Research Focus

Issue No. 50 AUGUST 2002

PROMOTING THE APPLICATION OF RESEARCH IN BUILDING AND CIVIL ENGINEERING

IN THIS ISSUE

Tyred of waste?

Waste materials are both an embarrassment and a liability. HR Wallingford has just won a DTI Partners in Innovation (PII) contract to reduce both problems by examining potential uses for scrap tyres in coastal and river engineering.

About 60% of the rubber consumed worldwide is used to produce tyres. Around 40 million tyres are scrapped each year in the UK alone and about 10 million of these end up in landfill. A European Directive will ban the disposal of whole tyres in this way by 2003 and of 'tyre shred' by 2006. There is therefore a looming problem of tyre disposal.

'There is now technology that allows us to compress large numbers of tyres into cuboid bales,' explains Jonathan Simm, HR's Project Manager for the work. 'These could be useful as void fillers in sea defences and bank protection.' During the PII programme, researchers at Wallingford will work with partners from the Environment Agency, local authorities, recycling organisations, contractors and universities. 'We will review current knowledge and look at case studies in the UK and overseas where scrap tyres have been used in engineering projects,' says Simm.

Enviro-Block tyre bales in use as part of an embankment dam
(Photo courtesy of Anglo Environmental and Mackley Construction)

Laboratory scale tests will be carried out on the new rubber cuboids at Wallingford and there are plans to organise pilot studies of these at three UK sites.

For further information please contac Jonathan Simm at HRW (01491 822355; fax: 01491 825539; E-mail: jds@hrwallingford.co.uk).

DESIGN & MATERIALS

BS 5950–1: 2000's amendments guide

BS 5950–1: 2000, the major code for structural steelwork design, became effective on 15 August 2001. A new publication from the Steel Construction Institute based on its research – *Guide to the major amendments in BS5950–1: 2000* – eases designers' transition to the new code.

The Guide gives short descriptions of each important change and simple worked examples illustrate the revised design procedures. The major changes are:

- revised rules for checking frame stability;
- changes to the method for selecting an appropriate steel sub-grade;
- the introduction of the effective-area method for Class 4 slender sections;
- lateral-torsional buckling, where the n-factor method has been removed;
- changes to the clauses on shear buckling, stiffener design, tension members, compression members, combined axial load and bending and the design of column bases;
- in-plane stability of portal frames, prying forces;
- transverse strength of fillet welds.

The project was funded by Corus and the former DETR. The Guide (P-304, ISBN 1 85942 131 8) is available from Publications, The Steel Construction Institute at £40 for non-members or £20 for corporate members.

For further information please contact Dr Martin Heywood at Steel Construction Institute (01344 623345; fax: 01344 622944; E-mail: m.heywood@steel-sci.com). www.steelbiz.org/shop

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.

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E-mail: abigail.dua@ice.org.uk).

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

MATERIALS AND HIGHWAYS

Alternative road surfacing

DFID Department for International Development

Road networks in developing countries are essential infrastructure for providing services to rural communities and providing those communities with access to markets. Limited resources usually mean that access must be provided for low initial costs and low maintenance costs. Natural gravel surfacing is rightly viewed as an appropriate low-cost solution in many circumstances, between basic engineered earth and the higher-cost, usually bituminous, surfaces.

Gravel Road (courtesy of Intech Associates).

A gravel road surface can be appropriate where material quality is to appropriate surfacing specifications, if gravel haul distances are short, if longitudinal road gradients are less than about 6%, when rainfall is low or moderate, when traffic is not excessive, when finance and resources are going to be available for the necessary ongoing periodic re-gravelling, and/or where dry season dust generation is not severe.

Unfortunately, the above suitability criteria are often not met. Many organisations or communities cannot provide adequate maintenance and the risk is high for deterioration back to earth standard. There are also environmental and other justifiable concerns relating to gravel surfacing.

Fortunately, there is a range of alternative surfacing and paving options, proven in various countries, that could provide appropriate, economical and sustainable alternatives in many instances. Suitability will depend on local circumstances but these alternatives, together with an appropriate use of the available gravel materials, may be cheaper in whole-life-cost terms. Some of the alternatives can be constructed by labour and light equipment methods suitable for rural road application by small local enterprises, and would have lower maintenance requirements than gravel.

Intech Associates have been preparing guidelines on the use of alternative surfaces for rural roads under the DFID Knowledge and Research (KAR) programme. Documentation will be made available through the DFID Transport Links website: www.transport-links.org.

For further information please contact Robert Petts of Intech Associates by E-mail: rob@intech-consult.demon.co.uk.

ENVIRONMENT

Using non-ferrous industry waste as aggregate

A new BRE project will demonstrate the use of non-ferrous industry wastes as aggregate in construction, and encourage their use in areas local to the manufacturing sites producing them. This will reduce the need for landfill space and be of economic help to local manufacturing industries.

The economic and environmental costs of sending non-ferrous industry wastes to landfill are high. However, their volumes are small when compared with aggregates consumed annually by the UK construction industry, and can easily be consumed in the locality of production without affecting any local economy reliant on producing primary aggregates.

This project will firstly develop the mix designs of cementitious and bituminous systems containing ferro-silicate slag from the Imperial Smelting Furnace production of zinc (ISF slag), and the carbon and refractory portions of pot linings associated with aluminium production (spent pot linings – SPL). It then aims to prove the performance of the new ISF slag mixes by using them in the construction of trial sections of road.

A recent feasibility study co-ordinated by the Non-Ferrous Alliance and supported by the Engineering Industries Directorate of the DTI, highlighted the potential use for waste streams from non-ferrous metals production as aggregates bound in cement or bitumen (BRE Report 423, available from www.BREbookshop.com). Previous laboratory studies have shown that it is technically feasible to use ISF slag in concrete construction.

Interested parties across the waste management, construction and environmental industries are being invited to join the project's consultative group.

For further details please contact Andrew Dunster of BRE (01923 664365; E-mail: dunstera@bre.co.uk).

BRE

Evaluating Humber Estuary realignment schemes

The development of a sustainable estuary management strategy relies on a thorough understanding of the physical and ecological components of an estuary system. In the Humber Estuary ABP Marine Environmental Research Ltd (ABPmer) used a range of modelling tools to understand the impact of managed realignment schemes on the estuary.

This work at both estuary-wide and local scales has been carried out under the Environment Agency-funded Humber Estuary Shoreline Management Plan as well as ABPmer's own research initiatives. The Shoreline Management Plan work was led by Binnie, Black and Veatch Ltd and also involved the British Geological Survey, HR Wallingford Ltd, WL Delft Hydraulics and the University of Newcastle.

To evaluate the physical impacts of the scheme, ABPmer used a suite of numerical models. At an estuary-wide scale, these tools produced an understanding of how the estuary reached its current shape and form and how it is likely to respond to changes in the future, including various realignment scenarios along the length of the river-estuary system.

At a local scale, ABPmer have undertaken detailed modelling of proposed realignment schemes, which has included tides, waves, mud transport and morphodynamic changes.

The Humber Estuary, N.E England

To assess the impacts of losses or gains of inter-tidal habitat, ABPmer has also developed a series of ecological models in conjunction with the Centre for Ecology and Hydrology (CEH).

One such model allows the quantitative prediction of how faunal communities of mudflats will change in response to managed realignment schemes. Another model aids assessment of the effects of habitat changes on bird populations while another predicts future changes in the distribution of saltmarshes in response to sea-level rise.

The underlying principles of the ecological and morphological Humber models for the are applicable to other estuaries and have the potential to make a significant contribution to their sustainable management. This will improve our scientific understanding of these complex systems and provide a sound basis on which management systems can be created.

For further information please contact Dr Nigel Pontee, ABP Marine Environmental Research Ltd, Pathfinder House, Maritime Way, Southampton (023 8033 8100; fax: 023 8033 8040; E-mail: npontee@abpmer.co.uk; Website: www.abpmer.co.uk).

Promoting sustainable drainage

CIRIA's project, *SUDS – Promoting good practice*, is disseminating the benefits of Sustainable Urban Drainage Systems (SUDS) to construction professionals, improving awareness of good practice and the latest technology, as well as encouraging the wider incorporation of sustainable drainage in developments.

With recent flooding highlighting the importance of improved management of surface water drainage, the need to implement SUDS is becoming a reality for the UK construction industry. The potential advantages of sustainable drainage techniques are numerous, including reductions in downstream flood risks, improvements to water quality and increased water resources, as well as considerable benefits for the urban environment and ecology.

This has been recognised in the recent Planning Policy Guidance Note 25 *Development and flood risk*, which identifies the potential for sustainable drainage systems in preventing increases in runoff from new developments. Yet, despite active support from the Environment Agency, local authorities and the Government, take-up of such techniques remains relatively low.

One of the biggest barriers to uptake so far has been the lack of standards and guidance in this field. Until recently, sustainable drainage was not actively promoted by Building Regulations, which instead offer more generic guidance to drainage issues. From 1 April 2002 the revised Part H3 of the Building Regulations came into force and facilitates the use of SUDS. However, the approach will not be prescriptive and implementation of sustainable drainage techniques will remain a matter of choice.

CIRIA has published guidance on the design of SUDS and also included best practice guidance on their incorporation in developments. To further improve the uptake of SUDS, CIRIA's latest project, *SUDS – Promoting good practice*, provides information on good practice in the use of SUDS, ensuring that progress in developing SUDS is communicated in an independent and objective way.

A pond is often a feature of sustainable drainage systems.

This includes the development of a website – www.ciria.org.uk/suds – which is frequently updated to include the most recent developments in this evolving field of work, and also a bi-annual newsletter. Both offer guidance, case studies and information on research projects currently being undertaken. Content is provided by those involved in the practical implementation of SUDS, as well as by those carrying out R&D.

Whilst CIRIA cannot guarantee publication, it welcomes contributions that are relevant to innovation and good practice in sustainable drainage for the website and newsletter.

For further information, or to contribute to the project, please contact CIRIA (020 7828 4441; fax: 020 7828 4055; E-mail: rfocus@ciria.org.uk; website: www.ciria.org.uk/suds).

Light Earth Construction

In partnership with the DTI and other organisations, Gaia Architects in Edinburgh have been awarded support through the 'Partners in Innovation' programme to investigate the potential of 'Light Earth Construction' for the UK.

A house at Raisio, near Turku in Finland, constructed using straw-clay blocks, with lime render and timber cladding at first floor level. Architect: Teuvo Ranki. (Courtesy of Chris Morgan of Gaia Architects)

Light Earth Construction (LEC) is the generic name given to a technique whereby straw, woodchip, or some other 'fill' material is coated in clay slip and set within formwork within a load bearing structure. As the clay dries out the mix sets to form a solid, insulating mass. Light Earth can be made *insitu* or pre-fabricated into blocks or panels. It can be used on internal and external walls, surfaces are normally rendered on both sides, with breathable finishes.

Whilst the 'fill' material gives the mass much better thermal insulating properties than earth alone, the clay protects the fill material against both fire and decay. It also gives an element of thermal capacity, and this relationship between insulation and thermal capacity can be adjusted to suit the environmental conditions required.

LEC has a number of key benefits for the UK industry.

- It is a fundamentally environmentally benign technique using renewable materials with extremely low embodied energy. There is no pollution associated with disposal, as all elements are non-toxic and biodegradable.
- The technique fits into the existing industry preference for, and experience of, timber frame construction so may be more readily adopted than other more radical ecological methods.
- LEC is an extremely safe, flexible and simple form of construction with no special skills or tools needed. Material costs on *insitu* construction are low, which should endear it to the self-build market in particular. On the other hand, pre-fabricated blocks and panels are eminently suitable for most project types.

Whilst the technique has been used only on a couple of buildings in the UK, it is widespread in Europe and the US. There is a considerable body of experience in building with the material, from which it is hoped the UK industry can gain and thus avoid some of the pitfalls and duplication of effort in other countries, which have tended to develop the technique in isolation.

The 15-month study will investigate the challenges and benefits of Light Earth Construction and, through an approved testing regime, will establish the technical viability of the method in the UK. A test building will be built, costed and monitored as part of the study.

The study will support compliance with building regulations, and lenders' and insurers' requirements, through the development of a set of guidelines that all relevant agencies can approve. The study will also contain international examples, costings and advice on best practice design and maintenance, grounded in the experience of Europe's leading LEC practitioners.

Ultimately, the study will aim to encourage the development and wider application of the technique, leading to increased competitiveness and improved sustainability within the UK construction industry at large.

For further information please contact Chris Morgan at Gaia Architects, The Monastery, 2 Hart Street Lane, Edinburgh EH1 3RG (0131 557 9191; fax: 0131 557 9292; E-mail: gaiachris@aol.com).

MATERIALS

Non-destructive reinforcement corrosion testing

Corrosion of steel reinforcement is a significant problem in UK and worldwide construction. At Loughborough University one of the Research Engineers at the Centre for Innovative Construction Engineering (CICE), Matthew Ing, has been developing a non-destructive corrosion detection tool as part of his Engineering Doctorate. Matthew is sponsored by Balvac/Balfour Beatty on the EngD programme, which is funded overall by the EPSRC.

Reinforced concrete is a common construction material in the UK and worldwide. However, poor design and workmanship, combined with the widespread use of de-icing salts on road networks and carparks too often leads to corrosion of the steel reinforcement. The expansive corrosion product, with volumes of up to 12 times that of the steel, eventually results in spalling and cracking of the cover. The loss of steel section, and loss of bond with the concrete can create serious durability and serviceability problems, often associated with costly repairs. Early detection of corrosion, before any significant damage to the concrete has occurred, can dramatically reduce repair costs and provide greater opportunities in the choice of remediation methods.

The new tool being developed incorporates techniques used in the aerospace and petroleum industries. A prototype was trialled on a section of the M5. Three areas that had been identified using existing corrosion detection techniques were scrutinised. The new system successfully detected active pitting corrosion within one of these three areas,

An example of advanced concrete corrosion

the only area confirmed on breakout to contain active corrosion. This success demonstrated the potential of the tool as a reliable and viable commercial technique.

Extensive laboratory research has proven the ability of the technique to detect the very early stages of corrosion, providing some potential means of reducing the £615m annual repair bill in the UK due to reinforcement corrosion. Future research is being aimed towards using the method as part of an asset management technique and hence better prediction of future maintenance costs.

For further information please contact Matthew Ing at CICE (01509 228549; fax: 10509 223982; E-mail: cice@lboro.ac.uk; Website: www.cice.org.uk).

U-values for light steel frame construction

Light steel frame construction can potentially incorporate a very high standard of thermal insulation resulting in comfortable, energy-efficient dwellings. This construction method has been attracting interest in the UK in recent years and is increasing in popularity for both individual houses and for apartment blocks.

There are now several companies supplying light steel framing to the housing sector and many developers and Registered Social Landlords (RSLs) are actively using this technology. The use of light steel framing can help to address issues of skills shortage, provide high construction standards, achieve precise tolerances and increased off-site manufacture.

Simplified U-value calculations for light steel framed constructions have presented a particular difficulty as compared with many other forms of construction because of the large difference in the thermal conductivity of the steel alongside thermal insulation. With the implementation of the 2002 editions of the Approved Documents L1 and L2 for the Conservation of Fuel and Power, U-values will now have to be calculated by the method given in BS EN ISO 6946 (Combined Method). However, BS EN ISO 6946 specifically excludes from its scope constructions in which insulating layers are bridged by linear metal elements. It is therefore not applicable for many light steel frame designs (other than warm frame construction – see below).

To address this issue, BRE, in partnership with The Steel Construction Institute, and with sponsorship from DTI and Corus, has developed a simplified method that is acceptable for use with light steel framing.

The new method is based on research carried out by BRE, SCI, and several key suppliers. The work involved returning to first principles to analyse the heat flows through steel framed constructions, and comparing these with predictions made by simplified methods. It was found that for warm frame constructions, where all the insulation is placed outside the steel frame, the normal U-value calculation as set out in BS EN ISO 6946 can be applied. However, for constructions where some or all the insulation is placed within the thickness of the steel frame, the methodology has to be adapted to allow for the increased effect of the steel.

The new method is generally similar to that used in BS EN ISO 6946 but amended to increase accuracy for these types of construction. It is designed to be easily implemented in U-value calculation software. It was found that, with the amendments, the mean error in the prediction was less than 3%, with a maximum error of 8% when compared to more accurate thermal modelling techniques.

The method is described in detail in BRE Digest 465 (1). BRE is also producing U-value calculation software for use to demonstrate compliance with the new Approved Documents L1 and L2. This software will include provision for light steel frame construction enabling U-values to be easily calculated. Other commercially available software may also integrate the routines for light steel framing.

In addition to more stringent U-value standards, Approved Documents L1 and L2 also require that thermal bridging is more comprehensively addressed. One way of satisfying the requirements is to use Robust Construction Details (2) published by DTLR. This publication includes a range of light steel frame details, which can be used to demonstrate compliance.

(1) S.M. Doran, & M.T. Gorgolewski, 2002, *U-values for Light Steel Frame Construction*, BRE Digest 465, BRE
(2) *Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings*, The Stationery Office, 2001

For further information please contact Dr Sean Doran at BRE, Kelvin Road, East Kilbride, G75 0RZ (01355 576224; fax: 01355 576210; E-mail: dorans@bre.co.uk) or Dr Mark Gorgolewski of The Steel Construction Institute (01869 347376; E-mail: markgorgolewski@aecb.net).

Light steel frame construction at Tunnel Wharf.

MATERIALS & URBAN DESIGN

Natural stone streets

Leading landscape architects are increasingly specifying stone as a road and footpath surfacing, leading to the 'stone streetscape' becoming a popular centrepiece in towns and cities. The appearance of stone is seen to create a quality feeling that improves with time. The new interest in the use of stone, coupled with a desire to use sizes and arrangements that have not been used before, has presented the engineering community with a challenge. TRL has undertaken research for a range of clients in this area.

Guidance on the use of natural stone surfacings can be found in *Natural stone surfacing – Good Practice Guide*, published in 2001 by the Society of Chief Officers of Transportation in Scotland (SCOTS).

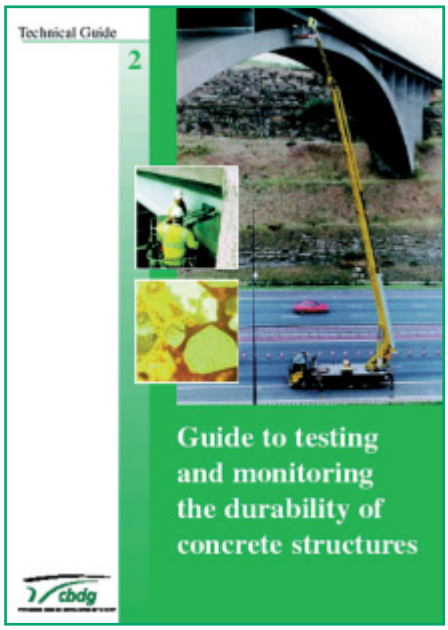
However, information on using stone in a modern context is limited. Further research is required to widen the knowledge base (from design to aftercare) with the objective of 'marrying' theory with practice.

For further information contact Michael McHale at TRL (0131 455 5180; fax: 0131 455 5188; E-mail: mmchale@trl.co.uk).

A modern stone streetscape

Concrete structure durability guide

A guide to testing and monitoring the durability of concrete structures has been published following over five years' work by a Task Group of the Concrete Bridge Development Group (CBDG). All sections of the industry were represented by group members, including clients, consultants, research organisations and test houses.



The guide provides concise information and advice on all of the most useful tests for concrete durability, each one set down in a standard format that explains their principles, apparatus, relevance for durability, advantages, disadvantages, sources of inaccuracy and practical advice on use. References are provided for more detailed study.

The guide is intended for the use of all involved in assessing concrete durability, including those who specify, interpret or undertake the tests. In particular, the guide encourages tests to be specified with a particular purpose in mind, with defect photographs leading through a tabular selection process.

The guide's preparation has been part-funded by the ICE Research & Development Enabling Fund. It is hoped that availability of concise information, applicable to all forms of concrete structure, will contribute to an improvement of the quality of durability testing. The Guide is available from www.concretebookshop.com.

For further information please contact Colin Cleverly at CBDG (01344 725727; fax: 01344 772426; E-mail: enquiries@cbdg.org.uk).

CEEQUAL goes into Phase 2

The Institution of Civil Engineers-led project to develop an environmental awards scheme for civil engineering projects – CEEQUAL – has been awarded funding from the DTI's Partners in Innovation Programme for a further two-year phase of development and implementation.

The project started in 2000 with a two-year Feasibility Study, which was successfully completed in April this year having also been supported under the PII scheme. The outputs from this first phase of the project, a draft Manual and a Business Plan laying out how the scheme could work as a self-sustaining business at the end of the development and implementation phase, were delivered to the DTI at the end of February. In April, a project progress report was presented at the ICE at the launch of *Society, Sustainability and Civil Engineering*, the Sustainability Strategy and Action Plan for the civil engineering sector.

The next phase of the project started in May, when working groups were set up to develop and refine the scoring and weighting of the assessment questions within the CEEQUAL scheme, to develop assessor training, and to build on the business and marketing aspects of the CEEQUAL feasibility study.

The revised assessment scheme will be trialled on further real-life civil engineering projects later this year and the aim is to pilot the project and give the first CEEQUAL awards in 2003.

Any client interested in offering projects for trial assessment is invited to contact the Project Team at Crane Environmental Ltd, 12 Cranes Drive, Surbiton, Surrey KT5 8AL (020 8399 4389; fax: 020 8390 9368; E-mail: ceequal@crane-environmental.co.uk).

Capturing concrete knowledge

Case studies are being sought for a new project designed to capture best practice knowledge gained from efficient concrete construction projects – knowledge usually lost when construction teams disband. Dissemination for undergraduates and continuing professional development (CPD) will be via CALcrete, a computer-learning suite that will be updated to include Eurocode EC2, plus new modules on the environment and health & safety.

A case study project to be reviewed for key lessons to be disseminated through CALcrete

Concrete construction often seems to be more removed from the design process than is apparent with other materials. Hard-won knowledge and experience is lost at the end of many projects, as teams disperse rather than feeding back to others in design and construction. This industry and DTI-funded project will use real-life examples and case studies to identify key lessons that can be passed to all in the design and construction process. The work will help to achieve better integration across the sector's construction process.

There is still low awareness and understanding of the issues of sustainability, best value, best practice, and health & safety, despite promotion by government and other bodies. A major awareness and learning exercise must take place if Eurocode EC2 is to be launched effectively in 2003. Updating CALcrete to the latest EC2 complements other help being developed by the Concrete Industry EC2 Group (CIEG – see www.bca.org.uk for details).

CALcrete is already used by industry leaders for CPD, and by undergraduates via some 90 university departments and 25,000 student discs. An established delivery system, CALcrete enables the development team to concentrate on producing new material.

CALcrete is free of charge to UK universities (and via them to students) and at low cost (not for profit) for industry. The Reinforced Concrete Council would welcome contributions of your experience in efficient concrete use or concrete-related health & safety issues, especially through real-life examples.

For more details, or if you could help with contributions, please contact Martin Southcott, Reinforced Concrete Council (01344 725733; E-mail: rcc@bca.org.uk Website: www.rcc-info.org.uk).

New guidance on rehabilitating sewers

HR Wallingford has produced a document setting out the general principles that should be considered when repairing or rehabilitating sewers. This work supports the *European Standard Drain and sewer systems outside buildings – Part 5: Rehabilitation* (EN752-5) and has involved specialists from 10 organisations based in 5 European countries.

Since 1800 the population of Europe has risen by over 500 million people. Population increases have (necessarily) been followed by the construction of sewer networks. Some networks are therefore 200 years old and most were designed before the standards and criteria that we now regard as desirable were set. Rehabilitation is the process of bringing such sewerage systems into line with current hydraulic, environmental and structural standards.

At present, there is a range of national methods for measuring the structural, environmental and hydraulic performance of drain and sewerage systems. 'Individual countries often have their own rehabilitation criteria,' says Richard Kellagher, project leader at HRW. 'There was a need for generic guidance providing best practice advice that could be used across Europe, but which was flexible and took account of local issues.' With this procedure, users are able to select the most appropriate criteria applicable to their own country.

In 1998 the EU invited tenders to produce a Rehabilitation Guide, and a consortium led by HRW won the contract, work starting in 1999. 'Our team included experts from academia, consultants, contractors and renovation product supply organisations as well as end-clients,' says Kellagher. 'The fact that we covered the whole spectrum of experience strengthened the project.' Partners were selected for their expertise in particular areas and their links with relevant CEN Working Groups.

Neglected sewers can collapse with dramatic consequences.
(Courtesy of Insituform Technologies®, Inc)

The structure of the new document is closely related to that of EN 752–5. In each case the rehabilitation procedure is split into four phases:

- initial planning;
- diagnostic study;
- development of solutions; and
- implementation and monitoring.

The new guidelines cover current methods for measuring the structural, hydraulic and environmental performance of sewers. They also look at assessing and prioritising the need for rehabilitation. 'We have expanded the section on 'developing solutions' to include a method for finding the most cost-effective solutions for rehabilitating sewers,' explains Kellagher. Standards for testing rehabilitated networks and certifying renovation products are also addressed. In each section of the new guide, users are referred to relevant parts of EN 752–5.

It should be stressed that the Guidelines set out a generic approach that can be modified according to national needs. They are not intended to replace existing national procedures, but will be particularly valuable in countries where there is currently no national procedure. They should also help to achieve convergence of rehabilitation practices across Europe in the longer term. A final draft version of the entire guide can be viewed at www.hi.ihe.nl/srguide. CD and paper versions of the document are planned for later in 2002.

For further information, please contact Richard Kellagher at HRW (01491 822419; fax: 01491 825916; E-mail: rbbk@hrwallingford.co.uk

Prioritising future construction research and adapting infrastructure to climate change

The UK Climate Impacts Programme (UKCIP) was established in 1997 to help organisations assess how they might be affected by climate change, so that they can prepare for its impact. Apart from providing updated UK climate scenarios, they have co-ordinated impact studies, both sub-UK and sectoral.

The Construction Research Innovation Strategy Panel (CRISP) set up a Climate Change Task Group to establish a research agenda for the UK construction industry within the built environment and its transport and utilities infrastructure. CRISP commissioned TRL Limited to review research work about the impacts of climate change upon the infrastructures of the transport and utility sectors. TRL was also asked to identify adaptations within areas of benefit as well as threats within areas of vulnerability.

It was concluded that further work should be directed, as a matter of priority, to the design of drains (to various structures), to the construction of better-insulated structures, and to the influence of wind forces on structures such as bridges, towers and pylons. Plans for upgrading existing infrastructure should be in keeping with UK Government policy on sustainable construction.

Improvement to drainage systems will be necessary to reduce the occurrence of flooding on roads and other infrastructure

For further information please contact Marilyn Burtwell or Matthew Wilson at TRL (01344 770214 or 770435; fax: 01344 770880; E-mail: mburtwell or mwilson@trl.co.uk).

Developing biomimetic coatings

Nature has evolved a great variety of structural materials that enable living organisms to function effectively in extremely challenging environments. Material scientists are now beginning to look at the building blocks used by plants and animals for guidance when designing new products to meet the demands of modern society. The BICEPS project (Biomimetic coatings for enhanced protection of construction surfaces with an added environmental benefit), managed by the Paint Research Association, has brought together a team including the Biocomposites Group at Southampton University, and an advisory group of a number of interested industrial organisations, to examine the development of new biomimetic coatings.

Primary funding for the project has been provided by the Government's Partners in Innovation programme. In addition to supplying some co-funding, the Industrial Advisory Group's members have ensured that the work programme has been sensitive to the needs of industry. Furthermore they are providing a vehicle for taking the results of the research forward to commercial products.

Natural exposure of experimental coatings as part of the test programme.(Courtesy of Anthony Buxton of the Paint Research Association)

For several years the Southampton Biocomposites Group has been studying the ways in which nature manufactures macro-polymeric materials. In living systems, the raw materials are usually small, water-soluble molecules that can be readily transported to the 'construction' site for assembly into tough water-insoluble tissues. One particular mechanism, which forms the basis for construction of the shells of crustaceans, involves the oxidative condensation of water-soluble species derived from dihydroxy-benzene derivatives (known as catechols).

Dopamine is a simple, naturally occurring catechol species used by crustaceans in both the construction of their shells and by certain molluscs in the production of anchoring adhesives. Polymeric macromolecules formed by this process build and bind around other tissue to result in a strong water impermeable shell, which is attached to and protects the enclosed animal.

Industry, meanwhile, has been developing and providing polymeric paints and varnishes that decorate and protect often expensive substrates, for example wood and metal. For effective application, most such coatings need to be solvent-borne and increasingly, in an environmentally concerned age, water has become the solvent of choice. Thus waterborne polymers are required to dry to form strong durable hydrophobic films with good interfacial adhesion to a substrate.

The BICEPS project has identified polymeric technology as an ideal instance where man-made systems might benefit from adapting some of the techniques of nature.

In the early stages of the BICEPS project, potentially suitable catechols were screened, incorporated into test paint systems and evaluated. A number of not-insignificant challenges have had to be overcome. For instance, nature uses complex enzymatic polymerisation mechanisms, not readily suited to the chemistry of typical industrial coatings, while paint formulations often contain components that may adversely react with the catechols, rendering them ineffective. Nonetheless a catechol-containing paint formulation has been prepared, for which promising enhancements in adhesion and in lifetime durability are indicated.

Based on initial results, a programme of re-formulation experiments have been designed, with the intention of taking the improvements to a point where commercially interesting products are possible. The ultimate test is an evaluation of the behaviour of the new coatings in the real environment. The results of these ongoing field trials will be known early in 2003.

For further information on BICEPS please contact Anthony Buxton at the Paint Research Association (020 8614 4800; E-mail: coatings@pra.org.uk).

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