PRACTICAL APPLICATIONS FOR CONSTRUCTION AND THE BUILT ENVIRONMENT

Innovation & Research FOCUS

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IN THIS ISSUE

Building homes for the future

No-one in the property market could have failed to notice the current enthusiasm for the development of brownfield sites. In the UK there are an estimated 360,000 hectares of previously used land, a considerable proportion of which is undeveloped. With a projected 4.4 million new dwellings required by 2016, brownfield development should present an attractive proposition. The reality, however, is that many landowners and developers are still reluctant to embark along the path of land remediation. A new CIRIA guide aims to help clients step-by-step through the process.

Brownfield development can be more complex than construction on 'greenfield' sites. Even an undeveloped site will often require clearance before construction can begin. Add to this an element of land contamination and confidence wanes. There is also a lack of confidence in the outcome of remediation processes.

Certainly there are disadvantages associated with developing previously used land but, as those who have ventured into this area will testify, the problems are usually outweighed by the benefits. VAT relief for refurbishment work, landfill tax and stamp duty exemptions, financial support from redevelopment agencies, and tax credits of 150% specifically for the redevelopment of contaminated land are all advantages that help to make brownfield projects highly profitable.

CIRIA has produced the first comprehensive guide for clients to manage brownfield development. Its aim is to offer clients at all levels (public and private sector) a step-by-step guide, identifying the main issues they will encounter, whether legal, technical or financial. The uniformity of the issues faced means that the guide is equally applicable to those engaging in housing projects or commercial, industrial and retail development. Its comprehensive nature means that it may also be of benefit to those organisations already active in this field.

For further information please contact CIRIA (020 7222 8891; fax: 020 7222 1708; E-mail: irf@ciria.org.uk; website: www.ciria.org.uk).

Development on previously used land. (Photo courtesy of Lattice Property)

Measuring road condition non-destructively

TRL are evaluating for the Highways Agency two different but highly innovative non-destructive pavement testing devices.

Trials of equipment for measuring the deflection response of pavements under a loaded wheel at traffic speed have recently been undertaken on roads around the south of England. The equipment is called the Road Deflection Tester (RDT) and was developed by the Swedish National Road and Swedish Transport Research Institute (VTI).

Based around a heavily modified Scania lorry, the RDT has two transverse arrays of lasers, one mounted midway between the axles, the other mounted behind the rear wheels. By subtracting the transverse profile measured midway between the axles from the profile measured behind the rear wheels, it is possible to determine the profile difference, which should, at least in theory, be due to the pavement deflection.

Further trials of other high-speed deflection equipment are planned, the ultimate aim of the project being to allow the Agency to measure the structural strength of its road network without disrupting traffic.

A second project is evaluating a detailed investigation tool for assessing surface cracks. Developed by Utsi Electronics Ltd, the Groundvue Crack Detection Head is a radar-based device designed to measure the depth of surface cracking in flexible pavements at walking speed (see illustration below). Crack-depth information is already widely used by pavement engineers in helping to determine maintenance treatments on thick flexible pavements. However, this information is only currently available from coring, which is slow and destructive and consequently very disruptive to traffic.

Measurements with the new equipment have been made on a number of UK sites and the cracks have subsequently been cored to confirm the depth of cracking. The results to date have been extremely promising. Further trials covering a wider range of surface materials are planned.

For further information please contact Brian Ferne or David Gershkoff at TRL (01344 770668 or 770370; E-mail: bferne@trl.co.uk or dgershkoff@trl.co.uk).

HIGHWAYS & APPROPRIATE DEVELOPMENT

Paving for rural development

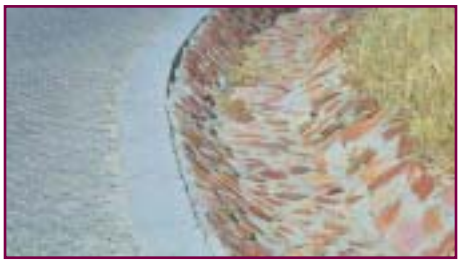
For their basic social and economic needs, rural communities in developing countries require year-round, sustainable access that is affordable, and easily maintainable at low cost. Experience of a range of alternatives is being written up to provide guidelines on their use.

For many years gravel/laterite has been popular as the principal surface for providing road access for rural communities in developing countries. Recent DFID-funded investigations in Cambodia, Vietnam and elsewhere confirm the particular maintenance and environmental problems of gravel/laterite surfacing. In addition, high capital costs often arise if the roads are used by long haul trucks, so reducing the attractiveness of the gravel option.

There is clearly an advantage in utilising local labour and materials (whether processed or un-processed), the choice depending upon what is available. In SE Asia local clays have been made into bricks and blocks, fired with rice husk fuel, to form a robust, low-maintenance road pavement.

These brick and block pavements are two of a range of low-cost, low-maintenance surfacings – including clay and concrete brick, dressed or hand packed stone, low cost seals, and stabilised materials – that are already proven in various communities. However, knowledge of their use is not widely available.

The long term objectives of developing the guidelines are:



Low-cost clay block paving

- the provision of year-round access to all rural communities at low cost;
- manageable maintenance liabilities;
- maintenance to be feasible with the realistic mobilisation of local funding and resources, and arranged with the involvement of local communities and enterprises.

Rural communities will, it is hoped, benefit from the improved infrastructure.

For further details visit www.Transport-links.org, and go to KaR project R7782 or contact Peter O'Neil at DFID (020 7023 1227; E-mail: p-oneill@dfid.gov.uk).

DFID Department for International Development

ABOUT *INNOVATION & RESEARCH FOCUS*

Aims – The aim of *Innovation & Research Focus* is to promote the application of research in building, civil engineering and the wider built environment.

Its articles on current research and innovation are written for a wide-ranging audience, including practising engineers, architects, surveyors, environment specialists and their clients. The objective is to disseminate research and innovation news as widely as possible. Its sponsors wish to promote the benefits of research and innovation, improve contacts between industry and researchers, encourage investment by industry in research and innovation and the use of results in practice, and facilitate collaboration between all the parties involved.

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IMPACT on dams and flood defences

Staff from HR Wallingford are coordinating a 3-year research project – called IMPACT (Investigation of extreMe flood Processes And unCertainTy) – to improve our understanding of how dams and embankments fail. The results should be applicable to the management of both dams and flood defence embankments.

The IMPACT Project is supported by the European Commission under the Fifth Framework Programme and is contributing towards the implementation of the Generic Activity on 'Natural and Technological Hazards' within the Energy, Environment & Sustainable Development programme. The project involves nine main collaborators, including HR Wallingford, and runs from December 2001 to November 2004. It builds on work carried out under a recent Concerted Action on dambreak called CADAM and aims to answer some of the questions identified within it.

The project is also supported by DEFRA and the Environment Agency and feeds into a current R&D project entitled 'Reducing the risk of embankment failure under extreme conditions'. The IMPACT work programmes investigate three 'extreme' flood process areas:

- beach formation;
- flood propagation; and
- sediment movement.

In addition, a cross-cutting theme objective is to address the issue of uncertainty associated with prediction of each of these processes.

Researchers have already carried out physical modelling of embankment breach in the laboratory at Wallingford, as well as two (out of a series of five) field test failures on 6m high embankments in Norway. The Norwegian tests, managed by Statkraft Grøner, are being undertaken in conjunction with a Norwegian National Research Programme on embankment dam safety and stability. Results from both laboratory and field work will be used to test, validate and develop numerical breach models.

Breaching a 6m high clay embankment in Norway (Oct. 2002)

For further information about IMPACT, visit the project website (www.impact-project.net) or contact Mark Morris at HR (01491 822283; fax: 01491 825539; E-mail: m.morris@hrwallingford.co.uk).

Sustainable steel construction: Building a better future

The Steel Construction Sector has been developing a Strategy for Sustainable Steel Construction. The resulting document, *Sustainable Steel Construction: Building a Better Future*, was launched on 4 December 2002 in London. The Strategy builds on the work the sector has been doing for the last ten years and prioritises actions for the future.

Sustainable Steel Construction: Building a Better Future has identified those actions that are necessary to ensure that the steel sector will continue to develop sustainable construction good practice in line with the UK Government's Sustainable Construction Strategy, *Building a better quality of life*. It also aims to encourage leaders within the steel sector to adopt sustainability as a business objective and to commit to carrying out the actions that are necessary. The key future activities are:

- supply chain engagement;
- informed decision making;
- developing solutions in line with priorities;
- measuring progress.

The Strategy has been produced by the Steel Construction Sector Sustainability Committee (SCSSC), which includes representatives of the SCI, BCSA and Corus and is chaired by Professor Roger Plank of the University of Sheffield. Guidance was also received from the Sustainable Development Commission and the DTI through the Pioneers Group that was set up to help industry groups develop individual sector strategies. The Strategy is available on the SCI, BCSA and Corus websites:

- www.steel-sci.com,
- www.steelconstruction.org, and
- www.corusconstruction.com.

For further information please contact Graham Raven at The Steel Construction Institute (01344 62334; fax: 01344 622944; E-mail: g.raven@steel-sci.com).

Charter School – an example of innovative construction in steel (courtesy of the Babtie Group)

Electronic toolboxes for timber

dti Department of Trade and Industry

Information Technology is widening the boundaries of engineering and removing barriers of time requirements (and hence cost) of information location and retrieval. Cheaper computer technology and competitive analysis packages have made complex modelling accessible to even the smallest businesses. In today's market, where speed of design can make the difference between an engineer's profit and loss, timber as a structural material will not be competitive against others unless software design and information tools are available.

Access to information, from fundamental background to codes and standards, through to summaries of recent research and development, is therefore very important and can be addressed effectively by harnessing modern IT. This is currently being tackled in the development of a number of IT Toolboxes for timber design, acting as information resources and providing design guidance and calculation tools.

In Serviceability Limit States (SLS) design of timber structures, fine-tuning designs for specific performance targets can enhance value significantly whilst incurring only minor additional costs. Serviceability design studies have shown that the deflection and vibration performance of domestic floors could be significantly improved simply by increasing the joist width to the next stock size. The SLS Toolbox covers:

- general timber design issues;
- Eurocode SLS design methods;
- SLS action combinations, deflection and deformation of members and assemblies;
- vibration;
- joint slip;
- glossary of SLS terms;
- worked examples; and
- calculation tools.

The software is structured as a very large website, operating from within standard Internet Explorer software, with potential for delivery on CD-ROM, intranet or internet. A key feature is the navigability, which has been tackled through a combination of direct hyperlinked text, drop-down menus, section tab bar links, hyperlinked software maps and an index of contents.

In addition to increasing accessibility to design information, the toolbox has calculation facilities that reflect the fundamental changes to timber design codes for the UK. BS 5268 is essentially a 'slide-rule' code, whereas the formulaic structure of Eurocode 5 is particularly amenable to programming and development of software. The increased emphasis on, and complexity of, tackling serviceability limit states issues in line with Eurocode principles and application rules also requires enhanced appreciation of more general performance and structural behaviour phenomena.

The benefits of the SLS Toolbox over traditional printed media include:

- quick and easy navigation;
- a broad or deep scope of the toolbox, as chosen by the user;
- lower electronic media duplication costs;
- use of calculation tools to gain knowledge and for direct use in practice.

The SLS toolbox is supported by the National House Building Council (NHBC), Chiltern Clarke Bond, Wilcon Homes and Stewart Milne Timber Systems. Other software packages are under development by TRADA Technology, through the DTI's Partners in Innovation programme, covering various aspects of timber design (see TRADA website – www.trada.org.uk – for details).

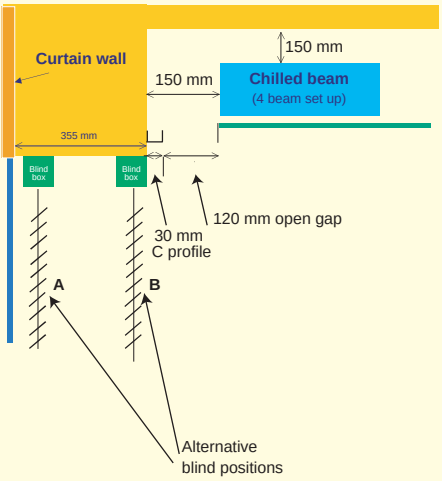
For further information see the research section of the TRADA Technology website (www.trada.co.uk)or contact Rob Bainbridge (E-mail: rbainbridge@trada.co.uk).

Example of timber structure – prefabricated modular units – where vibrational and acoustic performance control serviceability design. Courtesy C. J. Mettem, TRADA Technology.

Progress on chilled beams

BRE

As reported in RF49, BRE are using a new test rig to study the interaction between passive chilled beams and heat gains within the perimeter zones of buildings. Significant progress has recently been made.



A number of generic perimeter chilled beam configurations are being tested. In this example, the perimeter structural beam or soffit is very wide, such as with concrete frame construction, pushing the chilled beam back from the window blind.

Chilled beams are passive cooling systems designed to counter the effects of solar gain in buildings. Cold water passes through the beams in thin tubes, cooling the room by natural convection. The new test rig – see RF49 for details – is unique in that it physically models solar heat gains at windows and blinds far more realistically than has been achieved before.

Air movement and temperature distribution is much more difficult to predict with systems such as chilled beams and ceilings, which rely on natural convection. The tests, which are being carried out in BRE's Environmental Chamber, will continue for about another three months. The resulting guidance will include graphical and pictorial design aids and show the effect of alternative installation configurations (publication is due in Autumn 2003).

The study has involved leading practitioners in the design and promotion of low-energy and sustainable building services systems and is jointly funded by industry partners and the DTI under its Partners in Innovation Scheme.

For more information please contact David Butler at BRE (01923 664300; fax: 01923 664095; E-mail: butlerd@bre.co.uk).

Strengthening concrete structures

Fibre-reinforced polymers incorporating glass, carbon or aramid fibres (generally known as FRPs) are now widely used for strengthening concrete structures. Applications include bridges, buildings and industrial plants, and the materials may be in the form of prefabricated plates or shells, fabrics or rods. The relative economics of the use of FRP depends on factors such as the cost of access and possession time. However, the few published comparisons with other strengthening techniques indicate that they provide a very cost-effective solution.

In 2000, the Concrete Society published Technical Report 55[1], which was the first design guide on the use of fibre composites in strengthening in accordance with British Codes. While preparing the Guide, the Working Party kept a close eye on developments elsewhere to ensure than the guidance was broadly in line with that being proposed by other organisations.

Strengthening with FRP is highly dependent on the correct choice of materials and appropriate application of the composite. All stages of the strengthening process should be carefully supervised. On completion, a full inspection should be undertaken to determine the 'as installed' condition, which will act as a reference for subsequent inspections.

FRP materials should need little or no maintenance, provided that they have been correctly specified and installed. However, they should be routinely inspected, to check for signs of cracking, debonding or local damage. Each inspection should be recorded, particularly noting any significant changes since the previous inspection.

There are only limited methods for testing the installed FRP. Tapping gently with a light hammer or coin is a simple, established method but it is very dependent on the skill of the operator in interpreting the sounds produced. More precise methods are being developed but, in the meantime, it is recommended that additional samples of the FRP material should be applied in non-critical regions of the structure. Destructive tests can then be carried out on these samples as part of the inspection regime. Moisture is one of the main causes of deterioration of FRP strengthening systems. All gutters and drains must be kept clear so that rainwater is carried away. If any cleaning (such as graffiti removal) is carried out, check that the methods used will not cause damage to the FRP.

Bible Christian Bridge, Cornwall: columns strengthened with FRP

Full details of the requirements for inspection and monitoring concrete structures strengthened with FRP will be published as Technical Report 57[2] shortly. It is hoped that this will increase confidence in this important technique.

(1) The Concrete Society, *Design guidance for strengthening concrete structures using fibre composite materials*, Technical Report 55, 2000.
(2) The Concrete Society, *Strengthening concrete structures with fibre composites: acceptance, inspection and monitoring*, Technical Report 57, In preparation.

For further information contact John Clarke at The Concrete Society (01344 466007; fax: 01344 466008; E-mail: j.clarke@concrete.org.uk).

Harmonising water management

European water specialists are coming together in a collaborative, EC-funded project – HarmonIT – to help simplify the practical application of water policy and legislation by defining new standards for integrated modelling.

In December 2000, the European Parliament adopted the Water Framework Directive. This establishes overall policy for managing the water environment in Europe to 2020 and comes into force in December 2003.

The trend in Europe is towards integrated catchment management, a philosophy that involves taking a wider view of rivers and their environs, rather than managing each catchment process in isolation. The principle is sound, but the processes involved are complex, and managers need to understand all of the possible impacts of pursuing a given policy.

HarmonIT seeks to model complex river environments

Allowing a coastline to undergo managed set-back, for example, might reduce flood defence costs but could have adverse effects on agriculture, employment and habitats. Given this complexity, managers are turning to decision support tools that can help them sift out the most important issues in each area.

Models can help to predict the likely outcome of following particular policies and can be used to explore best options, but no *single* model can adequately represent every aspect of the catchment environment. A method is therefore needed to link and unify the tools available. HarmonIT aims to provide this. The project, which involves water experts from 14 European organisations will seek to develop a framework on which existing models can be mounted and within which they can interact.

Wallingford Software and HR Wallingford are both involved in the project. Chris Hutchings of HR Wallingford explains: 'The first task was to identify existing decision support models and review how they worked. We then looked at what users and developers wanted from a model linkage framework and have now come up with a suitable software architecture to realise it. The next three years will be required to turn this into reality and test it.'

'HarmonIT will create an Open Modelling Interface (OMI) – a specification for a linkage mechanism that allows models to be woven into a core of decision support systems for catchments' explains David Fortune of Wallingford Software.

Once validated and agreed, the HarmonIT specification will be promoted as a standard within Europe and, potentially, worldwide. HarmonIT should allow truly integrated modelling and help to satisfy European demands for more coordinated water management of whole catchments.

For further information about HarmonIT, or for an opportunity to contribute to the study, please contact either Chris Hutchings at HR Wallingford (01491 822219; fax: 01491 832233; E-mail: chu@hrwallingford.co.uk) or visit the HarmonIT website: www.harmonIT.com).

Industrial waste used as aggregate in trial roadway

BRE

A trial access road has recently been constructed on a smelting site operated by Britannia Zinc in Bristol, using a cementitious mix that includes non-ferrous industry waste as a bound aggregate.

Construction of trial access road using non-ferrous industry waste as aggregate

Construction of the road is part of a BRE-industry partnership project aiming to encourage and demonstrate use of these waste materials in construction in areas local to the manufacturing sites.

A recent feasibility study undertaken by BRE, co-ordinated by the Non-Ferrous Alliance and supported by the Engineering Industries Directorate of the DTI, highlighted the potential use for waste streams from non-ferrous metals production as aggregates bound in cement or bitumen (BRE Report 423, Hooper, McGrath and Collins, 2001). Additionally, previous laboratory studies at BRE showed that it is technically feasible to use ISF slag (ferro-silicate slag from the Imperial Smelting Furnace production of zinc) in concrete construction.

The objective of the trial is to reduce the use of valuable landfill space and support the economic viability of the local manufacturing industry. The trial road uses ISF slag as a partial replacement for sand in concrete. It will carry a large amount of heavy industrial traffic and will be monitored for:

- compressive strength;
- general condition;
- carbonation; and
- chloride ingress.

Sections prepared from cores taken from the roadway will be examined under a microscope to determine concrete quality and durability. A concern with this concrete is the possibility of leaching of lead and zinc from the ISF slag, so leach testing will also be carried out. The project partners hope to demonstrate that ISF slag can be used without problems as a bound aggregate.

The next stage of the project will involve the laying of a bituminous road that will be monitored in a similar way. In the longer term, the partners also hope to secure funding for a demonstration trial to create construction materials incorporating the use of spent pot linings and refractory bricks from aluminium smelting.

The project partnership includes Alcan Smelting and Power UK; Anglesey Aluminium Metal Ltd, BRE; Britannia Zinc Ltd; Britannia Refined Metals Ltd; Engineering Industry Directorate, DTI; The Non-Ferrous Alliance; Rowan House Ltd; and Scott Wilson Pavement Engineering Ltd.

For further information please contact Andrew Dunster at BRE (01923 664083; fax: 01923 664786; E-mail: dunstera@bre.co.uk).

STRUCTURES & MATERIALS

New stainless SteelCAL module

The Steel Construction Institute has recently produced a computer-aided learning CD, Stainless SteelCAL, to help architectural students and young architects learn about the benefits and versatility of stainless steel. The CD is sponsored by the International Stainless Steel Forum (ISSF).

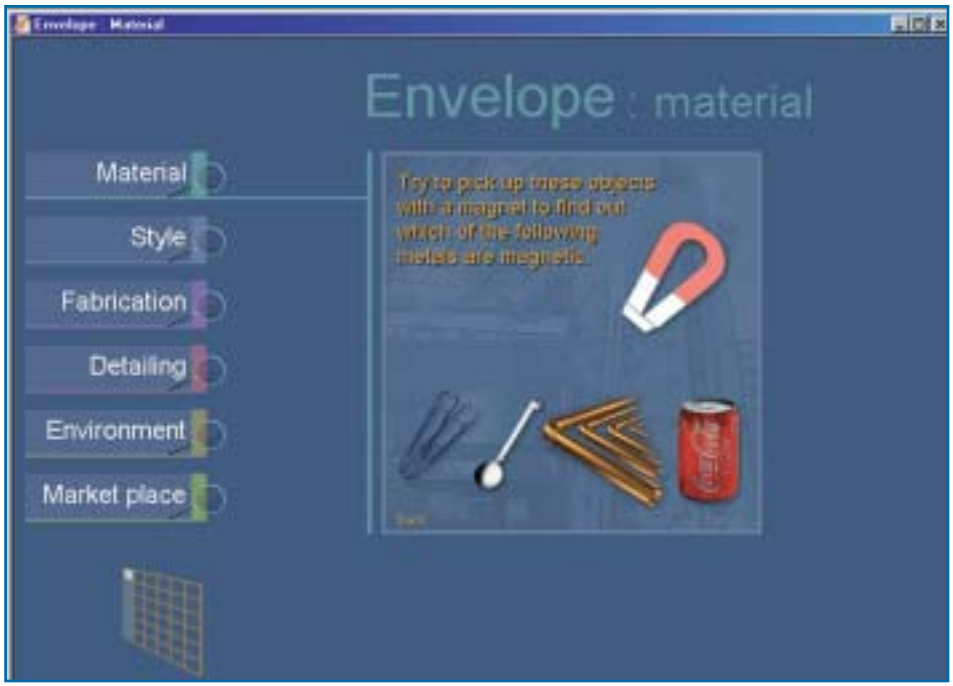
Stainless SteelCAL can be used either independently or in conjunction with ten other modules in the SteelCAL family. SteelCAL was a four-year, European Union-funded project to produce interactive learning material for students. Eight European organisations were involved in the development of the original modules and students all over Europe are now benefiting from the result.

The computer-aided learning facility (CAL) not only presents factual information but, most importantly, is interactive, with particularly high quality graphical content. Video clips, multiple-choice questions, animations, an image library and information all form part of the module.

The package comprises six application areas: Fit-out, Art, Fixings, Street, Structure and Envelope. And each application area can be investigated under any one of six investigation topics: Material, Style, Fabrication, Detailing, Environment, Market Place.

To receive a free copy of Stainless SteelCAL, see www.worldstainless.org/external/sscal/index.htm.

For further information please contact Nancy Baddo, The Steel Construction Institute (01344 623345; fax: 01344 622944; E-mail: n.baddo@steel-sci.com).



A learning activity using the 'Material Inspector' that involves dragging and dropping the magnet on the objects to find out which metals are magnetic.

Overcoming barriers to recycling architectural flat glass

SCI (The Steel Construction Institute) and CWCT (Centre for Window and Cladding Technology) are collaborating on a project funded by WRAP (Waste and Resources Action Programme), on barriers to better recycling of glass used in construction.

Recycling of flat glass on site in the UK is assumed to be minimal, as refurbishment and demolition contractors often ignore the glass content of components, which usually becomes mixed with rubble or is landfilled. The main aim of this project is to encourage and facilitate a significant increase in the recycling rates of this glass.

Currently about 600,000 tonnes of glass are incorporated in building envelopes each year and a further 160,000 tonnes used for interior applications. The mass of glass incorporated in buildings has grown over time with the change from single to multiple glazing and as larger areas of glazing are used. A mass balance has shown that there is currently some 200,000 to 250,000 tonnes of glass that could be reclaimed each year.

The project has identified types and volumes of glass historically and currently used in UK construction, in existing buildings and in future potential usage. In addition, the types of structural and supporting frame material used, and how these factors influence the type and fitting of glass used and its recyclability are being identified.

Technical barriers to recycling are based primarily on glass type and composition. For instance, monolithic glass is easier to recycle than wired or laminated glass. There is also

Glazing replacement contract

a requirement to separate the constituent components of insulated glazing units.

A further barrier to recycling is the process of collecting glass and glazing frames. The domestic and commercial replacement window sectors lend themselves to the return of complete windows to a re-processing plant. For commercial windows, particularly those on demolition sites, it is less clear whether glass alone or entire windows are reclaimed from site for processing or whether glass can be broken down at site. Many of these barriers can be overcome to encourage economically viable recyclate processing and achieve greater separation and recycling rates.

Use of more-easily recycled products will lead to easier and more economical recycling. This will reduce the environmental impact of new buildings and allow a greater proportion of glass to be recycled in 20 to 30 years' time. Future work in the project will include guidance notes to specifiers and contractors.

The economics of reclaiming glass from site are influenced by the ability to reclaim and recycle the framing materials in addition to the glass. Methods of recycling PVC-U window frames have been developed in Germany, and aluminium has an established route for recycling along with other metals.

The work is running in parallel with a BRE project that is also collecting site data from both the glazing and waste management industries. More information on this project and a brief questionnaire to provide data can be found at www.bre.co.uk/news.

For further information on this project, please contact: Brian Tandy at SCI (E-mail: b.tandy@steel-sci.com) or Stephen Ledbetter at CWCT (E-mail: cwct@bath.ac.uk). The websites for further information are: CWCT (www.cwct.co.uk), SCI (www.sci.org.uk) and WRAP (www.wrap.org.uk).

Getting value from managing knowledge

Interest in Knowledge Management (KM) – the active management of corporate knowledge to allow companies to respond quickly to customer demands and avoid repeating costly mistakes – has led a number of organisations to commit costly resources to developing KM systems.The Knowledge Management for Improved Business Performance (KnowBiz) project at Loughborough University recognises that investment in KM should result in clear benefit to the organisation.

The KnowBiz project is a three-year research project that focuses on how companies investing in KM can (a) question the rationale behind existing Knowledge Management (KM) initiatives and (b) demonstrate the impact of KM initiatives on business performance. The project aims to:

- investigate current KM practices in UK construction contracting organisations;
- investigate the extent to which key business performance measurement models are used by construction contractors' organisations;
- investigate the relationship between Knowledge Management practices and business performance in some flagship organisations;
- develop and evaluate a Knowledge Management framework and supporting IT architecture for managing companies' knowledge assets, including intellectual capital.

A three-stage conceptual KM framework has been developed and evaluated by the project's partners. The framework is divided into three stages as shown in the figure left.

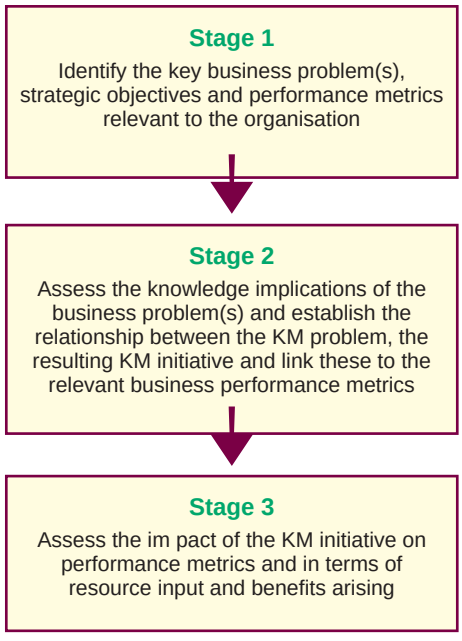


Figure 1: *The Conceptual KM Framework*

Company evaluations have shown that this is a unique and valuable tool for justifying expenditure on KM initiatives to senior management. It offers a structured manner to link KM initiatives, their cost and benefits so that KM expenditure can be better justified and optimised.

For further information please contact Dr Patricia Carrillo at Department of Civil and Building Engineering, Loughborough University (01509 222634; fax: 01509 223981; E-mail: P.M.Carrillo@lboro.ac.uk).

A second CICE article on Benefits of computer-integrated manufacture of cladding systems is on the IRF website. It reviews a report on the subject prepared as part of the CIMclad project (www.cimclad.com).

Sustainable towers

dti
Department of Trade and Industry

The DTI's Partners in Innovation scheme is currently supporting a project that aims to re-open the debate on high-rise living in contemporary circumstances. 'Sustainable Towers: an exploratory study on its benefits in today's context' is aimed at developing a definitive design brief that could lead to a new generation of high-rise towers in the UK.

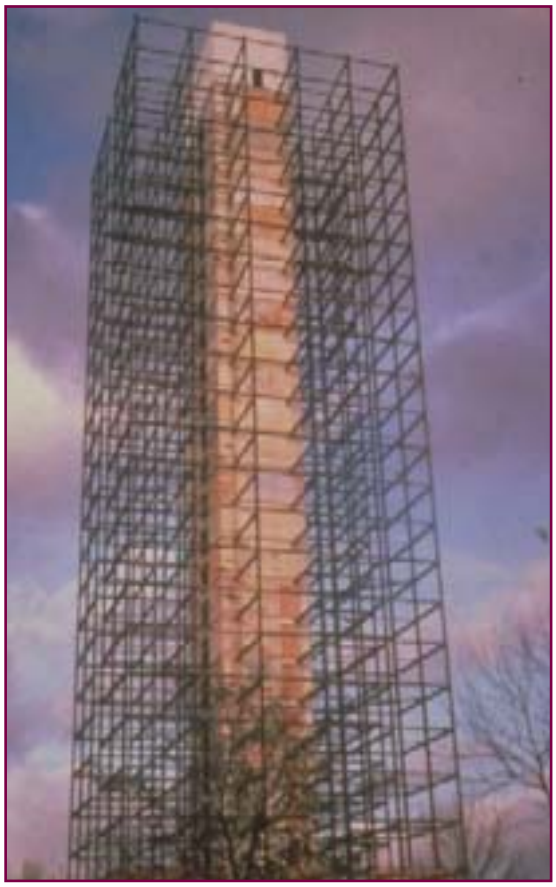
Battle McCarthy Limited is an environmental building engineering consultancy that brought together a group of diverse partners representing various skills in high-rise construction to develop the research. The project has thus far produced:

- a general state of the art report;
- a case study review document;
- a sustainability brief;

all of which are available on the project website, www.sustainabletowers.co.uk.

Later this year, some of the architects most experienced in high-rise construction in the UK will provide final designs for sustainable towers based on the research to date. The end products will be CPD (Continuing Professional Development) material and the publication of a book.

The project came about because towers are becoming recognised as a potential solution to the environmental, social and economic problems that are now confronting our cities. Corbusier argued that skyscrapers have a relatively small footprint and can therefore provide more open space than low-rise development. More people can be housed vertically in a smaller space than horizontally in the same space. The United Nations claims that skyscrapers can lower transportation costs due to centralisation, which will result in less energy consumption. The challenge is to integrate existing sustainable building technologies into the design, which is not always seen as a practical or economical solution.



Winterton House, London – stripped to it's steel structure prior to refurbishment

There has also been a general social stigma against towers, especially in the UK. This began years ago when it became apparent that many of the tower blocks built in the 1950s and 1960s for social housing were of low quality, and quickly fell into a state of disrepair. The terrorist attacks on 11 September 2001 also caused a re-evaluation of the pros and cons of towers. The research is addressing all of these issues and is learning from the lessons of the past.

To date, the case studies have found that the main strategies adopted during the design process of sustainable towers are quite simple: the design of a climate responsive envelope; reduction of the needs of mechanical air conditioning; provision of an adaptable environment for the occupants; use of low-embodied energy materials; use of re-used or prefabricated materials; and more-efficient structural systems.

However, the introduction of more-sustainable practices, such as water recycling, waste management and an extensive use of non-renewable sources of energy within tall buildings, is still in a preliminary stage. With the assistance of the National Sustainable Tower Blocks Initiative, the study is also revealing various design factors that help to define social sustainability including character, ownership, authenticity, amenities, nature, social and private space.

The project has recently produced some spreadsheet tools that will describe graphically how various design factors will affect social, environmental and economic factors in the sustainability balance. These will help to inform the next stages of the project, which will produce a definitive design guide for the coming generation of designers.

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