

Innovation & Research



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Tough line on pollution

The nature of linear construction projects, such as railways, roads or pipelines, means that they are likely to have a high interface with the natural environment, crossing differing types of land, each with specific characteristics, different water regimes and different requirements for environmental protection. As a consequence, linear projects are often more complex than, for example, construction sites for buildings, and therefore pose challenges on a significantly larger scale, with greater potential for cumulative environmental damage, with a higher overall cost and resulting adverse publicity. The application of good practice in preventing water pollution is often very different for linear sites and requires experience and guidance to ensure appropriate measures are taken. Those involved in the design, construction and maintenance of linear projects need to be aware of the necessary environmental obligations at all stages, as decisions taken at the planning and design stage can have a significant impact on the control of water pollution once the project reaches the construction stage.



Haul route run-off (Courtesy Transco)

CIRIA's new guidance *Control of water pollution from linear construction projects* (C648) provides specific guidance to clients, consultants, designers and contractors on how to plan for the control and management of water pollution from linear projects. The guidance outlines the characteristics of linear construction projects, provides an understanding of water pollution, and covers the project lifecycle from planning, early environmental assessments and design considerations for the construction phase, through to commissioning. The focus is on the prevention of contamination of watercourses in order to improve the

environmental performance of linear construction projects. Although the guidance is of particular relevance to those working on linear construction projects, the principles can also be applied to most construction sites.

To purchase a copy of *Control of water pollution from Linear construction projects* (C648) visit www.ciriabooks.com

For further information please contact
CIRIA (020 7549 3300);
 Fax: 020 7253 0523;
 E-mail: enquiries@ciria.org.



BikeGuard™ motorcycle-friendly barrier system

The Highways Agency has piloted a motorcycle-friendly barrier system at the A2070 Cloverleaf Junction, Ashford, Kent, to reduce the severity of crashes associated with motorcyclists colliding with existing safety barriers.

The Cloverleaf Junction comprises a combination of bends at which there had been numerous fatalities and serious accidents, mostly involving motorcyclists losing control and colliding with the support posts for the safety barrier. In the five years prior to the installation of this motorcycle friendly barrier system, there were 14 casualties attributed to motorcycle accidents. Highways Agency customers have also complained about the danger they perceive from collisions with the barrier support posts.

In response to these accident figures and customer views, the Highways Agency identified a product called BikeGuard™ as likely to achieve the reduction in severity of the accidents, without compromising the performance of the safety barrier system.

BikeGuard™ was developed in Germany and introduced into the UK by Highway Care Limited. It is fitted beneath the horizontal beam of existing barriers to form a smooth, continuous surface. It was



Completed BikeGuard installation at the Cloverleaf Junction

tested to European Standard CEN 1317 before receiving approval for widespread use by the Highways Agency in August 2005. It is expected that if a motorcyclist loses

control of the motorcycle, a collision with BikeGuard would be less severe than colliding with the support posts for the safety barrier system. Since its installation in March 2004, there is evidence that only one vehicle, thought to be a motorcycle, has collided with the BikeGuard barrier. No accident report was logged by Kent Police, which suggests that there was no injury from the impact.

These early results indicate that if the system is deployed elsewhere, it will have significant safety benefits for the network. Other Highways Agency agents have recognised the potential safety benefits illustrated by the Cloverleaf trial and have requested further details on the possibility of installing BikeGuard at other similar locations within the Highways Agency network.

For further information please contact Daniel Ruth, Highways Agency, Federated House, London Road, Dorking RH4 1SZ (E-mail daniel.ruth@highways.gsi.gov.uk).

DESIGN & SAFETY

Integrating building design with fire safety engineering

Professor Jose Torero holds the RAEng-BRE sponsored Research Chair in Fire Safety Engineering at the University of Edinburgh. Edinburgh's BRE Centre for Fire Safety Engineering has state of the art facilities and aims to provide new impetus behind fire safety research and education.

Traditional fire safety engineering is introduced into the built environment through codes, standards and sometimes through engineering calculations. Nevertheless, it has remained an ancillary attachment that tends to follow after the design concepts emerging from architects and structural engineers. This practice is costly, inefficient and hampers innovation. It is therefore essential to better integrate fire safety practices into the design process.

Integration often requires scientific and technological innovation to make it possible. In the case of fire safety, the technological leap generated by the analysis of the *Cardington Tests* represents the enabling scientific knowledge. The value of this analysis lies in the clear demonstration that the performance of a structure in fire is intimately linked to its geometry, and thus to the definition of space. A natural link between fire safety engineers, structural engineers and architects is then formed.

The objective of the BRE Centre for Fire Safety Engineering is thus to exploit this link and in the process establish, with the example of fire, how safety should be integrated into the design and development of the built environment. The Centre wants to emphasize the development of communica-

tion paths between structural engineers, architects and fire safety engineers in such a manner that the inherent value of each contribution to a better design becomes obvious. This, and the talent of the individuals involved, will enhance the importance of the role of fire safety engineers and lead to better design of buildings.

For further information on the Academy's Research Support schemes please contact Mr Rob Barrett, Manager, Research Support, The Royal Academy of Engineering (020 7277 0500; E-mail: robert.barrett@raeng.org.uk; Website: www.raeng.org.uk/research).

For further information please contact Professor Torero direct on his work contact details (0131 650 5723; E-mail: J.Torero@ed.ac.uk).



The burning Windsor Tower, Madrid, February 12, 2005.

Charging for irrigation services



One of the major problems in managing irrigation systems in developing countries is how to ensure that sufficient costs are recovered from farmers to run their irrigation water services on a sustainable basis. What is needed is a methodology that can help identify a cost recovery mechanism for different situations, and that takes into account what farmers are realistically prepared to pay.

Two issues especially dominate the management of irrigation systems – scarcity of water to meet competing demands, and scarcity of funds for operations and maintenance. Different approaches for appropriate charging policies have been advocated, such as demand management, volumetric charging, and tradable water rights. While some of these ideas have been demonstrated in the municipal and industrial sectors, their relevance to the irrigation sector was less certain.

In the irrigation sector the use of “economic instruments” to achieve water savings or enhanced economic efficiency has been strongly advocated, but field evidence shows that there are few successful examples.

An HR Wallingford study found that charges and charging mechanisms vary widely even within a single country. It recommends that if water charging is to be introduced then it should be accompanied by other measures so that a good water



(Top) Irrigation, Indonesia. (Above) Gujarat, India, Water charging to farmers associations is based on delivery at this flume

service is achieved that farmers are willing to pay for. It found that pricing of water had little success in controlling water use, whereas quotas do. The study also identified the institutional and political factors that constrain the use of water charging policies, such as the difficulty of enforcement. Even the widely advocated policy of transferring irrigation management to farmers’ associations, although increasing revenues, does not achieve sufficient recovery of real costs.

The guidelines produced as a result of the study show how to identify national charging objectives, how to compare alternative approaches for achieving successful charging, how to identify which is the most effective approach, and how to identify what revisions to policies, rules and infrastructure are needed.

For further information please contact Tom Brabben at HR Wallingford (01491 822310; E-mail: teb@hrwallingford.co.uk).

FLOODING & DESIGN

Floating houses for flood plains



The Dutch are responding to climate change by building floating houses in high flood risk areas. If rivers rise above their banks, the houses simply float upwards as well. This innovative form of housing could offer a solution for other parts of the world, including UK flood plains such as the Thames Gateway, where 200,000 new homes are planned.

The houses have built-in flotation in the form of a flat-bottomed, sealed concrete box that provides buoyancy and also offers additional living space in the form of a basement. When flooding occurs, the house can rise up to 15ft, guided by two concrete piles. The low centre of gravity makes the structure very stable, and they have an estimated design life of around 100 years. Services such as gas, water and electricity are provided through flexible pipes, allowing articulation during flooding.

The basic concept was developed by Anges Snel in collaboration with Koen Olthuis, a 34-year-old Dutch architect who has become a leading advocate for floating homes.

Dura Vermeer, one of Holland’s largest builders, is also experimenting with floating structures and is responsible for developing a community of 48 floating homes in Maasbommel, on the banks of the Maas



A floating concrete basement provides buoyancy and additional living space.

River. The company is currently designing a floating town near Schiphol Airport, which will house around 12,000 people, and is in one of the fastest-growing regions of the country.

With the North Sea predicted to rise by as much as 900mm (3ft) over the next 100 years, this highly adaptive approach to climate change could offer a cost-effective solution for areas of the Thames Gateway where conventional housing may well prove impractical and potentially uninsurable. By 2080 it is predicted that the cost of flood damage in the UK could increase 20-fold to more than £20 billion unless adequate funds are put into flood defences and preventing coastal erosion.

For further information please contact Brian Blight at The Concrete Centre (01276 606800; E-mail: bblight@concretecentre.com).

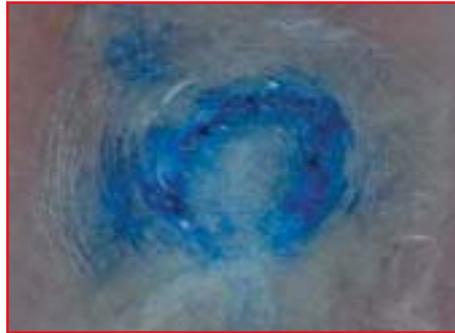
Bruisable Composites

As part of the Government's ten-year Science and Innovation Investment Framework, published in July 2004, the DTI has contributed £5m funding to 12 Collaborative R&D projects in Advanced Composite Materials and Structures. Projects range in size from £70k up to £2.9m with between 3 and 17 collaborators in each consortium. DTI funding for each project ranges from £40k to £1m.

Today, composite materials are widely represented in sectors such as medical, construction and transport. It is a multi-billion US\$ industry and, according to a study called *Structure and dynamics of the composites industry*, is expected to grow between 2 and 3% in terms of value, per year, between 2005 and 2008.

Composite materials generally consist of a reinforcing fibre and a bonding matrix to produce a solid composite structure. The reinforcement (such as glass fibre) provides the majority of the mechanical strength and stiffness. The resin matrix allows stress to be transferred through the structure and provides environmental resistance. In general, composite structures have very good specific strength and stiffness (per unit mass) coupled with increased environmental, impact and fatigue resistance compared with traditional materials such as woods and metals.

It is widely accepted that one of the major drawbacks of composite materials is their inability to show impact damage or evidence of over-stressing. Upon impact, metals deform making damage detection a relatively simple exercise. When a composite is impacted it is possible that no damage to the impacted surface may be visible due to the manner in which the composite it made up.



Bruise (blue) is visible in the composite laminate

However, within the laminate (hidden from the eye) there may be substantial damage that severely compromises the structure.

Technologies exist to detect such damage, but these tend to be expensive and require trained personnel. Further, the checks tend to be conducted on a periodic basis rather than reacting to known problems.

The aim of the project was to develop a novel, low-cost, visual-based inspection technique for advanced composite materials and structures based on the concept of "bruisable composites". This concept involves incorporating microencapsulated polymer spheres containing different coloured dyes into the

resin system, which are released when subjected to various forms of mechanical rupture (i.e. impact) or overstrain to form a "bruise".

It is proposed that, by modelling the area and colour intensity of the "bruise", it should be possible to produce guidelines that enable engineers unfamiliar with composites or non-destructive testing techniques to rapidly identify and quantify any deterioration in a composite structure, thereby actioning further detailed inspection, monitoring, repair or replacement. Relevant industries include infrastructure such as bridges, columns, wind turbines, transport such as road, rail, marine, air, and chemical engineering. This technique will be particularly appropriate for structures that are inaccessible.

The rationale behind the Bruisable Composites concept is to provide a low-cost method of detecting whether a composite structure has suffered damage. No skilled technician is required and it is applicable to both low and high technology applications where an instant visual damage identification method would be of great benefit to critical structures.

For further information please contact Dr Matthew Turner, Composite Design Engineer, Euro-Projects LTTC Ltd (0116 2376693; Fax 0116 2303989; E-Mail m.turner@europrojects.net).

COASTAL ENGINEERING

Improved guidance for assessing the overtopping of sea defences



Understanding future changes in flood risk from waves overtopping seawalls and other structures is a key requirement for effective management of coastal defences. Seawalls make up most of these defences, and range from simple earth banks through to vertical concrete walls and on to more complex composite structures, which often involve wave return walls and/or rock armouring. EA guidance on seawall design has been updated so that issues such as climate change and sea-level rise can be better taken into account.

Research for Defra and the Environment Agency, carried out at HR Wallingford, has provided techniques for predicting the mean overtopping discharge, and the consequent flood volumes and drainage requirements, for a range of seawall types.

One major step forward has been the production of updated guidance on the design of coastal defences. This is being produced by HR Wallingford, with inputs by European partners, in the form of the *European Overtopping Manual*.

Designers will now have access to a set of advanced calculation tools based on recent projects. The



Dealing with overtopping is important for minimising down-time and other impacts on coastal facilities. Railway at Saltcoats, SW Scotland.

European Overtopping Manual will incorporate new techniques to predict wave overtopping at seawalls, flood embankments, breakwaters and other shoreline structures facing waves. Supported by web-based programs for the calculation of overtopping discharge and design details, the Manual's appendices will give photographic and video visualisations of overtopping processes, graphical presentations, case studies, and example calculations.

For further information please contact Dr Tim Pullen, HR Wallingford (01491 822231; Fax 01491 8322333; E-mail: tap@hrwallingford.co.uk).

HSE research news – at your fingertips!



Science and Research Outlook (SRO) – www.hsesro.com – is a unique online service delivering the research output of the Health and Safety Executive (HSE) to the widest possible audience. Designed and developed by SCI, the service is a key part of the coordinated response to the challenge set by the Health and Safety Commission's *Strategy for workplace health and safety in Great Britain to 2010 and beyond*.



(Left) SRO Homepage – <http://www.hsesro.com/>
(Below) Typical Article – “Dehydration in the workplace”
(Bottom) RSS Feed

The primary aim of SRO is the effective communication of the HSE's research activities. This is achieved through concise, often topical, news articles containing the most important research findings in an easy-to-read format. The site has been designed for simplicity of use, presenting abstracts from a selection of recently added articles, and a searchable database containing over 70 articles dating back to June 2004. The majority of articles contain links to full research papers for those requiring more detail.

By registering (for free) with the site, users have access to a range of additional facilities. Registered users are able to subscribe to the SRO newsletter, issued quarterly, covering the most important recently completed research activities, and comprising titles and abstracts with links back to the complete articles on the website.

In addition, registered users can forward a collection of articles to a friend or colleague, and add comments to the bottom of articles. In this way the HSE seeks to utilise 'trust networks' to disseminate information, and directly access the knowledge and experience of the wider community to stimulate debate and highlight areas requiring further research.

A recent review highlighted a number of readily achievable steps that could be taken to significantly increase the accessibility of SRO, resulting in the development of an RSS feed, webmaster links pages, and the upgrading of the site to full compliance with the WAI-A accessibility standard.

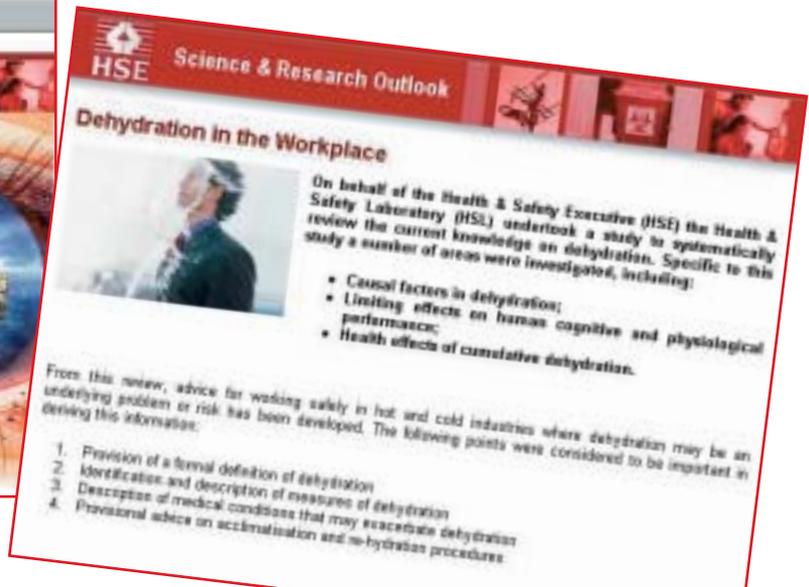
RSS stands for Really Simple Syndication; RSS feeds are accessed by programs called 'News Readers'; which may be either desktop-based or form part of a web page. A user with a News Reader does not have to keep visiting a website to find out if anything new has been added; their News Reader simply checks its RSS feeds at regular intervals and displays any items that have been added since it last looked. RSS provides a straightforward and standard means for users to keep up-to-date with SRO developments.

The webmaster tools page presents developers with code that can simply be pasted into their webpage to provide their internet and/or intranet users with a range of link types comprising standard text hyperlink, SRO icon hyperlink, or full SRO database search facility.

WAI-A compliance ensures that all potential users, irrespective of their physical abilities, are able to navigate the SRO site and access the available facilities.

SRO will continue to develop in response to the changing technology and needs of its users. HSE invites your comments on this article and all aspects of the SRO site via the online feedback form <http://www.hsesro.com/Feedback.aspx>.

For more information please contact James Way, Principal Engineer, The Steel Construction Institute (01344 623345; E-mail: J.Way@steel-sci.com).



Acknowledgement

The image showing flood risk areas in North Wales that was part of the page 1 article in issue IRF 63 was reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2005. All rights reserved. Ordnance Survey Licence number 100019904

Whole-life costing research showcase



As part of the successful series of EPSRC-sponsored showcases of funded research, the free whole-life costing event that took place at the Institution of Civil Engineers on 24 January was no exception. Whole-life costing is increasingly becoming best practice in construction procurement as a method that quantifies financial values for buildings from inception and throughout a building's life.

Chaired by Sean Lockie, Director of Faithful & Gould and Head of their Whole Life Value Centre of Excellence, the event united speakers from across academia and the engineering industry, who provided over 100 delegates with a sequence of presentations on the benefits of whole-life costing and life-cycle assessment.

While much of the recent promotion of whole-life costing has focused on the role of the 'construction client' and the gains to be made on their behalf, it is a beneficial tool for organisations involved in all stages in the construction supply chain.

A perceived key barrier to the use of whole-life costing is the sheer scale of the data collection exercise, inconsistencies across data sets and the level of detail required to make a meaningful calculation of whole-life costs at the design level (whether considering new build or, increasingly, refurbishment). As such, the impact of the EPSRC-funded

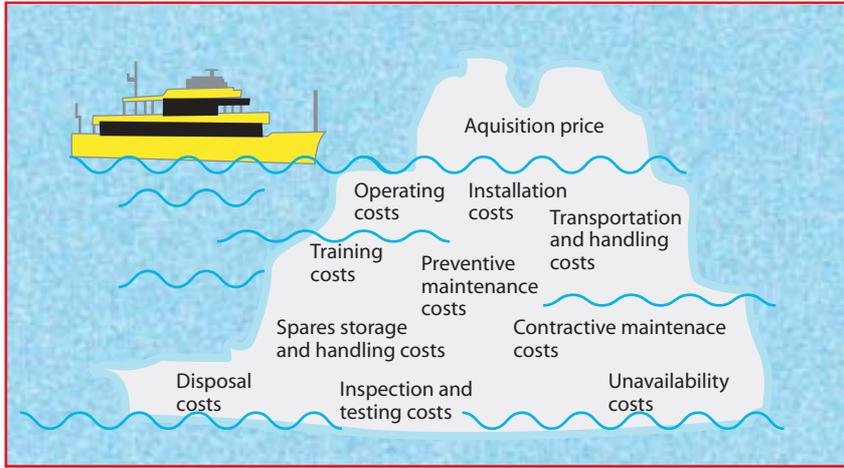


Image courtesy of RISI (Resource Information Systems Incorporated) Featured in their Pulp and Paper Magazine Jan/Feb 2002 Edition Volume 7, Number 1

research cannot be underestimated.

Presentations were delivered on various strands of whole-life costing, from the drivers for implementing whole-life costing, performance models and data collection, to water asset management and whole-life assessment methods to measure environmental impacts. Each lecture included an introduction to the various research projects and some of the key

results. A lively Q&A and discussion ensued.

The Institution of Civil Engineers and the EPSRC would like to thank all the speakers who kindly participated in the showcase event: Dr Mohammed El-Haram, University of Dundee; Professor Adrian Saul and Dr Adrian Cashman, University of Sheffield; Professor Dragan Savic and Dr Slobodan Djordjevic, University of Exeter; Professor Joseph Tah and Mr Nick Bakis, University of Salford; and Dr Sandy Smith, Sustain Ltd.

Further details of the EPSRC-funded research are available from Fionnuala Costello, Research Portfolio Manager, at the EPSRC (01793 444134; E-mail Fionnuala.Costello@epsrc.ac.uk).

For further information about ICE's involvement please contact Simon Whalley, Policy Executive at the ICE (020 7665 2210; E-mail Simon.Whalley@ice.org.uk).

INNOVATION, MANAGEMENT & HIGHWAYS

ITSRadar: scanning the transport world for innovative developments



The Highways Agency is committed to improving services to road users, tackling congestion and improving safety. One way of achieving these aims is for Highways Agency staff to share information with colleagues overseas to help to bring quick benefits to drivers through innovative traffic control systems.

The ITSRadar project has been developed in order to maintain this overseas network. This service captures intelligence on technology developments relating to Intelligent Transport Systems (ITS) projects worldwide and keeps Highways Agency staff up to date through a variety of means such as an e-mail update service and a website.

The specific services available through ITSRadar are:

- a regular Newswire email service, delivered to your inbox, individually tailored, containing summaries of new developments in the technology world;
- a website containing information and research on topics of interest;
- an electronic library and information request or retrieval service;
- seminars and workshops on specific innovative topics;
- a series of regular summary reports of recent happenings relevant to the HA (in more detail than the newswire);
- 'hot topic' leaflets on an ad-hoc basis.



The ITSRadar service was launched in August 2005 and currently has over 70 subscribers to its Newswire service. The service was initially developed for Highways Agency staff but its success has attracted subscribers from within the Department for Transport and some of the Agency's contractors.

This project also supports the Highways Agency project HA EU Watch that provides information from European developments in areas such as Standards, the European Commission and ITS Safety.

For further information on ITSRadar please visit the project website www.itsradar.co.uk or call 0121 262 6066. For more information on HA EUWatch visit www.haeuwatchinfo.com.

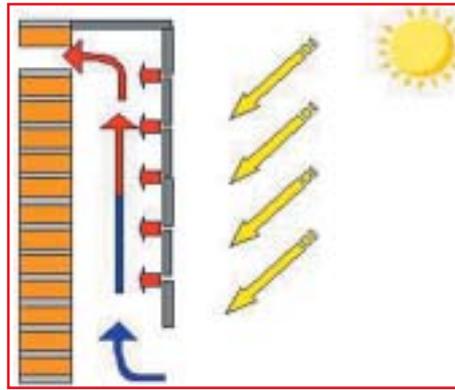
Towards new cladding solutions

Corus have received funding for a project entitled *New Cladding Solutions to Produce a Step Change in Construction* as part of the DTI's Technology Programme.

Over the period 2005 to 2008, £320 million will be available to businesses in the form of grants to support research and development in the technology areas identified by the Technology Strategy Board. The need for sustainable construction, and in particular energy-conserving buildings, is high on the agenda for change in the construction industry.

Corus are leading this project with project partners The Steel Construction Institute, Oxford Brookes University and BSRIA. The project is looking for long-term innovative changes to building envelope concepts, the drivers being the requirements of the Kyoto Agreement and the need to reduce CO₂ production from energy use in buildings. The Energy White Paper is being addressed through changes to the Building Regulations, in particular to Part L and projects like this one.

New insulation and airtightness requirements mean that existing cladding systems may no longer be adequate. An overhaul of cladding concepts is being addressed, with the aim to create systems that are safe and economic, make use of environmentally responsible materials, satisfy new sustain-



The solar thermal effect of a twin skin building facade

ability requirements and make use of off-site manufacturing methods. The objectives of this project are thus:

- to produce designs that will improve the environmental performance of buildings through reduced energy consumption and increased opportunities for re-use and recycling of the components;

- to respond to the need for improved thermal insulation and reduction of heat loss from air leakage;
- to deliver improved construction quality to ensure compliance through the use of off-site manufacturing methods.

The focus will be on concept designs for new and innovative roof and wall composite cladding systems, detailed investigation into issues relating to the materials used by the components in these systems, and production of the necessary design guidance and tools to allow manufacturers to produce detailed designs to suit their particular market needs.

The overall aim is to lay the foundations for manufacturers of cladding systems to build on in the future, by undertaking the research and development work that most cladding manufacturers (who are SMEs) are unable to perform, on their own, perhaps due to lack of skills and/or resources.

For further information please contact Phil Parkin, Senior Engineer, Corus RD&T, Swinden Technology Centre (01709 825303; E-mail phil.parkin@corusgroup.com).

CONSTRUCTION FUTURES

Sustained competitiveness in UK construction: a fresh perspective



The world in which we live and work is a rapidly changing place, and only by looking ahead can we prepare ourselves today for the potential threats and opportunities that may arise in the future. A 3-year EPSRC-funded research project aims to identify and understand the challenges and opportunities of the UK construction sector over the next 20 years. *Sustained competitiveness in UK construction: a fresh perspective*, or 'The Big Ideas' for short, is a collaboration between industry and the Innovative Manufacturing Research Centres at Loughborough, Reading and Salford Universities.

The project involves five interconnected phases:

- 1 grounding the project in a thorough investigation of the current structural and cultural configurations and dynamic capabilities of the UK construction industry as a whole;
- 2 identifying key issues that could shape the industry over the next 20 years;
- 3 establishing a range of possible future scenarios based upon groupings of their interdependencies;
- 4 creating an interactive IT tool to explore and simulate these future issues and scenarios; and
- 5 developing appropriate strategies and policies at both industry and firm levels to help organisations prepare for the future.



Looking to the future

tion of construction industry representatives and experts from other disciplines. The team

is interested in practitioners' views and ideas regarding the issues affecting the industry today and in the future – your participation can be anything from a brief conversation through attendance at one of our future scenario workshops up to regular consultation. Through their contributions, participants will be able to influence the focus of the project towards issues that are important to them and their organisations, as well as gaining early access to findings and recommendations.

The Big Ideas project presents a unique opportunity for firms and practitioners involved in construction to understand, prepare for and help guide the potential future of the sector. IRF readers are invited to participate.

For further information please contact Chris Goodier at Loughborough University (01509 222814; E-mail c.i.goodier@lboro.ac.uk) or visit the Big Ideas website at www.thebigideas.org.uk.

The research will engage a diverse cross-

Rural road surfacing research

DFID Department for International Development

Natural gravel or laterite has long been regarded as the low-cost solution to road access for rural communities in South East Asia. However, because of increasing recognition that gravel is not always the best surfacing solution in all circumstances, the Government of Vietnam's Ministry of Transport requested studies of alternative surfaces. A consequent Rural Road Surfacing Research (RRSR) programme is being funded by DFID under the South East Asian Community Access Programme (SEACAP), with additional support from the World Bank and Asian Development Bank. This research initiative concerns alternative road surfacing technologies in Cambodia, Vietnam and Laos.

A key part of this initiative has been a national gravel performance study in Vietnam undertaken by the UK consultants Intech Associates, with the UK Transport Research Laboratory (TRL) as specialist sub-consultant. This recent survey of gravel roads found surface material loss rates to be more than 20mm per year at more than half of the 700 sites monitored. Such losses are very difficult to support and are of course very expensive to replace.

High gravel loss rates are related to specific road environments in South East Asia comprising generally high rainfall levels, inappropriate materials, flooding incidence and poor or non-existent maintenance. Such environments contrast with some drier regions where unsealed gravel roads have an established history of providing more sustainable rural access.

The overall aim of the RRSR programme is to devise a strategy that will offer a better response to the need to provide all-weather roads for rural communities and poverty reduction. To this end, the Intech-TRL team is developing a series of guidelines on a range of surfacing options that can be adapted to the varied road environments in South East Asia. The initial trial sections of road have been constructed in Cambodia and Vietnam,



Dressed Stone Paving – one of the surfacing options trialled.

and Phase 2 trials expansion is about to start. The initial guidelines on gravel use are already available for web downloading. Initial guidelines on the use of the alternative surfaces will be available soon.

For further information please visit www.cnctp.info and www.mt.gov.vn/rural-transport/rrsr or contact [Yogita Maini \(y-maini@dfid.gov.uk\)](mailto:Yogita.Maini@dfid.gov.uk).

For SEACAP contact [David Salter](mailto:David.Salter@online.com.kh) davidsalter@online.com.kh, and for Intech-TRL contact [Robert Petts](mailto:Robert.Petts@intech-trl.com) or [Dr Jasper Cook](mailto:Dr.Jasper.Cook@intech-trl.com) at intech-trl@fpt.vn.

ABOUT INNOVATION & RESEARCH FOCUS

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

Aims – The aim of *Innovation & Research Focus* is to promote the application of innovation and research in building, civil engineering and the built environment by disseminating new information 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. Articles may be reproduced, provided the source is acknowledged.

Enquiries – If you wish to know more about a specific project, contact the person or organisation named at the end of the relevant article.

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CIRIA

Classic House, 174–180 Old Street, London, EC1V 9BP (020 7549 3300; fax: 020 7253 0523)
Website: www.ciria.org, E-mail: enquiries@ciria.org

HR Wallingford Ltd

Wallingford, Oxfordshire, OX10 8BA (01491 835381; fax: 01491 832233)
Website: www.hrwallingford.co.uk
E-mail: hrinfo@hrwallingford.co.uk

The Steel Construction Institute

Silwood Park, Ascot, Berkshire, SL5 7QN (01344 623345; fax: 01344 622944)
Website: www.steel-sci.org
E-mail: reception@steel-sci.com

PROFESSIONAL INSTITUTIONS

Institution of Civil Engineers

1 Great George Street, Westminster, London, SW1P 3AA (020 7222 7722; fax: 020 7222 7500)
Website: www.ice.org.uk
E-mail: enquiries@ice.org.uk

Institution of Structural Engineers

11 Upper Belgrave Street, London SW1X 8BH (020 7235 4535; fax: 020 7235 4294)
Website: www.istructe.org.uk
E-mail: mail@istructe.org.uk

Royal Academy of Engineering

29 Great Peter Street, London SW1P 3LW (020 7227 0500; fax 0207 233 0054)
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INDUSTRY

Ove Arup Partnership
Geotechnical Consulting Group
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