Delivering sustainable construction

This article discusses the key drivers of sustainable construction, explains what sustainable construction has to offer and how these benefits can be realised.

What is sustainable construction

In the context of the whole sustainable development debate sustainable construction can be thought of as a subset of sustainable development and defined as: "Development which meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development encompasses such issues as the reuse of existing built assets, design for minimum waste, minimising resource and energy use, and reducing pollution.

Drivers for sustainability

Business can benefit from pursuing sustainability in two ways: by generating top line growth through innovation and new markets, and by driving cost efficiencies.

A review of how the sustainable agenda is being address has demonstrated that the steel construction sector is an efficient, competitive industry; that steel framing and cladding systems facilitate the development of energy efficient buildings; that levels of material recycling and/or reuse are high and that the use of offsite manufacturing promotes safer working, stability in the workforce and skills development while at the same time minimising the impact of site construction.

However more needs to be done through:

- understanding what sustainable development means for you, your client and customers
- whole of life thinking, best value considerations and high quality information to inform decision making
- design and construct with maximum speed and minimum site disruption
- design to minimise operational impacts such as energy use
- designing for demountability, to encourage future re-use and recycling of products and materials
- engaging organisations within your supply chain about sustainable development
- selecting responsible contractors with sustainable development principles.

Understating sustainable development

The steel sector has produced a number of guides on the complex and wide-ranging issues impacting sustainable development.

In Britain they conducted a survey to determine the attitude of clients and their advisers to the issue of sustainable development.

The results of the survey showed that design briefs from public sector clients are increasingly reflecting the government sustainable development policy, and that, while the private sector is still often driven by lowest cost, growing consideration is being given to other issues such as whole- life costing, health and safety and business probity.

Sustainability demands a change in emphasis, not towards abandonment of profit but a shift in focus towards business as part of the whole economic social and environmental system.

Speed and predictability of construction remain high priorities, and flexible buildings capable of accommodating change are valued. There is an increasing appreciation of the need to consider end-of-life issues, where the ability to reuse components and recycle material is important, and clients are responding to stakeholder pressure for socially responsible behaviour.

Decision making

There is a need for designers to consider and balance all impacts across the full life of the building. This can be achieved partly by using Life Cycle Assessment, using reliable methods and data, but needs to be complemented by considerations of social and economic impacts.

Software tools help in this process and support informed decision making in design and construction. These tools assess the performance of buildings across a range of areas such as management, energy use, health pollution, transport, land use, ecology, material and water use. These are then weighed to give an overall 'score'.

Design for long life and low maintenance

Buildings which can accommodate changes to the functions for which they were originally conceived can contribute significantly to sustainable development.

Useful life can be extended by adapting internal spaces, structural extension and upgrade of the external envelope. This facilitates reduction in the life cycle costs and lifetime impact and encourages extraction of increased value from available resources. Extending building life can also preserve cultural and historic value.

Long span construction in particular can create flexible spaces which facilitate changes in use and service requirements. This can maximise letting potential and reduce refit costs. Flexible buildings which can accommodate changes in use, increase lettable areas and maintain asset value are highly valued by clients. The high strength-to-weight ratio of structural steel makes it ideal for long span floor and roofing systems.

Designing buildings so that they are adaptable and flexible can extend their useful life. A key issue is to provide long span floor and roof systems, creating wide column-free spaces.

Steel construction products require little maintenance, generally only where the steel is exposed to an external or corrosive atmosphere, or for cosmetic reasons.

A wide range of coatings is available which when used in accordance with a suitable inspection and maintenance program, will give excellent life protection.

Speed and efficiency

Speed, efficiency and accuracy of construction are high priorities in construction, saving money and reducing local impacts associated with building work. For busy, congested urban development sites, where land values are high, rapid construction is essential.

Computer based design and information systems allied to significant improvements in erection techniques have led to great improvements in logistics and planning, enabling rapid and reliable steel construction.

Increased prefabrication, extending to modular construction is also having a considerable impact on building construction efficiency. Factory working facilitates accurate and high quality workmanship which has a considerable impact on speed and efficiency of on-site construction.

Efficient operation

The energy associated with the occupation and use of buildings can dominate that used in manufacture and construction by as much as 10:1 over a 60 year design life in a high usage air conditioned building. Even for a naturally ventilated office building with a 30 year life span the operational to construction energy ratio is typically 3:1.

Reducing operational energy consumption in buildings reduces environmental and financial impacts and generally has a greater impact than reducing the burdens associated with construction.

In commercial offices, cooling is usually the most significant consumer of energy. Fabric energy storage, ideally used in conjunction with natural ventilation, can be utilised to reduce or even eliminate the need for air conditioning. This typically takes advantage of the exposed surfaces of composite or other types of floor slab and is readily accommodated on typical steel framed construction.

One of the major issues is to minimise cooling requirements, provide high levels of natural lighting while avoiding direct sunlight, and minimising heat losses.

The balance between these depends on the building i.e commercial or residential. In residential buildings energy is more likely to be wasted as result of heat loss during cold weather. Providing a comfortable internal atmosphere which encourages good productivity can have the most economic value.

Recycling and reuse

Design for recycling and reuse can significantly reduce the environmental burdens in construction. As a general rule, reuse, either of complete buildings or individual components, represents the greatest value but recycling is easier.

Recycling should not be confused with downcycling. The former implies the ability to repeatedly return a component to its original state with no loss of quality. Downcycling implies some reduction in quality or value and this can limit the number of times a product or material can realistically be reprocessed. Material which can be recycled has the greater benefit to sustainable construction.

Steel is the world's most recycled material. Of the world's total production almost half is recycled from scrap. Steel is unique in construction material in that it always contains some recycled content.

The long life of modern steel components means that aggregate demand cannot be met from available scrap supplies. That makes it necessary to use steel from primary ore to supplement production.

An extensive world-wide infrastructure for recycling steel has been in existence for over 100 years and over 80 per cent of scrap arising is captured.

Providing that the steel can be recycled in future, virgin steel today can be regarded as an investment into efficient resource for use for the future.

Supply chain engagement

No sector of the construction industry can move the sustainability agenda far in isolation. Economic growth, community and workplace involvement, environmental protection and resource use all involve a complex web of interactions between commercial organisations. Sustainability demands a change in emphasis, not towards abandonment of profit as an essential measure of success, but a shift in focus towards looking at business as part of the whole interdependent economic, social and environmental system.

One of the problems of the construction industry is that it is typified by a relatively small number of large organisations and a large number of small organisations. There is an onus on the larger organisations in particular to drive the sustainable agenda by adopting sustainable practices and by insisting that their suppliers and contractors meet their standards of environmental reporting, social responsibility and skills retention.

This article has been abridged from *Sustainable Construction* by Roger Plank, Sheffield University and John Dowling, Corus Construction & Industrial published in *Steel Buildings* by the British Constructional Steelwork Association.

Applying sustainability in Australia

Winner of the Royal Australian Institute of Architects (RAIA) Sir Zelman Cowen Award for Public Building, the Birabahn Indigenous Higher Education Centre at University of Newcastle has fully integrated sustainable systems.

Designed by architects Richard Leplastrier, Peter Stutchbury and Sue Harper this multi award winning building has passive heating and cooling throughout. Light shelves bounce daylight onto ceilings across the northern elevation, eliminating the need for artificial lighting. A key feature of the building is a large spectacular double cantilevered roof made from COLORBOND® steel.

Deep 600mm tapered steel beams supporting the roof allowed the architects to create a passive ventilation system using the roof space in conjunction with louvers on the outside of the building that open and close for optional climate control.