd edition was launched by the Minister for Construction in 1998, and contained over 200 specifications[2]. Since that time, *The Green Guide* has been part of the BRE Environmental Assessment Method (BREEAM)[3], EcoHomes[4], and more recently The Code for Sustainable Homes[5], becoming the UK's leading construction-embodied impact assessment tool. A version developed specifically to appraise the materials used in housing was released in 2000[6]. The 3rd edition, profiling around 300 different commercial specifications, was published in 2002[7].

Information on the relative environmental performance of materials and components is continually advancing, reflecting changes in manufacturing practices, the way materials are used in buildings, and our evolving environmental knowledge. This developing context has led to the compilation of this 4th edition of *The Green Guide*.

1.4 CONTENT AND LAYOUT OF THE GREEN GUIDE

The scope of this book examines the relative environmental impacts of the construction materials commonly used in six different generic types of building including:

- commercial buildings, such as offices,
- educational buildings, such as schools and universities,
- healthcare buildings, such as hospitals,
- retail,
- residential,
- industrial.

Materials and components are arranged on an elemental basis: external wall construction, internal walls, landscaping, etc., so that the reader can compare and select from comparable systems or materials. Furthermore, it is meaningless to compare the environmental profiles of, say, concrete floors and a particular type of paint; ratings are therefore based only on product performance within each respective element group. The principal building elements covered in this edition of *The Green Guide* include:

- ground floors,
- upper floors,
- roofs,
- external walls,
- windows,
- internal walls and partitions,
- insulation,
- landscaping.

Across these building element categories *The Green Guide* provides an extensive, but not complete, catalogue of building specifications covering most common building materials. It is therefore intended that the number of products profiled will continue to increase with subsequent editions and through updates to the online version of *The Green Guide to Specification*[8]. It is also fully expected that other building element categories will be added in time.

Materials and components are presented in their typical, as-built, elemental form. They are compared on a like-for-like basis, for 1 m^2 of construction, as components that fulfil the same or very similar functions; important variables such as the mass of a material required to fulfil a particular function are therefore taken into account. For example, a direct comparison between the Environmental Profile of 1 tonne of structural steel and 1 tonne of structural concrete would be misleading, as less steel is required to achieve the same structural performance.

It should be noted that *The Green Guide* does not take operational performance into account in terms of the potential energy-saving benefits of materials with high insulation values or high thermal mass. Because *The Green Guide* is intended for use within overall building assessment tools such as BREEAM[3] and The Code for Sustainable Homes[5], which already reward the minimisation of operational impacts, it would be double counting to also include these benefits within *The Green Guide*. All relevant specifications are compared on the basis of a common U-value and therefore equivalent heat loss.

1.5 ENVIRONMENTAL IMPACTS

The environmental ratings in this publication are based on life cycle assessment (LCA), an environmental impact assessment method for products and materials that is described in *Chapter 3*. The LCAs that underpin the ratings take into account the environmental impacts of the winning of the raw materials, manufacture, transport, assembly, maintenance, repair and replacement, demolition and waste management at the end of life.

LCA also takes into consideration a wide number of environmental issues. The environmental issues covered by *The Green Guide* ratings reflect the generally accepted areas of concern related to the production of building materials used in the UK and were arrived at through an industry consultation and consensus process that took place during *The Green Guide's* development work. The issues included are listed in Box 1.1.

Box 1.1:* Environmental issues covered by *The Green Guide

- Climate change
- Water extraction
- Mineral resource extraction
- Stratospheric ozone depletion
- Human toxicity
- Ecotoxicity to freshwater
- Nuclear waste (higher level)
- Ecotoxicity to land
- Waste disposal
- Fossil fuel depletion
- Eutrophication
- Photochemical ozone creation
- Acidification

1.6 THE GREEN GUIDE RATING SYSTEM

Although the environmental ratings in this publication are underpinned by extensive quantitative LCA data, it was felt that these numerical values and comparisons would be of interest only to specialists rather than those involved in the day-to-day procurement of building projects.

To assist decision making, *The Green Guide* translates the numerical LCA data into a simple environmental rating system to enable specifiers to make meaningful comparisons between materials and components. As a means to this end, an A+ to E ranking system is used, where 'A+' equals good environmental performance, ie least environmental impact, with A, B, C, D and E ratings increasing as environmental impact increases. Every specification included in *The Green Guide* is rated using this scale for each of the 13 categories of environmental impact, together with an overall Summary Rating. This is explained in more detail in *Chapter 4*.

1.7 STATUS OF SPECIFICATIONS

The specifications shown throughout this publication are generic and are used to illustrate a range of typical materials and are not intended to be used to specify construction. Although every effort has been made to ensure that the information given here is accurate, knowledge and understanding in this new field is still evolving. The ratings shown here represent our best efforts to provide objective, helpful guidance to enable the specifier to make more informed choices, based on the data and methodologies available at this present time.

1.8 BALANCING THE GREEN GUIDE WITH OTHER REQUIREMENTS

Designers will be aware of the view among many environmental researchers that operational impacts of buildings normally outweigh the embodied impacts arising from materials production and construction, by a factor in the region of 9:1. There may therefore be circumstances under which a less than environmentally ideal specification choice can be justified in the interests of better long-term operational environmental performance. This is not to say, however, that embodied impacts presented here in *The Green Guide* are inconsequential. For example, the materials sector still consumes around 30% of total UK industrial energy and approximately 10% of all UK energy. The Environmental Profile (ie LCA) of a building material is only one of many factors which needs to be taken into consideration when compiling a specification. Other important and potentially decisive issues are:

- cost,
- durability,
- appearance,
- development control issues,
- buildability,
- function and operational issues (including the benefits of using high thermal mass materials),
- maintenance,
- availability.

It must also be recognised that the scientific understanding of what is best environmental practice is subject to change. Designers will be aware of the ongoing debate concerning the merits of recycling and how recycling may not always represent best environmental practice, especially where high value and polluting energy resources are consumed to recycle low-value material. The merits of recycling should be judged on a case-by-case basis, looking particularly at key issues for each individual material and location. For example, the relatively low impacts of some reclaimed materials can be adversely affected if they have to be transported over long distances when compared with new materials that may be produced more locally.

The most successful approach for establishing the appropriate balance between conflicting requirements is to establish the underlying objectives and priorities in the early stages of a project.

Even in the best buildings, compromise is an inevitable part of design and specification; 'green' considerations will no doubt be subject to this same process of trade-off in achieving the right balance of priorities for a particular project. It is hoped that, by thoughtful consideration and the careful use of this book, designers and client organisations will at the very least begin to 'move in the right direction' towards reducing the environmental impacts of construction projects.