

Research Focus

Issue No. 41

MAY 2000

PROMOTING THE APPLICATION OF RESEARCH IN BUILDING AND CIVIL ENGINEERING

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Developing Himalayan hydropower

India and Nepal are presently facing an acute power shortage, which will be aggravated in the future through increasing population and economic development. Environmental concerns over deforestation and the use of conventional fuel sources make it essential to harness the available renewable energy in the region, including hydropower.

Sources may be wind, biomass, solar or small-scale hydropower. The vast mountain ranges of the Himalayan region, with their steep topography and perennial supplies of water, are highly suitable for the development of hydropower. A potential of 10,000 MW has been estimated from small-scale hydro across India as a whole, most of it available from the Himalayan and sub-Himalayan Regions.

Development of small-scale hydro in hilly areas will combat poverty, and enhance quality of life by providing good quality lighting, which makes homes and villages safer, more productive environments, and makes studying easier at night. It will also arrest outward migration, through providing opportunities for small-scale enterprise.

Over-exploitation of firewood has caused depletion of forest, resulting in landslides, soil erosion and environmental degradation. Small-scale hydro reduces dependency on forest and fossil fuel products to meet energy needs, through the use of low wattage cookers.

An essential first step in the implementation of a hydropower scheme is to determine whether there is sufficient river water to drive the turbines. Several schemes have failed due to a lack of sufficient hydrological information. The UK Department for International Development (DFID) has commissioned a project to develop software that would enable the hydrological regime, and hence the hydropower potential, to be determined for any prospective site in two Himalayan regions. The software incorporates hydrological models derived from multi-variate regression analysis between ob-



TOP The Trisuli River, Nepal, is the site of studies on hydro-power potential. ABOVE Flow gauging station on the Trisuli River.

served low flow statistics and the topographical, climatological and physiographical characteristics of catchments.

The project, titled REFRESH (Regional Flow Regimes Estimation for Small-scale Hydropower Assessment), involves collaboration between the UK Institute of Hydrology, the Alternate Hydro Energy Centre of Roorkee, India, the Himachal Pradesh Energy Agency (HIMURJA) and the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu. The three-year project is now nearing completion, with software due for launch before the end of the year 2000.

For further information please contact either: Mr Gwyn Rees, Institute of Hydrology, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB (01491 692343; fax: 01491 692424; E-mail: grees@ceh.ac.uk) or: Mr Arun Kumar, Director, Alternate Hydro Energy Centre, University of Roorkee, Roorkee, 247 667 (U.P), India (00 91 (0)1332 74254; fax: 00 91 (0)1332 73517; E-mail: ahec@rurkiu.ernet.in or ahec@vsnl.com).

The Institution of Civil Engineers, on behalf of the Editorial Advisory Board, has great pleasure in welcoming the Department for International Development as a new Sponsor of Research Focus.

DFID Department for International Development



ABOUT RESEARCH FOCUS

Aims

The principal aim of *Research Focus* is to promote the application of research in building and civil engineering.

Supported by many organisations in the British construction industry, its brief articles on current research are written for practising engineers, architects, surveyors and their clients with the objective of disseminating research news as widely as possible. Its sponsors wish to promote the benefits of research, improve contacts between industry and researchers, encourage investment by industry in research and the use of research in practice, and facilitate collaboration between all the parties involved.

Formally, *Research Focus* is an unrestricted newsletter containing invited factual records or case studies of building or civil engineering research projects. Articles may be reproduced, provided the source is acknowledged.

Enquiries and Comments

If you wish to know more about a specific project, you should contact the person named at the end of the relevant article. Look on the back page for addresses, telephone and fax numbers of the sponsoring research organisations and professional institutions. General information about their activities may be obtained from them directly.

We welcome your ideas on ways to improve *Research Focus* and so help it to achieve its goals. If you have a suggestion, or an article about an interesting piece of R&D, please send it to the Editor, Roger Venables, at the address below.

Distribution

If you receive *Research Focus* by direct mail (i.e. not with *Civil Engineering* or NCE) and the address it is sent to is incorrect, if you would like additional copies for circulation within your organisation or if you would like to be added to the direct mail list, please contact James Galassi at the Institution of Civil Engineers, 1 Great George Street, London SW1P 3AA (020 7655 2213; fax 020 7799 1325; Email galassi.j@ice.org.uk).

Research Focus is also downloadable from the ICE website (www.ice.org.uk) and readable using Acrobat software.

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Overall editorial policy is set by the Editorial Advisory Board which comprises:

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Editor: Eur Ing Roger Venables

Secretary: Dr John Bennett (ICE).

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Enhancing the performance of oversized plant

All too often, heating ventilation and air-conditioning plant (HVAC) is oversized for its intended application. To promote the identification and reduction of HVAC plant oversizing, BSRIA has undertaken research into the extent of oversizing and, in particular, measures that can be undertaken to enhance plant performance. The work has been 50% funded by the DETR under the Partners in Innovation Scheme. Monitoring of 50 HVAC systems has been conducted, to establish the typical extent of oversizing that can be found in buildings in the UK.

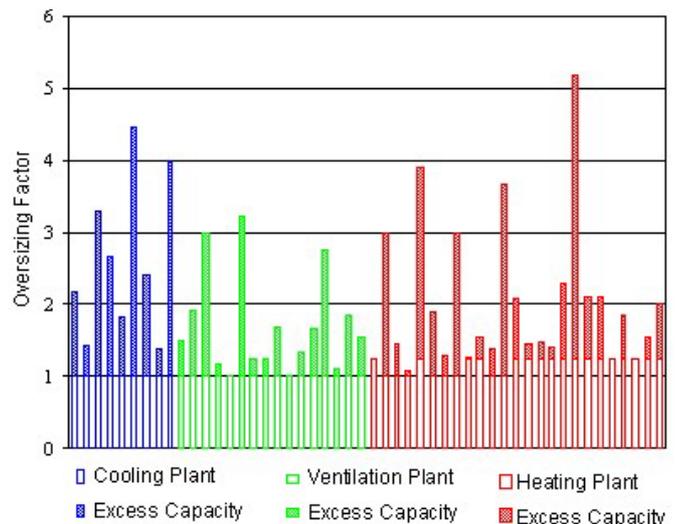
The results of this work are illustrated in figure

1, in which excess capacity is referred to in terms of oversizing factors (OFs). Plant with an OF of 1 can be defined as plant with the 'ideal' capacity sized for steady state design conditions. This does not allow for any margins, or stand-by capacity, or pre-heating requirements for intermittently operated heating systems. The additional factor for preheat gives an 'ideal' OF greater than 1.

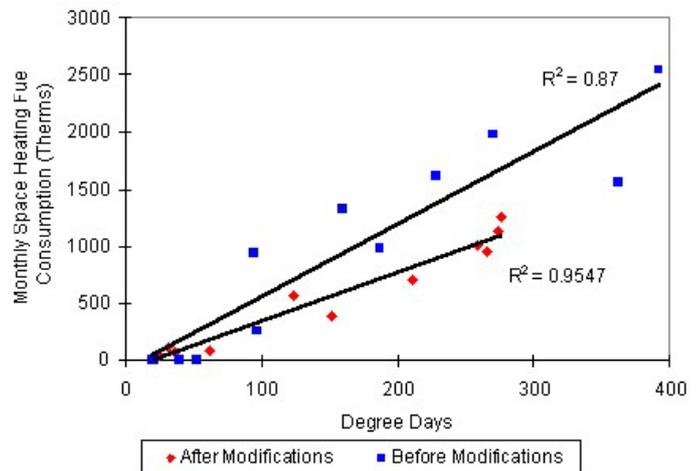
Any OF above the selected 'ideal' will infer over-capacity in the system. For example, in a continuously operated heating system, an OF of 2.5 implies that the plant has a superfluous margin of 150%.

The project also included some 'before and after' case studies where oversized plant had been identified, a remedial action implemented, and energy savings demonstrated. One example of savings that can be achieved is that a simple motor controller installed on two chiller compressors reduced energy consumption by 7 to 8%. A second example is shown in the lower figure opposite.

Further details on how to establish if your HVAC plant has excess capacity, and the measures that can be taken to enhance the performance of such plant, can be found in BSRIA Application Guide AG1/2000, *Enhancing the performance of oversized plant* which is due out in spring 2000.



Oversizing factors in a range of systems



This figure shows space heating energy consumption trends in an office building before and after modifications. Savings were achieved through boiler replacement and a simple improvement in control strategy. Closer control through improved zoning and optimised sequencing of boilers can be seen by the scatter of the points being much closer to the 'after modifications' trend line. The improved capacity control has produced a 43% reduction in space heating energy consumption in this building.

For further information please contact Barry Crozier at BSRIA (01344 426511; fax: 01344 487575; E-mail: barryc@bsria.co.uk).



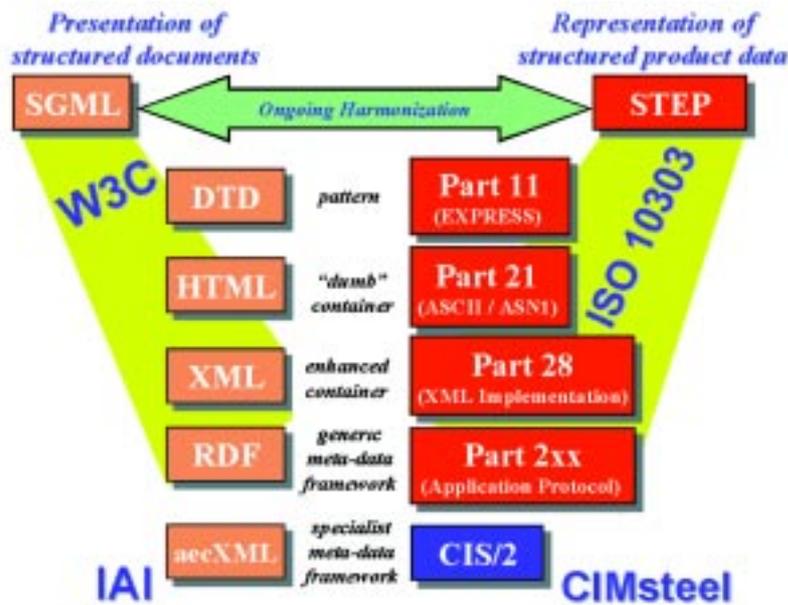
Intelligent data for the electronic age

As most of us have found out, searching the World Wide Web can be a slow and tedious task, and one that often ends with unsatisfactory results. This is because the 'search engines' are limited by the capabilities of the web documents themselves. What users really need is a context-sensitive search engine that can recognize that structural engineers, dentists and card players will, for example, all be interested in different types of 'bridges'.

The demand for intelligent 'meta-data' (which is data about the main data to which it is attached, and is based upon 'Document Type Definition' (DTD)), led to the development of XML (eXtensible Markup Language). In theory, this allows 'documents' (which includes all sorts of media) to be 'tagged' with meta-data. Now, an XML 'document' can contain the necessary tags that place the document's content into an appropriate context.

Long before the Web was invented, researchers were investigating 'Product Modelling' and its use as the basis of an international standard for data exchange throughout manufacturing. Published in 1994, the resulting standard – ISO 10303 – is commonly known as STEP.

Since STEP was created to **represent** information, and the Web was created to **present** information, there is an obvious case for combining the two



technologies, particularly considering the introduction of XML.

The construction industry is now taking advantage of both of these initiatives. Firstly, the Eureka CIMsteel Project developed the CIMsteel Integration Standards (CIS) based on STEP and product modelling technology. The

second release of CIS is documented in a new series of publications by the Steel Construction Institute. Moreover, The International Alliance for Interoperability (IAI) plans to incorporate CIS into its Industry Foundation Classes (IFCs). Joint Anglo-Finnish Research is currently mapping CIS/2 to IFC/2.

Secondly, the IAI has adopted aecXML – an XML schema – for project and business-to-business communication for architecture, engineering, construction, and facilities management transactions.

The ongoing harmonization between product modellers and the World Wide Web Consortium (W3C) will provide significant savings, via Internet-based electronic data exchange among industry participants regardless of their software applications.

The relationship between them is represented in the accompanying figure.

For further information please contact Andrew Crowley, The Steel Construction Institute (01344 623345; Fax: 01344 622944; E-mail: a.crowley@steel-sci.com).



EUROPE & R&D MANAGEMENT

Signposts into the European Commission

What are the opportunities for research funding in the European Commission's Fifth Framework for Research and Technological Development? Where is the information about calls for proposals, work programmes and submission deadlines to be found? Which countries are eligible to participate in EC-funded research programmes? What are TACIS, LEONARDO, ANTARES and EUREKA? Is there any advice on how to define and protect intellectual property in research? Are there any special concessions or arrangements for small organisations – and what is 'small' to the European Commission?

All these questions, and many more, are answered in the ICE's 1999/2000 Year Book *Engineers in Europe*, a guide to the complexities of the European Commission and its activities. It includes a valuable section on *Research and Development: General Policy and Sources of Funding*, with EC website addresses for further information and UK national contact points for advice and assistance. This is a good starting-point for anyone trying to understand the European research landscape, and a quick reference point for those already involved.

The 175-page technical reference section also includes chapters on transport and infrastructure, environment policy and sources of funding, health and safety, education and training programmes, Eurostandards and information technology. Information about the European Union, European organisations and useful data sources is compiled in 43 pages of general reference.

The Yearbook is particularly directed towards the engineering and construction sectors, for which it distills a mountain of information into a manageable A4

ring-binder. It is available from the International Affairs Department of the ICE, price £25 (including postage and packing) in Europe, £20 plus postage and packing worldwide.

For further information or to order a copy please contact Diana Maxwell at the ICE (020 7665 2155; fax: 020 7233 1806; E-mail: maxwell_d@ice.org.uk).



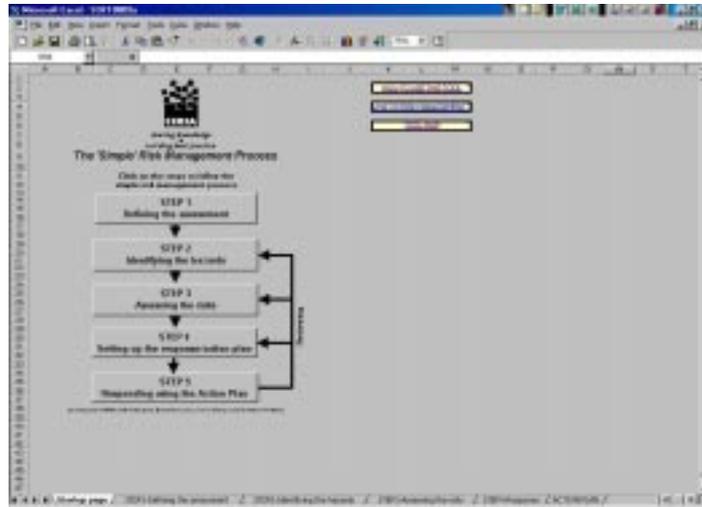
New software tool for risk management

A new software tool could soon help the construction industry standardise its approach to risk assessment and management. Building on a previous CIRIA project to produce a client's guide to the control of risk, an HR Wallingford-led consortium (University of Bristol, Currie & Brown and Sir Robert McAlpine) is working under contract to CIRIA to develop supporting software specifically for newcomers to risk management.

Ian Cruickshank, project leader at HR Wallingford explains, 'A survey of current construction industry practice demonstrated a wide variation in levels of risk management activity. Whilst some organisations systematically manage risks, often using software tools, others do no formal risk management'.

The DETR-funded project aims to encourage the wider application of risk management techniques across the industry by providing an easy-to-use tool, which includes information and guidance on best practice. Unlike many more-sophisticated tools, it is intended for widespread use throughout the supply chain, as it encourages communication of risk issues in a common format using spreadsheet software already owned by most organisations.

The software is focused on organisations that do not have extensive risk management experience. However, it can also interface with



The opening screen in the new risk management software tool

more-sophisticated software tools used by some organisations.

'At the heart of the new user-friendly software is a risk register spreadsheet. It also in-

cludes a large amount of embedded knowledge and guidance. For example, it includes generic risk lists, which can be adapted to specific projects and can be used to capture corporate experience of risk management on previous projects,' says Cruickshank.

The software should result in the clarification of risk ownership and timing of risk mitigation, while offering residual risk analysis. Ultimately, the software is intended to increase risk communication along a project's supply chain, thereby enabling projects to deliver better value and certainty to clients.

For further information please contact Ian Cruickshank,

HR Wallingford
(01491 835381;
Fax: 01491 832233; E-mail:
icc@hrwallingford.co.uk).



ENVIRONMENT & BUILDINGS

Building on difficult ground

Many of today's building challenges are associated with the ground. While some land presents few problems, developers, if they are to meet the demands for new homes and other needs, must increasingly encroach onto sites that have been avoided because of both natural and man-made hazards.

Of particular current concern are brownfield sites that have been disturbed by extractive industries, or that contain the residues of past occupancy, including contamination from industrial processes, or that simply retain the remnants of demolished buildings. The Construction Directorate of DETR is funding studies at BRE to address several of these problems.

Work is under way to develop new models of the partially-saturated behaviour of fill, in order better to predict likely settlements from simple tests on samples. Having already examined the commonly-used forms of treatment to improve the load-carrying abilities of poor ground, BRE is now studying new, potentially cheaper and quicker ways to compact loose ground and to mix in additives to increase the strength and reduce the compressibility of soft soil.

At the same time, work is addressing

some of the problems of contaminated land. A new site investigation probe for detecting contamination is being developed. Both field and laboratory studies are being carried out to improve the performance of ground barriers comprising deep trenches filled with a wet mixture of cement, bentonite clay and slag. This material has been designed such that, on setting, it will be durable, ductile, strong and impermeable, in order to contain contaminants. A new specification for the material will shortly be published by the Institution of Civil Engineers.

Informed application of these and other developing technologies should enable developers to make better use of brownfield sites.

For further information please contact
R Driscoll, Centre for Ground Engineering
and Remediation, BRE (01923 664218;
fax: 01923 664085;
E-mail:
driscollr@bre.co.uk)



ENVIRONMENT

Rewarding environmental quality

The Institution of Civil Engineers has been successful in the year 2000 round of DETR's Partners in Innovation Scheme with a project aimed at improving the environmental quality of civil engineering projects by providing an award scheme and associated assessment methods.

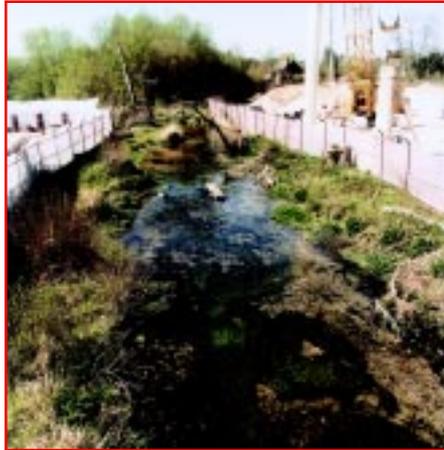
To be called CEEQUAL (Civil Engineering Environmental QUALity award scheme), it is hoped that such a scheme will act as an incentive to clients, designers and contractors to adopt environmental best practice and assist in delivery of sustainable construction. There are already 12 Partners in the project but more, especially clients of construction, would be very welcome. Second paragraph in column form.

Anyone interested in participating in the project is invited to contact
Dr John Bennett at the ICE
(020 7665 2268; fax: 020 7799 1325;
E-mail: bennett_j@ice.org.uk).



Reducing pollution from construction sites

A CIRIA project *Control of water pollution from construction sites – guidance for consultants and contractors* has produced detailed guidance for the construction industry to help reduce water pollution from construction sites. The study is nearing completion and the final report will be available from April.



Shallow watercourse at Newbury By-pass with temporary fencing. Photo courtesy of Costain Limited

The report provides good practice guidance on the prevention of water pollution and treatment of discharges, and covers:

- risk assessment and planning to reduce the risk of pollution, from the project inception stage through construction and beyond into demolition and site clearance;
- the allocation of environmental responsibilities through a construction contract, including standard forms of contract and more innovative approaches such as partnering;
- the chemical properties of controlled waters and commonly encountered indicators of water pollution;
- types of pollution that may result from site activities, and how to avoid and treat them;
- the regulators' approaches to assessing pollution, relevant legislation (throughout the UK), and related health and safety issues.

A series of conclusions and recommendations have also been developed and are designed to help the industry take up the guidance developed and further improve its environmental performance. Following this work, CIRIA is developing a study to provide a voluntary Code of Practice for Water Pollution Prevention for the construction industry, and a training pack for use by site staff in presenting tool box talks.

The project has been funded by DETR through the Partners in Innovation Scheme and by the Environment Agency, the Scottish and Northern Ireland Forum For Environmental Research, the BOC Foundation, the CIRIA Core Programme, and the CAPITB Trust (through the European Social Fund Adapt Supply Chain Environmental Training Project).

For further information please contact
Craig Elliott at CIRIA
 (020 7828 4441; fax: 020 7828 4055;
 E-mail:
rfocus@ciria.org.uk.)



MATERIALS & ENVIRONMENT

Low-VOC primers prove effective on steelwork

The preliminary results of a study of the performance of compliant low-VOC primers on construction steelwork indicate that they are as durable as proven conventional coatings that tend to have higher solvent contents.

It is estimated that 16.5 million litres of paint are used to coat structural metal work each year in the UK, resulting in the emission of 8000 tonnes of solvent volatile organic compounds (VOCs). In recent years there has been increasing concern over the environmental and health issues associated with VOC emissions. For example, they react with car fumes to create ozone which, at ground level, can cause respiratory problems and damage vegetation.

There is now increasing legislation aimed at reducing VOC emissions and more is planned, including possible restrictions on the use of certain raw materials in coating systems. Paint and resin manufacturers are therefore under pressure to develop coatings of ever lower VOC content.

However, there is little independent guidance on the performance of low-VOC primer and coating systems on steelwork compared with that of traditionally used systems. Designers, specifiers and users need clear and impartial information, especially on the ease of application and durability of these products. At present many are reluctant to change from proven, conventional, organic-based coatings.

In April 1997 BRE started a project to

provide guidance on the application and performance of low-VOC, pre- and post-fabrication primers and coatings for preventing corrosion of structural steelwork. This work was funded by DETR under the Partners in Innovation programme with the support of 16 industrial partners.

A total of 40 different primers (18 pre-fabrication and 22 post-fabrication) were applied to steel panels. An 'X' was scratched onto the test face of each panel as an artificial defect. Triplicate coated panels for each primer were subjected to two natural weathering environments (urban/rural and industrial/coastal) and accelerated corrosion testing (cyclic corrosion test).

The work finished in March 2000 and initial analysis of the results indicates that low-VOC products have performance characteristics comparable with proven conventional coatings. Full details of the project's findings will be given in due course in a BRE Information Paper.

For further information please
 contact **John Kempster at BRE**
 (01923 664153; fax: 01923 664786;
 E-mail: kempsterj@bre.co.uk.)



Testing the effectiveness of low VOC organic primers on steelwork

A better deal for pedestrians

UK Government policies aim to promote walking, both as part of an integrated transport policy and as a sustainable mode of transport. However, many factors act to discourage footway use and hence reduce the effectiveness of their performance. Cracked or uneven footways are the most common perceived problem facing footway users. Improvement in the condition of footways is therefore needed to increase their use.

Recent research, commissioned by the Highways Agency and the CSS examined user satisfaction to bring users' views in line with the engineering of footway construction. The main objectives were to establish practical guidance to enable engineers to better prioritise and manage footway maintenance and, ultimately, to define levels of performance for use in overall indicators of footway condition.

A pilot study, carried out in a major city, compared measurements from prototype profile measuring equipment against measurements of users' perceptions of footway serviceability. Results showed that it may be possible to derive a relationship between actual measured condition and users' satisfaction with the walking surface.

Two larger-scale surveys were then undertaken to confirm these findings and to derive models of footway condition, based on the measured condition and satisfaction parameters. These involved one-to-one interviews with over 2000 users and measurement on 24 sites with asphalt, flagged and block paved surfaces. Interviews scores at each site were rated and good correlation was found between the ratings predicted by the models and the mean rating given by users at each site.

The results demonstrated that predictive models, based on machine measured profiles, can be effective in predicting the mean rating of site condition given by users. The outcome will identify the factors that most affect users' attitudes to the condition of the walking surface. The derived predictive models could then form the basis of future footway performance indicators.

For further information please contact Peter Scott at TRL (01344 770031; fax: 01344 770356; E-mail: pscott@trl.co.uk)



Cracked and uneven footway

DAMS & WATER ENGINEERING

Flushing reservoir sediments

Around 40 000 large reservoirs are used worldwide for water supply, power generation, flood control and storage. A significant proportion of the total storage volume is lost annually as a result of sedimentation, and many new dams need to be constructed annually just to maintain current total storage. Researchers at HR Wallingford have just completed a collaborative DETR project to investigate where and when the flushing of sediment may be an appropriate method of sustaining reservoir storage.

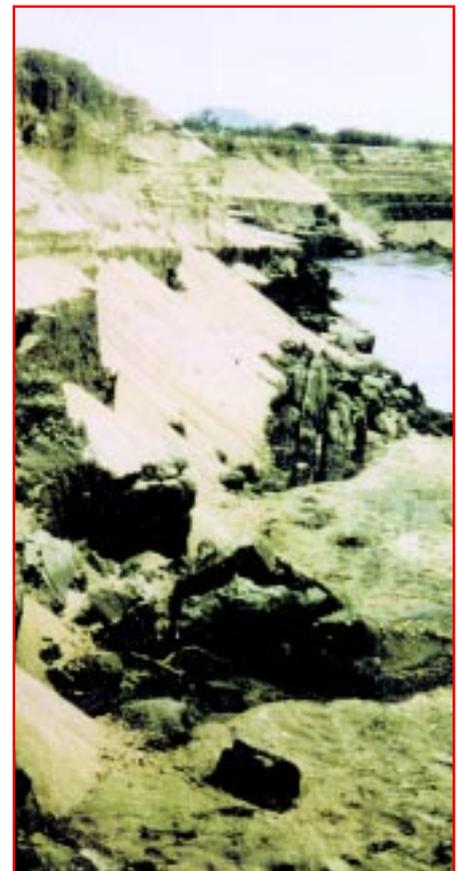
The research at HR made an initial assessment of the scale of reservoir sedimentation problems and an estimation of the volume of storage required to meet continuing demand. This revealed that sedimentation is accountable for the loss of 0.5% to 1.0% of reservoir storage worldwide per year. This is a very significant amount, especially when researchers estimated the annual demand for new storage to be around 100 cubic kilometres per year.

Dr. Rodney White, project leader at HR explains, "One way of preserving reservoir storage is to flush sediments through purpose built outlet works within the dam. This technique can be applied to existing dams (with adaptation of the engineering works) and to new dams. However it is only effective under certain favourable conditions and is not universally applicable."

By examining current knowledge of sediment flushing and reviewing worldwide experience, factors were identified for the successful flushing of sediment. These included the importance of maintaining a low reservoir level throughout the flushing period and ensuring the availability of enough water to transport the required volume of sediment. This led to an examination of geographical and climatic factors, which established that well-defined wet and dry seasons would be most favourable for flushing, since low reservoir levels at the end of the dry season, for flushing, would be followed by certain rainfall in the wet season to refill the reservoir.

The study also looked at 50 reservoirs where sediment flushing is, or has been, undertaken. This provided information on the influence of factors such as reservoir size and shape, hydrology and sedimentology.

It is anticipated that the outcomes of this research will be of great value to organisations such as the World Bank, as a method of prolonging the life of existing res-



Sedimentation visible in a drawn-down reservoir.

ervoirs, rather than facing the environmental and social disturbances associated with new dam sites.

For further information please contact Dr Rodney White, HR Wallingford (01491 822253; fax: 01491 825428; E-mail: wrw@hrwallingford.co.uk).



ENVEST: Estimating environmental impact of buildings

The production, use and disposal of building materials accounts for significant quantities of energy and resources. As awareness of the environmental impact of these processes has increased, many construction professionals and property owners have started to take account of the environmental impacts arising from their selection of building materials and components.

Materials used in the construction of buildings are selected early in the design process but it is difficult to judge the environmental attributes of different material or component specifications, as they depend on both attributes such as resources used and pollution, and the mass of each material required to fulfil the function. In addition, use of one type of material or component may have implications for the quantities of materials used elsewhere in the design.

The Centre for Sustainable Construction at BRE has been creating tools for several years that allow designers, developers, building owners and occupiers to place environmental factors at the heart of their decision making. ENVEST, an environmental impact estimation tool, is a new software tool currently being developed based on life cycle assessment methodology. Its development is funded by the DETR under the BRE Framework agreement.

ENVEST is the first UK software for estimating the environmental impacts of a building from the early design stage. The first available version is for office buildings, and considers the environmental impacts both of materials used during construction and of the energy and resources consumed over the building's life.

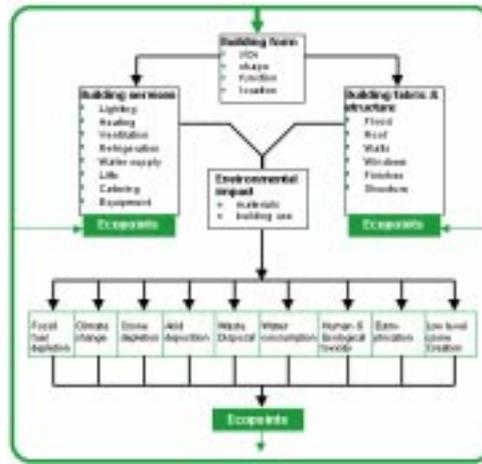
Using minimal data entered through simple input screens, ENVEST allows designers to identify those aspects of the building that have the greatest influence on the overall impact. All environmental impacts are measured using a single points scale, called Ecopoints, allowing a designer to compare different designs and specifications.

Ecopoints have been developed to allow different environmental impacts to be added together and compared, on a single scale – see upper figure. To do this, a weighting system was required that allowed the relative importance of different environmental issues to be established. This was achieved by carrying out consensus-based research across a broad range of interest groups in the UK construction industry. The result is a system whereby 100 Ecopoints are equivalent to the environmental impact of the average UK citizen in one year.

Easy to use, the software incorporates much research data on materials, operational use, impacts and weightings that underpin its calculations.

The tool has been designed to deliver a wide range of benefits for designers:

- optimising form for least environmental impact;
- informing choice of main construction materials;
- enabling the environmental impacts of construction and operation to be balanced over the life of the building;



Schematic of Ecopoints derivation



Example screen showing menu choices

- giving comparisons for different buildings and specifications;
- graphically illustrating the environmental credentials of a design to clients.

From just four straightforward steps by the user (listed below), ENVEST can provide an Ecopoints score for any building. Almost all data entry is from menu choices – for example there is no need to look up U values or building regulation requirements – see lower figure.

- Step 1: Select a building shape from a choice of eight generic shapes.
- Step 2: Input basic building dimensions and details such as height, storeys and window area.
- Step 3: Enter details of main building elements [all presented as menu choices]. Refine the design by experimenting with different specifications to see how this affects the Ecopoint score.
- Step 4: Enter details for the building services such as heating, lighting and air conditioning so that ENVEST can estimate operational impacts.
- Step 5: Examine the final 'Ecopoints' score. Compare with benchmarks for typical buildings.

For further information please see <http://www.bre.co.uk/envest> or contact Prashant Kapoor at BRE (01923 664308; fax: 01923 664084; E-mail: envest@bre.co.uk).



CONSTRUCTION FUTURES

New Construction Engineering Doctorate at Loughborough

A radical alternative to the PhD is at the centre of a new research initiative between the Engineering and Physical Sciences Research Council (EPSRC), the Centre for Innovative Construction Engineering (CICE) at Loughborough University, and 22 leading firms in construction and related industry.

The Centre for Innovative Construction Engineering was set up in April 1999 following an expansion of the EPSRC's prestigious Engineering Doctorate (EngD) scheme. It is unique in being the only EngD Centre devoted to meeting the research and training needs of the construction industry. Initial funding for the Centre consists of £3M from EPSRC over 5 years matched by an additional £1M in cash and over £2M of 'in kind' support from industry to provide 200 manyears of industry-focused research.

The Engineering Doctorate (EngD) is a 4-year programme of advanced study and research intended for the UK's leading research engineers who aspire to key managerial positions in industry. The first 10 research engineers enrolled on the EngD programme in 1999.

For further information please contact Dr Chimay J Anumba, Centre Director, (01509 222615; fax: 01509 223982; E-mail: c.j.anumba@lboro.ac.uk; or visit the CICE Web site: <http://www.lboro.ac.uk/cice>).

Reducing cladding fires

The potential for external fire spread on buildings via the cladding system has been carefully reviewed following a fire in multi-storey flats in Irvine, Scotland, last June. The review included a Parliamentary Inquiry by the Environment Sub-Committee of the Environment, Transport & Regional Affairs Committee.



Cladding fire test at BRE Cardington

In their report, published in January, the Sub-Committee said: 'All reasonable steps should be taken towards minimising the risks'. Several recommendations were made, including the use of a BRE test method, developed under a joint research programme with Government and industry, to demonstrate the fire performance of these systems.

The method is detailed in BRE Fire Note 9, *Assessing the fire performance of external cladding systems: a test method*. The revised 2000 version of the Building Regulations Approved Document B on Fire Safety also cites the test.

The test is undertaken at full-scale using a test specimen representing 'end use' conditions, with details such as cavity barriers and joints installed according to standard practice. The specimen must be at least 6m in height and 2.4m wide on the primary face and 1.2m wide on the return wing. The fire source used is designed to represent a post-flashover fire exiting a room through a window opening, with an incident heat flux of $90 \pm 20 \text{ kW/m}^2$ at 1m above the opening.

The criteria used to assess these systems is based on the time taken for the fire to spread upwards through each layer of material in the system, including the internal and external faces, and cavities where present. Thermocouples are located at the mid-depth of each layer and cavity (where present). Assessment of the overall performance of the system is then based on the rate of fire spread in each component.

For further information please contact Sarah Colwell at BRE (01923 664942; fax: 01923 664910; E-mail: colwells@bre.co.uk).



BUILDINGS

Energy ratings of domestic windows

Buildings account for about fifty per cent of the UK energy consumption and almost fifty per cent of the UK CO₂ emissions. A large part of this energy use is caused by inefficient windows and there is a need to fully quantify and inform users about the energy losses that windows generate. The technology to make highly energy efficient windows already exists and window energy rating will accelerate its uptake.

The CWCT, as part of a DETR Partners in Innovation project, is seeking to establish a domestic window energy rating system for the thermal performance of windows and doors.

The scheme, to be run under the auspices of the BFRC (the British Fenestration Rating Council) will allow energy efficient materials and designs to be reliably compared with other materials and designs. This 'fair, accurate and credible' system produces results that are reproducible, materials-independent, easily accessible and widely available.

The BFRC scheme has to conform to European standards and be simple and easy to operate. The total rating includes a whole-window U-value as well as solar heat gain and ventilation factors – important factors not included in alternative energy rating methods. The rating process can make substantial use of computer simulations to reduce testing costs and to make the scheme accessible to all window manufacturers.

Energy rating will enable purchasers and clients to make informed choices and promote the use of good practice and energy-efficient products. It has been said that the average Scandinavian cowshed has better insulation and is more energy-efficient than the average UK house. Window energy rating will enable us to improve UK performance – there is certainly a long way to go.

The project has a Web Site at <http://www.bfrc.org> with full details of the progress to date. Alternatively, for further information please contact Dr Stephen Ledbetter, CWCT (01225 826541; fax: 01225 826556; E-mail: cwct@bath.ac.uk).



SPONSORING ORGANISATIONS

GOVERNMENT

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Eland House, Bressenden Place,
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Website: www.construction.detr.gov.uk

RESEARCH ORGANISATIONS

British Cement Association,
Century House, Telford Avenue, Crowthorne,
Berkshire, RG11 6YS
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Construction Industry Research and Information Association,

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The Steel Construction Institute,

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Email: reception@steel-sci.org

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Website: www.trl.co.uk
Email: bdu@trl.co.uk

PROFESSIONAL INSTITUTIONS

The Chartered Institute of Building,

Englemere, King's Ride, Ascot, Berkshire,
SL5 7TB (01344 630700, fax 01344 630777)
Website: www.ciob.org.uk

Institution of Civil Engineers,

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

Institution of Structural Engineers,

11 Upper Belgrave Street, London SW1X 8BH
(020 7235 4535, fax 020 7235 4294)
Website: www.istructe.org.uk
Email: enquiries@ice.org.uk

INDUSTRY

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Geotechnical Consulting Group

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