

# Innovation & Research



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## FireGrid: integrated emergency response

Hindsight is a wonderful thing. It is often said that were the information from retrospective analysis of an event available beforehand to those responsible for tackling the emergency then the incident would have been approached differently. This was tragically illustrated when emergency crews continued operations oblivious to the impending collapse of the World Trade Centre buildings.

**F**ireGrid, a 3-year, £2.3 million project started in April 2006, led by BRE and supported by the DTI's Technology Programme, brings together a multi-disciplinary consortium to develop a prototype emergency response system. The consortium includes the University of Edinburgh; Arup; ABAQUS UK Ltd.; ANSYS Europe Limited; Vision Systems (Europe) Limited; the London Fire and Emergency Planning Authority and the Institute of High Performance Computing. In the event of a fire, it will provide fire fighters with information concerning the likely sequence of events before they unfold.

This intelligence, previously only available in hindsight, will allow the emergency services to execute a more-effective response to a fire incident. The information supplied will include details of how the fire is expected to spread, how the structural integrity of the building will be affected and how the building occupants are likely to react in response to the fire. The system will also make use of advanced command and control algorithms to provide operational instructions for the deployment of response systems and emergency personnel.

To forecast such events in a timely and reliable manner requires considerable resources, including data from the developing event, extensive computing power and robust modelling algorithms. FireGrid will create the ability to use real-time data from sensor networks within the affected building combined with Grid and high-performance computing in order to model event development, as well as to predict changes to the structural fire response of the building and the reaction of its occupants to the fire itself.



*FireGrid: An integrated Emergency Response System for the Built Environment*

For example, the ability will be created to quantify time to impending collapse, or to determine areas that will become too dangerous to occupy. A key component will be the use of information from the building's sensors to confirm or correct the results of the modelling processes.

In addition to providing information for emergency responders, outputs from the FireGrid system will be exploitable in other ways. This includes a training mode in which the FireGrid system is used to generate a sequence of events based on a specific scenario.

The data so generated may be input to a virtual reality portal or simulator used for the training of emergency responders. The FireGrid system may also be used to develop simulation archives and databases. Such resources may be used by building and systems architects to facilitate the design and construction of safer buildings in the future, by enhancing understanding the response of modern construction forms to fire events. A further application is the use of FireGrid-generated data as part of a Grid-enabled R&D tool enabling remote collaboration between industry and academia in the field of fire safety engineering.

Although initially focussing on fire, the methodologies developed by FireGrid may also be extended to other hazards such as environmental incidents, natural disasters and acts of terrorism.

*Further information can be obtained from the FireGrid website [www.firegrid.org](http://www.firegrid.org), or by contacting the project leader, Professor Suresh Kuma (E-mail: [kumars@bre.co.uk](mailto:kumars@bre.co.uk)).*

# Investigating moisture damage in asphalt



With the help of a RAEng Global Research Award, Dr Gordon Airey from University of Nottingham is currently spending 4 months working with the Materials Engineering Group at Texas A&M University using surface energy measurements, continuum damage mechanics and fracture mechanics to assess moisture damage in asphalt.

The Nottingham Centre for Pavement Engineering is one of the leading international research groups in pavement engineering and asphalt technology. A key area of investigation is the susceptibility of asphalt pavement materials to moisture. The team has developed a combined ageing/moisture damage durability test to assess performance of asphalt mixtures when subjected to water. Moisture damage is a complicated mode of asphalt mixture distress that leads eventually to costly failure of the road structure.



Resistance of the asphalt mixtures to damage in dry/wet conditions assessed by means of a Dynamic Mechanical Analyzer (DMA)

The NCPE testing procedures have been used to quantify the performance of traditional UK asphalt materials to moisture damage. Increasing the understanding of the interfacial bonding strength between the bitumen and aggregate and understanding the mechanisms that influence the cohesive strength of the binder and/or mastic should improve the resistance of asphalt mixtures to moisture damage.

Texas A&M University researchers have successfully developed a methodology to study the susceptibility of aggregates and bitumen to moisture damage by understanding the micro-mechanisms that influence the adhesive bond between them and the cohesive strength and durability of the binder. The group has developed the capability to rank good and poor-performing mixtures. Dr Airey is currently working with Drs Eyad Masad and Dallas Little at Texas A&M on evaluating the susceptibility of UK aggregates and binders to moisture damage. Bond energies and the viscoelastic and fracture properties obtained at Texas A&M will then be correlated with the moisture performance indices previously determined in Nottingham for asphalt mixture combinations.

For 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 Gordon Airey at The University of Nottingham (0115 9513913; E-mail: [gordon.airey@nottingham.ac.uk](mailto:gordon.airey@nottingham.ac.uk)).

## MANAGEMENT

### Building on 'values'



Over recent years values have been holding an increasingly prominent place in both business ethics and organisational theories, and there is a detectable shift from 'management by instructions and objectives' to 'management by values'. Some organisations now devote significant energy to integrating values and beliefs into their business practices, which requires a clear and thorough understanding of the organisational values in the first place.

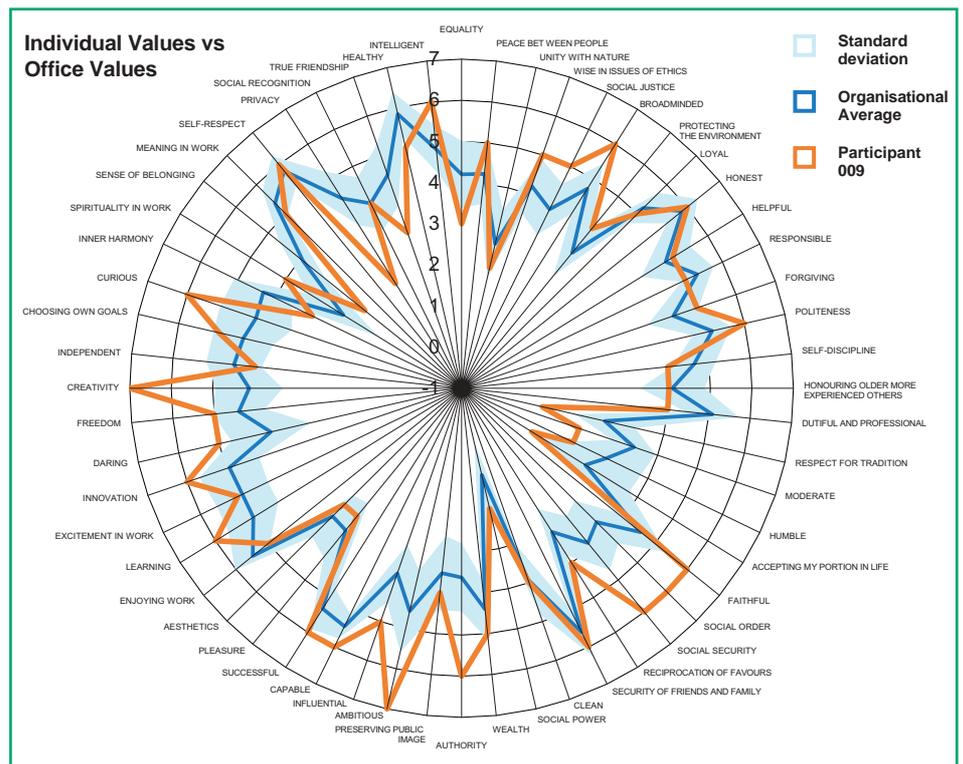
Many believe that organisations should have values that both reflect the collective values of all employees and align with individual values. The establishment of the linkage between individual and organisational values can provide legitimate insight into improving staff satisfaction and retaining employees over the long term. This is especially critical for the construction industry, as the industry has long been known for facing tremendous challenges in attracting and maintaining a qualified workforce.

'Lean office environment' is a collaborative research project between Loughborough University's Centre for Innovative and Collaborative Engineering and Currie & Brown, an international construction consulting company. As part of the research, a values study has recently been conducted across 14 UK offices of Currie & Brown. By utilising a questionnaire survey developed

using Schwartz's theoretical framework of human values, employees' values profiles were collected and analysed. Several follow-up workshops facilitated the identification and sharing of the common values, established the linkage between individual and organisational values, and provided guidance to the organisational behaviours.

This bottom-up approach made the organisational values explicit in an understandable and useful way, and improved the congruence between individuals and the organisation. It is believed that this approach will enable organisations to create and sustain a competitive advantage, strengthen it day by day, therefore meeting and exceeding the current and future demands placed upon them.

For further information please contact Grace Zhang at Currie & Brown (0121 212 2433; E-mail [grace.zhang@curriebrown.com](mailto:grace.zhang@curriebrown.com)).



# Lightweight gantry trial

The Risk Management and Vehicle Restraint Team (RMVR Team) in the Highways Agency has recently completed a project to evaluate the risks in using lightweight gantries (LWGs), primarily to support signage as part of the Agency's roll out of variable speed controlled motorways.

If these gantries can be used without the need to protect the legs with barriers, they could offer substantial savings in costs, erection times and subsequent maintenance, but the Highways Agency needs to make sure they do not pose a risk to drivers.

Crash tests were carried out in 2005 using a full-size prototype aluminium lightweight gantry spanning both carriageways of a 3-lane motorway and supported on A frame legs at each side and in the central reservation. A Rover 75 was driven into the gantry support legs on the nearside to see what the effect would be on the gantry itself and on the vehicle and its occupants.

By using signs of different weight on the gantry, the RMVR Team were able to demonstrate that if only one leg of the supporting A frame was demolished, the gantry did not collapse. When the whole A frame was demolished, although the gantry partially collapsed, lane 3 was not obstructed and lane 2 only partially obstructed by the fallen structure.

Because the structure offered relatively low resistance to impact, it was demonstrated that the occupants would have been likely to have survived the crash.

Output from the crash tests was then fed into a driver simulator and the reactions of 24 drivers of mixed ages and sexes to a collapsing gantry were tested. A range of reactions was observed including braking, driving under the available space and changing lanes.

The project has concluded that under certain circumstances, the risk of using LWGs on the network could be acceptable. Acting upon this advice, the Agency has commenced the writing of a new standard for Lightweight Gantries and a draft standard is scheduled to be available for use on a selected motorway widening scheme in early September this year.

Closely tied to the new standard, is the need to develop lighter-weight electronic signs including Advance Motorway Indicators and Variable Message Signs. The Highways

Agency is now running a project to develop a new generation of lighter weight signs that compliment the passively safe operation of the gantry. Currently the message signs are very heavy and, in this trial, weighed over 50% of the total gantry system's weight.

The project will review Agency standards that restrict the design of signage, particularly of enclosure weight and construction. It will also consider operational and maintenance procedures with the aim of reducing the costly process of accessing signs above the carriageway. These developments will offer benefits to road users of greater safety, more reliable journey times and better information.

*For further information please contact Ian Mills, Technical Advisor and Project Sponsor, RMVR Team (0161 874123; Fax: 01306 878301; E-mail: [ian.mills@highways.gsi.gov.uk](mailto:ian.mills@highways.gsi.gov.uk))*

(Below) Sequence showing collapse of gantry



## ICT & CONSTRUCTION PROCESS

# Impacts of the Avanti approach assessed



Avanti is an approach to effective use of information and communication technologies (ICT) to enable collaborative working within construction project teams. The approach has been developed over the last three years by industry partners under a DTI-funded research programme called 'ICT-enabled collaborative working'.

The Avanti approach builds on existing best practices and is supported by handbooks, toolkits and expert mentoring. It improves business performance by increasing the quality of information and the predictability of outcomes, and by reducing risk and waste. Whilst mentioning that Avanti is an approach, it is worth noting that it is not, therefore, an ICT system or tool, nor an organisation or club.

Avanti has been implemented during the design stages on a range of real construction projects (as opposed to scenarios), at the point where information is being rapidly generated and exchanged between project team members. An independent consultant has been appointed to assess the impact of the

approach's implementation on projects. The findings show that, whilst teams are required to make an investment of time and effort in adopting the approach (as with any new way of working), the benefits are:

- savings of 50-80% of effort in achieving design co-ordination;
- savings of 50-85% in time spent reworking information into a format where it can be reused;
- savings of 60-80% in time spent finding relevant information.

In addition, the approach is deemed to have the potential to have very significant savings through avoidance of on-site remedial

work. The independent consultant estimates this as over £0.5M on one projects investigated.

Constructing Excellence, who are the lead partner in the DTI-funded programme, are now taking on the 'ownership' of the Avanti approach on behalf of its members, and will be looking to make the approach more widely available to the industry.

*For further information please contact Paul Waskett, Avanti Programme Manager (02476 236929; E-mail: [contact@avanti-construction.org](mailto:contact@avanti-construction.org); Website: [www.avanti-construction.org](http://www.avanti-construction.org)).*

# Second annual gTKP Workshop held in Tunisia DFID Department for International Development

Seventy-eight delegates from 28 countries converged on Tunis in February to share their transport-related knowledge and expertise and to set clear priorities for the Global Transport Knowledge Partnership (gTKP) – an innovative partnership-based approach to the dissemination of transport knowledge for practitioners in developing countries [see *IRF* issue No. 63].



Delegates at the Tunis Workshop

This year's workshop was hosted by the African Development Bank. It was opened by Abderrahim Zouari, Tunisian Minister of Transport, who stressed the importance of the transport sector in attaining development goals such as poverty reduction.

With 56 organisations represented, the workshop was a unique opportunity to learn from different experiences and share research findings. Discussions centred on the need to harvest and connect to existing knowledge in addition to addressing knowledge gaps and barriers such as the lack of access to Southern based expertise and the low number of transport-based comparisons across developing countries.

Participants also took part in workshops, which made use of electronic voting to determine work priorities and plans for the Partnership's four key research areas: rural access to transport; sustainable urban mobility; vulnerable road users; and transport governance.

Increasing rural accessibility was identified as a major priority. Similarly, the need to improve the dissemination of knowledge on sustainable urban mobility issues was also raised. It was suggested that gTKP could support this by hosting workshops and helping to create centres of excellence. Delegates also discussed the development of 'a vulnerable road user manual' in partnership with the WHO, the World Bank and other partners.

Corruption in transport projects was highlighted as a major obstacle to sustainable development. In response, delegates produced a five-step plan to combat corruption:

- devising anti-corruption systems with internal monitoring;
- encouraging governments to do the same – only allowing companies with anti-corruption units to tender;
- encouraging greater transparency;
- encouraging independent monitoring;
- ensuring corruption is reported.

Highlights of the Tunis work shop including presentations and speeches by participants are on gTKP's web portal [www.gtkp.com](http://www.gtkp.com).

*For further information please contact Jenni Borg at gTKP (0207 212 4004; E-mail: [info@gtkp.com](mailto:info@gtkp.com) or visit gTKP's web portal).*

## SAFETY & KNOWLEDGE MANAGEMENT

# SCI enables HSE to improve workflow and dissemination



PROMIS (Project Records Online Management Information System) is the latest addition to the family of information systems provided by SCI's ICT Division to the Health & Safety Executive (HSE). A web-based knowledge management information system, it will handle > £35m worth of science projects per year for HSE and facilitate coordination of all HSE's projects.

Promis manages information about HSE projects under development and then ensures timely evaluation and monitoring of the outputs, collecting, accommodating and reconciling the workflow of information from various stakeholders. Replacing existing paper-based systems with its electronic solution, PROMIS will allow users to complete and submit forms online while benefiting from assistance throughout the process: wizards, prompts, help screens and checkers.

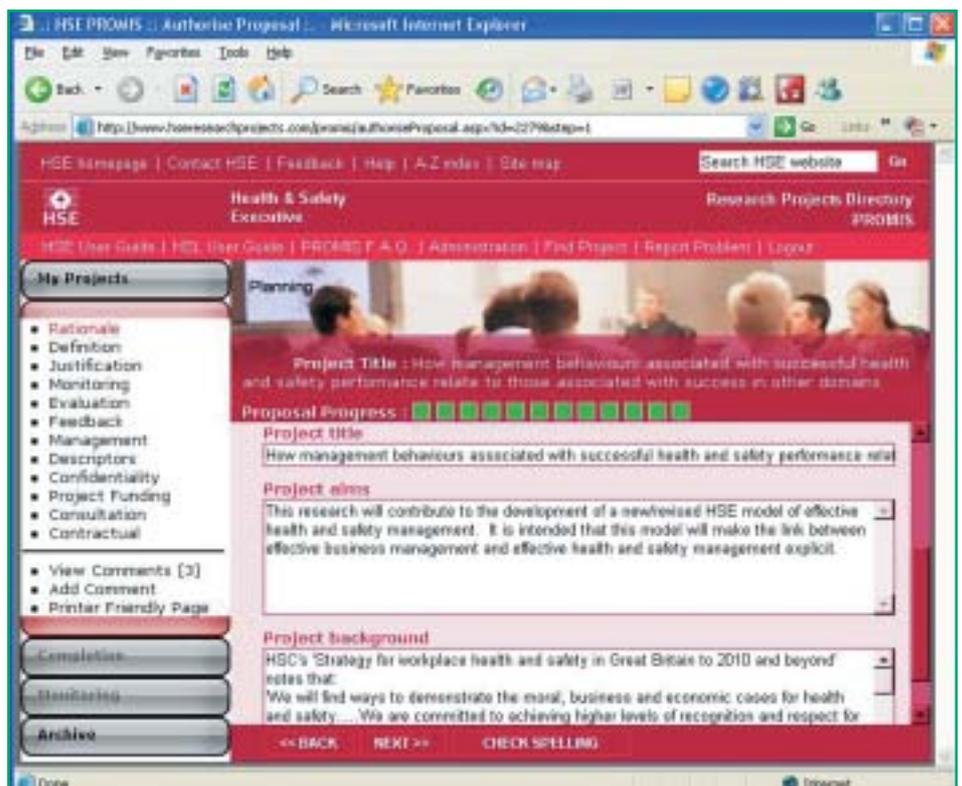
This solution reduces the effort encountered when running research contracts, cuts down on data entry errors and makes it easier for HSE to analyse management information.

SCI's approach was to examine and model the business processes of HSE and HSL and map the information requirements associated

with their workflows to a new system. This has made HSE's commissioning of projects more methodical, rigorous and easier to control.

Promis extends the Research Projects Directory (RPD) (<http://www.hseresearchprojects.com/>). SCI also created 'Science & Research Focus' (SRO) (<http://www.hsesro.com/>) see *IRF* Issue 65. RPD and SRO are public facing systems delivering the HSE's research output to the public. PROMIS, by contrast, is an 'extranet-style' system aimed at better access and dissemination amongst HSE, the Health & Safety Laboratory and local authorities when developing that output.

*For further information please contact Andrew Crowley, Technical Specialist, SCI (10344 623345; E-mail: [a.crowley@steel-sci.com](mailto:a.crowley@steel-sci.com)).*



Typical screen of the project details held within PROMIS

# Accidents involving powered, two-wheeler vehicles

'Power Two Wheeler' vehicles (PTWs), for example mopeds and motorcycles, are part of the UK traffic mix, and their use is on the increase. The active UK PTW rider population is estimated to be around 1.5 million. The number of motorcycles in use, and the distance they travel, is up by around 50% since 1993, and looks set to rise further. Commuting accounts for two-thirds of all motorcycle journeys, and such use has been shown to contribute to a reduction in congestion. A significant issue for the Government is the safety of motorcyclists, as accidents involving PTWs are an increasing problem on the Highway Agency's Network. Currently, they are the only casualty class to have shown an increase in the numbers of people killed or seriously injured over the last decade. In addition, unlike most other mode type casualties, the accident rates (per vehicle-km travelled) have not declined over the same period.

In 2005, the Highways Agency commissioned TRL to research the scale of the accident problem involving PTW vehicles to identify a range of remedial measures. Key findings from the research were:

- PTWs form 0.6% of trunk road traffic but accidents involving PTWs made up 8.9% of all trunk road accidents in 2001–2003;
- in accidents involving a PTW and another vehicle, the rider and passenger (if present) are the most likely to be injured;
- PTW accidents occur on all road types on the Agency's Network but are more likely to occur on single carriageways;
- most (87%) of those involved are male, and the 30–40 age group have the highest number of accidents;
- Fridays are the worst day for accidents overall, but for single vehicle accidents the worst day is Sunday;
- most accidents are in the summer, and occur in daylight, in fine weather, on dry roads;
- almost half (49%) of PTW accidents between 2001 and 2003 involved a bike over 500cc;
- accidents involving larger machines are more likely to be fatal or serious.



The Highways Agency promotes Motorcycle safety at the International Motorcycle Show.

Single vehicle PTW accidents were also identified as a particular problem. They were less likely to occur at junctions than accidents which also involved other vehicles. The accidents involving manoeuvring around bends were very high severity. Over half of these accidents were fatal or serious, and a high proportion (85%) of fatal single PTW accidents involved the PTW leaving the carriageway. The observation studies undertaken in

this research (routes ridden by an experienced rider) have shown that while there may be some specific problems for PTW drivers on trunk roads, these are limited in extent. The accident 'hot spots' are probably related more to higher numbers of PTWs in particular areas than to road design features. This suggests that engineering measures, while important, may not provide the reduction in casualties required to meet the DfT 2010 casualty reduction targets. Remedial measures will concentrate on driver education.

As a result of this research, the Highway Agency Safety Action Plan Team are developing a comprehensive Driver Information Programme aimed at behavioural change that will help reduce PTW accidents, injuries and deaths on the Network. The Programme is currently being developed and will be implemented later in 2006.

For further information please contact Stuart Lovatt in the Highway Agency Safety Action Plan Team, Highways Agency (0161 930 5836; Fax 0161 930 5610; E-mail: [stuart.lovatt@highways.gsi.gov.uk](mailto:stuart.lovatt@highways.gsi.gov.uk)).



## HOUSING, ICT & ENVIRONMENT

# Intelligent and green housing



For the past decade INTEGER has been the UK's leading partnership committed to delivering the benefit of step-change innovation in housing, achieved by combining sustainable building design and construction with intelligent building systems and management. In 1998 the partnership designed and built the INTEGER Millennium House, which has become a global exemplar of intelligent, green housing and inspired a range of innovative housing schemes throughout the UK.

In 2001 INTEGER formed a partnership in Hong Kong under the leadership of the British and Hong Kong Governments. With intensive support from the governments, the corporate founders and over 160 commercial partners, they demonstrated the application of intelligent and green innovation to high-rise housing in Hong Kong with the INTEGER Hong Kong Pavilion.

This pavilion was an unprecedented success at demonstrating the UK's capabilities in this critical area, attracting widespread professional and public interest, and it served as a research and learning centre for secondary and tertiary education in the region. The INTEGER Hong Kong Pavilion has now been re-located to Beijing where it is opening as the National Electric Power Science and Technology Exhibition Centre.

Inspired by the success of the INTEGER



INTEGER Millennium House

Hong Kong Pavilion, the first intelligent and green project in mainland China has just been completed in Kunming, in Yunnan Province. The INTEGER Kunming project is the first eco-town in southern China, with an emphasis upon environmental protection, sustainable lifestyle, and intelligent technology. This project provides a focal point for the improvement of housing standards and building technology in the China context, demonstrating a sustainable housing and lifestyle model appropriate for the urbanization of the southern and western regions of China.

For further information please contact Alan Kell, i&i Ltd (01923665950; Fax 01923665951; E-mail [integer@integerproject.co.uk](mailto:integer@integerproject.co.uk); website: [www.integerproject.co.uk](http://www.integerproject.co.uk)).

# Impact resistance of façades

Recent changes in façade materials and construction have led to a review of impact performance. Existing guidance in BS 8200 is dated and new European Standards need to be calibrated for UK use. CWCT is producing guidance for specifiers in support of its new 'Standard for systemised building envelopes'.

There is a wide range of causes of impact to building envelopes. Walls are required to be resistant to impact from soft bodies, principally people, which deform on impact to distribute the load, and from more rigid objects referred to as hard bodies. Hard body impacts are generally considered to have lower impact energy than soft body impacts but hard body impacts from access equipment, skateboards etc could be at higher levels of impact energy. Hard body impacts tend to cause failure by localised punching whereas soft body impacts tend to cause failure by generalised bending. For this reason hard impacts can be damaging even at low impact energy.



Impact testing of a curtain wall

Façades must be able to resist impacts without causing unacceptable hazards to the safety of people within or around the building. Damage affecting serviceability or appearance should also be minimized but may be accepted where components are readily replaceable. Materials such as masonry and concrete are robust and can generally be expected to resist normal impacts. However, many materials used in modern façades are

more susceptible to damage and require testing to assess their performance.

Hard body tests are commonly carried out with a steel ball of 0.5 or 1 kg that is dropped onto a horizontal specimen supported off the floor. Tests can also be carried out by swinging the ball against a vertical specimen.

Soft body tests have traditionally been carried out using a bag filled with sand or glass spheres that is allowed to swing

against a vertical specimen. BS 8200 uses a sphero-conical canvas bag filled with glass spheres. More recently the double tyre pendulum impact test has been developed and this is now used for glass (BS EN 12600), windows (BS EN 13049) and curtain walling (BS EN 14019).

BS 8200 has been widely used in the UK as the basis of specification of impact performance of façades. This Standard uses a combination of hard and soft body tests, and test criteria based on research carried out by BRE.

However, BS 8200 has been declared obsolescent and

no alternative guidance has yet been produced. Although BS EN 14019 gives a test method and a series of impact resistance classes, it gives no guidance on how performance is to be related to building use. CWCT is therefore producing guidance in a Technical Note to address this issue.

*Further information please contact CWCT (01225 386541; E-mail [cwct@bath.ac.uk](mailto:cwct@bath.ac.uk); website [www.cwct.co.uk](http://www.cwct.co.uk)).*

## FLOODING & RISK ASSESSMENT

# SAM will help assess urban flood risks



Urban flooding was recently highlighted by incidents such as the Carlisle flood. Responsibility is divided between management of urban drainage systems (local councils, highway authorities and water companies) and fluvial and coastal flood management (Environment Agency). There is a need for an integrated, risk-based assessment of urban systems that considers flooding from fluvial, coastal and pluvial sources as well as the range of available infrastructure modifications and management responses.

HR Wallingford has been appointed by DTi to lead a project developing a risk-based approach to sewerage asset management. The DTi SAM project (System-based Analysis and Management of urban flood risks) is developing a new generation of models and procedures for assessing and predicting the performance of urban drainage assets. This is being achieved by extending RASP-based methods into the urban drainage environment. It has the potential to provide step change in the way that urban drainage is managed – both above and below ground.

In addition to providing new simulation tools needed for such an integrated approach, SAM is developing new system evaluation procedures. The new tools relate to:

- flood modeling;
- risk-based assessment of sewerage assets;
- risk-based methods for options evaluation.

Since this risk-based approach will require



Flooding in an urban environment

multiple simulations, a step-change in computational speed is also needed. SAM is bringing a significant change to sewerage asset management and performance assessment.

The project involves a steering group of key stakeholders including the Met Office, Wallingford Software, Scottish Water, Thames Water, Yorkshire Water, UK Water Industry Research, Imperial College, Sheffield University, several consultants, and the Environment Agency.

Readers associated with the urban drainage sector are invited to provide their views concerning potential applications of SAM.

*For further information, and to offer input, please contact Richard Kellagher at HR Wallingford (01491 822419; E-mail: [rbbk@hrwallingford.co.uk](mailto:rbbk@hrwallingford.co.uk)).*

- rainfall;

# Masonry homes can have lowest whole-life CO<sub>2</sub>



New research undertaken by Arup shows that over the 21st century masonry houses can significantly reduce energy consumption and related CO<sub>2</sub> emissions, when compared with lighter-weight construction techniques. The key to this is exploiting the inherent thermal mass in masonry construction.

An in-depth study commissioned by The Concrete Centre and the British Cement Association compared embodied and operational CO<sub>2</sub> emissions of light, medium and heavyweight houses built to the revised edition of Part L of the Building Regulations. The findings suggest that passive design – making use of thermal mass in masonry construction (i.e. brick and block) – offsets any additional embodied CO<sub>2</sub> burden in as little as 11 years, as a result of energy savings, and ultimately achieves the lowest whole-life CO<sub>2</sub> emissions. The savings occur in two areas:

- through the ability of thermal mass to minimise the need for air conditioning in the face of climate change; and
- through the ability of appropriately designed masonry houses to take advantage of solar gains during the heating season, a simple and well established technique often referred to as 'passive solar design'.

The modelling was based on a two-bedroom house in the South East of England, typical



*The basic house design used for the research*

of the type of 'starter home' envisaged by the Government for major areas of housing development. From the outset, all the houses had solar shading and an appropriate ventilation strategy to help limit overheating in

the coming years. The weather data took account of predicted climate change using UK Climate Impacts Programme scenarios and in line with guidance from the Chartered Institution of Building Services Engineers. A house was judged to have overheated if 1% of the occupied hours in the living room were over 28°C, or 26°C in the bedrooms. An additional caveat required overheating to occur in at least 3 in 5 consecutive years before it was assumed that air conditioning would be installed.

The research shows that, when considering building sustainability and housing performance it is essential to consider whole-life performance and the way in which passive heating and cooling techniques can be used to mitigate and adapt to climate change.

*For further information please contact Tom De Saulles, British Cement Association / The Concrete Centre (01276 608714; E-mail: tdesaulles@bca.org.uk).*

## FLOODING & RISK ASSESSMENT

# Assessing Tsunami hazard to UK & Irish coasts



Following the Indian Ocean tsunami, many governments and agencies have been considering the possible consequences of another similar event occurring in other parts of the world.

A study for Defra on 'The threat posed by tsunamis to the UK' was completed in May 2005 by HR Wallingford in collaboration with British Geological Survey, Proudman Oceanographic Laboratory and the Met Office. This study established that the risk to the UK coastline of a significantly damaging tsunami was extremely low. Results showed that the heights of an arriving tsunami wave would only be similar to a typical surge. It is reassuring that all UK centres of population have flood defences that will cope with such levels.

HR Wallingford recently led a follow-up study for Defra, the Health and Safety Executive and the Geological Survey of Ireland to refine our understanding of the initial ocean floor movement and the consequently generated tsunami. This study primarily focussed on a Lisbon-type event, which is similar to the tsunami caused by the 1755 'Lisbon' earthquake. By refining the source conditions, and improving the modelling of wave propagation (in both ocean and shelf waters), the study led to better understanding of

the dynamics of a tsunami at the UK and Irish coastline.

The study reviewed three potential earthquake locations at two different magnitudes. The tsunami wave was modelled numerically and maximum water surface elevations were

predicted for South-West England, the Bristol Channel and Southern and Western Ireland.

The results of the numerical modelling were used in a hazard assessment that carefully considered the joint probabilities of high tide and tsunami. For the unlikely event of such a tsunami reaching South-West England and coinciding with high tide, the study showed that UK extreme (1 in 100 year) sea levels would only be exceeded at a few locations between Cape Cornwall and Lizard Point. Even here, the modelling suggests that the margin conventionally allowed in sea defences for wave action would not be exceeded.

During and since the completion of this study HR Wallingford has responded to a number of requests worldwide for the modelling of tsunami threats to specific coastlines.



*"Worst-case" water elevations around the Cornish coast following an Atlantic tsunami are predicted generally to be less than those already anticipated in the design of coastal defences.*

*For further information please contact Dr Stephen Richardson, HR Wallingford (01491 822298; Fax 01491 8322333; E-mail: srr@hrwallingford.co.uk).*

# Improved coastal understanding

A successful showcase of EPSRC-funded research into maritime and coastal issues took place at the Institution of Civil Engineers (ICE) in March. It brought together individuals from both academia and industry to discuss coastal erosion and morphology, the effects breaking waves and coastal surveying techniques.

**E**meritus Professor Brian O'Connor, Honorary Visiting Fellow in the Department of Engineering at the University of Liverpool and Honorary Chief Editor of the ICE Maritime Journal, chaired the event, which united speakers from universities across the UK. They provided over 50 delegates with a variety of presentations on coastal erosion and morphology, the effects breaking waves and coastal surveying techniques.



Engineering work in the coastal zone.

Coastal erosion is a huge problem worldwide and a natural phenomenon that cannot entirely be prevented. Hundreds of miles of UK coastline could be affected by erosion over the next century and the work required to improve sea defences is anticipated to cost millions of pounds each year. Rising sea levels, breaking waves and more frequent violent storms are blamed. Over the past decade there has been an increase in the construction of sea defence systems to counter the attrition. While such structures are relatively easy to build, they are expensive and in some cases counter-productive.

Very few studies have been carried out to assess the impact these defence structures have on coastal morphology. A greater knowledge of the effectiveness of the present defence systems is essential as are additional investigations into viable alternatives. In this area, the impact of the EPSRC-funded research is high.

Presentations covered the impact of breaking waves on steep fronted coastal structures, the effects of waves on blockwork structures, the impact of shore-parallel segmented breakwaters on beaches and integrated geomatics techniques for coastal surveying.

The study into coastal survey techniques led to the development of a more-efficient system for coastal monitoring based on three component technologies – Global Positioning Systems (GPS), digital small format aerial photogrammetry and satellite Interferometric Synthetic Aperture Radar (InSAR) – using combined data to minimise the limitations of over-reliance on individual components. The provision of accurate and effective monitoring

is essential and the result has been greater potential for an efficient approach to achieve this. Coastal and landform monitoring is essential considering the associated potential hazards to human life, assets and the legal and financial implications.

A project called LEACOAST studied the impact of shore-segmented breakwaters on beaches. Such examinations have taken place into the vulnerability to flooding and history of erosion, the impact of storm-scale events, out of which has come the development of information for the engineering and coastal management community to aid future beach management schemes.

The ICE and the EPSRC thank all speakers who contributed to the showcase event.

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](mailto:Fionnuala.Costello@epsrc.ac.uk)).

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