PRACTICAL APPLICATIONS FOR CONSTRUCTION AND THE BUILT ENVIRONMENT

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IN THIS ISSUE

Evaluating climate change impacts on English coastal zone habitats

Coastal habitats are likely to be impacted both by sea-level rise and by changes in the frequency of coastal flooding. An assessment of the potential impacts is being carried out to provide an evidence base on which management strategies for habitat adaptation to climate change can be developed. The work is being carried out by a team of experts including HR Wallingford's Environment Group.

The consequences of climate change for coastal zone habitats are being evaluated at a national scale. The work for this Defra-Natural England funded study supports adaptation to climate change and planning for replacement habitat, and focuses on Biodiversity Action Plan (BAP) habitats behind both the natural and defended coastline.

HR Wallingford is using the latest UK Climate Projections (UKCP09) within a coastal flood risk model to investigate future flooding conditions. Habitat sensitivity criteria are being specifically developed to enable the effects of inundation by brackish or saline inundation. The national scale study quantifies the sensitivity of the coastal zone habitat to flood duration and flood frequency.

The flood risk model takes into account the probability of a particular flood loading event occurring and the consequences arising from the flooding. The model comprises a novel application of risk assessment methods in an environmental context, including an exciting use of climate change scenarios in the structured risk assessment framework to predict the future risks to coastal habitats.

The work is identifying areas of BAP habitat around the English coasts that will potentially be damaged or lost under different climate change and flood risk management scenarios. The results will help to support Defra and Natural England in planning for future habitat creation requirements.

The techniques developed, such as the robust risk assessment framework, are applicable throughout the world and represent significant advance in how coastal engineering society can assess and respond to climate change.

For further information, please contact Valerie Bain, Senior Scientist, Environment Group, HR Wallingford (01491 822418; E-mail: v.bain@hrwallingford.co.uk).

Coastline at Holkham, Norfolk

SCI researches next generation of offshore wind tower foundations

SCI has been commissioned by the Research Institute for Science and Technology (RIST) in South Korea to evaluate the latest European practice, research and design information on foundations and sub-sea structures for offshore wind towers.

Overseen by SCI Director Dr Bassam Burgan, the project includes:

- a survey of the development history and experience of foundation structures in Europe;
- a survey of codes and standards for the design and construction of offshore wind structures and their foundations, both at a national level and from certifying authorities;
- a study of foundation types according to water depth, soil types and wind turbine capacity, based on an overview of recent experience – this will extend to a broad economic assessment of each foundation type;
- a review of current and planned R & D activities into offshore wind turbine foundations at European Institutes.

SCI evaluates Sub-Sea Structures

SCI's work is intended to support the development of the next generation of foundations for offshore wind towers in deeper water.

For further information please contact Dr. Bassam Burgan, Director SCI (01344 6545; E-mail: b.burgan@steel-sci.com).

Lightweight advanced composite bridge decks

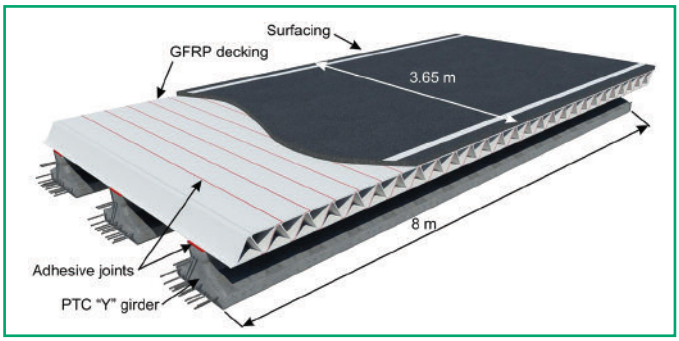
A key challenge facing modern bridge engineers is the acceleration of bridge construction (to reduce costs from traffic flow disruption during construction) without compromising the structural integrity of the completed bridges. Another challenge is reduction of maintenance costs for the bridges once in service.

Both demands may be met using advanced composite decks for traffic bridges. Fabricated commonly by pultruding glass fibre reinforced polymer composites into modular units, these decks can accelerate construction due to the modularity and to low weight (only 20% that of concrete decks). The modularity also improves site safety. These composites are also corrosion-resistant, which could lead to reduced maintenance strategies compared to other deck types.

Bridges using advanced composites for the deck and/or the main beams have been built in, for example, the USA, UK and Spain. But despite its obvious advantages, this novel bridge technology is not yet mainstream. A key issue is the absence of relevant design standards based on underpinning research, especially where fatigue performance is concerned.

This situation has triggered a project to construct and test a large-scale bridge specimen with composite decking at the Structures laboratory of the University of Bristol. The specimen is 8 m long, 3.7 m wide and comprises ASSET composite decking (provided by Fiberline Composites of Denmark) spanning across pre-tensioned concrete (PTC) main beams.

The PTC beams match the corrosion resistance of the decking and also improve stiffness. One novelty is that only adhesive connections are used between deck units and to connect the deck to the main beams. This further simplifies and accelerates construction. The project is supported by the Highways Agency, the Institution of Civil Engineers R&D Fund, Network Rail, Mouchel, Tarmac and Weber.



(Top) *Schematic of Test Specimen*
(Above) *Specimen in Test Frame at Bristol University*

The specimen will be subjected to over 100 million cycles of full-scale, code-specified fatigue wheel loading. The large plan area of deck will be exploited to investigate the effects on deck performance of different surfacings. Finally, the specimen will be loaded to failure.

Structural response is being recorded using state-of-the-art instrumentation and data acquisition equipment. Interpretation of the test outputs will underpin design guidelines for short and long term actions of this innovative bridge form.

For further information please contact Wendell Sebastian at the University of Bristol (0117 331 5733; E-mail: Wendell.sebastian@bristol.ac.uk).

Glass in buildings

CENTRE FOR WINDOW AND CLADDING TECHNOLOGY

CWCT publishes practical guidance on facades in the form of Technical Notes. Four existing Technical Notes relating to the use of glass have been revised and the series is being expanded to eight. There are now four Technical Notes covering the general issues relating to different types of glass, glazing units, glass breakage modes and thermal fracture of glass. The remaining four deal with different aspects of the selection of glass for safety and are described in more detail below.

CWCT's TN68 considers the risks associated with overhead glazing. The scope of the guidance includes the use of both vertical and sloping glazing where there is a risk of glass falling on people. The approach taken to the selection of appropriate glass configurations is one of risk assessment based on the probabilities of:

- glass breaking;
- glass falling when broken; and
- glass falling on people.

TN68 describes the risks associated with different types of glazing in roofs, facades and canopies. It discusses methods of risk analysis and of assessing post-failure behaviour, and gives guidance on the selection of appropriate glazing.

Traditionally, sloping glazing has been defined as any glass within 75 degrees of the horizontal. The new guidance recognises that any glass that is not nominally vertical is more prone to falling from place than vertical glass. Although there is less probability of glass falling from a vertical façade, there may be many more panes of glass that could fall in the same place. The guidance also recognises that post-failure behaviour depends on the method of glass retention and glass may be more likely to fall when modern fixing methods are used rather than with traditional rebates.

Another aspect when specifying roof glazing is the risks associated with working above and around the glazing. Guidance on specification for safety and fragility of glazed roofing is given in CWCT TN66. The safety issues concern the safety of people below the roof, who may be affected if the glass fails and falls, and if objects fall through the roof. They also affect people who may be on the roof who may be injured by contact with the glass or by falling through it.

TN66 provides guidance on glass selcection, and defines four classes of performance:

- Class 0 are roofs designed for unrestricted access;
- Class 1 are roofs that are walked on for occasional cleaning and maintenance activities;
- Class 2 are roofs that are not intended to be walked on but on to which people may fall whilst working on an adjacent roof or on access equipment; and
- Class 3 are fragile roofs requiring appropriate barriers and signage.

Methods of testing and assessment are given in a separate Technical Note TN67.

Finally, guidance will soon be published on the selection of glass to prevent falls from height. In buildings, barriers are required at changes of level to prevent people from falling. Barriers may be in the form of balustrades or full height walls and in both cases glass is commonly used as an infill material. Glass may also be used as the primary structural material both in glass walls and balustrades.

Nickel sulfide failure of toughened glass (courtesy of Sandberg)

Barriers are required to be designed to resist static loads but, where glass is used, it is also necessary to consider impact loads. The new guidance will consider the effect of the adoption of the new Eurocode for loading and give advice on the selection of glass for use in facades and freestanding barriers.

For further information: please contact Brenda Apted, Centre for Window & Cladding Technology, University of Bath (01225 386506; E-mail: absbaa@bath.ac.uk).

New measurement network

BIS

Businesses and universities across the UK can sign up to a new Measurement Network to access the most up to date measurement knowledge and research, to add weight to their work and help new ideas flourish.

On 20 May, the National Physical Laboratory (NPL) launched its new Measurement Network to provide comprehensive access to the latest measurement science. It brings together nineteen existing NPL knowledge transfer clubs and networks into a central hub – making it easier for a wide range of stakeholders to engage with NPL and for new groups to develop as technologies change. Focus areas for the new Network include Engineering and Optical, Environment & Energy, and Materials.

The Environment & Energy special interest group provides a focus for those working in the energy sector – fossil fuels, nuclear and renewable energy technologies – and in organisations where environmental measurements are important, including climate change, air pollution and air quality.

The Network is designed to stimulate innovation in the UK by providing easy access to world-class measurement knowledge and expertise through a single network. By uniting existing groups under a single banner, NPL is aiming to provide a more-efficient and coordinated service for stakeholders including industrial partners, SMEs, universities and manufacturers.

The new network will provide targeted events and information for members. This will disseminate the latest research and knowledge from NPL in the sectors that are most relevant to each member.

Key markets and user communities will be invited to collaborate with NPL to provide measurement input into other for a such as the Knowledge Transfer Networks, building links to maximise reach and impact.

For further information: organisations and individuals who want to become members can register at www.npl.co.uk/measurement-network.

Agro-environmental zoning for biofuel production in East Africa

DFID Department for International Development

Biofuels must be produced in a sustainable and equitable manner in East Africa if they are to increase energy self-sufficiency whilst at the same time reducing deforestation and GHG emissions compared to fossil fuels. This is confirmed by a study carried out by the DFID-funded Policy Innovation Systems for Clean Energy Security (PISCES) research programme in collaboration with United Nations Environment Programme (UNEP). The study – environmental suitability and agro-environmental zoning of Kenya for biofuel production – was aimed at determining suitable areas of eleven biofuel feedstocks in Kenya, and at identifying high value biodiversity areas and areas of high socio-cultural values to be recommended for *exclusion* from biofuel production.

Among the areas identified as being suitable for *exclusion* were protected areas, wetlands, areas under cultivation, wildlife movement corridors, human conflict areas, slopes over 45% and important bird areas.

In terms of the size of suitable area, sweet sorghum has the highest coverage of 185,821 km^2 (32.6%) followed by castor at 171,557 km^2 (30.1%) and Jatropha at 15,047 km^2 (27.6%). The feedstock with the least area suitability is coconut with 1,860 km^2 (0.3%) followed by palm oil at 9,359 Km^2 (1.6%) and canola at 12,743 km^2 (2.2%). Feedstocks with wider suitability could be more appropriate when considering a national biofuel programme, but this is not to say that the smaller feedstocks in terms of area should be ignored, since different feedstock have their advantages and disadvantages.

It can also be expected that indigenous feedstocks such as *Croton megalocarpus* may emerge to have a more extended range than predicted and be less problematic than currently-better-known crops such as Jatropha.

The result of this comparison has shown that the coastal, central and western areas have the highest potential for feedstock production given the high number of feedstocks suitability per scene. Northern and Southwestern Kenya has the lowest potential.

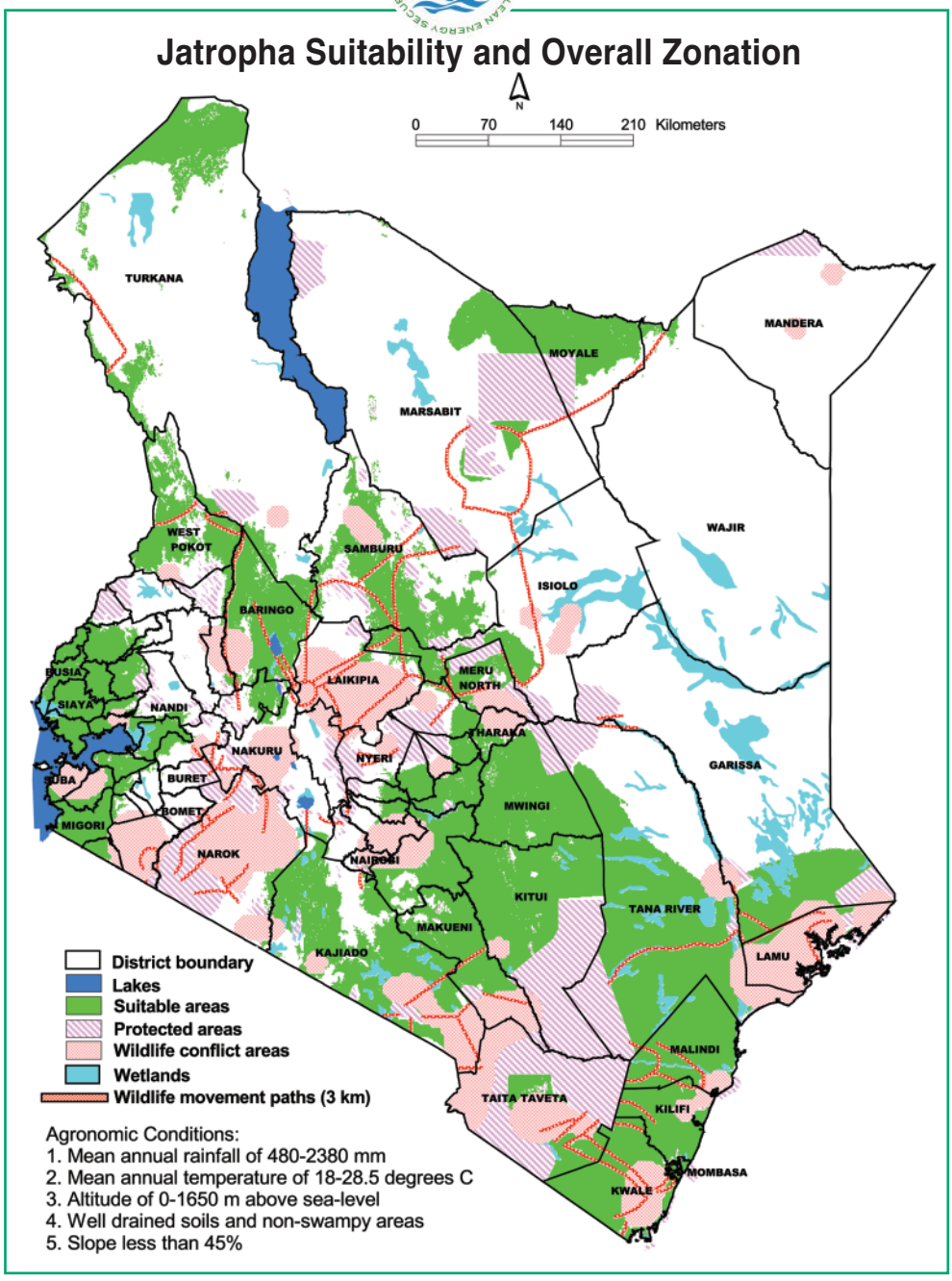
Most feedstocks yield best in agriculturally high potential arable lands. Few feedstocks (castor and sweet sorghum) were classified as highly suitable in areas of marginal to medium agricultural potential. Others such as Jatropha are tolerant to drought and, once established, can survive in agriculturally marginal areas.

However, without sufficient rainfall and nutrients, general yield and productivity is very low, making these areas unprofitable for investing in non-irrigated feedstock production. Therefore, careful balancing is required between high suitability areas for feedstock production and the overarching need to safeguard food production and water resources.

Marginal and degraded areas where production of biofuels would pose the least competition with food crops may not yield commercial results with most feedstocks unless accompanied by heavy investment in soil fertility improvement, water harvesting and conservation. Research is needed to develop arid or semi-arid feedstock varieties that are productive in such areas. There is a need for clear policies, including appropriate policy incentives to attract investors to the agriculturally marginal (degraded) areas.

In view of increased demand for extensive land areas for investing in bio-fuels, there is need to improve the land administration systems to deal with conflicting claims between vested interests and the traditional land usages and ownership rights that are emerging under bio-fuels expansion. There is need to ensure that changes in land use and practices associated with bio-fuel production are sustainable. Responsible land allocation, land use change and policy enforcement are required to manage competition over land, reducing food insecurity and encroachment on protected and communal areas.

There needs to be careful consideration of whether to promote non-edible



feedstock for biofuel production in place of edible oils. In Kenya, jatropha, castor and croton have been given high priority by development agents, while edible oils such as palm oil, coconut, sunflower, crambe and canola have been less considered. This focus is not based on any policy guidelines and is in contrast to Tanzania, where there is large scale planting of palm oil for biofuel. There is a need for a clear policy on this to guide investors on suitable Kenyan feedstock development.

A strategic, comprehensive and credible Environmental Impact Assessment (EIA) that prevents unsuitable crops needs to be undertaken for all biofuel development projects, especially those in areas of high biodiversity, wildlife, forest and water conservation. The EIAs conducted must meet international standards such the internationally recognized principles published by The International Association for Impact Assessment. The Convention on Biological Diversity and Ramsar Convention, as well as the Round table on Sustainable biofuels, have produced guidance on EIAs and these, along with the current guidelines from the Kenyan National Environment Management Authority can provide for environmental and social safeguards in biofuel development.

Areas of high conservation value, global and national endemic species habitats, biodiversity hotspots, remaining woodland and forest stands, wetlands and key water catchments need to be identified, listed and actively excluded from any large scale biofuel introduction. If these areas are not protected Kenya's functioning but fragile ecosystems will not support future development.

A development and conservation Master Plan should precede any large scale biofuel development to ensure that social, economic, conservation and development objectives are taken on board at the same level and scale.

Biodiversity and endemic habitats that have evolved over decades and centuries are effectively irreplaceable. It is critical that conservation planning precedes development planning, to avoid irreversible biodiversity and habitat losses. It is also important to develop management plans and mobilize resources to support any conservation areas set aside, in order to maintain globally threatened species, fragile ecosystems and associated invaluable ecological goods and services. Well-managed conservation areas would in turn provide a healthy environment and safe buffer zones for any future development projects and provide adequate insect pollinators, birdlife and natural pest predators.

Since most of the biodiversity resources are trans-boundary in nature, the study recommends carrying out a similar study in all eastern Africa countries.

Principals in the study have been Benard O Muok (ACTS/PISCES), Meshack Nyabenge (ICRAF), Benson Okita Ouma (KWS), Anthony O Esilaba and Tabeel Nandokha (KARI) and Benard Owuor (KEFRI).

For further information please contact Benard Muok (B.Muok@acts.or.ke) or visit the PISCES webite www.pisces.or.ke.

Soft formwork problem solved

The increasing thermal insulation requirements of The Building Regulations, together with the introduction of 'soft' permanent formwork has led to problems in ensuring that the formwork provides the steel reinforcement with the specified cover at all locations within the concrete. An example of the problem is shown in Figure 1.

So-called 'soft' formwork is a term applied to a range of products, for example expanded polystyrene (such as Eco-slab used for insulation purposes in sustainable construction), cellular plastic sheet (CPS) as shown in Figure 1, or plastic encapsulated steel fabric (PESF). Soft formwork is sometimes used for ground beams, ground bearing and suspended ground floor slabs, and foundations.

The spacers and chairs used to achieve the specified cover to the reinforcement are required to comply with British Standard 7973:2001 Part 1, and be used in accordance with the requirements of Part 2 of that Standard. Plastic 'A' spacers to Part 1 are particularly successful when used with hard formwork such as plywood and steel and were developed for this purpose.

The new soft formwork spacer (see Figure 2) builds on the success of the 'A' spacer and was developed for use with expanded polystyrene insulating soft formwork such as Eco-slab, which won the Shell Springboard 2010 Award for Innovation in Carbon Reduction. The spacer could (subject to the provisions of BS 7973:2001 Parts 1 and 2) also be used with CPS or PESF providing sufficient numbers were used to provide the additional support required.

The development of a soft formwork spacer is another significant and innovative step forward to better and more-sustainable construction, and is particularly suited for use with expanded polystyrene insulating formwork such as Eco-slab where a 'U' value of 0.13 can be achieved. The spacer is made from at least 95% recycled plastic and is currently available from stock in 40 and 50 mm cover sizes. It is used with 10 and 12 mm size reinforcement which is the most common size for links. Where a damp proof membrane is used under the spacer the cover can be reduced and a 25 mm cover version is currently being developed.

Figure 1 *Lack of specified cover to reinforcement.*

Figure 2 *The new soft formwork spacer.*

For further information please contact Chris Shaw, Consultant, (01483 53657; E-mail: echrisshaw@yahoo.co.uk). To order the soft formwork spacer phone 0800 028 536577

Innovating for the future

"We cannot predict the future, but we can enable it through our ingenuity and collaboration," So said Professor Paul Jowitt in his opening address at the ICE's conference *Innovate to Survive Engineers for a 'One Planet' Future* held in June.

The two-day conference examined many areas where innovation will be crucial. These included decarbonisation of the energy sector, the economics of climate change, the future of transport infrastructure, how engineers can affect behaviour and attitudes to climate change, and the challenges in the water sector.

Key questions for the audience included "Is an infrastructure project helping society on the journey to a 'One Planet' future?" and "Beyond new infrastructure, what else needs to be done?" Paul Jowitt stressed that, whilst engineers have of course to work with many others to solve the challenges that face us in addressing these questions, "the role of engineers is critical because we must provide the practical solutions".

A longer article on the conference is planned for the next issue of IRF. In the meantime, if you are interested in following up on the conference, please contact Mike Chrimes, Acting Director of Engineering Policy and Innovation at the ICE (020 7222 7722; E-mail: mike.chrimes@ice.org.uk).

Improving the therapeutic design of healthcare environments

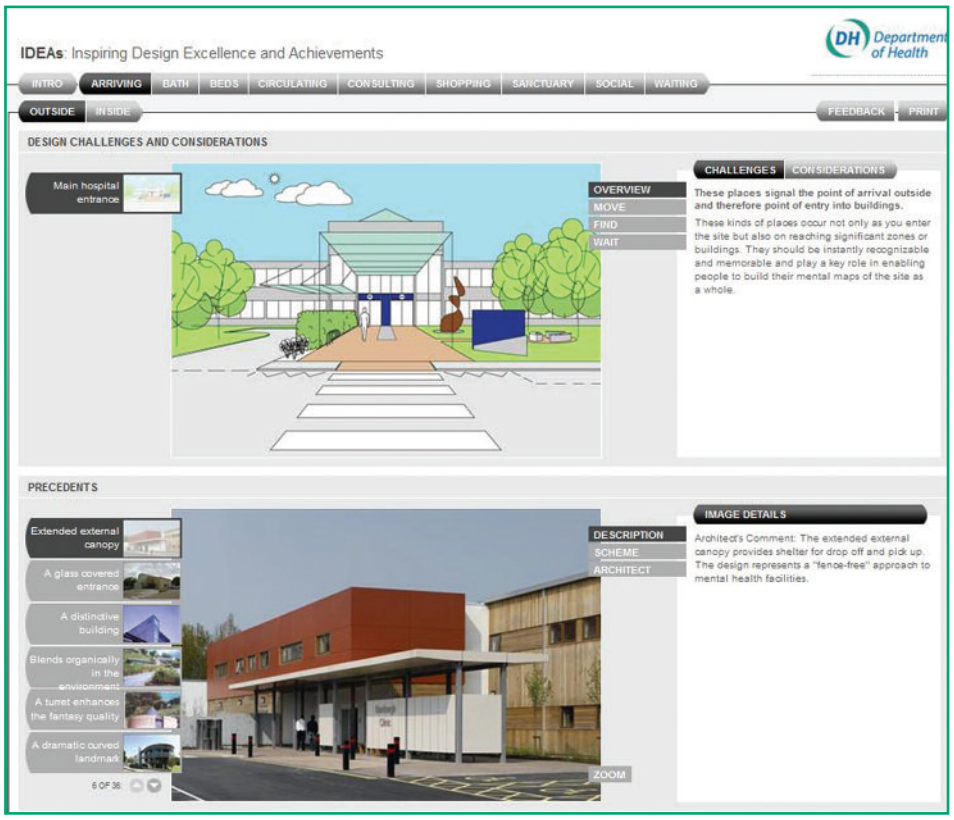
For many years, there has been a prevailing belief that higher investment in the initial phases of healthcare infrastructure projects not only reduces the life cycle costs but also improves, in the long term, service delivery and patient experience. The project *Improving the therapeutic design of healthcare environments through modelling, simulation and visualisation* commenced in 2007 and has been funded for three years by the Engineering and Physical Sciences Research Council (EPSRC) as part of a HaCIRIC (Health and Care Infrastructure Research and Innovation Centre) award. It was aimed at improving the therapeutic design of healthcare environments by developing an environmental design framework that supports assessments and improvements within multiple variable parameters.

Its progress to date has included a wide range of activity.

- Collaborative work with a Special Issue of the *Journal of Building Performance Simulation* disseminating research of authors from almost every continent in the area of "*Optimising Healthcare Building Design and Performance through Modelling, Simulation, and Visualisation (MSV)*".
- Collaborative work with Purdue University in the USA through three of its centres – the Regenstrief Center for Healthcare Engineering, the Envision Centre for Data Perceptualization, and the Division of Construction Engineering and Management. The work has been evaluating the potential of digital mock-ups in improving healthcare facility design and performance.
- Consultations with VTT Technical Research Centre of Finland and STAKES (now part of the Finnish National Institute for Health and Welfare) with agreement in principle to explore undertaking funded research related to digital mock-ups for improvement in healthcare facility design and performance, and patient well-being.
- Collaborative work with MJ Medical Healthcare Consultancy that includes the enhancement of Building Information Modelling (BIM) with performance data, including those related to healthcare facility equipment planning.
- The adoption of BIM, but also the enhancement of this approach by developing purpose-built models and digital mock-ups that are a product of the interface of Activity DataBase (ADB) with BIM and parametric modelling and environmental simulation software. The aim was to assess healthcare environment-related issues, and develop a parametric environmental design framework. The benefits inherent in such an integrated approach have included the reduction in the cost and time required for various aspects of the healthcare building design and development process.

A wide range of deliverables and notable achievements have so far been delivered.

- Development of a Parametric Environmental Design Framework.



The Inspiring Design Excellence and Achievements (IDEAs) web pages on the Department of Health's website (www.ideas.dh.gov.uk/) contain a wide range of suggestions for improvements in built environments.

- Development of a Healthcare Digital Mock-Up Facility.
- Determination of the human aspects related to the use of modelling, simulation, and visualisation.
- The Special Issue of the *Journal of Building Performance Simulation*.
- Seven journal papers, five conference papers, two articles and six reports. One of these reports is *Impact of the Built Environment on the Healing Environment*, which was authored by Loughborough University's Emeka Efe Osaji, and co-authored by Professor Andrew Price and Dr Peter Demian. It is a 2008 HaCIRIC Informing Study Report that reviewed relevant literature and case studies, and identified the impact the built healing environment has on the patient experience and patient well-being, medical staff productivity, and clinical outcomes.
- Successful Expression of Interest (EoI) in the Technology Strategy Board (TSB) competition for funding *Design and Decision Tools for Low Impact Buildings*.
- Successful completion of the Centre of Excellence in Customised Assembly (CECA) and HaCIRIC Proof of Concept (PoC) project *Integrating Digital Tools in the Built Environment and Healthcare Sectors for Improved Hospital Performance*.
- Invited lectures to disseminate the project's findings and outputs.

For further information please contact Emeka Efe Osaji at Loughborough University (01509 222814; E-mail: e.e.osaji@lboro.ac.uk) or Professor Andrew Price (a.d.f.price@lboro.ac.uk) or visit http://www.haciric.org/.

Tools and techniques for flood risk management planning

Under the large European R&D project FLOODsite, a wide range of integrated flood risk analysis and management methodologies were investigated and developed. Over 35 organisations under the leadership of HR Wallingford were involved in this EU 6th Framework Programme (FP6) project. The Environment Agency, who provided essential partnership funding during FLOODsite, are working with HR Wallingford to ensure the benefits of this research feed into industry practice. The FLOODsite work, which was completed in 2009, ranged from basic science through to detailed methods and prototype tools.

The flood management research outputs delivered by FLOODsite were substantial (see www.floodsite.net). HR Wallingford is now working closely with the Environment Agency, a key FLOODsite sponsor, to ensure the knowledge and outputs are drawn through to realise the true benefit of this work. An important first step has been the demonstration, in the context of the Humber Estuary, of the tools and techniques for pre-incident flood risk management planning.

The reliability and breach modelling techniques are being demonstrated on the earth embankment defences along the Stallingborough to Immingham coastline on the south bank of the Humber.

The reliability prototype tool, RELIABLE, developed under FLOODsite and available at http://www.floodsite.net/html/toolkit.asp, enables generation of structure-specific fragility curves. These performance curves are based on a reliability analysis of multiple potential failure modes linked together. The breach model (HR Breach) incorporates a detailed physics-based approach, which predicts breach growth through flood embankments of different material types and construction, combining hydraulics, soil mechanics and structural analysis into a single breach prediction model.

(Inset) *Typical Humber Estuary flood defences*
(Above) *Ferriby sluice gate provides key flood protection at the River Ancholme's confluence with the Humber Estuary*

In addition, an estuary-wide risk-based strategy study is exploring flood risk management strategies through to 2115. It is utilising many of the risk-based and long-term planning methods developed during FLOODsite and now embedded in the Environment Agency's Modelling and Decision Support Framework 2 (MDSF2).

These tools are providing a rich, consistent evidence base of risk information for the whole estuary. They provide a powerful tool for decision-makers to better understand the behaviour of the flood risk system both now and in the future.

For further information, please contact either Caroline McGahey, Principal Engineer, Floods Group, HR Wallingford (01491 822226; E-mail: C.McGahey@hrwallingford.co.uk), or Dr S Surendran, Principal Scientist, Evidence Directorate, Environment Agency (01189 535259; e-mail suresh.surendran@environment-agency.gov.uk).

HR Wallingford

Water management challenges in a changing climate

BIS

This report has been produced by CIRIA on behalf of the MBE KTN and in collaboration with the Environmental Sustainability Knowledge Transfer Network. The report, *Knowledge Summary Challenges for water management in a changing climate* April 2010 provides an overview of the challenges of water management in a changing climate by identifying good practice and innovation gaps, highlighting business opportunities and providing links to further information.

Our climate does seem to be changing, and wetter winters and drier summers will affect existing buildings and change the requirements of new buildings.

There is a need for a twin-track approach of mitigation and adaptation, with the reduction of greenhouse gases, particularly carbon dioxide through mitigation measures, and managing the consequences of climate change through adaptation measures. Buildings, and activities within buildings, account for nearly half of the UK's carbon emissions and provide opportunities for both mitigation and adaptation.

Buildings can have a lengthy working life. So new buildings need to be designed in such a way that, from the outset of their operation, they have reduced energy consumption and carbon emissions. In addition, their design needs to be adaptive to future climate change, whilst being able to cope with current conditions, in order to provide a suitable living and working places for people.

For further information visit the Modern Built Environment Network via the new website for the KTN at https://ktn.innovateuk.org/c. Registration to the Connect website will give access to a range of knowledge networks of relevance to the sector such as Materials, Transport, Environmental sustainability and Nanotechnology.

Grid-friendly connection of renewable energy

The Royal Academy of Engineering

Energy generated from renewable sources is becoming increasingly important as the UK reduces its use of fossil fuels but this type of energy often goes into the grid via a common device called an inverter. These devices correct the voltage and frequency of the energy going into the grid and help in its regulation, but adding large numbers of them can have damaging effects on the power system. Dr Qing-Chang Zhong at The University of Liverpool has developed a grid-friendly solution for connecting energy from renewable sources to the national grid as part of his Royal Academy of Engineering and Leverhulme Trust Senior Research Fellowship programme.

Dr Zhong and his collaborator Professor George Weiss at Tel Aviv University have developed a way to make inverters mimic grid-friendly synchronous generators, which are used by power stations to control peaks and troughs in energy demand.

The new technology is a software programme, called 'synchronverter', which mathematically models synchronous generators and can be easily installed into inverters without changing the existing hardware.

The main purpose of synchronverter technology is to make renewable energy grid-friendly but it may also be used to improve the performance of static synchronous compensators (STATCOMs) and uninterrupted power supplies (UPS). Synchronverter technology would remove the need for external communications between parallel-connected units, ultimately making them more reliable.

Synchronverter technology could also be implemented in the charging systems of electrical vehicles, making charging stations an essential part of future smart grids and a critical support system to the main grid.

Dr Zhong will be moving in October to Loughborough University to take up a Chair in Control Engineering.

The Royal Academy of Engineering and Leverhulme Trust Senior Research Fellowships enable mid-career academic engineers who want to focus on research to be relieved of their teaching duties for up to 12 months. Details of this scheme can be found on The Academy's website www.raeng.org.uk or from the Scheme Manager, Misty Palmer (misty.palmer@raeng.org.uk).

For further information please contact Dr Qing-Chang Zhong, The Royal Academy of Engineering and Leverhulme Trust Senior Research Fellow, The University of Liverpool (Q.Zhong@liverpool.ac.uk).

The wind turbine donated by Nheolis, France, being used to demonstrate the technology

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PROFESSIONAL INSTITUTIONS

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