

Innovation & Research



Issue No. 67 Also at www.innovationandresearchfocus.org.uk November 2006

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Research-inspired Policy & Practice Learning in Ethiopia and the Nile Region (RiPPLE)

DFID's Central Research Department has identified the need to provide sufficient and flexible resources over a long enough period to enable genuine development and the application of expertise and new thinking in the water sector.

RiPPLE is a £3.82m five-year research programme consortium aimed at advancing evidence-based learning on water supply and sanitation (WSS). RiPPLE focuses specifically on issues of financing, delivery and sustainability, and the links between sector improvements and pro-poor economic growth. It will contribute to millennium development goal objectives by providing new knowledge and skills at all levels to enhance sector financing approaches, improve targeting mechanisms and identify more effective governance arrangements and sustainable technologies. A key objective will be the dissemination of outputs targeted at policy makers, NGOs and other organisations.

The project will analyse how to increase the flow and efficiency of funds to the sector and how to ensure that strengthened capacity leads to more-sustainable service provision, supporting pro-poor growth and human security. It will determine how better financing can provide more-sustainable water and sanitation for poor people, strengthening their human security and opportunities for pro-poor growth in Ethiopia and the Nile region. RiPPLE's overall strategic objectives are:

- To create research structures and processes that enable effective collaboration across all partner institutions and with key stakeholders;
- To establish a set of research programme activities that lead to strengthened sector financing approaches and the delivery of WSS services that maximise opportunities for pro-poor growth;
- To build long-term approaches to training and capacity building that reinforce



Finding better and sustainable ways to get water to poor people

research capacity development in Ethiopia and the Nile region.

Working in three regions of Ethiopia, the consortium will develop a new body of high quality policy and practice-relevant knowledge by establishing Learning and Practice Alliances at different levels. In parallel, RiPPLE will build outward linkages to networks and partnerships within other Nile region countries.

The shape of the consortium reflects the need for a range of disciplines, research skills, experience of practice on the ground and engagement in regional networks. By the end of the 5-year period, RiPPLE will have completed key research of benefit to policy makers and practitioners throughout the region and further afield; will have substantially contributed to the sectoral knowledge base in Ethiopia; and will have helped develop the capacity of new generations of development practitioners to address critical water supply and sanitation issues.

For further information see website Research4Development (www.research4development.info), or please contact Dr Alan Nicol, RiPPLE Director (Fax: 02070230105; E-mail: a.nicol@odi.org.uk).

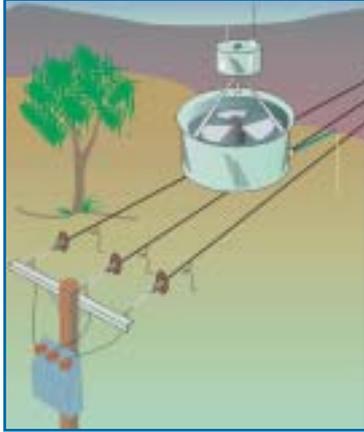


Autonomous rotorcraft for power line inspection



With the help of a Global Research Award, Dr Dewi Jones from the University of Wales, Bangor worked for 12 months at CSIRO (Commonwealth Scientific and Industrial Research Organisation) in Brisbane, Australia. He conducted a feasibility study on the use of a small, electrically-driven rotorcraft for inspecting overhead power lines with emphasis on methods for control, guidance and autonomous capability.

Using unmanned aerial vehicle systems (UAVS) for power line inspection has advantages over current methods, including economy, data quality and more frequent coverage. Dr Jones and colleagues have proposed using a ducted-fan rotorcraft operating close to the overhead line, obtaining its electrical power via a pick-up mechanism. The vehicle's on-board battery power is limited, effectively tethering it to the immediate vicinity of the line. This is an advantage when preparing a safety case to allow autonomous flight beyond the operator's visual range.



(Above) Artist's impression of the power line inspection vehicle in action. (Above right) The AVS 'pod' (the simulated rotorcraft) approaching the one fifth scale power lines under visual feedback control. (Inset) The cranked linkages of the pick-up mechanism fixed below the AVS 'pod'.

Researchers at CSIRO have constructed an Air Vehicle Simulator (AVS) – a hybrid-testing facility based on a cable-array robot. A computer model of the rotorcraft's dynamics generates velocity demands to the cable array so that the motion of the simulated vehicle within its 10x8x4 metre workspace mimics that of the real rotorcraft.

Dr Jones has been collaborating with CSIRO. The AVS has been used to test soft-

ware for controlling the rotorcraft's lateral position and height relative to overhead power lines, by means of an artificial vision-based system. Dr Jones has also designed and tested an experimental power pick-up mechanism, which uses force sensors to maintain contact with the conductors despite changes in the rotorcraft's position and attitude.

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).

For further information on this project please contact Dr Dewi Jones at the University of Wales, Bangor (01248 382701; E-mail: dewi@informatics.bangor.ac.uk).

CONSTRUCTION PROCESS

Modern methods of formwork for insitu concrete



Considerable attention is currently being directed towards Modern Methods of Construction, a term associated with rapid, labour-saving construction systems typically fabricated off site. However, recent years have also seen significant innovation and improvement applied to many traditional on-site systems.

A good example of this is System Formwork, a flexible, integrated approach to formwork that can offer considerable time savings compared to traditional techniques. The use of pre-engineered standardised components ensures rapid assembly and reduces the need for skilled site labour. Versatile couplings allow panels to be joined horizontally, vertically or at corners, and can avoid the need for additional stiffing or aligning of components.

System Formwork makes extensive use of aluminium, which greatly assists manual handling, with many components light enough to be carried by one person. Health and safety is also improved through scaffolding, guardrails and slab edge platforms, designed to work with the overall system, and to fit formwork of varying heights and lengths. This approach reduces the risk of falling accidents, particularly during the erection and dismantling processes.



Standardised panels with integrated walkway system (Inset) Innovative coupler design allows rapid panel joints (both courtesy Peri Ltd).

The factory-produced panels are of a high quality, ensuring a good surface finish, and can be re-used up to 250 times. They are typically made from aluminium or steel, but plywood can also be used (with the addition of a steel frame for rigidity). Where required, suppliers can offer a design and construction service to meet specific projects' needs.

The overall concept of System Formwork was developed to meet the same challenges as other modern construction techniques, namely to reduce site time, increase the unskilled labour element, and move towards assembly line production on site. Whilst the cost of materials is slightly higher than traditional solutions, the savings in formwork labour are much more significant.

For further information please contact Andrew Minson at The Concrete Centre (01276 606828; E-mail: aminson@concretecentre.com).

Highways Agency safety action plan: driver information programmes

The Highways Agency's Strategic Safety Action Plan, published in 2005, sets out how the Agency (HA) is working to meet its target of reducing the number of people killed or seriously injured on England's motorways and major A roads. The Agency has already made progress towards the casualty reduction target through engineering interventions to improve locations with a poor safety record. Alongside this, they recognise that they cannot "engineer out" all driver error and need to work with their customers directly to encourage more responsible driver behaviour. This requires the Agency to develop an educational role alongside its new network operator and traditional engineering roles.

HA research shows that accidents and unplanned incidents cause up to 25% of delays on the strategic road network. Reducing accidents and the disruption they cause will have a major impact on journey reliability, as well as preventing injuries and saving lives.

The Driver Information Programmes (DIPs) contribute to the Safety Action Plan by providing advice to drivers, and also direct drivers to information provided by the Agency to help them plan their journeys. In doing so, the DIPs will contribute to the Agency's achievement of its 2010 targets for reducing congestion, improving safety and providing better information to road users.

We have begun by concentrating on the four primary groups involved in casualties on the HA road network:

- motorcyclists;
- drivers of commercial vehicles;
- drivers on business;
- young drivers aged 17–19.

A specific programme of communications is being devised for each target group, for launch before 31 December 2006. In particular, DIPs aim to:

- improve safety and contribute to a reduction of delays on the network by:
 - encouraging drivers to adopt more responsible behaviour;
 - challenging poor driver behaviour by showing road users the consequences of their actions and making irresponsible behaviour socially unacceptable;
- improve journey reliability by:
 - showing drivers the benefits of planning their journeys and making sure their vehicle and load and/or passengers are safe and secure;
 - directing drivers to tools provided by the Agency, which they can use to plan a safer and more-reliable journey.

The content of the programmes is summarised in the four sub-sections below.



(Left) 'The Saint' stick character, from the website www.heavygoodvehicle.com
(Right) Customers using 'Now that's what I call Worst Hits'.



engage with the target group of drivers, inviting them to adopt the ideas and advice contained in the DVD and website. The programme is targeted at employees, and will complement the proposed DfT awareness-raising campaign aimed at employers.

Young Drivers – 'Now that's What I Call Worst Hits' is a resource that has been produced for driver education in the 16 to 19-year-old market. It is an interactive DVD 'game' using 'state-of-the-art' 3D animation

designed to provoke discussion amongst the target group. The animation features three characters, Shaz, Gaz and Chaz, representing stereotypes that newly qualified young drivers will recognise.

Focus groups have found that young drivers know the 'correct' behaviour, but they take risks because they have high confidence in their driving ability to get out of difficulty. At the same time, however, they do not know their limitations. The DVD provides a series of scenarios with a number of driver choices. It is designed for use in safety presentations for young people led by a road safety officer or similar professional, who will discuss the options – and their consequences – with the group.

The scenarios were selected after interviews with police accident investigators from Cleveland police to devise the 10 most common crash scenarios experienced by drivers aged 17–19. During the development of the DVD, prototypes have been tested on young people in the Stockton on Tees' area and post production with a series of focus groups to gauge reaction and measure acceptance of the concepts.

For further information please contact Stuart Lovatt, Highways Agency, Room 406, City Tower, Manchester M1 4BE (0161 930 5836; Fax: 0161 930 5610; E-mail: stuart.lovatt@highways.gsi.gov.uk), or Julie Smith, Highways Agency, Room 7W, City House, Leeds, LS1 4UR (0113 283 6440; Fax: 0113 283 6481; E-mail: julie.smith@highways.gsi.gov.uk).

Motorcyclists – The motorcycle DVD *Great Roads Great Rides* takes riders step-by-step through everything they need to know to enjoy the best and safest riding on UK roads. With 14 separate sections, riders can choose to take from it as little or as much as they require. Topics covered include bike maintenance, choosing the best kit, security advice, keeping your licence and planning your ride. The sections include a range of technical commentaries. Some incorporate unique helicopter footage that presents a new perspective and learning experience in sections like Reading the Road and Group Riding.

Commercial Vehicle Drivers and Operators – This website-based planning tool is designed to assist drivers and operators of commercial vehicles in their day-to-day negotiation of England's core trunk road network. The site – www.heavygoodvehicle.com – is packed full of useful journey planning tools that have been created to keep freight moving and thereby help minimise delay. The aim is to engage with drivers and appeal to their sense of professionalism. The theme plays on the word 'good', hence the Agency's very own trademark 'Saint' character. The emphasis is placed on drivers to buy into and adopt 'good' driving behaviour – adhering to restrictions and rules of the road.

Drivers on Business – This programme is aimed at those who drive on business, particularly those who are pushed to drive less safely because of time and cost pressures. The theme is designed to appeal to and

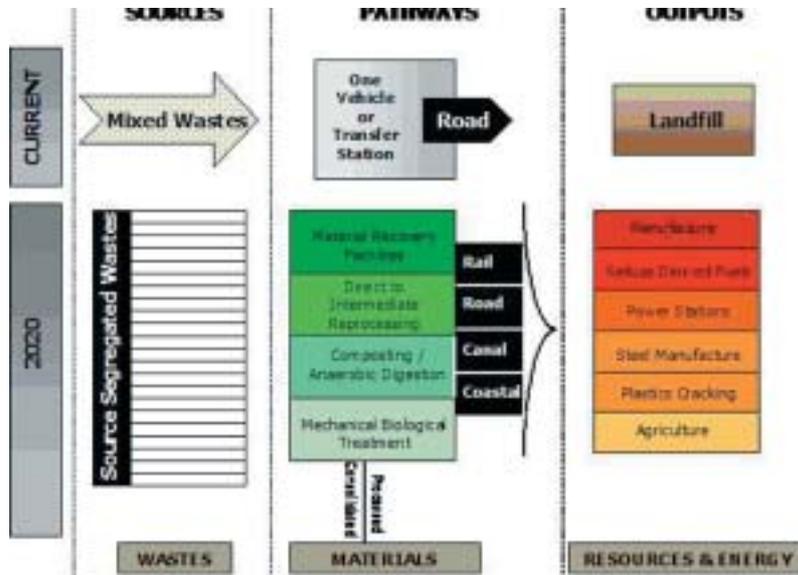
Sustainable Transport Resources & Waste: STRAW

The UK faces a revolution in waste management practices as the demands of sustainable waste management policies drive the creation of a modern, integrated network of reprocessing, recycling, recovery and disposal facilities. The challenge is to design a new waste management system, effectively from 'scratch' – the chance to consider how this system might be made as sustainable as possible – and to strategically analyse the choice of technology mix and locations for the infrastructure, together with the options for moving materials between facilities.

The STRAW project's vision was of an integrated network of strategic resource recovery facilities, incorporating a range of industrial ecology concepts. A mass balance to waste was applied, demonstrating the benefits to the economy and the environment of placing waste management decision-making in the context of the material and energy needs of the economy.

The research demonstrated the economies of scale brought about by strategic and supersites, facilitated by intermodal transport and strategic spatial planning, and produced complimentary planning guidance.

The research also placed waste in a carbon context, by modeling a 'win-win' scenario, based on waste management technology producing a



Paradigm Shift of Waste to a Materials and Resource System

carbon neutral biomass-based fuel usable by coal-fired power stations. Finally, the project reveals the capability

of intermodal transport infrastructure to move materials within a network of strategic sites throughout England and Wales.

The Institution of Civil Engineers' Research and Development Enabling Fund co-funded the project as part of its charitable commitment to innovation and research. For information on the ICE Fund, awarded projects and how you could gain funding, visit www.ice.org.uk/knowledge/specialist_innovation.asap and www.ice.org.uk/knowledge/spec_news.asp?ARTICLE_ID=1502

For further information on the STRAW Project please contact Robin Curry (028 9027 8330; E-mail:

rccurry@environcentre.co.uk; website: www.straw.org.uk).

MATERIALS & STANDARDS

Access Steel – Eurocodes made easy



Access Steel is an online information system at www.access-steel.com, which is unique in offering a completely free, fast and easy route to application of Eurocode 3 for steel and Eurocode 4 for composite construction.

Targeted primarily at the needs of architects, engineers and their clients, the content of the site ranges from conceptual to detailed design to the Eurocodes, with comprehensive coverage of single and multi-storey buildings and residential construction. Special attention is given to the new opportunities for fire safety engineering. The technical guidance is practical, quality assured and harmonised, and has been produced in English, French, German and Spanish by six leading technical institutes in Europe.

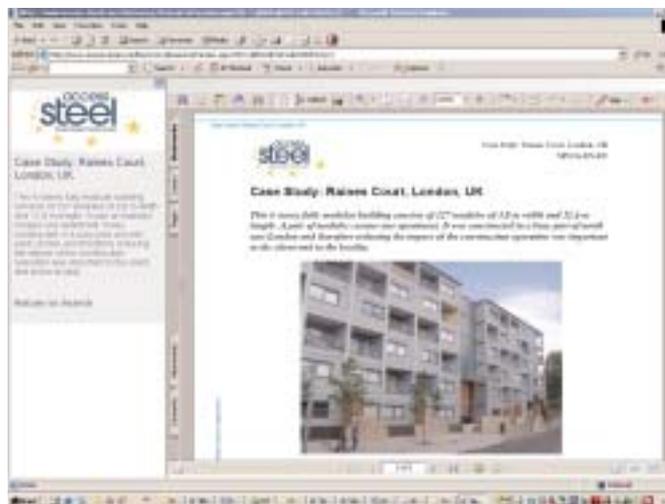
There are also direct links through to the relevant Eurocode clauses in English, courtesy of BSI. Resources include 50 interlinked modules on the detailed design of elements, free element design software, step-by-step guidance, full supporting information, case studies and interactive worked examples. The site also offers downloadable media; Eurocode FAQs; information about the different time-

lines for Eurocode implementation across Europe; and simple, user-friendly tools to enable individual countries to add value with

their own complementary National Annex information.

Access Steel was funded by the European Union eContent Programme, together with seven major steelmakers - Arcelor, Corus, Peiner Träger, Ruukki, Voest Alpine, Dillinger Hütte and SSAB. The project was led by the SCI (Steel Construction Institute) in the UK, in collaboration with CTICM (F), CSC (UK) Ltd, eTeams Ltd (IRL), Labein (E), RWTH (D), SBI (S), Arcelor (L) and Corus (UK/NL).

Access Steel sends out a very clear message to designers everywhere – take the plunge now and get ahead with the Eurocodes at www.access-steel.com.



Case study resource for frame analysis

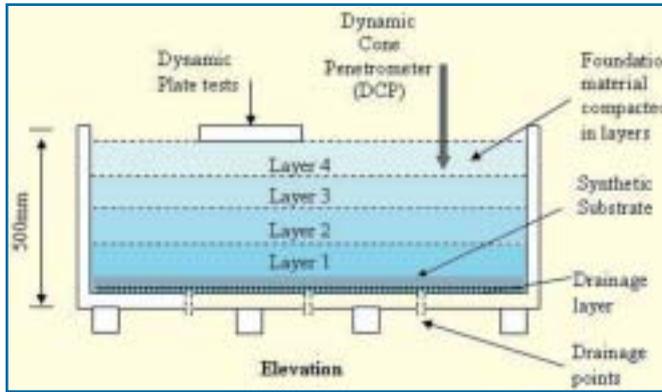
For further information please contact Christine Roszykiewicz, SCI International Coordinator, (01344 636525; Fax: 01344 636570; E-mail: Christine@steel-sci.com; Website: www.access-steel.com).

Novel assessment test for granular road materials

The current UK pavement foundation design process is based around the California Bearing Ratio, coupled with a 'method' specification founded on past experience and proven performance. This provides an empirical indicator of adequate performance, but limits the development of performance-based design and specification.

The wider use of marginal and recycled or secondary aggregates is necessary for achieving sustainability targets. There is a move towards analytical design, based upon the fundamental material performance properties of elastic stiffness and resistance to permanent deformation. Analytical design, combined with 'performance' specifications, potentially allow any materials that are 'fit for purpose'. This approach, however, requires field measurements to confirm the assumed design performance is achieved. In addition, performance data for design is required before the materials are used to ensure confidence in their likely behaviour.

A large-scale laboratory assessment test has been developed to measure the performance of coarse granular (capping) materials. The test utilises the same portable dynamic plate and cone devices proposed to measure performance in the field, thus providing directly comparable results. The test method developed provides a tool for industry, which indicates a material's potential com-



posite stiffness and strength, and provides useful information on its moisture susceptibility. The test is used to provide data for design and general suitability.

This work was undertaken as an EngD research project, which was funded by the UK Highways Agency and the EPSRC and run by the Centre of Innovative and Collaborative Engineering at Loughborough University.

For further information please contact John Lambert at Scott Wilson (01159 07700; Fax: 01159 077001;

E-mail : John.Lambert@scottwilson.com) or Dr Paul Fleming at Loughborough University (01509 222616; Fax: 01509 223981; E-mail: P.R.Fleming@lboro.ac.uk; website: www.cice.lboro.ac.uk).

(Above) The Falling Weight Defectometer and pavement foundation construction.

(Below) Laboratory test apparatus set-up schematic.

MODELLING & RIVER & COASTAL ENGINEERING

Computational Fluid Dynamics (CFD) – state-of-the-art and recent progress

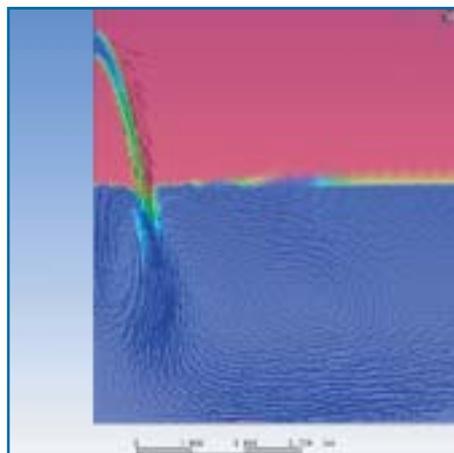


Recent development work at HR Wallingford has extended the capability of using CFD software (Computational Fluid Dynamics) to solve complex problems involving steady-state, transient, laminar or turbulent flow. The approach is particularly pertinent to the solution of coastal engineering projects. This work has been undertaken in conjunction with physical model measurements so that the results could be accurately verified.

The ANSYS-CFX computational model solves the Reynolds Averaged Navier-Stokes (RANS) equations, with an array of turbulence models, for both single- or multi-phase problems. This modelling approach has been developed for use across a wide range of studies varying from wave impacts and tidal flow through to testing of structures in coastal and offshore situations.

CFD modelling can now be used to simulate highly complex situations in single-phase flow. Examples of these situations are:

- i the bulk flow patterns that occur as water is moved through a pumping station;
- ii the flow patterns at sea water intakes of power stations;
- iii currents around an obstacle in, or close to, the seabed – such as the foundation pedestal of an offshore wind turbine; and



CFD image of effluent flowing over a weir into receiving waters

at a more general level, the air flow around obstacles.

Applying the software to the open sea, the CFD modelling approach can also now be used for multi-phase flow situations. These can include:

- i complex (free-surface) wave movement;
- ii interaction of waves with a structure such as a breakwater;
- iii overtopping of waves or impact loading on seawalls or caissons; and
- iv the interactions of waves and currents around pipelines.

For further information please contact Philip Besley or Stephen Richardson at HR Wallingford (01491 822264 or 822298; E-mail: pb@ or srr@hrwallingford.co.uk).

Reports on Radio Frequency Identification (RFID)

The Building Research Establishment (BRE) have undertaken a project funded under the DTI's Partners In Innovation (PII) programme investigating the use of Radio Frequency Identification (RFID) and associated technologies in the manufacturing, installation and maintenance of high-value construction products.

The final report will give a brief introduction to RFID tagging and wireless technologies and will highlight the business benefits they can offer to the construction industry.

Radio Frequency Identification, or 'smart tagging', has been developed in the retail sector to track produce through the logistics and sale stages of their life. This technology has significantly developed and reduced in price over the last five years. The improvements include increased flexibility, the introduction of common standards, the advent of read/write chips and universal reader capability.

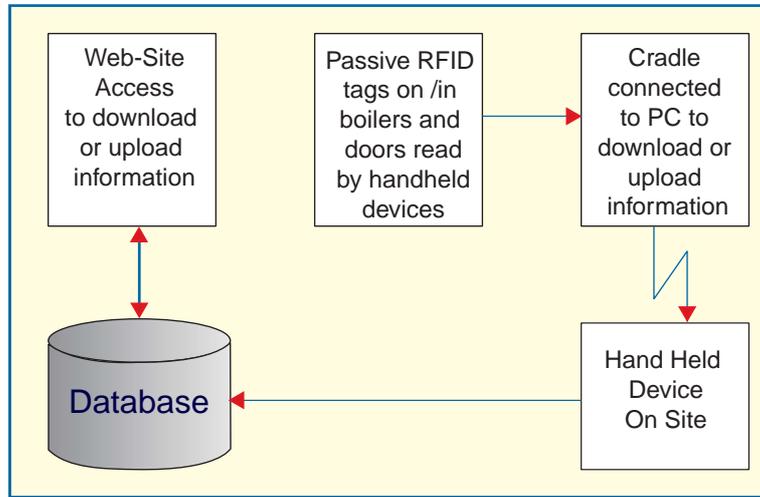
The construction sector in the UK has shown interest for a number of applications. Tags can be incorporated into boilers and doors, which can be used by most housing associations and FM asset management systems. There already are asset management systems that allow tracking of assets using barcode, and Corgi provide software to record servicing of gas appliances. Using e-tags will add flexibility and, where appropriate, the information on the tag can be updated throughout the life of an asset, such as a boiler. By contrast, barcodes cannot be used for such items as they will be easily destroyed or vandalised. Tags with an internet-enabled scanner could provide additional information in real time, such that basic health and safety requirements, maintenance inspection notes etc can be downloaded from the internet and records all linked with specific building components.

Potential applications appear to be very wide, particularly in conjunction with the industrialisation of construction. To date, work has been carried out in the UK into the use of RFID in quality control, logistics tracking, system or component build, reduction of waste, and asset management.

A RFID system consists of two main components, the tag and the reader, which work together to provide the user with a non-contact solution to uniquely identify items and their locations.

Tags consist of two parts, an integrated circuit and an antenna. The antenna is the key factor in determining the read range of the tag, and, unlike barcodes, RFID tags do not require a line of sight for identification.

RFID readers are available integrated with a purpose-built hand-held computer or as an external reader which can be linked to a standard hand-held computer. The hand-held can identify the tag, call up a database via its cellular phone, download the required information and display it on the hand-held's screen.



An overview of the tagging and system

A simple tag identity can therefore be used to provide the operator with potentially complicated information or as a trigger to carry out inspection routines or product installation and removal procedures. Finally, having completed an inspection or operation, the operator can synchronise the collected data with the rest of their IT system. In addition, tags can be both read-and-write-capable, or read-only; the write capability enables information to be written back to the tag from the reader.

The system developed and implemented for one of the pilots was to improve the asset management and maintenance scheduling system part of the process. The system uses tagging and hand-held devices to automate asset tracking and the scheduling of maintenance tasks. It provides wirelessly collected data that can be presented through the web browser for remote access and interface to the existing asset management system. An overview of the tagging and system is shown in Figure 1 above.

The tagging system consists of three components:

- a centralised database with reporting through the web browser;
- wireless hand-held devices with data transfer capability between the database and RFID tags;
- RFID read/write passive tags embedded into or on to the boilers and front doors of houses in the Bourneville Village.

The main conclusion is that this technology is becoming cheaper and should offer construction new opportunities to improve the maintenance of assets and manufacturers to develop smart products and new services. The potential savings (money and efficiency) that these pilots have shown are:

- productivity improvements;
- availability of 'real time' data capture;

- job tracking;
- better quality control;
- better stock control;
- reduction in paperwork;
- reducing the incidents and associated cost of sending incorrect products to site;
- improvement in customer information;
- web-enabled customer information system;
- improved health and safety;
- allowing manufacturers to offer new value added maintenance services for their products.

Although there are a number of potential uses of RFID in manufacturing and asset maintenance, at present the following are thought to offer most potential:

- paperless invoicing, ordering and delivery;
- inventory control;
- stock control;
- manufacturing process control through centralised tracking and resource allocation;
- project monitoring – correlating manpower used with tasks performed;
- project monitoring – correlating use of equipment resources with tasks performed;
- tracking of components on site;
- erection and installation tracking;
- maintenance;
- demolition and disposal (end of product life);
- dispute resolution.

International review

DTI, together with TEKES, the National Technology Agency of Finland, and the National Agency for Enterprise and Housing for Denmark, have commissioned a review of the current international state of the art with regard to the implementation of RFID in construction and to consider the future needs for research in this area.

The objective of the review was to obtain an overview of the present application of RFID technology in the construction sector and to present recommendations for further research into RFID in construction.

A consortium led by the Danish Technological Institute has undertaken the research. The final report has been received and is placed on the main DTI website – see www.dti.gov.uk/sectors/construction/innovation/page14362.html.

For further information, please contact Dr Ranjit Bassi, BRE Knowledge Division (01923 664800; E-mail: bassi@bre.co.uk).

New strategy for flood mapping in Northern Ireland

Using experiences from the rest of the United Kingdom, HR Wallingford are supporting the Northern Ireland Rivers Agency in developing a new flood mapping strategy.



HR Wallingford have developed a range of flood mapping products and tools to provide a framework for the continued improvement, coverage and quality of flood risk information. This has been done as part of a project led by RPS plc. The new strategy sets out the quality-assured flood mapping needed to support national and local assessments of flood risk, and subsequent flood risk management activities. The flood risk information covers both probability of flooding and the potential local consequences of flooding.

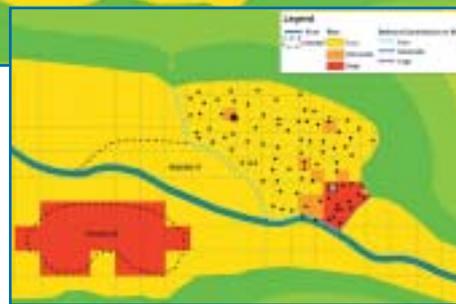
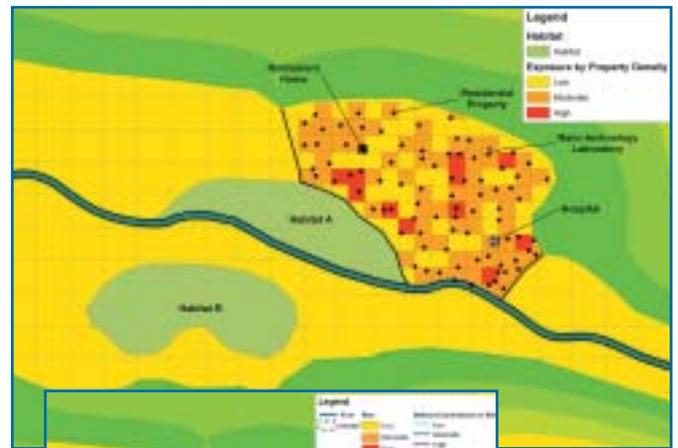
The flood mapping products have been developed using a hierarchical approach to flood mapping based on the RASP concepts – RASP = Risk Assessment (of Flood & Coastal Defence) for Strategic Planning, developed by HR Wallingford (and currently being implemented in England and Wales by the Environment

Agency). This approach enables local data to feed into a national or regional overview. The accuracy of the mapping products will be updated over time through a process of needs-based evolution.

An example of the Mapping Strategy products is the Flood Exposure Map, which shows the location of different types of receptors within the floodplain, for example the impact of property density on flood height.

A second example is the Residual Flood Risk Map, which reflects the actual probability of flooding taking place across the whole region, taking account of all the different flood defences and their associated impacts.

For further information please contact Caroline McGahey or Paul Sayers at HR Wallingford (01491 822226, or 822344; E-mail: cmg@ or pbs@hrwallingford.co.uk).



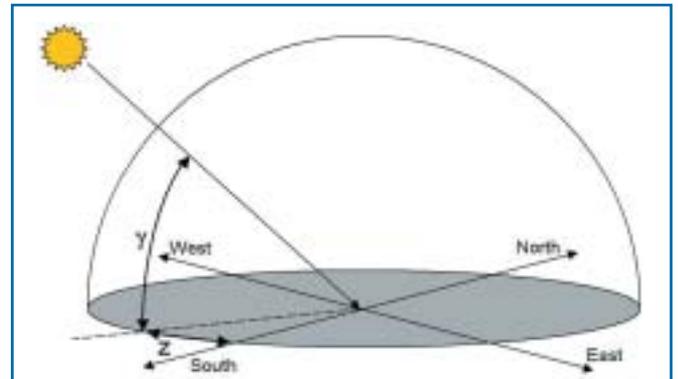
(Top) Flood Exposure Map.
(Left) Residual Flood Risk Map

BUILDINGS & MATERIALS

Control of solar gain



Tighter Building Regulation requirements have focussed attention on preventing the overheating of buildings. This principally requires a reduction in solar gain from incoming solar radiation. However, the answer is not simply to use smaller areas of glazing as there is a need for daylighting and views out, and the appearance of the building has to be considered. Spectrally selective glasses and shading devices may be used to change the proportion of both infrared to visible light transmitted and the radiation admitted at different times of the day and year.



The Centre for Window and Cladding Technology has just published two new Technical Notes: TN 50 *Environmental control glasses* and TN 51 *Solar gain and shading*. These give an introduction to the control of solar gain, explain the technologies available, the advantages and limitations of each, and the implications for constructing and operating buildings that incorporate environmental control glasses and shading devices.

Environmental control glasses range from simple body-tinted glasses through rudimentary hard coatings to complex soft coatings comprising several layers, some with thickness similar to the wavelength of short-wave infrared. Evaluating the solar control perfor-

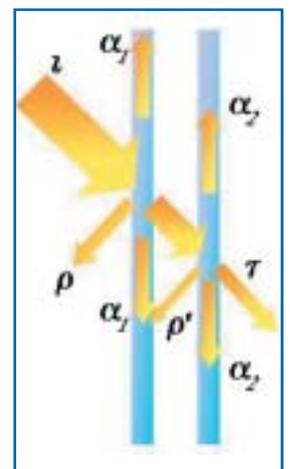
mance of different glass and coating configurations is only part of selecting glazing solutions. TN 50 also describes the use of coated glasses as toughened and formed glass and their integration into glazing units. Finally it deals with the issues of quality and appearance.

Shading devices include blinds, diffusers and brise soleil and they may be static or controllable. Shading may be used to reduce solar gain or glare and the design or selection of shading devices varies greatly according to the performance required. The design of shading devices to reduce solar gain is further complicated by the option of using a shading device, a solar control glass or both.

TN 51 describes the advantages

and disadvantages of different shading devices and gives methods for calculating the effectiveness of brise soleil and similar shading devices based on sun paths and the size and geometry of the device. It also gives advice on the implications for construction and maintenance of buildings incorporating shading devices.

For further information please contact Dr Stephen Ledbetter, Centre for Window and Cladding Technology (01225 386541; E-mail: cwct@bath.ac.uk; Website: www.cwct.co.uk).



(Top) Derivation of sun path.
(Above right) Reflectance, absorptance and transmittance of an insulated glazing unit

M60 widening Innovation Award

The Highways Agency's M60 Junction 5–8 widening scheme has won the Institution of Highways and Transportation 2006 Award for Innovation by retaining three twin-decked post-tensioned bridges due to be demolished under the scheme.

Junction 5 is a major intersection of the M60 (120,000 vehicles per day), M56 and the A5103 Princess Parkway (82,000 vehicles per day), where the motorway was to be significantly raised to accommodate a high load route on Princess Parkway. As well as replacing the existing structures, traditional widening through-



Temporary jacking at Princess Parkway prior to installation of permanent steel support columns

out the scheme would have required considerable traffic management restrictions involving major temporary works, long-term closures of Princess Parkway and severe traffic disruption.

The Joint Venture contractor, Amec/Alfred McAlpine, and designer Halcrow devised a solution to reconfigure the bridge decks and incorporate them within the scheme. However, this required a sophisticated analysis of the 30-year-old structures to ensure there would be sufficient reserves of strength to meet current design standards. The analysis also demonstrated that the structures would be subject to twisting or deflection from their original profile, thus inducing large forces into the decks.

A system of interlinked jacks was eventually devised, connected to a single central control point, allowing each twin deck to be lifted, tilted and monitored from a single location. Monitoring controls enabled the jacks to be locked off in the event of a hydraulic failure. By this process, the individual decks could be lifted as plates under calculated tolerances to prevent overstressing, thus enabling re-orientation of their opposite cambers by up to 1.8m to a common plane alignment. They would then be stitched together to form a single, new anticlockwise carriageway. Meanwhile, three new structures would be constructed alongside to form the clockwise carriageway.

As the deck diaphragms coincided with the

substructures, the piers and abutments could be used as jacking platforms, thus eliminating the need for extreme temporary works and reducing the hazard of working at heights. Steel and ekki hardwood timber packing was chosen as the most practical way of achieving the various heights required for positioning the temporary jacks. To

accommodate the permanent bearings, steel support columns, filled with concrete to improve their stiffness, were then lifted into place and bolted to the substructures prior to bearing installation and final transfer of the deck loads.

The increased level of the deck also meant that the abutment stems would be overstressed by conventional structural backfill. To avoid complex strengthening, a tight specification was developed and a departure from standards sought to design a lightweight, foamed concrete to reduce the loads. Additionally, durability was enhanced and future maintenance reduced by eliminating the existing joints to make the structures semi-integral.

The innovative methods used here have brought the key benefits of:

- improved health & safety;
- reduced disruption;
- £2m cost savings;
- a 6-month reduction in programme; and
- a sustainable and innovative solution.

For further information please

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

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