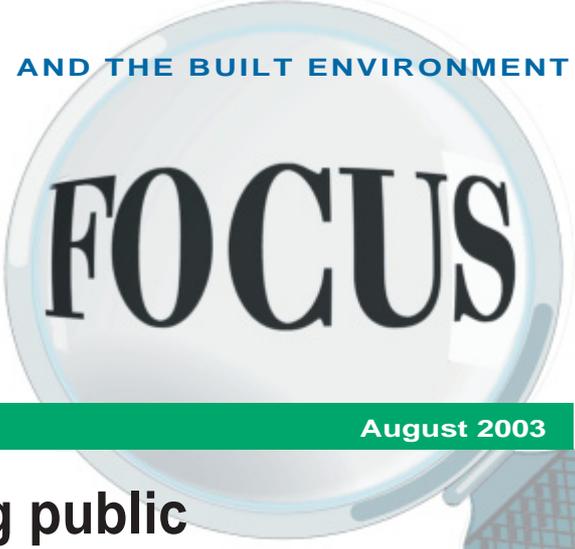


Innovation & Research



Issue No. 54 August 2003

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CEEQUAL going public

The CEEQUAL Environmental Assessment and Awards Scheme, being developed by a team of 28 Partners led by the Institution of Civil Engineers, is nearing its public launch. So far, the project has been trialled on projects undertaken by

Project Partners and, during the spring and summer, the first full assessments have been undertaken on Partners' projects, leading to the first set of CEEQUAL Awards to eight projects. Three were presented at the ICE 2003 Conference in Belfast in June, and the other five at the CEEQUAL London Launch to be held in September, after which anyone will be able to apply to have their project assessed.



The Project Team for the Greyabbey & Kircubbin Wastewater Treatment Works in Northern Ireland receive their Excellent CEEQUAL Award from ICE President Professor Adrian Long.

For further details please go to www.ceequal.com in the first instance. For more details, to register interest in attending the launch meeting and/or interest in applying for an award, please contact the CEEQUAL Project Team at Crane Environmental Ltd, (020 8399 4389; Fax: 020 8390 9368; Email: ceequalmailbox@crane-environmental.co.uk).



Façade design and procurement

The design of façades and their procurement are inseparable processes. Design has to recognise and sometimes expand the limitations of manufacture and construction. This may entail technical or commercial risks that have to be recognised within the procurement process. This is particularly so with the use of new materials such as titanium or terracotta panels, and with non-traditional use of older cladding materials such as glass, which is used in sizes unimaginable a few years ago.

The conference on façade design and procurement, which took place at the University of Bath in April 2003, covered the many different materials involved in, and aspects of, cladding performance. Principal areas for discussion were the use of glass, building physics, whole-life performance,

specification and verification. The conference comprised 29 papers, with authors from five countries, and the proceedings are available from CWCT. Communication of design intent was a particular theme throughout the conference. Specification was discussed in many of the papers with emphasis placed on the need to communicate clearly and appropriately. Methods for interactive specification were discussed and the roles of the different parties involved in design and procurement were explored.



GlaxoSmithKline Building, London (Courtesy of RHWL)

For further information, please contact Stephen Ledbetter at CWCT (01225 826541; Email: cwct@bath.ac.uk).

We are delighted to welcome the Royal Academy of Engineering as a new Sponsor of Innovation & Research Focus – see page 7 for their first article.

Steel fibres from waste tyres as reinforcement

Following the implementation of a number of EU directives, such as the 1999 Landfill Directive, the UK recycling industry is keen to develop new markets and products that will absorb the steel recycled from used tyres. The recycled steel is usually obtained in the form of fibres and the majority is either used as furnace feed or sent to landfill. One possible market area for the recycled steel fibres is concrete construction, where conventional steel fibres are replacing re-bars in a range of applications, such as slabs-on-grade, industrial floors, precast applications and sprayed concrete.

The University of Sheffield has recently completed a DTI Partners in Innovation project, *Demonstrating Steel Fibres from Waste Tyres as Reinforcement in Concrete*, which verified that these recycled steel fibres can be used effectively as concrete reinforcement. Two types of fibres were examined: a) shredded fibres and b) fibres obtained from the pyrolysis process.

One of the initial tasks was the material characterisation of the fibre where double pull-out tests were performed to evaluate the optimal length required by each type of fibres to develop sufficient bond with concrete. This was followed by the development of appropriate concrete mixes and the optimisation of fibres that can be practically incorporated in each mix.

This involved the examination of the properties of concrete at fresh and hardened state, and both the concrete compressive and



Testing of slabs

flexural strengths were evaluated by carrying out standard tests. At the final stages of the project, the mechanical behaviour of demonstration products was examined and an appropriate design method proposed.

The findings of the project indicated that

the use of recycled steel fibres in concrete leads to an increase in concrete strength, ductility and toughness and hence they could be used in a range of specialised applications, such as impact and sound barriers.

In addition to the environmental benefits that will be gained by the extensive use of these fibres in concrete construction, the relatively low cost of these fibres is expected to be advantageous when compared with that of conventional steel fibres.

For further information, please contact Dr Kypros Pilakoutas at the Department of Civil & Structural Engineering of the University of Sheffield (0114 2225065; Email: K.Pilakoutas@Sheffield.ac.uk or visit the project website www.shef.ac.uk/tyre-recycling).

STRUCTURES & MATERIALS

Standard reference for steel construction in fire

The SCI, together with Corus Fire Engineering and UMIST, have secured support from the DTI, Corus and some larger steelwork contractors for a Partners in Innovation project entitled *Standard reference for steel construction in fire*.

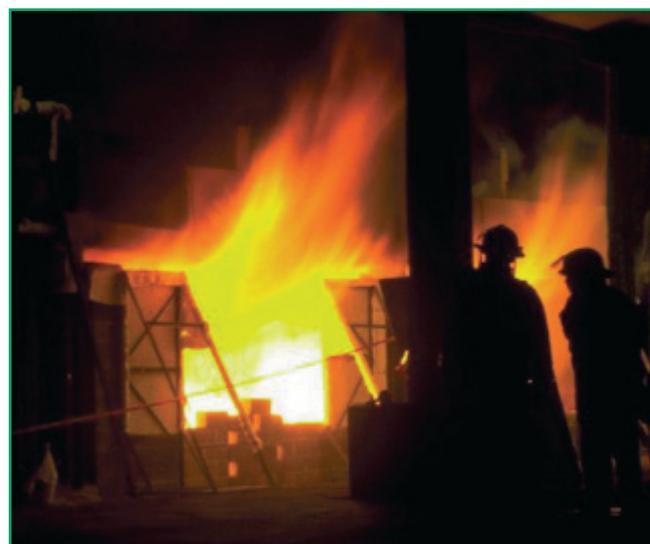
Scheduled to be completed in autumn 2004, the standard reference document (SRD) will contain design information for various types of construction that are safe for different fire risk categories. The designs are to be based on BS 7974, the draft for development of BS 9999 and BS 5950-8, and guidance published by SCI and Corus. For the first time in the UK, the designs will not be directly related to fire resistance. Instead the SRD will state that, provided certain design conditions are met, a design is safe to use for a particular type and size of building.

This change is occurring for two reasons:

- Risk-based approaches that do not rely on simple fire resistance (as measured in a standard test) are being introduced.
- Because of the European Construction Products Directive, the methods of establishing fire resistance are affected by the adoption of more-severe fire testing standards, the result of

which is that some forms of construction that have been safely used in the UK for many years, and which are allowed by BS 5950-8, will be much more difficult to

illustration courtesy of Corus



justify under the more-severe tests.

For example, in an 18-metre-high office, three levels of risk might be identified (low, medium, high) and for each risk level a design fire exposure would be computed (A, B, C). The medium risk would be aligned with the notional level of risk associated with Approved Document B.

The SRD will contain data sheets for various types of steel construction. Each sheet will contain tabulated details that are deemed to be adequately safe for the fire exposure corresponding to the various risk levels. For example, for beams, the data would be in the form of an allowable bending resistance whereas for columns compressive resistances would be tabulated for different effective lengths.

For further information please contact Gerald Newman, The Steel Construction Institute; (01344 623345; Email: g.newman@steel-sci.com).

Unlocking whole-life value in infrastructure and buildings – can you help?



In April 2002, ICE together with ACE, CPA, CECA and CIRIA, published *Society, Sustainability and Civil Engineering*, a sectoral sustainability strategy. During the workshops held to develop the strategy, a recurring theme was the view that encouraging the industry to increase its use of Whole Life Costing (WLC) and (Environmental) Life Cycle Analysis (LCA) was crucial to delivering sustainable construction. More surprisingly, a second theme was a tendency to use WLC and LCA interchangeably combined with a confusion over how and when to use the two techniques. Finally a desire to fuse elements of both techniques together to produce a more rounded sense of Whole Life Value also emerged.

Unlocking *Whole Life Value in Infrastructure and Buildings*, a project led by ICE with CIRIA, BRE and TRL, and supported by DTT's *Partners in Innovation Scheme*, aims to address these problems. The project will re-package the latest WLC and LCA information into an easy-to-use guide, and run a series of roadshows that will help the industry understand:

- What represents value to clients?
- What tools are available to measure value?
- When should I use these tools?
- What information will they give me?
- Can I use them for existing buildings and structures?
- Where do I get the data I need?
- When do I need to involve other team members?
- Can I integrate the results to obtain Whole Life Value?
- How do I demonstrate the business benefits?

The project team believes that this work will have a particular appeal to clients and integrated project teams engaged in PFI or other long-term contractual relationships. The project will provide these teams with a well-signposted guide through the mass of information on how to use whole-life techniques. It will help them to demonstrate value for money, recover initial investment, and develop alternative approaches to service delivery, while delivering long-term improve-



ments to sustainability performance.

Over 15 partners from across the construction industry have already been signed up. The project team are, however, looking for more partners – particularly clients – to ensure that the outputs reflect the current state of the art.

If you are interested in contributing ideas, cash or intellectual property, or in serving on the project advisory group, or want further information, contact Andrew Crudgington at the Institution of Civil Engineers (020 7665 2219; Email andrew.crudgington@ice.org.uk)

ENVIRONMENT & CONSTRUCTION FUTURES

A changing climate for construction

Although the cause may still be much disputed, there is growing evidence that the UK climate is indeed changing. The 1990s was the warmest decade for central England since records began in 1660. Winters over the past 200 years have become wetter, with a larger proportion of rainfall now falling on heavier rainfall days than it did fifty years ago.

The consequences for the construction industry are severe. Heavier and more frequent winter storms can cause significant damage to buildings and infrastructure. Rain penetration is one of many problems that led to dampness of over half a million homes in 1995. Over the past thirty years, there has been a steady increase in claims following summer droughts. There could also be considerable operational problems ranging from delays in construction projects to difficulties associated with concrete curing, and the need to develop more UV resistant materials.

Of course, most construction developments are already designed to withstand severe weather but, crucially, this is based on the assumption that the magnitude of such events is constant. Recent damage to the built environment caused by incidents believed to be attributable to climate change has confirmed that much construction practice in the UK is not able to cope with the increasingly severe weather.

CIRIA's new project *Technical risk assessment of climate change for the construction industry* will provide designers and contractors with practical guidance about how to deal with incidents believed to be related to climate change. Building on the experience of past examples, this project will focus on the assessment, identification and management of risk to housing and infrastructure schemes associated with such incidents.

The project is part of a new CIRIA programme of activities on climate change. Once the report is published, there will also



Photo courtesy of Turbines S P Systems Ltd

be a series of briefing workshops at the beginning of 2004 to improve construction professionals' awareness of the technical and financial implications of climate change.

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



Rural energy in developing countries

Two billion people in developing countries lack access to modern energy services. This problem is particularly acute in remote rural areas, where traditional energy resources are being eroded. Provision of modern energy services is a key element in enhancing life in rural communities. At present such services are rarely available and, if they are, involve the purchase of equipment. The result is that the poor tend to be excluded because the initial cost can be too high to the final user, the costs are too small for efficient lending of development funds, and the markets may be too small to support the required physical and institutional infrastructure.

A project funded by the UK's Department of International Development has provided a tool to support the establishment of Rural Energy Service or Supply Companies (RESCOs). RESCOs are organisations that can be specifically designed and set up to meet both the household and working energy service needs of rural communities, in an appropriate, affordable and sustainable way. There is significant scope for the establishment of RESCO organisations in many developing countries to meet the energy needs of rural populations and this work has a valuable role to play in achieving this.

The research was carried out by Future Energy Solutions (UK), Integrated Energy Solutions (South Africa) and Tata Energy Research Institute (India). The project drew on the increasing experience becoming available through the establishment of a variety of 'fee for service' organisations such as RESCOs and variants around the world. It aims to encourage new



The Gosaba biomass minigrad in West Bengal, India, provides power in the evenings to small enterprises such as this printing shop

RESCOs to build on this wider experience rather than 'reinventing the wheel'. A rational approach to navigating through the processes of selecting appropriate institutional framework was developed using a decision-tree-based approach.

The RESCOs Design Tool – available in web-based and paper versions – provides a comprehensive approach that will ensure that all the key issues are addressed, by providing the following within an attractive and easy to use electronic format:

- an overview of the issues to be considered;
- details of the options and possible solutions to many problems;
- examples of how other people have met similar challenges;
- checklists and other supporting documents.

For further information, as well as the Design Tool itself, visit the Energy Voices Website: www.etsu.com/energy-voice; or the DFID KaR Energy website: www.dfid-kar-energy.org.uk or

contact: Mark Thomas, Future Energy Solutions, AEA Technology, B154 Harwell, Didcot, OX11 0QJ (01235 436806; fax: 01235 432331; Email: mark.thomas@aeat.co.uk).

DESIGN & MANAGEMENT

Managing value delivery in design



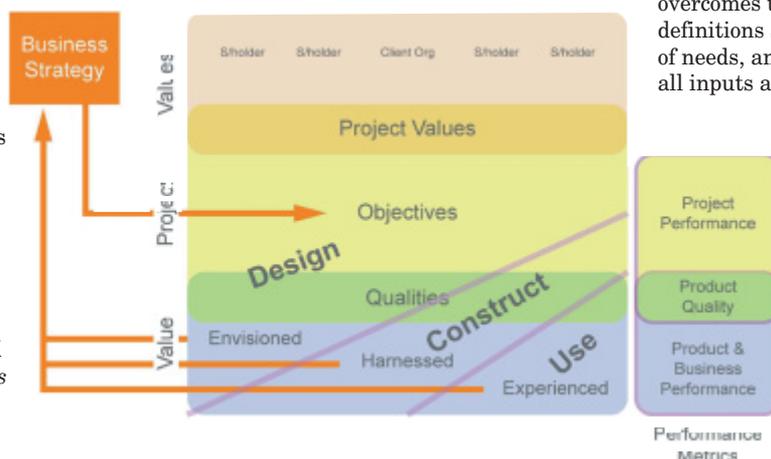
Government and industry initiatives are championing the cause of focusing on customer value, but there is no consensus on what value is, nor how to create or measure it.

This three-year project is addressing the crucial contribution of design, by relating it to the generation of value and hence enabling management of the process of delivering value. Not only is design key to providing value, but it is the stage with the greatest influence on the ability of a project to deliver customer value.

It is important to understand what we mean by *value* and to distinguish it from *values*. Values represent people's beliefs and attitudes that in turn influence their project goals and requirements. People judge the value of a product, service or other impact upon them in light of their values.

The project is part of the LINK Programme Meeting Clients' Needs through Standardisation in the Construction Industry. The research

team has developed a framework that enables a dialogue about value. One part of the framework is a hierarchy, in which societal and business values are translated, via shared project values, into specific objectives and product qualities.



The second part describes the assessment of a product's performance in terms of quality and value, defined as the relationship between benefits and sacrifices. This overcomes the limitations of narrow definitions such as cost, worth or satisfaction of needs, and makes explicit the balance of all inputs and outputs. Assessments of value will be made in the stakeholder dialogue during design, manufacture and assembly.

For further information please visit the website: www.valueindesign.com or contact Professor Simon Austin, Department of Civil and Building Engineering, Loughborough University (01509 222608; Email: s.a.austin@lboro.ac.uk).

Major new DTI-funded R&I programmes



For the first time, DTI, through Partners in Innovation, are part-funding two large programmes of research activity – breaking the mould of short-term, project-based research. The intention is that these programmes will develop into self-supporting networks of excellence, generating real long-term impact.

The first programme is *prOSP*a – promoting Off-Site Production application.

Despite much work undertaken in the past, off-site production is not being taken up by the industry because of both real and perceived barriers, meaning benefits are not being realised. The programme will focus on overcoming the barriers and realising the potential of this technology.

The programme will identify and promote OSP opportunities across a wide range of materials, construction technologies and sectors, through dialogue, delivering practical tools and guidance and dissemination. *prOSP*a will build on the work already done, making existing knowledge more accessible and focusing new work on directly addressing the barriers and any gaps in knowledge. The work will engage key stakeholders: clients, designers, contractors, the supply chain and statutory and financial bodies, all of whom have a role in realising OSP potential.

The activities within the programme will be structured under seven themes: effective knowledge; cost, value and performance; flexibility, customisation and inter-changeability; process; procurement; and management.

A number of specific work packages have been developed, which will cut across and feed into one or more of the themes. The first year comprises dissemination and utilisation – including an internet-mounted knowledge base, a forum and learning network for stakeholder dialogue on overcoming barriers to OSP, review, gap analysis and visioning the future, case studies on projects using innovative OSP, understanding the viability



Pier 3 at Gatwick. It is an impression of the Pier Segregation project that will start on site this December and utilises BAA's off-site manufactured corridor

of appropriate levels and the implications of OSP on management processes and targeting European and other funding.

The programme – commencing in July 2003 – is being undertaken by a consortium comprising Co-Construct members (BSRIA, CIRIA, Concrete Society, SCI and TRADA) and Loughborough University. The total programme cost will be over £1.8 million.

The second of the PII programmes is entitled *ICT-Enabled Collaborative Working: Sharing What We Know and Making it Work*. It involves 168 construction-based companies in a joint research project co-ordinated by BE-INCR (Built Environment Industry Network for Construction Research), IAI (International Alliance for Inter-operability and Teamwork).

The programme is designed to unlock some of the latent efficiencies in construction by better sharing of knowledge and 'making it work' at project level. It seeks to address the Strategic Forum's objective of 20% of construction projects being undertaken by integrated teams by 2004 and 50% by 2005. It

will not be, in the main, fundamental new research, but instead recognises the failure of the construction industry to re-define business processes to take advantage of new and emerging technological capabilities.

The programme will first engage the industry. It will then look at how much knowledge already exists – either as the result of previous government-sponsored and other research or within each company – and against this background determines what new work is needed. Workshops with the academic and research

community will be used to invite proposals that would add value to the programme.

The project work plan includes action research on live core projects, rapid cycle learning, championing within the consortium partners and developing a business case for ICT-enabled collaboration. Satellite projects will address sub-sets of the supply chain, for example the design chain, steelwork design and fabrication supply. Skills and experience will be diffused across a network of team partners and beyond. The work programme will integrate the ICT solution – ultimately the development of a single project model – with concurrent work elsewhere on commercial, contractual, professional and insurance barriers. The total programme cost will be just under £1 million.

For further information on PROSPA contact Ann Alderson at CIRIA (020 7222 8891; or enquiries@prospa.org) For further details on ICT contact Malcolm Dodds (0870 9220034; website: www.beonline.co.uk).

HIGHWAYS & SUSTAINABILITY

A sustainable approach to pavement design



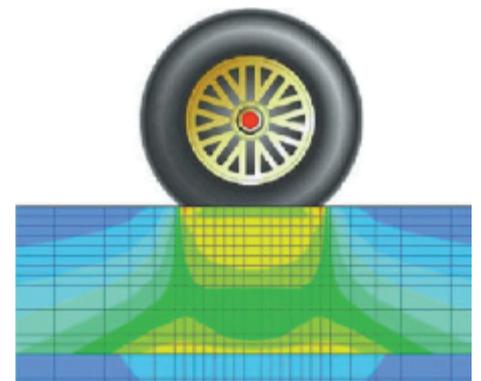
To conserve resources and minimise the environmental impact of pavement construction requires the optimum use and, where appropriate, re-use of materials. However, the current UK pavement design method is concerned mainly with the use of traditional materials in a limited range.

TRL and Scott Wilson Pavement Engineering have been jointly developing a new analytical pavement design method for the Highways Agency. The objective is to enable a wider range of materials to be used in the pavement structure, for example secondary and recycled aggregates that are bound together using different hydraulic or bituminous binders. The design method will provide a framework to enable the introduction of such materials in a consistent manner and ensure that future performance is appropriate in terms of best value.

This method will provide an incentive for designers and contractors to develop new materials and construction techniques and will promote the use of local materials, recycling and reuse.

For further information please contact Mike Nunn at TRL (01344 7700210; fax 01344-770356; E-mail: mnunn@trl.co.uk).

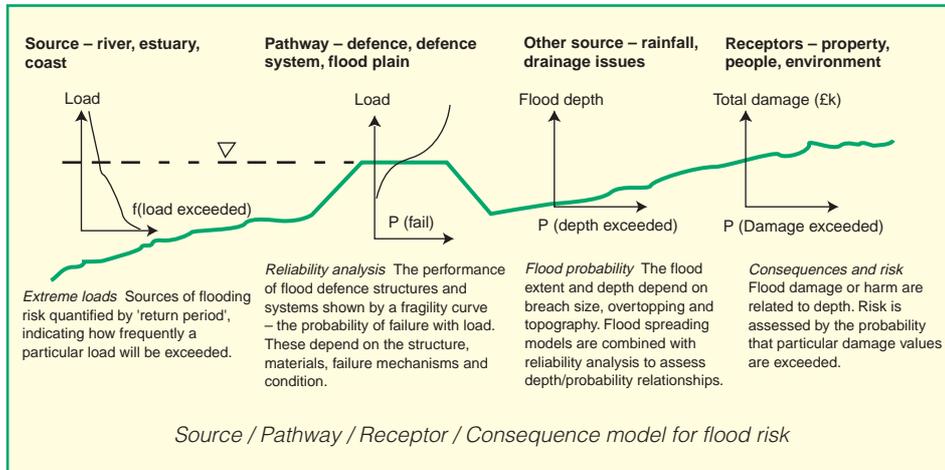
(Right) Stresses induced by wheel load – tensile (orange) and compressive (blue)



Managing performance of flood defences



Over the past 5 years there have been serious floods around the UK. In response, Defra and flood defence operating authorities have been developing a suite of tools and techniques aimed at improving the planning of flood defence investment.



- User Interface (GIS-based approach).

Dr Cliff Ohl of HRW explains the aims of the scoping study: 'We hope to demonstrate the practicality and utility of such a decision-support system for flood and coastal defence asset management. The PAMS project will also produce a plan for the development and implementation of a transitional system, supporting the longer-term development of a performance-based asset management system.'

Inspection and assessment of the state of flood defences is a key element in assessing risk. Initial inspections have to be relatively quick and simple to carry out, given the thousands of kilometres of flood defences in the UK. However, the risk-based approach must ensure that more-detailed investigation and assessment is carried out according to the potential consequences of any failure. The research team will work with EA staff in building on best practice in this area within operating authorities and in other infrastructure sectors (such as rail networks, waterways, and highways) over the coming months.

For further information please contact Dr Cliff Ohl at HR Wallingford (01491 822436; Email: c.ohl@hrwallingford.co.uk; website: www.environment-agency.gov.uk/flood-research.

For specific river or coastal defence assets, the Defra / Environment Agency R&D Programme in Flood Defence has identified the need for a decision-support system, enabling operation & maintenance and design engineers to assess the improvement in performance attributable to any management intervention.

A framework for performance has been established under recent work on *Risk, Performance and Uncertainty in Flood and Coastal Defence*. This builds on the 'Source – Pathways – Receptor – Consequence' approach to risk management (see diagram), establishing an approach to asset management that is able to focus on actions that provide the greatest reduction in flood risk.

Defra and the EA have now started a project to develop a 'Performance-based Asset Management System' known as PAMS. The overall objective of PAMS is to support the improved inspection, maintenance, operation and management of flood and coastal defence systems through the identification of appropriate management interventions that provide a desirable reduction in risk.

HR Wallingford is leading the project team, which involves experts and operational engineers from the EA and Defra, as well as risk management specialists, engineering consultants, and academics. The work is supported by the major EPSRC-led Flood Risk Management Research initiative.

The project (likely to last two to three years) will build on, and link into, databases and tools that are already being developed for asset analysis and national and catchment level assessment including:

- the Modelling and Decision Support Framework (MDSF) for Shoreline and Catchment Flood Management Plans;
- Risk Assessment of flood and coastal defence for Strategic Planning (RASP); and
- the National Flood and Coastal Defence Database (NFCDD).

A six-month scoping study started in April this year. This has identified the following principal

'modules' for a future asset management system:

- Inspection Methodology (revised to gather key information);
- Hazard Indexing (simplified approach allowing approximation of risk);
- Analysis Engine (for defence performance and flood risk, including structural deterioration);
- Decision Approach (using multi-criteria analysis); and

ENVIRONMENT & CONSTRUCTION FUTURES

Vegetation growth trials on alternative materials



The annual amount of construction and demolition waste (CDW) produced in the UK is estimated at 85 million tonnes – 17% of UK waste production. Basic Oxygen Steel Slag (BOS) is also produced in large volumes and generally stockpiled. One solution to utilising these materials is as engineering fill, thus reducing the waste requiring disposal and the impact of using sub-soil.

Trials are under way at the South Wales Geoenvironmental Research Park, in which TRL is a consortium partner, testing the performance of a 90-metre-long, 2-metre-high flood protection bund, constructed in three sections, each with a different core material: CDW, BOS and a locally sourced sub-soil. Each section of the bund has been seeded with grass and planted with shrubs and trees to assess the ability of the two alternative materials to sustain vegetation in comparison to the sub-soil control. Initial indications after 9 months' monitoring are positive in terms of landscaping and engineering applications for the alternative materials.

For further information please contact John Lewis, TRL Limited, Penllergaer, Swansea; (01639 820526; fax: 01639 821978; Email: jlewis@trl.co.uk).



Vegetated Bund Constructed at Geoenvironmental Research Park, South Wales

Promoting excellence in engineering



The latest sponsor of Innovation & Research Focus, the Royal Academy of Engineering, in its role of promoting excellence in engineering, has sponsored leading-edge engineering research for many years. It is committed to strengthening links between industry and universities and much of the research under way is co-funded with industry.

The Academy currently funds a wide variety of Research Chairs and Senior Research Fellows (22 in all at present) all for periods of five years. Each position is aimed at establishing, or enhancing, an internationally recognised centre of excellence in an identified area of engineering. The incumbent is expected to publish the results of their work as widely as possible to gain a high level of international standing and reputation for themselves and for the group in which they are based.

Post-Doctoral Research Fellowships provide support for young, high-quality engineers to encourage them to develop their interests in basic academic research as a stepping-stone to a successful research career. The scheme provides outstanding young researchers, who have attained a PhD, with five years of full funding of their salary plus a Fellowship Support Fund of £10,000 to support their research for each of the five years.

The call for applications for the next round of Fellowship awards is due this summer, with awards made in March 2004. Eight new Fellowships will be available, and further information on the scheme is in the PDRF area of www.raeng.org.uk/research.

Dr Jim Hall is a Post-Doctoral Research Fellow sponsored by the Academy at Bristol



Jim Hall

University. His research focuses on the handling of uncertainty in flood and coastal engineering projects. Dr Hall is working on a new non-standard approach to the representation of uncertainty in calculations of the probability of failure of flood and coastal defences. Many of the current risk-assessment methods are fundamentally uncertain, but on the other hand risk-based methods can enable resources to be used more efficiently. So it is vital to have a way of incorporating the uncertainty into the calculations.

'The method provides insights into the extent and implications of uncertainty in

reliability calculations', says Jim Hall. 'This will assist the decision-making process, which will in turn have safety and economic benefits for flood and coastal defence management'.

The Academy's Global Research Award scheme provides an exciting opportunity for engineers currently engaged in R&D in the UK to undertake engineering projects in centres of excellence overseas, for periods between three to twelve months. The scheme encourages the involvement of engineers in advanced engineering techniques, in particular where such technologies are novel, or not readily available in the UK. They are also designed to encourage engineering R&D networking around the world.

The Royal Academy will fund 50% of the total agreed costs of the visit(s) up to a ceiling of £35,000. A key component of the scheme is the requirement that the secondees disseminate the research upon their return, benefiting the UK engineering community as a whole.

For further information on these funding opportunities and the Academy's research interests, please contact Mr Rob Barrett, Manager, Research Support, at the Royal Academy of Engineering (020 7227 0500; Email: barrettr@raeng.co.uk; Website: www.raeng.org.uk).

SUSTAINABLE DEVELOPMENT

Sustainable development of cement and concrete



The UK Government and the Sustainable Development Commission started a Pioneering initiative in 2001 working through sector associations to encourage industries to tackle the problems – and gain the benefits – of sustainable development.

The British Cement Association (BCA) recognised how important sustainable development was as an issue for both the cement and concrete industries and for the specifiers and users of these materials. The association realised that developing a sustainability strategy for cement and concrete in construction was essential to address the concerns of stakeholders on issues such as climate change, fossil fuel depletion, resource depletion, and waste. A strategy would help to bring commitment and structure to something that many in the industry knew was the right thing to do.

A sustainability team has been established, jointly facilitated by the BCA and 'Concrete Thinking', to develop a strategy for the cement, concrete and concrete construction sector. The project team comprises senior representatives from companies and trade associations committed to sustainable development, as well as



designers, structural and civil engineers, architects, clients and contractors.

During 2002 this industry team progressed the strategy in collaboration with an EngD researcher from the Centre for Environmental Strategy at the University of Surrey. An interim report that communicates project progress, some of the sector initiatives already underway, and sector commitments, was launched on 8th April 2003, at the Climate Change Our

Business conference in Birmingham.

A project website was also created during 2002 to provide information and to encourage communication and engagement with external stakeholders (www.concensus.info). The interim report is also available to download from this website www.concensus.info/reports1/reports1.htm

To date the strategy project has focused in three main areas: cement sustainability; concrete sustainability; and promoting and assisting more sustainable concrete design and construction.

The sector understands it has a responsibility to develop in a sustainable manner and will continue to strive to make its full contribution to sustainable development in parallel with ensuring its continued economic prosperity.

For further information please contact: David Collins, BCA (01344 725762; Email: dcollins@bca.org.uk).

Using lasers to assess structures

BRE

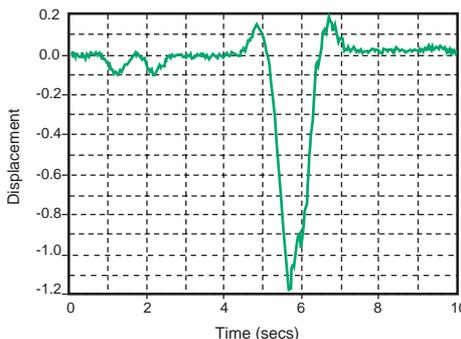
A project funded by the Foundation for the Built Environment has been investigating the use of lasers for determining the stiffness and strength of existing structures. Whilst stiffness can be measured directly, strength cannot be accurately assessed using non-destructive techniques, and so needs a combination of measurements and analytical methods for its evaluation.

In many branches of engineering, feedback from measured performance is used to improve design. But in structural engineering this has not been widely adopted because the large size of the structures involved makes it difficult to measure structural behaviour. This has resulted in relatively inaccurate methods of modelling some structures, so feedback on actual performance has great potential.

The development of lasers has provided an extra dimension for taking laboratory and on-site measurements that can be interfaced with existing measurement and analysis techniques. Two applications of lasers studied in the project have helped to demonstrate their uses.

The photograph shows the first example, a laser used to take remote measurements on a six-storey building. No target was needed on the structure and the velocity and displacement of the building's motion can be accurately measured. Measurements were used to determine the dynamic characteristics of the building and its racking stiffness, and were taken at various stages of construction and testing.

The second example involves measuring the vertical deflection of the mid-span of a stiff concrete bridge. The measured displacement-time history is given in the graph. The small displacements after 1 and 2 seconds are from cars; and the large response is for a lorry. With a main span and two shorter side spans, the centre of the bridge rises as the lorry crosses the first side span, sags as it moves onto the main span and rises again as it goes onto the second side span and leaves the bridge. Knowing the weight of the lorry enables the bridge stiffness to be determined. Taking measurements did not require direct access to the bridge nor any traffic control.



Displacement measurements on a concrete bridge as a lorry passes

For further information please contact Brian Ellis of BRE (01923 664566; fax 01923 664786; E-mail ellisb@bre.co.uk)

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also on the web at www.innovationandresearchfocus.org.uk

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