

# Innovation & Research

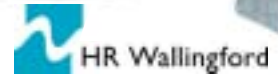


Issue No. 69 Also at [www.innovationandresearchfocus.org.uk](http://www.innovationandresearchfocus.org.uk) May 2007

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## Trend analysis for beach & sea-bed management



Improving our understanding of beach and near-shore sea-bed evolution often involves the collection of very large amounts of data. This inevitably covers large areas, and necessitates frequent and repeated surveys. Responding to the need to present this information in a form that is quickly understandable and can readily inform decision making about possible interventions, TRENDAMaT (Trend Analysis and Management Tool) is GIS-based Trend Analysis software recently developed by HR Wallingford.

GIS is commonly used by coastal managers to manage, display and analyse coastal, estuarine and riverine data. It is an ideal tool to deal with the spatial variability of the data. However, most landforms within these environments also experience temporal variation, and this makes time trend analysis an important requisite if coastal landform evolution is to be understood.

However, GIS techniques have not traditionally been able to calculate the change in values over time and, instead, a simple but perhaps misleading technique has been used (where a Digital Terrain Model (DTM) created for a given survey is subtracted from an earlier one). The net result of this calculation is purely the difference in levels between two "snapshots" of bathymetries or beaches in time. It gives no indication of the variation of the levels between these two snapshots, and yet is often misinterpreted to illustrate the time trend of the data.

One way to avoid this problem is to extract the levels for each DTM at each individual cell, plot them in a graph and perform a linear regression analysis on them. Clearly this is very time-consuming, particularly since many DTMs consist of over 10,000 data cells, and this method does not indicate the spatial distribution of the time trends.

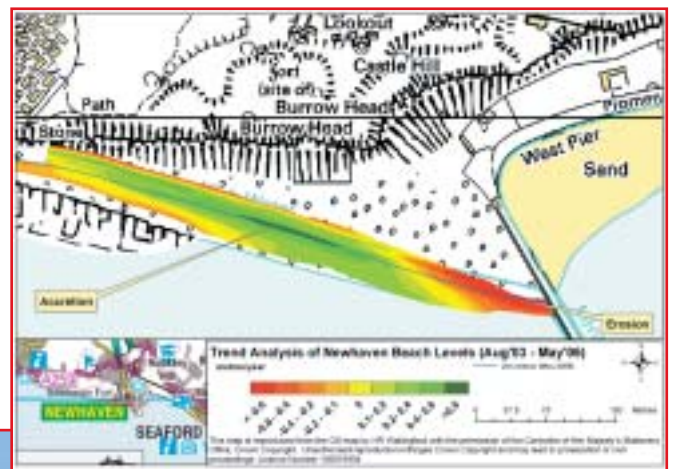
The new trend tool combines time trend analysis with the GIS spatial distribution and shows the changes in bed-level (or any other

parameter) both spatially and temporally. This provides new information on coastal landform evolution, as shown in the figure below.

The TRENDAMaT tool uses colours to map the trends it has calculated for tens of thousands of individual data points across the area of interest. Whilst this indicates the areas of high variability, the tool actually calculates the rate at which the levels are changing. Designed for use by for coastal practitioners, it provides a time-saving, analytical means of processing datasets of ever increasing size.

*For further information, please contact: Jonathan Kemp, HR Wallingford (01491 822412, fax 01491 832233; E-mail jak@hrwallingford.co.uk).*

Trend analysis for a Newhaven shingle beach



# Building roads into the landscape

How do we understand what constitutes 'history' in the landscape? What is historic character and how should it be preserved for future generations? These might seem unlikely questions for the Highways Agency, but with a motorway and trunk road network potentially impacting on an area the size of Wales the Agency is committed to managing its network in an environmentally responsible way. The Highways Agency has developed new guidelines for assessing the impact of its work on the historic landscape.

**T**he Agency's environmental strategy respects not only wildlife, but cultural heritage and the historic landscape. The new guide sets out formal procedures for evaluating, assessing and mitigating the impact of its activities on the historic landscape.

The Agency publishes its design standards in the Design Manual for Roads and Bridges. While the DMRB has no statutory status, it is used by many local authorities and the devolved administrations in Scotland, Wales and Northern Ireland to set design standards. The forthcoming revision of Volume 11 'Cultural Heritage' contains innovative new approaches to assessing the effects of road schemes on historic landscape.

When designing the guidance, the problem was how to define a landscape as 'historic'. Man-made landscapes such as parks and gardens – even battlefields – can be designated as culturally important, but there are no other landscapes designated as historically important in England.

The crucial issue is that the whole landscape is historic, in the sense that it has been shaped by past human activities which have contributed to its present form, use and perception. More problematic is how that history, visible in today's scene, is identified, its importance and value established and the effects of new development assessed. The key to the answer is in the concept of historic landscape character – measuring the effects on the landscape as a whole, rather than the individual elements.

English Heritage (EH) has led the way in characterisation studies, supporting research and sponsoring county-based historic landscape character mapping. The Agency has used EH's work to incorporate a formal assessment into its Environmental Impact Assessment process. The factors assessed include:

**Time-depth** – How many periods from the past can be identified as coherent landscape fragments?

**Local character** – How far is the character of the area unique to that locality?

**Legibility** – How far can past patterns of land use be appreciated in the present landscape?

**Cultural association** – Are historic events or people identified with the landscape?

**Research potential** – Are there historic documents, maps, research priorities etc that make the landscape particularly interesting for further research?

The benefits of the new approach are expected to be an earlier and more robust understanding of the effects of roads on the



(Left) A truly historic landscape: the M5, above Brindley's 1780s Old Main Line Canal crossing Telford's 1820s New Main Line Canal on the Steward aqueduct, with Robert Stephenson's 1850s Birmingham, Wolverhampton and Stour Valley railway (embankment at the extreme left) and the wall of Chance's historic glassworks.  
(Right) The recent A500 improvement in Stoke-on-Trent involved extensive work to move the canal and restore the River Trent to its original course.

sense of place and historic integrity. This will enable scheme designers to prepare more-sensitive designs that integrate better with the environment and which are more acceptable to both historians and local residents. Fewer objections offer better value through savings for the scheme in time and money.

Secondary benefits include alerting archaeologists and building historians to the potential existence of previously unknown or undervalued sites.

The new guidance has not yet been pub-

lished, but a similar approach has been used in the M11 corridor, a likely site for major house building developments, and in the Environmental Impact Assessment for the A46 Newark to Widmerpool Improvement. Though neither has been tested at Public Inquiry, both examples have shown the practicality and potential usefulness of the methodology.

*For further information, please contact David Freke, Highways Agency, Bristol (E-mail: david.freke@highways.gsi.gov.uk).*

## RESEARCH & INNOVATION

### Construction Research Project Showcase



A new publication from the Department of Trade and Industry – *The Construction Research Programme: Project Showcase* celebrates the achievements of the DTI Construction Research Programme. It highlights 14 case studies selected to show the breadth and range of the portfolio, from technologies, materials and building service engineering to the development of new processes. The report also highlights how the programme tried to address the reforms recommended by Sir John Egan's Construction Task Force in its seminal report *Rethinking Construction*.

**C**opies of the report can be obtained from the DTI Publication Orderline on 0845 015 0010 or a pdf version is also available on <http://www.dti.gov.uk/sectors/construction/innovation/page14362.html>.

The DTI takes this opportunity to thank the following organisations and project teams for their contributions: The Tavistock Institute, The Open University, CWC Avanti,

Buildoffsite, Immprest, BSRIA, BRE, Comit, Stratrisk, Valid, TRADA, and the Network Group for Composites in Construction.

*For further information please contact Terry Boniface, Department of Trade and Industry (0207 215 0826; E-mail: terence.boniface@dti.gsi.gov.uk).*

# Unsteady effects in wind turbine aerodynamics

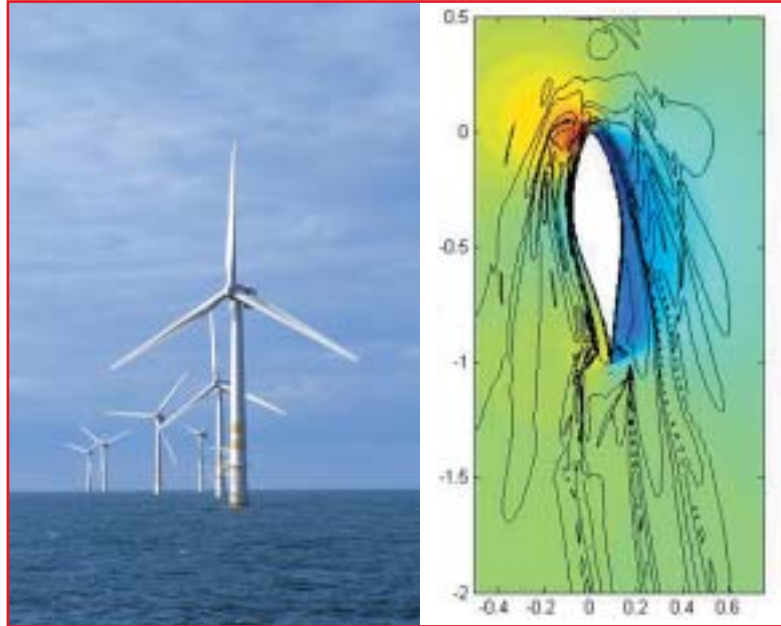


Through a Global Research Award, the Royal Academy of Engineering has enabled Dr Wolf Fröh from Heriot Watt University, Edinburgh, to work on unsteady phenomena in wind turbine aerodynamics for 4 months at the Institute of Turbomachinery and Fluid Dynamics of the University of Hanover. This study has shown that the interaction between the turbine tower and the rotor blade affects the lift force on the blade even if the rotor is upwind of the tower.

**T**he trend for wind energy is towards increasingly larger turbines, where the latest turbines for offshore installation are rated at around 5MW and have a rotor diameter in excess of 100m. This increase in power rating and size leads to new challenges in materials and structural mechanics as well as aerodynamics.

The aerodynamics of wind turbines are the same as for propellers but with the crucial difference that wind turbines often operate near stall conditions, and always operate at sizes and speeds comparable with the spatial and temporal fluctuations of the wind in the atmospheric boundary layer.

Dynamic stall occurs for two reasons: firstly the wind shear, because the wind increases with height across the rotor area and, secondly, the presence of the turbine tower. The wind upstream of the tower is modified as the air is diverted around the tower. This results in a brief change of the power output whenever a blade passes in front



(Left) Arklow Bank Offshore Wind Power Facility, Ireland, consisting of seven GE 3.6-megawatt (MW) wind turbines (courtesy GE Energy)

(Right) Snapshot of a model run showing the pressure field (colours) and some vorticity contours.

of the tower. Such a pulse could lead to sudden load fluctuations with implications for structural vibrations, material loading and fatigue.

A preliminary estimation showed that the

interference between the tower and the blade is likely to be noticeable. This problem was investigated in a pilot study using the computational fluid dynamics (CFD) software package NUMECA, which showed a number of features. While the lift force on the blade did not seem to vary much on the time scale of the pulse from passing the tower, the average lift was reduced by up to 30%. This pilot study is now being extended in further CFD calculations, in wind tunnel experiments on a scale-model of a full rotor in Hanover, and on a turbine blade section subjected to pulses in the flow direction, modelling those of the tower-blade interaction.

For further information on the Global Research Award scheme please contact Dr Chris Coulter at The Royal Academy of Engineering (0207 227 0500; E-mail: [chris.coulter@raeng.org.uk](mailto:chris.coulter@raeng.org.uk)).

*For further information on this project please contact Dr Wolf-Gerrit Fröh at Heriot-Watt University, (0131 451 4374; email: [w.g.froh@hw.ac.uk](mailto:w.g.froh@hw.ac.uk)).*

## CONSTRUCTION FUTURES

# Women 'CORE' to construction research



The WOMEN-CORE project has been established to address the under-representation of women working in construction-related research.

**C**onstruction is one of the most important industry sectors in terms of economic growth and employment. However, the sector's performance in research and innovation is poor, with less than 1 percent of its turnover being used to fund research and development. Construction is also one of the most male-dominated sectors, with women only representing 10 percent of the UK construction workforce and 8.2 percent in the EU.

Despite work addressing women's participation in science and engineering, very little is known about the role of women in construction research and the factors hindering a more equal presence of women and men. Furthermore, awareness of the need to attract, retain and promote women researchers seems less widespread among the main stakeholders in construction than

in other industrial sectors: hence the need for the **WOMEN-CORE** project.

**WOMEN-CORE** is co-funded by the European Commission Research Directorate's Women and Science Unit. The project started in April 2006 and runs until September 2008 and is aimed at addressing the unequal representation of men and women in construction research in Europe by strengthening women scientists' and engineers' participation. The specific objectives are to:

- enhance the knowledge of women and their influence in construction research;
- identify the main research areas that are attractive from women's perspectives;
- identify and assess the gender-specific needs of research and development in the construction sector;

- explore new opportunities and anticipate tendencies for empowering women in construction research;
- provide recommendations for empowering women in construction research; and
- establish a network of women scientists in construction.

The consortium partners are LABEIN Foundation, Spain (Project Coordinator); CIREM Foundation, Spain; Loughborough University, UK; Centre of Excellence for Women and Science, University of Bonn; Copenhagen Institute for Future Studies; and the Czech Technical University in Prague.

*For further details please contact Abigail Powell, Research Associate, Department of Civil & Building Engineering, Loughborough University (E-mail: [A.Powell@lboro.ac.uk](mailto:A.Powell@lboro.ac.uk)).*

# Promoting innovation in the built environment

Research and Development (R&D) plays an important role in the innovation process, leading to the key technologies or innovations that bring new products and services to the market place and making us more competitive. Innovation enables successful businesses, better goods and services, and more efficient processes. Innovation is key to opening up new markets and attracting new clients.

## DTI's Collaborative Research & Development Competition

This competition is aimed at assisting the industry and research community to work together on R&D projects in strategically important areas of science, engineering and technology that have the potential to lead to new products, processes and services by UK businesses. It supports pure basic research, applied research and experimental development.

Twice a year, calls are developed in what are called 'challenge areas', many of which are relevant to the built environment and engineering community. Such areas include:

- design engineering and advanced manufacturing;
- information and communication technologies;
- advanced materials; and
- sustainable production and consumption.

The Technology Strategy Board draws on advice from a number of sources including the research priorities generated by the National Platform for the Built Environment, chaired by Keith Clarke, Chief Executive of Atkins.

The built environment has had some reasonable success to date in securing funding from the Programme. For example, Corus, Atkins, Mott McDonald, Arup, Buro Happold, SCI, BRE and TRADA are all participating in current projects funded under the scheme.

## Support for smaller projects

The DTI also recognises that not every innovation is ripe for large research projects – or even collaboration. The Grant for Research and Development (Smart in Scotland) – administered through the Regional Development Agencies (RDA) – aims to help individuals starting up businesses, and SMEs, to carry out R&D on technologically innovative products and processes. Grants of up to £500k are available, depending on the nature of the project, but in reality most Grant awards are around £20–100K. Applications for funding are made through the RDA responsible for the region in which the applicant intends to carry out the project.

## Knowledge Transfer Networks (KTNs)

But generating new knowledge is only half the story – we need to better unlock the existing expertise and research 'back catalogues' in our universities and research organisations.

There are currently over 20 Knowledge Transfer Networks including a Materials KTN and Resource Efficiency KTN. The DTI has also approved £3 million funding for a Knowledge Transfer Network for the Modern Built Environment (MBEKTN), which will be formally launched in April 2007 and is keen



to encourage the structural engineering community into its fold.

Through the KTN website members will be able to access a wealth of knowledge and contacts relating to the modern built environment. If you would like to join, or find out more, register on the website at [www.mbektn.co.uk](http://www.mbektn.co.uk) to receive details at time of launch.

With guidance from industry boards, the new KTN is focused on identifying and actively facilitating the application of key innovations to three primary sectors:

**Healthcare** – led by BRE working closely with Department of Health;

**Infrastructure** – led by CIRIA, engaging with the road, rail and utilities community; and

**Offices** – led by BSRIA, engaging with property owners.

The initial priorities for technology transfer within these sub-themes will be identified by sector boards, which will then inform forays into academia and other knowledge bases to identify key innovation or emerging technologies that will help solve real business problems. This analysis will then be presented to members of the network, through a dedicated web area, and one-to-one meetings will be facilitated to try to encourage the take-up, or potential commercialization of the technology or innovations identified.

## Knowledge Transfer Partnerships (KTPs)

The aim of Knowledge Transfer Partnerships is to help businesses gain access to the knowledge and expertise available in the UK's universities, colleges and research organisations, which might be needed to develop new products, services and processes.

A KTP Consultant can help to identify a university, college or research organisation that has the right expertise for a business, then help the partners define a project that will enable the business to draw on their expertise and apply it. The agreed project could be for between one and three years, with the overall aim of helping the business make a step change in an area that it has identified as high priority. The KTP is part-funded by a DTI grant to the Knowledge Base Partner. This contributes to the costs it incurs through participating in the partnership, with the balance of costs borne by the company.

## European support

In addition to the domestic opportunities available to promote innovation, the DTI is also keen to encourage the built environment sector to take better advantage of the research funding available through the European Commission. Engagement in collaborative European research makes sense, and not just as a large funding opportunity. It is also a potential mechanism to gain a greater knowledge of the innovation drivers, and the status of potential European markets.

Traditionally, the UK has not been as proactive as our European competitors in obtaining funding from the EC Research Framework Programmes, despite the substantial funding being made available. Although the built environment sector has in the past quoted the administrative burdens and lack of 'real world' issues in the European research competitions as a reason for lack of engagement, the DTI is working to ensure this is not an issue in the future.

For Framework Programme 7, the DTI is encouraging engagement in European research through our support for the European Construction Technology Platform (ECTP), a pan-European group developing a Strategic Research Agenda and prioritized roadmaps in order to better inform the Commission's research competitions. The UK is currently represented on this group by a small group including Taylor Woodrow, Arup, Corus, architects and academic representatives and they present issues to ECTP arising from the work of our National Platform. DTI will be using the Platform to help encourage UK involvement in strong bids for funding from the Commission.

SMEs will be encouraged to collaborate with research partners through a new initiative called EUREKABuild, which aims to build on the funding available through the RDAs' grants for R&D, helping UK businesses find European partners willing to undertake cost-shared research.

For further information on these programmes please visit the websites:

### DTI Technology Programme:

[www.dti.gov.uk/innovation/technologystrategy/index.html](http://www.dti.gov.uk/innovation/technologystrategy/index.html)

### Knowledge Transfer Network:

[www.ktnetworks.co.uk/epicentric\\_portal/site/KTN/?mode=0](http://www.ktnetworks.co.uk/epicentric_portal/site/KTN/?mode=0)

### Knowledge Transfer Partnerships:

[www.ktponline.co.uk](http://www.ktponline.co.uk)

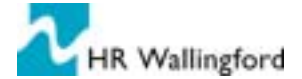
### Regional Development Agencies:

[www.englandsrdas.com/home.aspx](http://www.englandsrdas.com/home.aspx)

### European Construction Technology Platform: [www.ectp.org](http://www.ectp.org).

*For further specific information on DTI support, please contact Terry Boniface, Department of Trade and Industry (0207 215 0826; E-mail: [terence.boniface@dti.gsi.gov.uk](mailto:terence.boniface@dti.gsi.gov.uk)).*

# Managing the impacts of offshore dredging



A risk assessment framework for marine aggregate extraction has been developed by HR Wallingford and the team of consultants it led. The MARA framework enables the risks to be assessed to all potential sectors (such as marine ecology, archaeology and the fishing industry) from dredging of marine aggregates. The framework provides a practical approach to assessing risk at a range of temporal and spatial scales, from extraction at a single site to regional assessments of multiple extraction activities. It provides techniques for both quantifying uncertainty and assessing cumulative and in-combination effects. The project has been completed under the Aggregate Levy Sustainability Fund for Defra and CEFAS.

**T**he MARA Framework enables the consideration of both the nature of the impacts and the probability of those impacts occurring. The use of risk-based analysis means that the potential outcomes of the dredging activity can be better understood.

With an annual production of ~25 million tonnes, the dredging of marine aggregates from offshore waters is of major importance to the UK construction industry (mainly in England and Wales). It is essential that the marine aggregate extraction industry is managed with a sustainable and strategic approach and with minimised risk of harmful impacts.

Offshore aggregate dredging has a range of potential environmental impacts including disturbance of the physical processes of sediment transport, changes to habitat (and associated repercussions on marine ecology), impact on coastal and estuarine environments, changing



Marine aggregates recently extracted from the sea-bed for delivery to wharf. Photo HR Wallingford

the distribution of fisheries resources, impacts on marine archaeology and in-combination impacts with navigation, recreation and other uses of the marine environment. The extent of these impacts is presently assessed through Environmental Impact Assessment (EIA); the

MARA Framework offers a step forward in the assessment process, enabling greater transparency in the quantification of impact.

The MARA approach takes into account both the *consequences* of marine aggregate dredging, and the *likelihood* of those consequences occurring. It provides a means for quantifying the uncertainty associated with the analysis. This will enhance the transparency of assessments for dredging licence applications and make the decision-making process more easily traceable and auditable. It also provides a framework for reconsidering the impacts, as scientific developments and outputs of site-specific monitoring become available.

*For further information, please contact Valerie Bain, HR Wallingford (01491 822333; Fax 01491 832233; E-mail: vba@hrwallingford.co.uk).*

## HIGHWAYS & IT

# European Centrico award for Highways Agency



The Highways Agency won a prestigious award in Brussels last month for its work on a system to enable transfer of information between European Traffic Control Centres.

**T**he Agency won the 'Best Cross Border and International Project' Centrico award for leading technical developments on OTAP/DATEX II, a system that enables the access and exchange of real-time traffic and travel information between European Traffic Control Centres and also to service providers.

The project was managed by a specialist working group and involved the design, testing and software development at the traffic control centres. The technology was demonstrated at last year's Intelligent Transport System World Congress in London. It already connects eight European states, making a significant contribution to the

European Commission's vision of a pan-European network of traffic control centres.

Intelligent transport systems (ITS) are used by all European road authorities to improve safety and mobility on the trans-European road network. The benefits in co-ordinating ITS developments across Europe are such that the European Commission provides funding through the Euro-Regional Projects programme for research, development and implementation.

*Centrico* (Central European Region Transport Telematics Implementation Co-ordination) is one of seven ERPs, and is a body of 14 partners across France, Belgium, Luxembourg, the Netherlands and England.

The Highways Agency has been actively involved in *Centrico* since 2001. Benefits for the Agency include the sharing of knowledge and best practice, and the ability to influence standards, as well as access to EC funding support for relevant Agency-led projects.

The Highways Agency were also awarded a runner-up prize for its Freight Portal Project. There is an increasing volume of HGV traffic along and across the Channel Sea, and local authorities, ports and road operators share a desire to better serve freight operators. The output of the project is a web portal providing information and advice for cross-Channel freight users – go to <http://www.freteuroservice.com>. The Portal now covers north and west France, south-east England and Flanders.

The awards ceremony was held to mark the end of the six-year funding programme. The work on OTAP/DATEX II led to the development of the DATEX II specification set which is now the commonly agreed specification within Europe for information exchange. Discussions are currently under way about the possibility of future EC funding for ITS-related projects.

*For further information please contact Alan Raines, Highways Agency, Bristol (08459 556575; E-mail: alan.raines@highways.gsi.gov.uk).*



All smiles for the Highways Agency's Ian Fraser (2nd left) on receiving the Centrico award



The Freight Portal website provides information for HGV traffic using Channel ports

# Early-age thermal crack control in concrete



Support from the Institution of Civil Engineers R&D Enabling Fund has led to an update of a major guidance document on early-age thermal crack control in concrete.

**T**he new CIRIA publication C660, published in February 2007, is an update of CIRIA Report 9. A principal aim in its preparation was to bring the design into line with both EN1992-1-1 (replacing BS8110 as the general design code) and EN1992-3 (replacing BS8007 for water-retaining structures).

Unfortunately, the approach of EN1992 is fragmented. EN1992-3 provides general expressions for calculating the restrained strain that leads to cracking but refers to EN1992-1-1 for design of reinforcement. CIRIA's C660 is therefore complementary to EN1992, providing a design process based on the combined requirements of EN1992-3 and 1992-1-1, plus background data on the strains and the restraint that lead to cracking.

The design approach adopted by EN1992 is similar to that of BS8007 but there are some significant differences that could lead to insufficiently robust design solutions. In particular, EN1992-1-1 assumes different surface zones for estimating the minimum

area of reinforcement and the effective steel ratio used in the calculating crack spacing and width. EN1992-1-1 also includes a term for cover in the estimation of crack spacing.

The effect of these changes is to reduce significantly the reinforcement requirements for crack control. Observations of early-age cracking indicate that these reductions may lead to insufficiently robust designs and C660 recommends adjustments to coefficients used in calculating both the minimum area of reinforcement and the crack spacing.

EN1992-3 also defines two specific restraint conditions, continuous edge restraint and end restraint. End restraint leads to fewer larger cracks whose width is dependent principally on the tensile strength of the concrete when cracking occurs. Wide cracks, typically up to 1mm, may occur under controlled cracking conditions. The importance of recognising the nature of the restraint is stressed in C660.

Other significant changes in C660 include:

- a method for reinforcement design to deal with cracking caused by temperature differentials in thick sections;
- revision to the temperature drop (T1) values for CEM 1 and additional information on concretes containing fly ash and ground granulated blast-furnace slag;
- additional information on autogenous shrinkage (now a part of design to EN1992-1-1 for all structural concretes) restraint and tensile strain capacity;
- advice on specification, testing and on in-situ monitoring.

Calculators are also provided on CD to enable the estimation of temperature rise and temperature differentials; autogenous and drying shrinkage to EN1992-1-1; edge restraint; and reinforcement for crack control.

*For further information please contact Alan Gilbertson at Ciria (020 7549 3300; E-mail: alan.gilbertson@ciria.org).*

## WATER & SANITATION

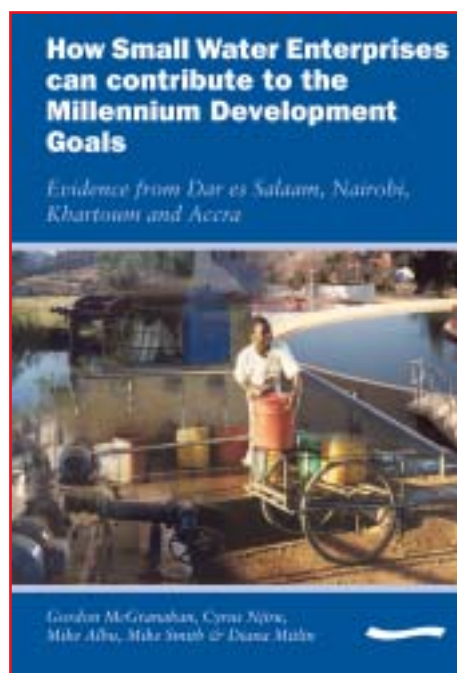
# What can water & sanitation engineers do for the poor in low-income countries? DFID Department for International Development

The Millennium Development Goals (MDGs) agreed in 2000 were aimed at combating poverty, hunger, illiteracy, environmental degradation and discrimination against women. Improving access to safe water supply and sanitation services is key to achieving these goals, as it impacts on all aspects of health, poverty reduction, education and environmental sustainability. Ensuring improved access to water and sanitation services for the poor has been the focus of a number of projects carried out by the Water, Engineering and Development Centre (WEDC) at Loughborough University.

**O**ne of these projects has a specific focus on designing services for disabled people and other vulnerable groups, as the lack of access to sanitation and safe water is a major contributing factor to the poverty of 500 million disabled people in low-income countries. The MDGs will not be achieved equitably without addressing the access needs of disabled people, as well as groups such as the elderly, pregnant women, parents with small children, and the sick, including people with AIDS.

*Water and Sanitation for Disabled People and other Vulnerable Groups* (available also in French, online, on CD or as hard copy) fills a significant gap in knowledge for people from both the engineering and disability sectors. Its main focus is on facilities at household level in rural and peri-urban areas of low- and middle-income countries.

Another area for improvement is the small-scale private water sellers who supply a large share of the urban water market of most low-income countries, especially to informal settlements that are not supplied with piped water from the local utility. Unfortunately, they attract little investment and support from gov-



*New WEDC publication.*

ernments, so the important service improvements they can provide are overlooked.

*How Small Water Enterprises (SWEs) can contribute to the Millennium Development Goals* identifies and tests ways of improving water services delivered to the urban poor through SWEs. It is an invaluable resource for water utility managers and policy makers.

Several Briefing Notes are also available on the theme of improving water supply and sanitation service provision – see <http://www.lboro.ac.uk/well/resources/Publications/WELL%20Briefing%20Notes.htm>. These include:

- *Improving sanitation services: Government engagement with Non-State Providers;*
- *SSIPs: a role in sustaining sanitation services to the urban poor;*
- *Private Sector Participation in urban water supply.*

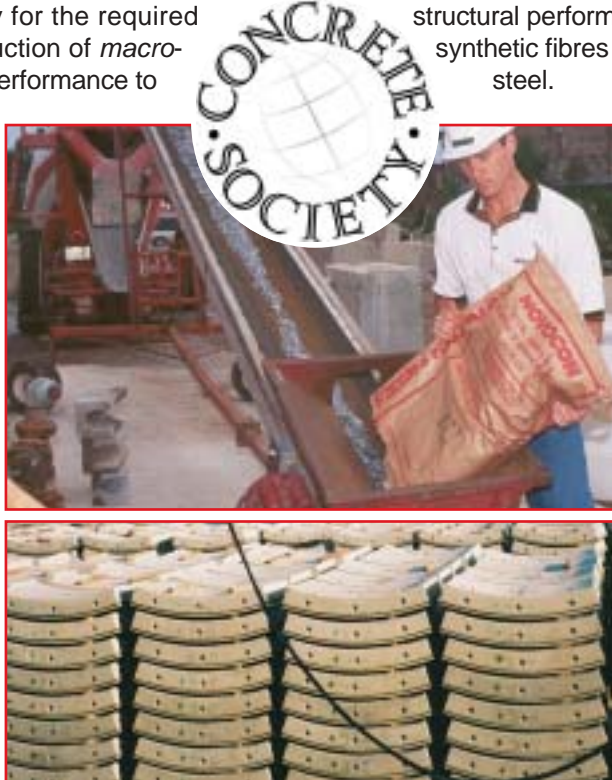
*For further information about these projects please contact Hazel Jones (E-mail: h.e.jones2@Lboro.ac.uk; website: <http://wedc.lboro.ac.uk/wsdp>) or contact Mike Smith (E-mail: m.d.smith@Lboro.ac.uk; website: <http://wedc.lboro.ac.uk/swe>).*

# Fibre-reinforced concrete

The use of fibres in concrete is growing, boosted mainly by the demand for large-area industrial floors for warehouses and distribution centres, and the associated areas of paving. For the past 40 years, the only fibres to provide concrete with the post-cracking capacity necessary for the required structural performance have been steel. A recent development has been the introduction of *macro*-synthetic fibres which, unlike *micro*-synthetic fibres, can provide similar post-cracking performance to steel.

European Standards are being developed to cover the properties of fibres and their effect on concrete, but much of the guidance on their use is currently provided by the suppliers of the fibres. For the market to develop with confidence, independent guidance is felt to be required, covering aspects such as design, construction and performance in service.

To this end, two Concrete Society Technical Reports have been prepared and will be published shortly, namely *Guidance for the design of steel-fibre-reinforced concrete* and *Guidance on the use of macro-synthetic-fibre-reinforced concrete*. The Reports aim to identify both the advantages of using fibres and also their limitations. They review the properties of the materials and their performance in concrete, and present an overview of the current applications, which include paving, pre-cast units, sprayed concrete and composite slabs on steel decking.



Often fibres are chosen in place of conventional reinforcement to simplify the construction process. Design of fibre-reinforced concrete is outside the scope of traditional reinforced concrete design; the Reports review the current approaches and, where appropriate, give design guidance.

The report on steel fibres also considers briefly those areas in which fibres may be used in the future, such as in fully suspended slabs, working in conjunction with traditional reinforcement or in ultra high performance concrete, though these applications are outside the scope of the Reports.

*For further information please contact John Clarke at the Concrete Society (01276 607152; E-mail: j.clarke@concrete.org.uk).*

(Top) Adding fibres via conveyor  
(Left) Fibre reinforced precast tunnel segments

## STRUCTURES

# Impacts of Part L on structural performance



Following a research project on the technical implications of changes to Part L (conservation of fuel and power) of the Building Regulations in England and Wales, SCI (the Steel Construction Institute) in association with DTI, Corus, the Metal Cladding and Roofing Manufacturers Association (MCRMA) and EPIC (Engineered Panels in Construction) has just published a best practice guide on the specification and installation of building envelopes and the supporting secondary steelwork.

The publication is aimed at architects, specifiers, designers and site erectors, and presents best practice guidance on all of the relevant aspects of modern steel cladding design and installation, which will lead to improvements in building envelope performance, health and safety and efficiency.

Changes to Part L, with the increased energy performance requirements, have resulted in deeper cladding systems, a need for improved airtightness and hence improved quality of design and construction. So 'What are the regulatory changes doing to our structures?'

To answer this question, SCI has carried out a 2-year research project into the impact of the Part L changes on the structural performance of buildings. Industry representatives from the National Association of Rooflight Manufacturers, Cold Rolled Sections Association, National Federation of Roofing Contractors, the British Constructional Steelwork Association, EPIC and MCRMA gathered to share experience and knowledge.

This formed the foundation of clear guidance to ensure that new metal-clad buildings

will comply with Part L. The resulting SCI publication – *Best Practice for the Specification & Installation of Metal Cladding & Secondary Steelwork* – establishes the way forward for steelwork contractors and speci-

fiers to deliver better buildings that meet the client requirements and comply with the new regulations.

The construction of large span single storey buildings is important to the UK economy. Approximately half the output of the steel construction sector is devoted to these buildings. They are widely used for distribution centres, retail outlets, sports and leisure facilities and manufacturing premises and so affect many aspects of modern life. For these reasons such buildings have to be very efficient and clear guidance needed to be identified and brought to the attention of constructors and specifiers.

In this respect the SCI Guide meets the needs of the industry and represents an opportunity to promote a greater understanding of the issues faced by the construction team and leads to better co-operation on site and in design.



*For more information please contact: Dr Martin Heywood, Manager Construction Technology, SCI (01344 636578; E-mail m.heywood@steel-sci.com).*

# ModCell – a new approach to super-insulated, high-performance ‘passive’ buildings



Super-insulated, high-performance ‘passive’ buildings, built using modern methods of construction with straw bales, is the vision of a research group, led by the University of Bath, developing a prefabricated straw bale cladding system.

**M**odCell is the vision of Craig White, of Architects White Design Associates, and Tim Mander, of Integral Structural Design. ModCell utilises the excellent thermal insulation qualities of straw bale construction to form prefabricated, factory-made, wall cladding panels.

A structural frame of solid timber is ‘infilled’ with stacked straw bales which are compressed and pinned together for stability. The bales are then plastered with a lime render. Panel sizes can vary to suit project requirements, although the most common size in recent projects, including York City Council’s new ecoDepot, has been 3 m high x 2 m wide and just over 500 mm thick.

A two-year research project started in January 2007, with total funding of £298k from the Department of Trade and Industry-led Technology Programme and the six industrial partners, and is looking at ways of further improving the efficiency and cost-effectiveness of ModCell.

ModCell is known to work well both structurally and in terms of its acoustics and thermal properties. The current work seeks to optimise the performance across all aspects. Structural testing is being undertaken by the University of Bath and thermal analysis by

the Centre for Window and Cladding Technology.

Up until now, straw bales have largely not been seen as a credible building material by much of the industry, even though straw has been used in building construction for centuries, and straw bales have been used for about 100 years. The BRE-sponsored Centre in Innovative Construction Materials at Bath has become involved in this project after it carried out a prototype panel test for the York ecoDepot, one of the largest straw bale buildings in Europe.

As well as White Design Associates and Integral Structural Design, the research team includes Agrifibre Technologies, Lime Technology, Eurban Construction and the Centre for Window and Cladding Technology.

The current project will optimise the design and construction process and thoroughly test the system. Work will include materials testing, further prototype panel tests, modelling the thermal performance of the straw bales, and monitoring building performance.

*For further information please contact Pete Walker at the BRE Centre in Innovative Construction Materials, University of Bath (01225 386646; E-mail: p.walker@bath.ac.uk).*



(Left) York EcoDepot, clad in ModCell panels (Right) Installation of ModCell panel at York EcoDepot

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*Innovation & Research Focus* is published by the ICE, typeset by PJM Design and produced by Thomas Telford Services Ltd, 1 Heron Quay, London E14 4JD, UK. ISSN 0960 5185

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